



May 2015



2014 Water Quality Report

Prepared by

**Minnehaha Creek Watershed District
Research and Monitoring Department: Water Quality Program**

**Water Quality Managers
Yvette Christianson and Kelly Dooley**

**Water Quality Technician
Kailey Kreatz**

**District Representatives - Water Quality
Brianna Haugen, William Long, and Emily Sandell-Nelson**

**15320 Minnetonka Boulevard
Minnetonka, MN 55345
952-641-4535
www.minnehahacreek.org**

PREFACE

The Minnehaha Creek Watershed District's Monitoring Program began in 1968. The major hydrologic features of the watershed that have been monitored include Lake Minnetonka, Minnehaha Creek, and the Minneapolis Chain of Lakes. The program has expanded and continued to evolve over the years. In 2014, the Hydrological Data, Research and Monitoring Department changed its name to the Research and Monitoring Department, which now encompasses three programs: Water Quality, Aquatic Invasive Species, and the Ecosystem Evaluation Program.

In 2014, the Water Quality Program monitored lakes and streams throughout the 181 square miles of the Watershed District. Staff and trained volunteers monitored 20 bays on Lake Minnetonka, 34 upper watershed lakes, 1 upper watershed wetland, 6 lower watershed lakes, 1 lower watershed wetland, 36 sites on 11 upper watershed streams, and 11 sites on Minnehaha Creek. The waterbodies were monitored for dissolved oxygen, flow, water level, nutrients, suspended solids, chloride, algal abundance, and *E. coli* concentrations

The Research and Monitoring Department collaborates with several agencies who also monitor lakes within the Watershed District. Minneapolis Parks and Recreation Board, Three Rivers Parks District, and Metropolitan Council Environmental Services' Citizen-Assisted Monitoring Program collected the data for an additional 4 upper watershed lakes, 1 upper watershed wetland, 12 lower watershed lakes, and 1 lower watershed wetland in 2014. The data will be summarized in this report.

This water quality information for 2014 is presented in three documents: Executive Summary, Water Quality Report, and Technical Report. The Water Quality Report summarizes the water quality on each of the 11 subwatersheds and watershed-wide. The Technical Report includes the 2014 monitoring protocols, data analysis, and summarizes precipitation, water level and groundwater data. There are also mini-reports for each of the 11 subwatersheds, which provides maps, data and detailed information about the waterbodies within the subwatershed.

TABLE OF CONTENTS

Acronyms of Water Quality Terms	vi
Glossary	vii
Executive Summary	1
1. Introduction	9
1.1 Minnehaha Creek Watershed District	9
1.2 The Water Quality Program	10
1.3 The Aquatic Invasive Species Program	11
1.4 The Ecosystem Evaluation Program.....	11
2. Water Quality Analyses.....	13
2.1 Ecoregion Guidelines	13
2.2 Ecoregion Lake Eutrophication Standards.....	13
2.3 Dissolved Oxygen Standard for Streams.....	14
2.4 <i>E. coli</i> Standard for Streams.....	14
2.5 Chloride Standard for Lakes and Streams.....	15
2.6 Lake Water Quality Grades	15
2.7 Trophic State Index for Lakes.....	16
2.8 Long-Term Trend Analysis.....	17
3. Water Quality Summary by Subwatershed.....	18
3.1 Christmas Lake Subwatershed	18
3.2 Dutch Lake Subwatershed	20
3.3 Gleason Lake Subwatershed.....	23
3.4 Lake Minnetonka Subwatershed	26
3.5 Lake Virginia Subwatershed.....	33
3.6 Langdon Lake Subwatershed	36
3.7 Long Lake Creek Subwatershed	38
3.8 Minnehaha Creek Subwatershed.....	42
3.9 Painter Creek Subwatershed	48
3.10 Schutz Lake Subwatershed	51
3.11 Six Mile Marsh Subwatershed	53
4. Watershed-Wide Water Quality Summary.....	59
5. Future Initiatives.....	61
6. References.....	62

Figures

1	The Subwatersheds of Minnehaha Creek Watershed District	1
2	Lakes within MCWD that do not meet the North Central Hardwood Forest Ecoregion Eutrophication Standards in 2013-2014	7
3	Lakes within MCWD that do not meet the North Central Hardwood Forest Ecoregion Chloride Standards in 2013-2014	8
4	Map of the Minnehaha Creek Watershed District	10
5	Lake Minnetonka Elevation and Grays Bay Dam Discharge During 2014 Open-Water ...	31
6	Annual Average Discharge at Grays Bay Dam and Browndale Dam.....	32
7	Runoff from Upper Watershed to Grays Bay Dam and Browndale Dam	32

Tables

1	Ecological features used to develop the E-Grade Program	12
2	Each Ecological Features in Table 1 will be Assessed on the List of Ecosystem Functions.....	12
3	North Central Hardwood Forest Ecoregion Water Quality Guidelines for Lakes and Streams	13
4	North Central Hardwood Forest Ecoregion Eutrophication Standards for Shallow and Deep Lakes, and Site-Specific Eutrophication Standards for Lake Hiawatha and Lake Nokomis	14
5	Dissolved Oxygen Standard for Streams.....	14
6	<i>E. coli</i> Standard for Recreational Use in Streams	15
7	North Central Hardwood Forest Ecoregion Chloride Standard for Lakes and Streams ...	15
8	Parameters Ranges for Lake Water Quality Grade Determination	15
9	Lake Water Quality Grade Description	16
10	Description of the Carlson's Trophic State Index	17
11	2014 Lake Grades, Means and TSI Values for Lakes in the Christmas Lake Subwatershed	19
12	2014 Concentration and Load Summary for Christmas Subwatershed Stream Sites	19
13	The Number of DO Readings that Exceed the Standard in the Christmas Lake Subwatershed Stream Sites	20
14	2014 Lake Grades, Means and TSI Values for Lakes in the Dutch Lake Subwatershed....	21
15	2014 Concentration and Load Summary for Dutch Lake Subwatershed Stream Sites	22
16	The Number of DO Readings that Exceed the Standard in the Dutch Lake Subwatershed Stream Sites	22
17	2014 Lake Grades, Means and TSI Values for Lakes in the Gleason Lake Subwatershed	24
18	2014 Concentration and Load Summary for Gleason Lake Subwatershed Stream Sites.	24
19	The Number of DO Readings that Exceed the Standard in the Gleason Lake Subwatershed Stream Sites	25
20	Lake Minnetonka Bays with Statistically Similar Water Quality	26
21	2014 Lake Grades, Means and TSI Values for the Lakes in the Lake Minnetonka	

	Subwatershed	28
22	2014 Concentration and Load Summary for Lake Minnetonka Subwatershed Stream Sites.....	30
23	The Number of DO Readings that Exceed the Standard in the Lake Minnetonka Subwatershed Stream Sites	30
24	2014 Lake Grades, Means and TSI Values for Lakes in the Lake Virginia Subwatershed	34
25	2014 Concentration and Load Summary for Lake Virginia Subwatershed Stream Sites..	35
26	The Number of DO Readings that Exceed the Standard in the Lake Virginia Subwatershed Stream Sites	35
27	2014 Lake Grades, Means and TSI Values for Lakes in the Langdon Lake Subwatershed	36
28	2014 Concentration and Load Summary for Langdon Lake Subwatershed Stream Sites	37
29	The Number of DO Readings that Exceed the Standard in the Langdon Lake Subwatershed Stream Sites	37
30	2014 Lake Grades, Means and TSI Values for Lakes in the Long Lake Creek Subwatershed	40
31	2014 Concentration and Load Summary for Long Lake Creek Subwatershed Stream Sites.....	41
32	The Number of DO Readings that Exceed the Standard in the Long Lake Creek Subwatershed Stream Sites	41
33	2014 Lake Grades, Means and TSI Values for Lakes in the Minnehaha Creek Subwatershed	44
34	2014 Concentration and Load Summary for Minnehaha Creek Subwatershed Stream Sites.....	46
35	The Number of DO Readings that Exceed the Standard in Minnehaha Creek Subwatershed Stream Sites	46
36	The Number of <i>E. coli</i> Samples that Exceed the Acute Standard in Minnehaha Creek ...	47
37	2014 Lake Grades, Means and TSI Values for Lakes in the Painter Creek Subwatershed	49
38	2014 Concentration and Load Summary for Painter Creek Subwatershed Stream Sites	50
39	The Number of DO Readings that Exceed the Standard in the Painter Creek Subwatershed Stream Sites	50
40	The Number of <i>E. coli</i> Samples that Exceed the Acute Standard in Painter Creek	50
41	2014 Lake Grades, Means and TSI Values for Lakes in the Schutz Lake Subwatershed ..	52
42	2014 Concentration and Load Summary for Schutz Lake Subwatershed Stream Sites ...	52
43	The Number of DO Readings that Exceed the Standard in the Schutz Lake Subwatershed Stream Sites	53
44	2014 Lake Grades, Means and TSI Values for Lakes in the Six Mile Marsh Subwatershed	55
45	2014 Concentration and Load Summary for Six Mile Marsh Subwatershed Stream Sites.....	57
46	The Number of DO Readings that Exceed the Standard in the Six Mile Marsh Subwatershed Stream Sites	57
47	The Number of <i>E. coli</i> Readings that Exceed the Acute Standard in Six Mile Creek	58

ACRONYMS OF WATER QUALITY TERMS

303 (d) List	Minnesota Pollution Control Agency's List of Impaired Waters under the Clean Water Act
CAMP	Citizen Assisted Monitoring Program
CFS	cubic feet per seconds
CFU/100 mL	colony forming units per 100 milliliters
CPR	Citizen Precipitation Recorders
DO	dissolved oxygen
CHLA	chlorophyll- <i>a</i>
Cl	chloride
EPA	Environmental Protection Agency
EQUIS	Environmental Quality Information System
GPS	Global Positioning System
lbs	pounds
LMCD	Lake Minnetonka Conservation District
MCES	Metropolitan Council Environmental Services
MCWD	Minnehaha Creek Watershed District
mg/L (ppm)	milligrams per liter, parts per million
µg/L (ppb)	micrograms per liter, parts per billion
µS/cm	micro Siemens per centimeter
MnDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
MPRB	Minneapolis Park and Recreation Board
MSP	Minneapolis – St Paul International Airport
NCHF	North Central Hardwood Forest (Ecoregion)
NOAA	National Oceanic and Atmospheric Administration
OHW	Ordinary high water (level)
NWS	National Weather Service
QA	Quality Assurance
QC	Quality Control
SECC	Secchi depth
SRP	soluble reactive phosphorus
TMDL	Total Maximum Daily Load
TN	total nitrogen
TP	total phosphorus
TRPD	Three Rivers Park District
TSI	Trophic Status Index
TSS	total suspended solid

GLOSSARY

Chloride: a compound of chlorine with another element or group, like a salt of the anion Cl^- . The concentration of chloride found in surface water often correlates with the proportion of impervious surfaces in a watershed. Once road salt is applied, chloride remains in a waterbody, and therefore, the watershed until it is flushed downstream.

Chlorophyll-a: Chlorophyll-*a* concentration is a proxy for phytoplankton (algae) biomass in the water.

Dissolved Oxygen: The amount of oxygen present in in the water which can indicate the ability of that waterbody to support aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams that vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Epilimnion: Upper layer of more or less uniformly warm, circulating, and fairly turbulent water during summer stratification.

Escherichia coli (E. coli): *E. coli* are a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication: Is excessive nutrients that accumulates in a waterbody that can support a dense growth of algae and plants. The resulting growth depletes oxygen that is needed to support aquatic life.

Hydraulic: The scientific study of liquid in motion and the forces and pressures associated with them.

Hydrology: Waters of the earth, their movement and occurrences on the surface and underground, and how it cycles as evaporation, precipitation, and flow to waterbodies.

Hypolimnion: The lowest stratum during summer stratification, which changes very little in temperature

Internal Loading: Release of phosphorus from lake sediments during oxygen-depleted conditions. Depending on the overall nutrient budget for a lake, internal loading can be a major source of in-lake phosphorus annually and can contribute to eutrophication.

Macrophyte: A relatively large aquatic plant. Examples include floating-leaved (e.g., water lilies), submerged (e.g., coontail), and emergent (e.g., cattail).

Metalimnion: The layer between the epilimnion and hypolimnion that exhibits a marked thermal discontinuity.

Nitrogen: Algae and other plants require N as a primary nutrient. Ammonia and nitrate N are the chief forms susceptible to algal and plant uptake, but certain dissolved organic forms can also be assimilated. Measurement of N provides insight into the total potential for algal and plant growth.

Nitrate: Nitrate-N is nitrogen dissolved as nitrate ion (NO_3^-). Elevated nitrate levels usually indicate bacterial nitrification, which is typical of sewage-contaminated waters.

Tailwater: Refers to waters located immediately downstream from a hydraulic structure, such as a dam

Total Kjeldahl-Nitrogen: Total Kjeldahl-Nitrogen (TKN) measures the total of all N in the form of either organic-N or ammonia-N. Organic-N includes particulate forms (such as cell matter from algae or bacteria, and sewage solids) and dissolved forms (such as proteins and peptides).

pH: pH measures the concentration of hydrogen ion (H^+) in water. Surface waters in the metropolitan area are usually basic (pH greater than 7.0), due to plant and algal photosynthesis and geologic characteristics.

Phosphorus: Total phosphorus (TP) measures the sum of all forms. Settling of solids, algal and bacterial cell matter, as well as uptake by rooted plants, removes P from the water. TP measurements show the maximum potential for algal growth and can be used to classify the trophic status of a lake.

Soluble Reactive Phosphorus: Soluble reactive phosphorus (SRP) or orthophosphate measurements show the amount of P immediately available for algae and plant life.

Secchi Depth: The Secchi depth provides a physical measurement of water clarity by observation of the Secchi disc at the maximum visual depth in the water column. Secchi depth is an indicator of algal population density and turbidity, and can be utilized to classify the trophic status of the lake.

Specific Conductance: Specific conductance is a measure of the water's ability to act as a conductor. High conductivity is an indicator of low water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Trophic State: The trophic state of a lake is a *qualitative* description of biological productivity. Common terms include eutrophic mesotrophic and oligotrophic

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.

EXECUTIVE SUMMARY

The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek watershed (Figure 1). The 2014 monitoring season results are summarized by subwatershed. Record high precipitation and unprecedented flooding across the entire watershed occurred in late spring into summer. This resulted in many of the lakes and streams reaching record high water levels and discharge rates. This also contributed to an increase in nutrient loading to streams and lakes.

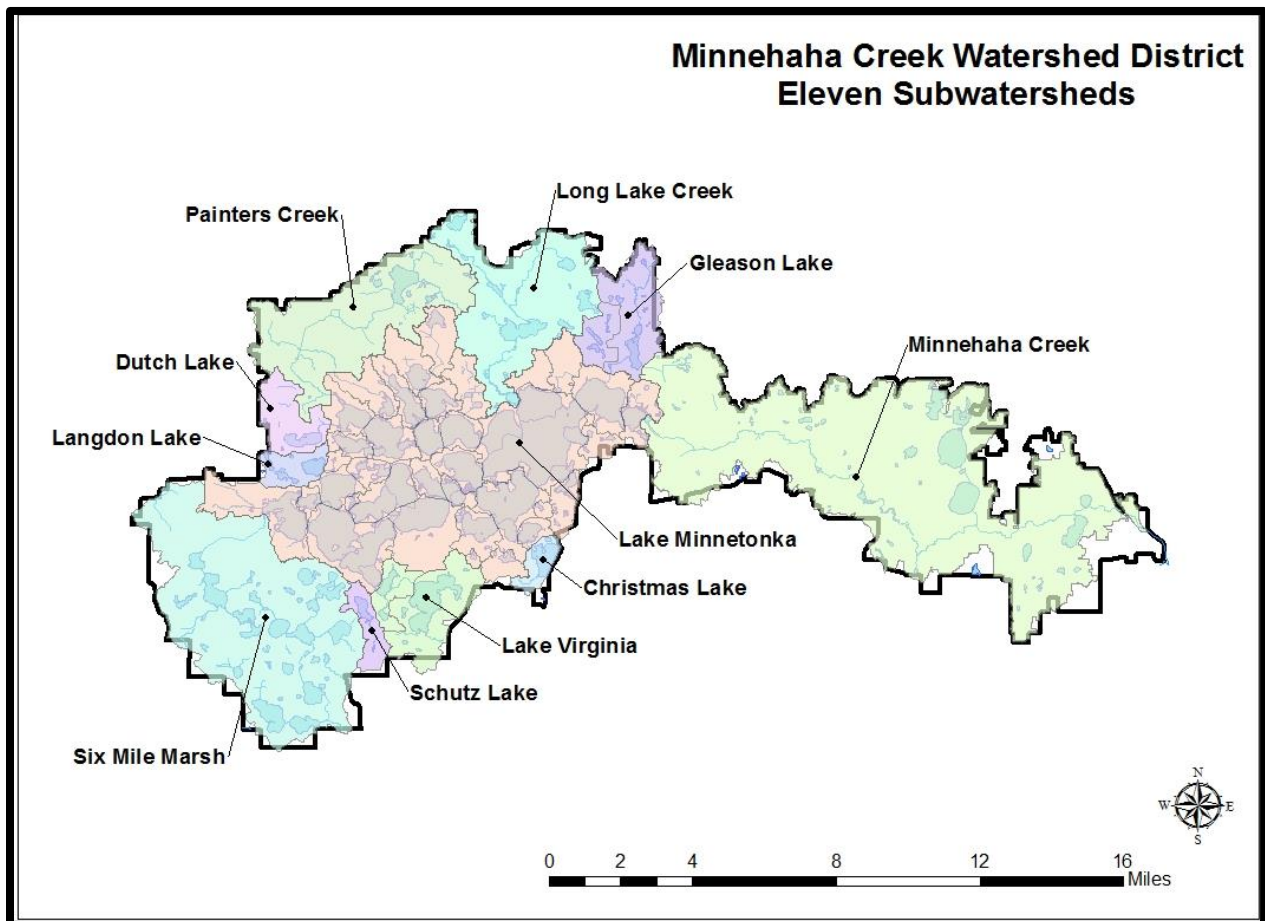


Figure 1. The Subwatersheds of Minnehaha Creek Watershed District

Each subwatershed section below details the following: (1) the number of waterbodies monitored in 2014, (2) the standards the lakes did not meet in 2014, and (3) the lakes that need to be evaluated for impairment. Figures 2 and 3 show the lakes that are currently on the MPCA's 303 (d) List of Impaired Waters for nutrient and chloride impairments, as well as the lakes needing to be evaluated for impairment (Note: At this time, there is no eutrophication standards to assess the water quality in wetland, represented in the tables as black).

Christmas Lake Subwatershed: Christmas Lake and two stream sites on Christmas Lake Creek were monitored in 2014.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Christmas				

Dutch Lake Subwatershed: Dutch Lake and two stream sites on Dutch Lake Creek were monitored in 2014.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Dutch	X	X	X	

Gleason Lake Subwatershed: There were two lakes and two stream sites on Gleason Lake Creek monitored in 2014.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Gleason		X	X	
Unnamed West	N/A	N/A	N/A	

N/A means insufficient data to assess if standards have been met

Lake Minnetonka Subwatershed: There were 20 bays/lakes on Lake Minnetonka, one upper watershed lake, and three streams monitored in 2014. Harrisons Bay was not monitored in 2014, but has statistically similar water quality as West Arm. Harrisons Bay is currently not on the 303 (d) List of Impaired Waters, and the past data indicates the need to be evaluated for nutrient impairment.

(X) Indicates Not Meeting the Standard in 2014																					
	Lake Minnetonka																				
Lake	Black	Carsons	Cooks	Crystal	Forest	Gideon	Grays	Halsted	Jennings	Lafayette	LL South	Maxwell	Peavey	Priests	Spring Park	St. Albans	Stubbs	Wayzata	West Arm	West Upper	Williams
SECC					X			X	X								X		X		
CHLA			X	X	X			X	X					X			X		X		
TP					X			X	X				X	X			X		X		
CI													X								

Lake Virginia Subwatershed: In 2014, there were four lakes and one stream site monitored (Note: Lake Minnewashta has two sites).

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Minnewashta		X		
Minnewashta: South Bay				
St. Joe				
Tamarack		X		
Virginia			X	

Langdon Lake Subwatershed: Langdon Lake and two stream sites on Langdon Lake Creek were monitored in 2014.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Langdon	X	X	X	

Long Lake Creek Subwatershed: In 2014, there were seven lakes and three stream sites on Long Lake Creek monitored.

Lake	(X) Indicates Not Meeting the Standard in 2014						
	Dickeys	Holy Name	Lake Minkta: Tanager	Lydiard	Long	Mooney	Wolsfeld
SECC			X		X	X	X
CHLA			X		X	X	N/A
TP	X		X		X		X
CI							

N/A means insufficient data to assess if standards have been met

Minnehaha Creek Subwatershed: There were 19 lakes, two wetlands, one site on Gleason Lake Creek, and 11 stream sites on Minnehaha Creek monitored in 2014. Pamela Lake needs to be evaluated for chloride impairment; where Powderhorn and South Oak lakes needs to be evaluated for nutrient impairment.

Lake/ Wetland**	(X) Indicates Not Meeting the Standard in 2014																			
	Bass**	Brownie	Calhoun	Cedar	Cobblecrest	Diamond**	Grass	Hannan	Harriet	Hiawatha*	Isles	Meadowbrook	Mother	Nokomis*	Pamela	Powderhorn	South Oak	Twin	Victoria	Windsor
SECC					N/A										X	X	X	X	X	N/A
CHLA					N/A			X			X	X	X		X	X	X	X	X	X
TP					N/A		X	X		X					N/A	X	X	X	X	X
CI		X			N/A	X									X	X		X		

*Site-Specific Standards; N/A means insufficient data to assess if standards have been met; no eutrophication standards to assess the water quality in wetland, represented in the tables as black

Painter Creek Subwatershed: There were one lake, one wetland and five stream sites on Painter Creek monitored in 2014.

Lake/Wetland**	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Katrina**				N/A
Thies	X	X	X	

No eutrophication standards to assess the water quality in wetland, represented in the tables as black

Schutz Lake Subwatershed: Schutz Lake and Schutz Lake Creek are the only waterbodies monitored in 2014.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Schutz		X	X	

Six Mile Marsh Subwatershed: There were 18 lakes, one wetland and 12 stream sites on Six Mile Creek monitored in 2014. Lundsten Lake South is currently not on the 303 (d) List of Impaired Waters, and needs to be evaluated for nutrient impairment.

Lake/ Wetland**	(X) Indicates Not Meeting the Standard in 2014																		
	Carl Krey	Church	East Auburn	West Auburn	Keslers	Lundsten: North	Lundsten: South	Marsh	Mud**	Parley	Piersons	Steiger	Stone	Sunny (Zumbra-Sunny)	Turbid	Wassermann	Wassermann: West	Wassermann Pond: North	Wassermann Pond: South
SECC							X								X	X			
CHLA		X	X	X	X	X	X			X	X			X	X	X	X		
TP		X	X			X	X			X				X	X	X	X	X	
CI																			

No eutrophication standards to assess the water quality in wetland, represented in the tables as black

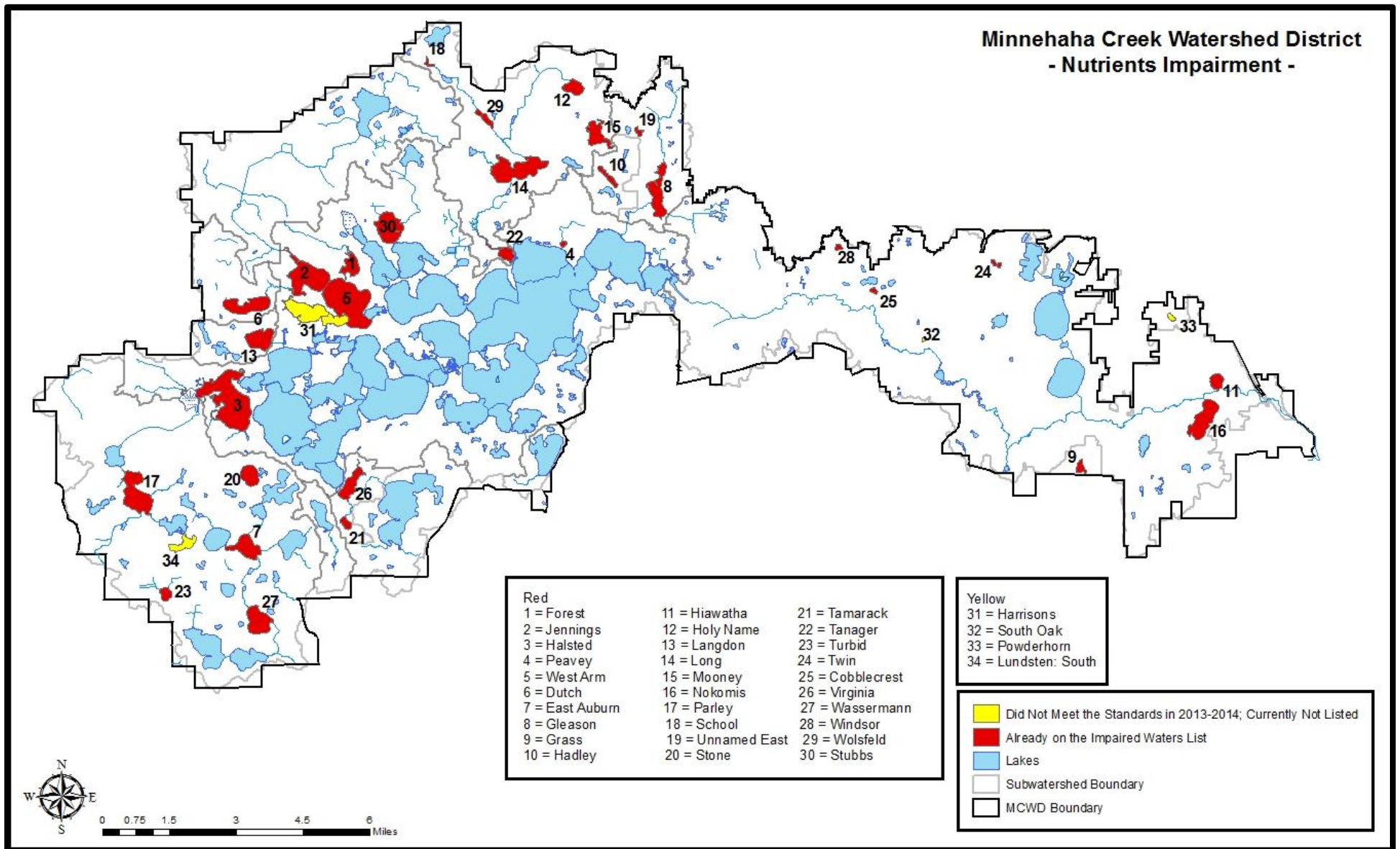


Figure 2. Lakes within MCWD that did not meet the North Central Hardwood Forest Ecoregion Eutrophication Standards in 2013-2014

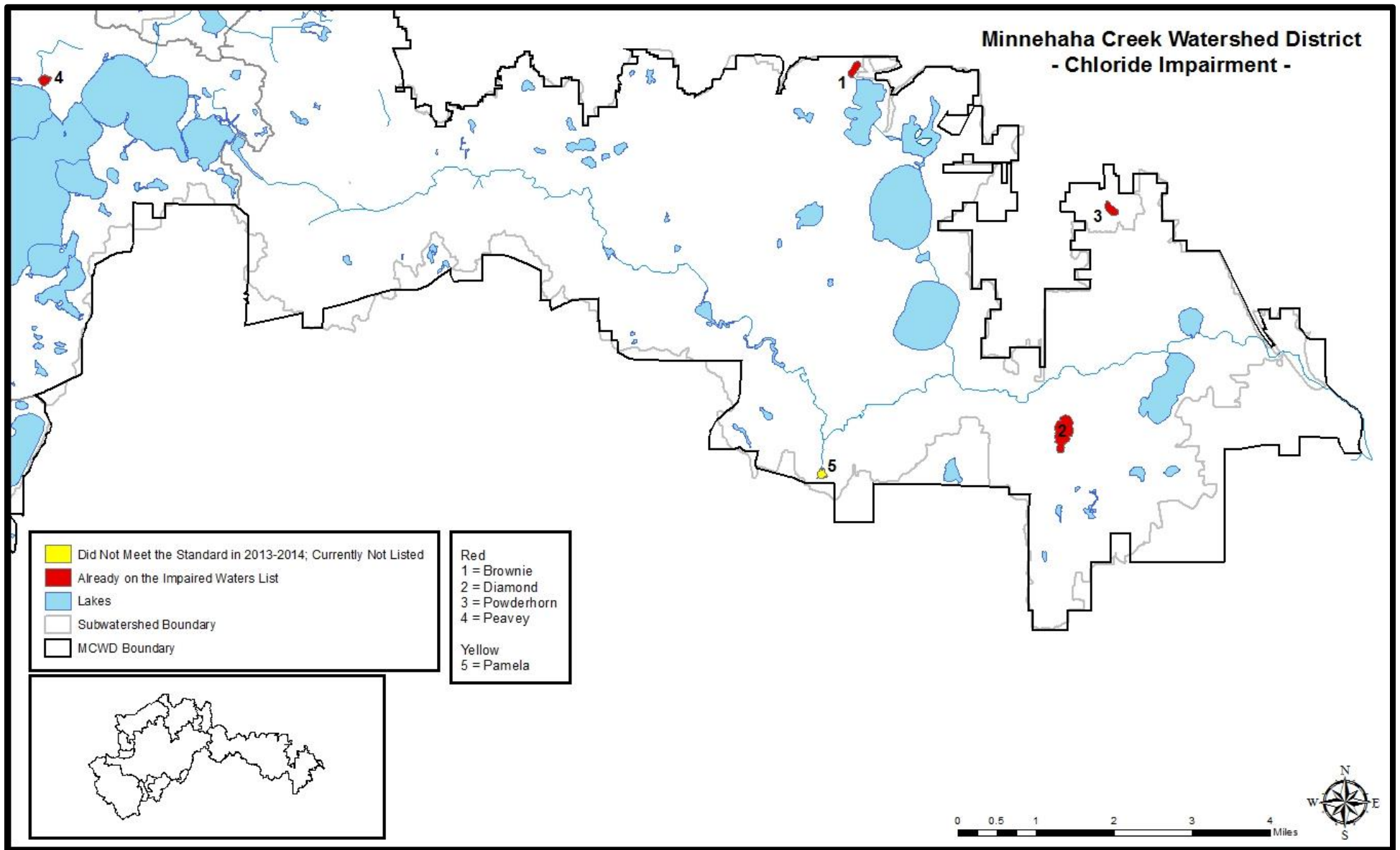


Figure 3. Lakes within MCWD that did not meet the North Central Hardwood Forest Chloride Standard in 2013-2014

INTRODUCTION

1.1 Minnehaha Creek Watershed District

The Minnehaha Creek Watershed District (MCWD) was established in 1967, and is responsible for managing and protecting the water resources of the Minnehaha Creek watershed drainage basin in parts of Minneapolis, Minnesota and its western suburbs.

The MCWD seeks to conserve the natural resources of Minnehaha Creek watershed through efforts in monitoring, protecting, restoring, education and communication. MCWD is responsible for 181 square miles that drain into the Minnehaha Creek and ultimately the Mississippi River. The watershed district includes eight major creeks, 129 lakes, and thousands of wetlands throughout all or part of 27 cities, 2 townships and 2 counties.

The watershed of Minnehaha Creek includes approximately 151 square miles in Hennepin County and 30 square miles in Carver County. The upper watershed includes Lake Minnetonka (est. 14,101 acres) and the land that drains into Lake Minnetonka. The lower watershed includes Minnehaha Creek (22 miles) and the land that drains into the Minnehaha Creek below Lake Minnetonka. The Lake Minnetonka outlet is located at Gray's Bay Dam, the headwaters of Minnehaha Creek (Figure 4).

The major hydrologic features of the watershed include Lake Minnetonka, Minnehaha Creek, the Minneapolis Chain of Lakes, and Minnehaha Falls. Each watershed feature provides unique recreational opportunities and aesthetic resources. Through monitoring and analysis of the streams and lakes, MCWD has identified areas of water quality degradation and flooding. MCWD has then used this knowledge to develop and implement solutions that improve or maintain the water quality throughout the watershed.

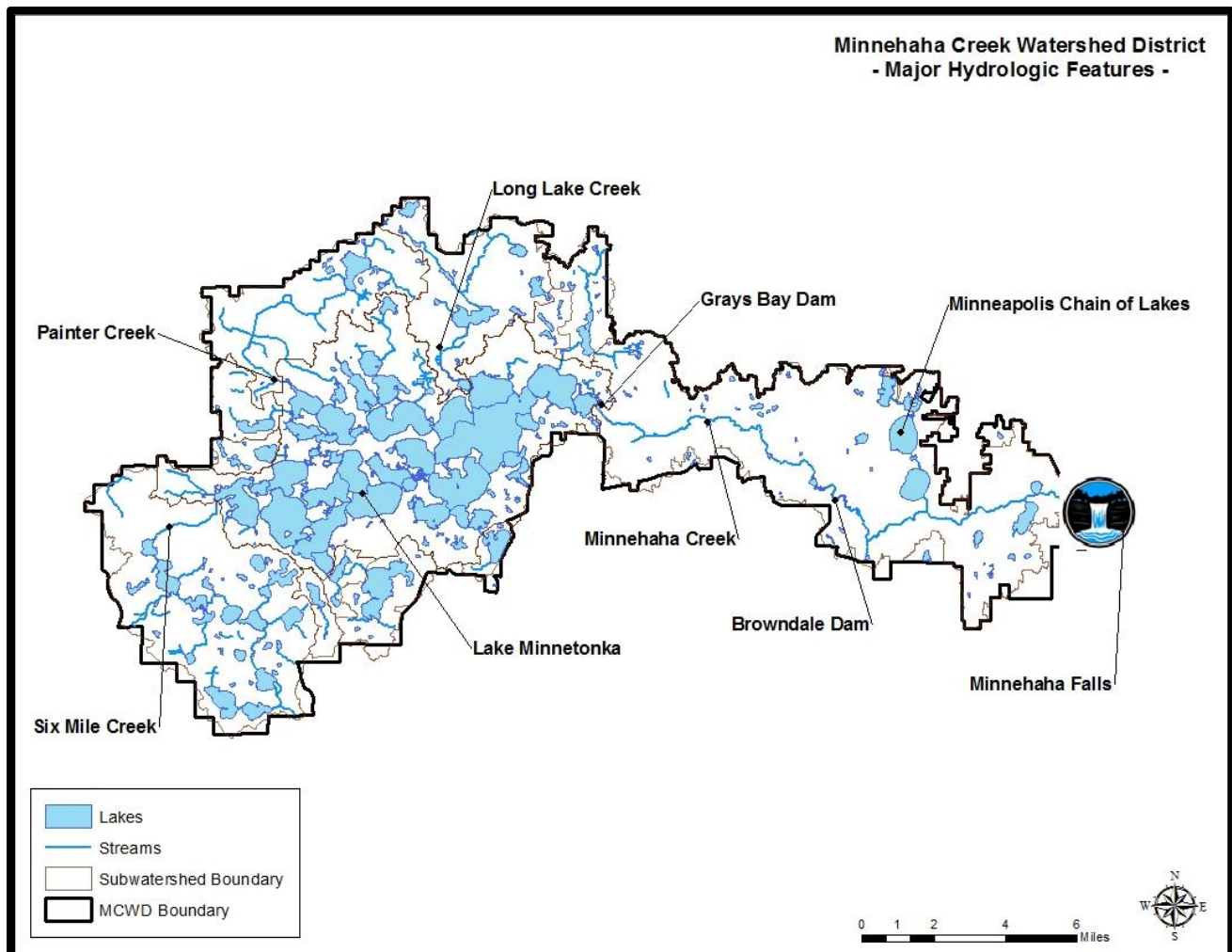


Figure 4. Map of the Minnehaha Creek Watershed District

1.2 The Water Quality Program

The MCWD has an extensive hydrologic and hydraulic data monitoring program which collects and analyzes precipitation, water level, discharge, water quality, stream flow, and groundwater level data. The MCWD publishes the information in an annual water quality monitoring report and technical appendix, which can be found on the MCWD website at www.minnehahacreek.org. Past water quality annual reports are available upon request. Historical hydrologic data that the MCWD has collected since 1968 is maintained through the MCWD's database and is available upon request. Historical data can be found at the MPCA's database (EQuIS).

The Water Quality Program is part of the Research and Monitoring Department, which also encompasses the Aquatic Invasive Species and Ecosystem Evaluation Programs. The Research and Monitoring Department monitors and manages the water resources within watershed district with the Minneapolis Park and Recreation Board (MPRB), Three Rivers Park District (TRPD), Lake Minnetonka Conservation District (LMCD), Metropolitan Council Environmental

Services (MCES) and its Citizen-Assisted Monitoring Program (CAMP), United States Geological Survey (USGS), Minnesota Pollution Control Agency (MPCA), and Minnesota Department of Natural Resources (MnDNR). In 2004, MCWD brought the Water Quality Program in house to conduct and manage the lake and stream monitoring. Since then, the program has expanded and continued to evolve over the years.

The current program is designed to collect and provide hydrologic and hydraulic data to:

1. Calibrate models used by MCWD and other organizations
2. Run statistical analysis of the data every 10 years:
 - Identify long-term trends on the water quality parameters
 - Maximize efficiencies in monitoring frequencies (i.e., biweekly vs. monthly), locations and events
3. Determine whether lakes and streams are meeting their established water quality goals/standards as determined by MCWD and MPCA
4. Identify loading hot spots, lakes with nutrient issues and/or biological issues, and new areas to conduct additional or investigational monitoring
5. Communicate the water quality results to raise awareness about the health of the waterbodies in each subwatershed
6. Conduct ecosystem service (E-Grade) monitoring and analysis by subwatershed (Analysis coming in 2017)
 - Identify stressors/emerging issues that need to be investigated or monitored

Staff updated the following site information for the lakes and streams: lake area, watershed area (both lakes and streams), and watershed to lake area ratio. The updated information is listed in *Monitoring Site Information* tables in each of the Subwatershed Reports.

1.3 The Aquatic Invasive Species Program

The Aquatic Invasive Species (AIS) Program was created in response to the zebra mussel infestation in Lake Minnetonka in 2011. The program implements MCWD's applied AIS research projects and prevention measures in the lakes and streams. Staff collaborate with local agencies, lake associations and residents to develop AIS management plans. Staff also advocates for sound AIS policies in local, state, and federal government. Lastly, the program promotes AIS awareness and education.

1.4 The Ecosystem Evaluation (E-Grade) Program

New to the Research and Monitoring Department in 2014, is the Ecosystem Evaluation Program (E-Grade). The E-Grade Program is a new grading system that provides a holistic view of the health of the entire watershed. This program will allow MCWD to better identify water resource areas that need improvement or protection in each of the 11 subwatersheds, which allows staff to focus management strategies in these areas. The new grading system will continue to incorporate lakes, but will also include additional ecological features and functions (Tables 1-2).

Table 1. Ecological Features Used to Develop the E-Grade Program

Ecological Features
Deep Lakes
Shallow Lakes
Streams
Wetlands
Terrestrial
Groundwater
Hydrology

Table 2. Each Ecological Feature in Table 1 will be Assessed on the List of Ecosystem Functions

Ecosystem Functions
Flood Control
Nutrient Cycling
Biodiversity
Habitat Diversity
Recreation
Drinking Water Supply

The E-Grade Program is under development from 2014-2017. During development, the test subwatersheds for the new grading system are the Lower Minnehaha Creek, Schutz Lake and Six Mile Marsh. These subwatersheds’ reports will be released in the fall of 2017. The remaining subwatersheds will be evaluated and graded on a three-year rotation, with the next reports to be released in 2019 and 2022 (See Section 5). The watershed-wide report for MCWD will be released in 2023.

2. WATER QUALITY ANALYSES

The Minnesota Pollution Control Agency (MPCA) has determined that lakes and streams have unique physical and chemical properties depending on where they are located in the state. Waterbodies within the MCWD reside within the North Central Hardwood Forest Ecoregion (NCHF). This is the transitional area in central Minnesota where the southeastern agricultural area meets the northeastern forested area. This ecoregion is comprised of upland wooded areas, as well as small plains that are used for agriculture. Much of this area has been developed for residential, recreational, urban and agricultural land use. The MPCA has established guidelines and standards specific to the NCHF ecoregion for both lakes and streams. At this time, there are no NCHF guidelines and standards for wetlands.

2.1 Ecoregion Guidelines: The MPCA provides guidelines based on median water quality data that is characteristic for the lakes and streams within the NCHF ecoregion (Table 3).

Table 3. North Central Hardwood Forest Ecoregion Water Quality Guidelines for Lakes and Streams

North Central Hardwood Forest Ecoregion	Water Quality Guidelines (25 th – 75 th percentile)		
	Units	Lakes	Streams
Secchi Depth (SECC)	m	1.5 - 3.2	
Chlorophyll- <i>a</i> (CHLA)	µg/L	5 - 22	
NO _x	mg/L	< 0.01	0.04 - 0.26
Temperature	°C		2 - 21
Total Kjeldahl Nitrogen (TKN)	mg/L	< 0.60 - 1.2	
Total Phosphorus (TP)	µg/L	23 - 50	60 - 150
Total Suspended Solids (TSS)	mg/L	2 - 6	4.8 - 16
pH	N/A	8.6 - 8.8	7.9 - 8.3

2.2 Ecoregion Lake Eutrophication Standards: Ecoregion lake eutrophication standards are used for assessing the recreational use of lakes in Minnesota. The data used for determining impairment must be collected from eight or more monitoring events over two consecutive years. If a lake fails to meet two or more of the water quality standards over the two consecutive years, then the MPCA evaluates listing the lake as impaired for nutrient/ eutrophication biological indicators.

Different eutrophication standards have been established for shallow and deep lakes. Shallow lakes are defined as a having a maximum depth less than 15 feet and a littoral zone less than 80 percent. The NCHF ecoregion eutrophication standards are based on total phosphorus (TP), chlorophyll-*a* (CHLA), and Secchi disc depth (SECC) means collected from June through

September (MPCA, 2014) (Table 4). Site-specific water quality standards have been approved for Lake Hiawatha and Lake Nokomis (Table 4).

Table 4. North Central Hardwood Forest Ecoregion Eutrophication Standards for Shallow and Deep Lakes, and Site-Specific Eutrophication Standards for Lake Hiawatha and Lake Nokomis

North Central Hardwood Forest Ecoregion	Eutrophication Standards (June-Sept Mean)				
	Units	Shallow Lakes	Deep Lakes	Lake Hiawatha	Lake Nokomis
Secchi Depth (SECC)	m	> 1.0	> 1.4	> 1.4	> 1.4
Chlorophyll- <i>a</i> (CHLA)	µg/L	< 20	< 14	< 14	< 20
Total Phosphorus (TP)	µg/L	< 60	< 40	< 50	< 50

2.3 Dissolved Oxygen Standard for Streams: To determine if a stream is able to support aquatic life, at least 20 dissolved oxygen (DO) readings from at least two years in a row is needed. Then from that data set, the standard has to be violated under the following criteria: (1a) more than 10% of the readings collected before 9:00 am May through September or (1b) more than 10% of the total readings from May through September or (1c) more than 10 % of the readings from October through April; and 2) there are at least three violations (Table 5). MCWD uses the criteria (1b) and (2) to evaluate the DO readings in the streams.

Two factors effect DO levels in the watershed district’s streams: intermittent flow and stream stretches classified as ditched. Intermittent streams tend to cease flow occasionally or seasonally. Low flow and/or no water negatively effects DO levels. The MPCA considers ditched streams as streams altered from their natural state, and will evaluate listing these stream sites for DO impairment on a case-by-case basis.

Table 5. Dissolved Oxygen Standard for Streams

DO Standards	
Dissolved Oxygen (DO)	> 5 mg/L

2.4 E. coli Standard for Streams: A minimum of five values per month for at least 3 months between June and September is preferred for determining violations of the *E. coli* standard. The criteria for the *E. coli* standard is shown in Table 6. MCWD uses the acute criteria for determining violation of the *E. coli* standard. The chronic criteria requires five samples within in a month, due to the intermittent streams, staff cannot always meet the sampling requirement.

Table 6. *E. coli* Standard for Recreational Use in Streams

	Chronic	Acute
	Impaired: Geometric mean of not less than 5 samples within any calendar month	Impaired: Not more than 10% of all samples taken during any calendar month individually exceed
<i>E. coli</i>	126 cfu/100 mL	1,260 cfu/100 mL

2.5 Chloride Standard for Lakes and Streams: For lakes to be evaluated for chloride impairment, concentrations of chloride at the surface or bottom of the lake must exceed the chronic or the acute standard by the criteria listed in Table 7. In streams, chronic exceedances of chloride occurs over a four-day average while acute exceedances of chloride occur over a one-hour duration. The criteria for streams to be evaluated for impairment is found in Table 7.

Table 7. North Central Hardwood Forest Ecoregion Chloride Standard for Lakes and Streams

North Central Hardwood Forest Ecoregion	Chloride Standard	
	Chronic	Acute
	Impaired: 2 or more exceedances in 3 years	Impaired: 1 or more exceedances of the max standard
Chloride (Cl)	230 mg/L	860 mg/L

2.6 Lake Water Quality Grades: Currently, MCWD reports lake water quality grades using the Metropolitan Council’s grading system (Osgood, 1989) (Table 8). For each lake, seasonal means are computed for TP, CHLA, and SECC from data collected from five or more monitoring events between May through September (Table 9). See the Technical Report for a complete grade determination.

Table 8. Parameters Ranges for Lake Water Quality Grade Determination

Grade	Total Phosphorus (µg/L)	Chlorophyll-a (µg/L)	Secchi Depth (m)
A	< 23	< 10	> 3
B	23 - 32	10 - 20	3.0 - 2.2
C	32 - 68	20 - 48	2.2 - 1.2
D	68 - 152	48 - 77	1.2 - 0.7
F	> 152	> 77	< 0.7

Table 9. Lake Water Quality Grade Description

Grade	Relative Ranking	Description
A	90% and up	Crystal clear, beautiful. These lakes are exceptional and are enjoyed recreationally without question or hesitation.
B	70 - 90%	These lakes generally have good water quality but algae may limit swimming, particularly toward the end of summer.
C	30 -70%	Average quality. Swimming, boating and fishing may be undesirable relatively early in the season. Algae blooms occasionally.
D	10 - 30%	These lakes have severe algae problems. People are generally not interested in recreation on these lakes.
F	Lowest 10%	Not enjoyable. Such a lake would have several limitations to recreational use.
N/A		Insufficient data to calculate a lake grade (Note: Either < 5 monitoring events and/or the Secchi disk was visible at the bottom of the lake and/or obstructed by vegetation during more than one monitoring event)

2.7 Trophic State Index for Lakes: Trophic State Index (TSI), which measures the productivity level of a lake or trophic state, is calculated from seasonal means of the same three parameters as used by the Metropolitan Council’s grading system. The TSI means are calculated from at least four monitoring events between June through September (Carlson, R.E., 1977). Index numbers for TP, CHLA and SECC range from 0 to 100, and are then averaged to determine an overall TSI score (Table 10) (Carlson, R.E., 1977).

If there is an insufficient number of monitoring events for any of the individual component index numbers, than no average is calculated. If this occurs, MCWD still calculates a TSI score with two of the three individual component index numbers. Lakes, to be classified as swimmable in the seven-county metro area, need to have a TSI score less than or equal to 59. An explanation of the productivity level for a range of TSI scores is in Table 10 (Moore and Thornton, 1998).

Table 10. Description of the Carlson's Trophic State Index

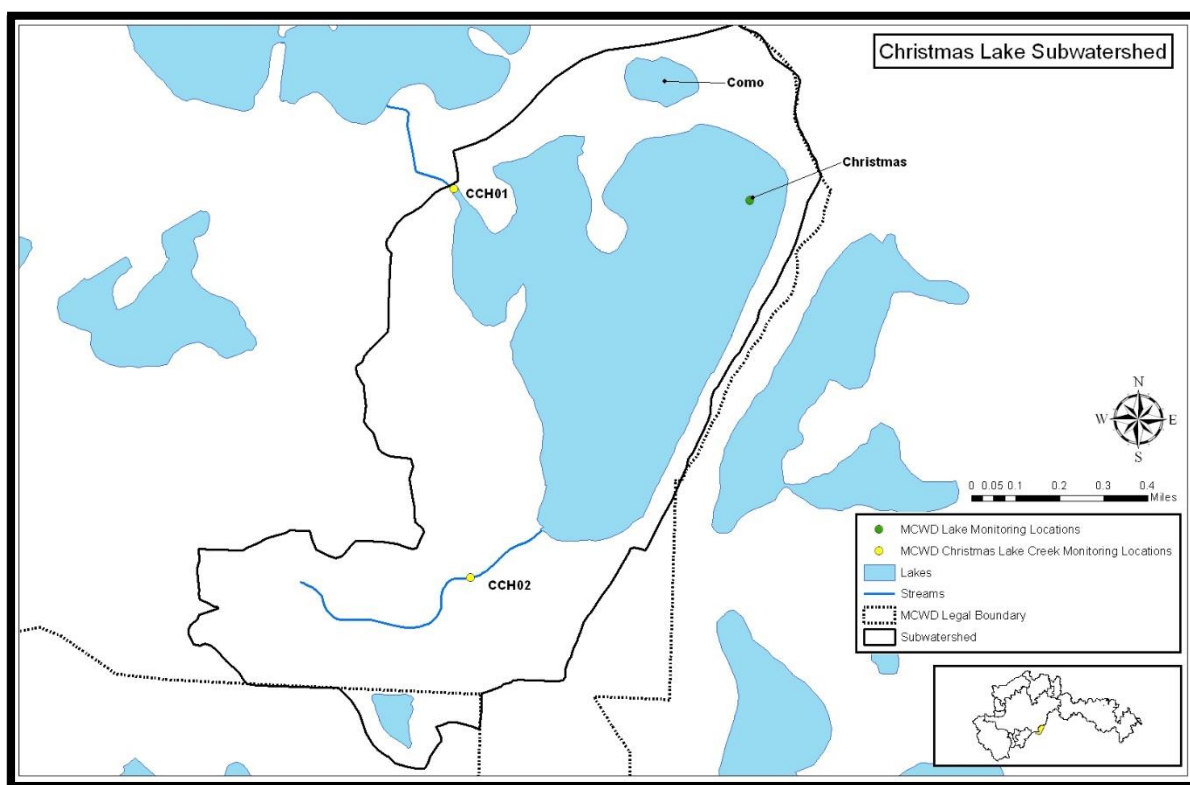
Trophic State	TSI	Description
Oligotrophic	< 30	Clear water, oxygen throughout the year in the hypolimnion. Salmonid fisheries in deep lakes.
	30 - 40	Deeper lakes still exhibit oligotrophic characteristics, but some shallower lakes will become anoxic in the hypolimnion during the summer
Mesotrophic	40 - 50	Water moderately clear, but increasing probability of anoxia in hypolimnion
Eutrophic	50 - 60	Decreased transparency, anoxic hypolimnia during the summer, macrophyte problems evidence, warm-water fisheries only
	60 - 70	Dominance of blue-green algae, algal scum probable, extensive macrophyte problems
Hypereutrophic	70 - 80	Heavy algal blooms possible throughout the summer, dense macrophyte beds, but extent limited by light penetration.
	> 80	Algal scum, summer fish kills, few macrophytes, dominance of rough fish

2.8 Long-term Trend Analysis: MCWD is interested in the long-term trends of SECC (water clarity), CHLA (estimation of algal abundance) and TP (nutrient that affects algal growth). To calculate long-term trendlines on the water quality data in any lake, eight to ten consecutive years of data is needed due to climate pattern impacts on a lake.

The long-term trendline needs to be statistically analyzed to determine if the trend is significant. Trendlines without statistical support maybe misleading. Statistical analysis of long-term trends for the lakes can be found here - <http://minnehahacreek.org/project/lake-data-statistical-analysis>.

3. WATER QUALITY SUMMARY BY SUBWATERSHED

3.1 Christmas Lake Subwatershed



Lake Water Quality: The water quality of Christmas Lake met all the NCHF ecoregion eutrophication standards as well as scored an A grade in 2014 (Table 10). The TSI scores describes Christmas Lake in an oligotrophic state, which supports observations of clear water and oxygen throughout the hypolimnion (Table 11). Chloride (Cl) concentrations in Christmas Lake did not exceed the acute and chronic Cl standard in 2014. High water did not appear to affect the water quality in Christmas Lake for there was no elevated nutrient levels coinciding with the heavy precipitation events.

Zebra mussels infested Christmas Lake in 2014. The mussels are known to deplete phytoplankton from the food web. The absence of phytoplankton may positively affect water clarity, and may negatively affect the food supply of aquatic organisms such as native mussels, invertebrates and fish (MacIssac, 1996). MCWD and the MnDNR diligently worked at eradicating the species from the Christmas Lake. In April 2015, the public access area was declared free of zebra mussels. The lake must remain free of zebra mussels for five years to be removed from the MnDNR's Infested Waters List.

Table 11. 2014 Lake Grades, Means, and TSI Values for Lakes in the Christmas Lake Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
A	Christmas	6.85	2.00	13.25	37

Note: Red indicates not meeting the Standard

Stream Water Quality and Discharge: Christmas Lake Creek: Christmas Lake inlet (CCH02) water quality was within the NCHF ecoregion guidelines in 2014, except for total phosphorus (TP) that had a mean concentration of 284 µg/L. The temperature, total suspended solids (TSS), and TP at the Christmas Lake Creek: Christmas Lake outlet (CCH01) was within the NCHF ecoregion guidelines in 2014.

Christmas Lake Creek: Christmas Lake inlet had a mean annual flow of 0.29 cfs, and the Christmas Lake outlet flow was 0.79 cfs (Table 12). The 2014 TP loading increased by 46% and SRP loading increased by 4% at the inlet site compared to 2013. The TN loading increased by 13% and the CI loading increased by 19% compared to 2013. The Christmas Lake outlet had insufficient data in 2013, therefore unable to compare 2014 loading results.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

The Christmas Lake inlet had two dissolved oxygen (DO) violations (< 5 mg/L) between June and July. The DO concentrations were above standard at the outlet until the waters became stagnant in late July (Table 13).

Table 12. 2014 Concentration and Load Summary for Christmas Subwatershed Stream Sites

Station	Christmas Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	CI (mg/L)	TP	SRP	TN	TSS*	CI*
CCH02	Inlet	176.73	0.29	238	84	1.28	3	23	136	48	729	2	13
CCH01	Outlet	565.51	0.79	26	1	0.43	3	28	40	1	659	4.6	43

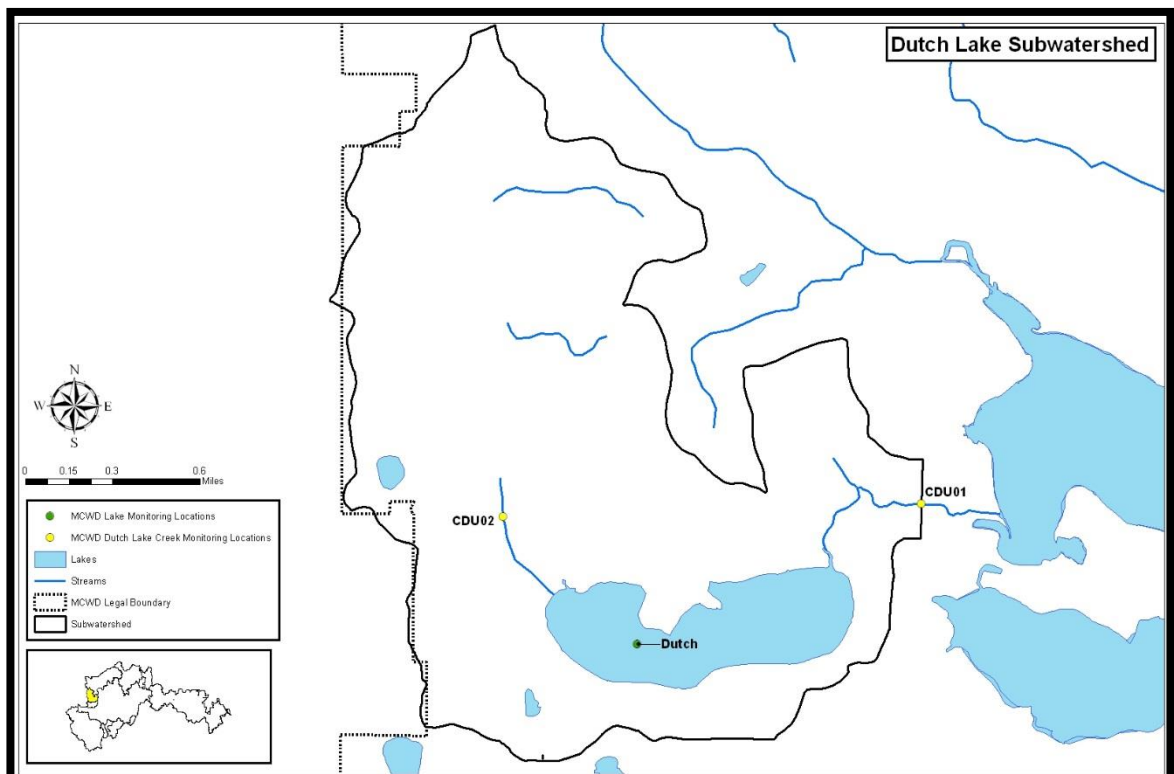
*Multiply Load by 1000

Table 13. The Number of DO Readings that Exceeded the Standard in the Christmas Lake Subwatershed Stream Sites

Month - 2014	CCH02	CCH01
May	0	0
June	1	0
July	1	1
August	0	
September	0	
Total	2	1
Total # of Samples	18	12
Total % of Samples Exceeded DO Standard	11%	8%

Subwatershed Diagnosis: Christmas Lake Creek: Christmas Lake inlet (CCH02) is a hot spot for TP and TN loading into Christmas Lake. Christmas Lake does not have a nutrient issue, but AIS have invaded the lake. The E-Grade Program will be assessing the Christmas Lake Subwatershed from 2019-2021. MCWD will be monitoring Lake Como and stream sites between Lake Como and Christmas Lake to complete data gaps.

3.2 Dutch Lake Subwatershed



Lake Water Quality: The TP concentrations increased in Dutch Lake in June and October, when

heavy precipitation occurred in the subwatershed. Algal abundance increased in July, most likely in response to the nutrient loading that occurred in June. Overall, the water quality in Dutch Lake did not meet the three NCHF ecoregion eutrophication standards, and received a D+ water quality lake grade in 2014 (Table 14). The TSI scores indicates the lake is eutrophic supporting observations of algae blooms and dense aquatic plant beds in the shallower areas of the lake. Algal blooms and poor water clarity makes recreational activities undesirable at certain times of the year. The CI concentrations in Dutch Lake did not exceed the acute and chronic CI standard in 2014.

Table 14. 2014 Lake Grades, Means and TSI Values for Lakes in the Dutch Lake Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
D+	Dutch	0.97	44.25	113.75	67

Note: Red indicates not meeting the Standard

Stream Water Quality and Discharge: Dutch Lake Creek: Dutch Lake inlet (CDU02) temperature and TSS were within the NCHF ecoregion guidelines in 2014, but there was an exceedance for TP with a mean concentration of 346 µg/L. Temperature, TSS, and TP at the Dutch Lake Creek: Dutch Lake outlet (CDU01) were within the NCHF ecoregion guidelines throughout 2014.

In 2014, Dutch Lake Creek: Dutch Lake inlet had a mean annual flow of 1.36 cfs. The flow at Dutch Lake outlet was slightly faster, than the inlet site, at mean annual rate of 2.74 cfs (Table 15). The 2014 TP and SRP loading decreased at the inlet site compared to 2013. The 2014 TP loading increased by 41% and SRP loading increased 25% at the outlet site compared to the 2013. The 2014 TN loading increased by 152% at the inlet site and 104% at the outlet site compared to the 2013. The 2014 CI loading increased by 248% at the inlet site and 165% at the outlet site compared to the 2013. The 2014 TSS loading increased by 260% at the inlet site and 168% at the outlet site compared to the 2013.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

The Dutch Lake inlet had 11 violations with DO (< 5 mg/L) between May and July, where the outlet site had 10 violations between May-August. Aquatic life would most likely be stressed at both sites in the Dutch Lake Creek (Table 16).

Table 15. 2014 Concentration and Load Summary for Dutch Lake Subwatershed Stream Sites

Station	Dutch Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	Cl (mg/L)	TP	SRP	TN	TSS*	Cl*
CDU02	Inlet	608.67	1.36	305	109	1.41	7	30	818	294	3779	18	80
CDU01	Outlet	987.56	2.74	99	37	1.64	11	42	533	198	8864	59	228

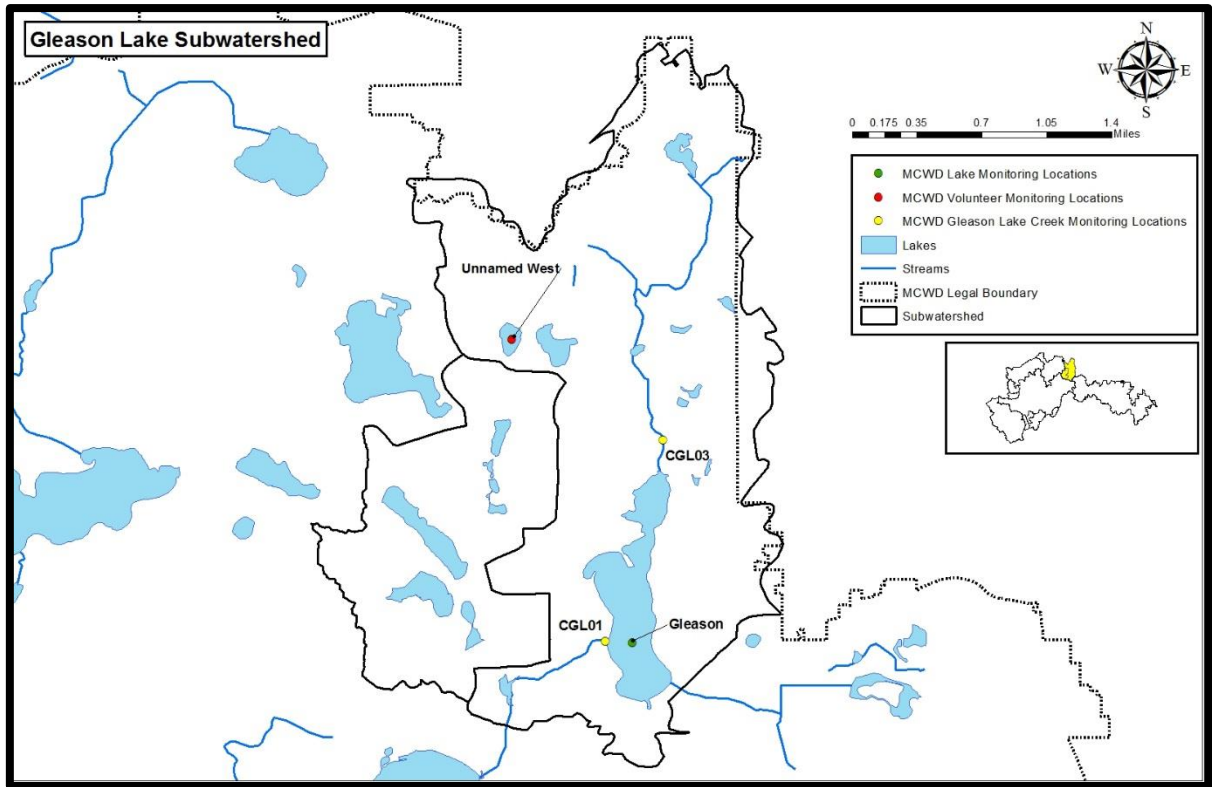
*Multiply the load by 1000

Table 16. The Number of DO Readings that Exceed the Standard in the Dutch Lake Subwatershed Stream Sites

Month - 2014	CDU02	CDU01
May	3	1
June	5	4
July	3	2
August	0	3
September	0	0
Total	11	10
Total # of Samples	14	22
Total % of Samples Exceeded DO Standard	79%	45%

Subwatershed Diagnosis: Dutch Lake is used for such recreational activities as swimming, boating, water-skiing and fishing. The northern shoreline is forested and has an active YMCA camp site. Protecting Dutch Lake from further degradation is important to preserving the ecosystem and recreational enjoyment of the lake. The TP loading at the Dutch Lake Creek: Dutch Lake inlet has fluctuated over the years depending on flow and concentration. Since 2013, TP and SRP loading at the inlet site showed a reduction of 1% and 48% respectively. This decrease could be due to the installation of the Dutch Lake sand iron filter project directly upstream of this site. The Dutch Lake Creek inlet and outlet sites are both high contributors of TN, Cl, and TSS with all parameter's loading increasing more than 100% from the previous year. Additional investigational studies are recommended.

3.3 Gleason Lake Subwatershed



Lake Water Quality: Gleason Lake did not meet two of the three NCHF ecoregion eutrophication standards for shallow lakes in 2014 (Table 17). The water quality of Gleason Lake also received a D+ grade. Filamentous green algae and coontail overgrowth in the shallow areas are observed in Gleason Lake and inhibit recreational activities in the northern bay. Data indicates algal blooms and elevated TP levels occurred in July and August contributing to poorer water quality.

The past four years, Gleason Lake productivity was on the low end of eutrophic scale. Resource management projects within the Gleason Lake Subwatershed (i.e., stream restoration, curlyleaf pondweed management) may have contributed to the improved trophic state. In 2014, the TSI score for Gleason Lake indicates a return to the higher end of the eutrophic scale (Table 17). Chloride concentrations in Gleason Lake in 2014 did not exceed the acute and chronic CI standard.

Unnamed West Lake (west of CR 101) had insufficient data to determine if the standards were met, and to calculate a water quality grade and a TSI score. Data indicated elevated phosphorus levels and limited water clarity (Table 17). Chloride concentrations in Unnamed West Lake did not exceed the acute and chronic CI standard in 2014.

Table 17. 2014 Lake Grades, Means and TSI Values for Lakes in the Gleason Lake Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
D+	Gleason*	1.08	85.75	97.50	68
N/A	Unnamed West Lake*				N/A

Note: Red indicates not meeting the Standard; * Shallow lake

Stream Water Quality and Discharge: Gleason Lake Creek: Gleason Lake inlet (CGL03) temperature and TSS were within the NCHF ecoregion guidelines in 2014, but there was an exceedance for TP. The TP mean concentration was slightly higher than the guideline at 172 µg/L. The Gleason Lake Creek: Gleason Lake outlet (CGL01) was within the NCHF guideline ranges for temperature, TSS and TP in 2014.

The mean annual flow at the Gleason Lake Creek: Gleason Lake inlet was 1.99 cfs. The Gleason Lake Creek: Gleason Lake outlet had a mean annual flow of 1.53 cfs. The outlet went dry at end of July (Table 18). The 2014 TN loading at the inlet site increased by 176% compared to 2013. The 2014 CI loading at the inlet site increased by 109% compared to 2013. At the lake outlet site, the 2014 TP loading increased by 60% and the SRP loading increased by 31% compared to 2013. The 2014 TN loading increased by 343% and the CI loading increased by 247% compared to 2013.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

The DO concentrations at the lake inlet were never below the DO standard in 2014, indicating full support of aquatic life. By early August, Gleason Lake was not discharging water. In late July, before the lake stopped discharging water, the lake outlet site had two DO violations (Table 19).

Table 18. 2014 Concentration and Load Summary for Gleason Lake Subwatershed Stream Sites

Station	Gleason Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	CI (mg/L)	TP	SRP	TN	TSS*	CI*
CGL03	Inlet	1642.10	1.99	147	79	1.27	4	129	576	308	4978	15	505
CGL01	Outlet	962.97	1.53	47	6	0.78	3	110	141	17	2354	9	333

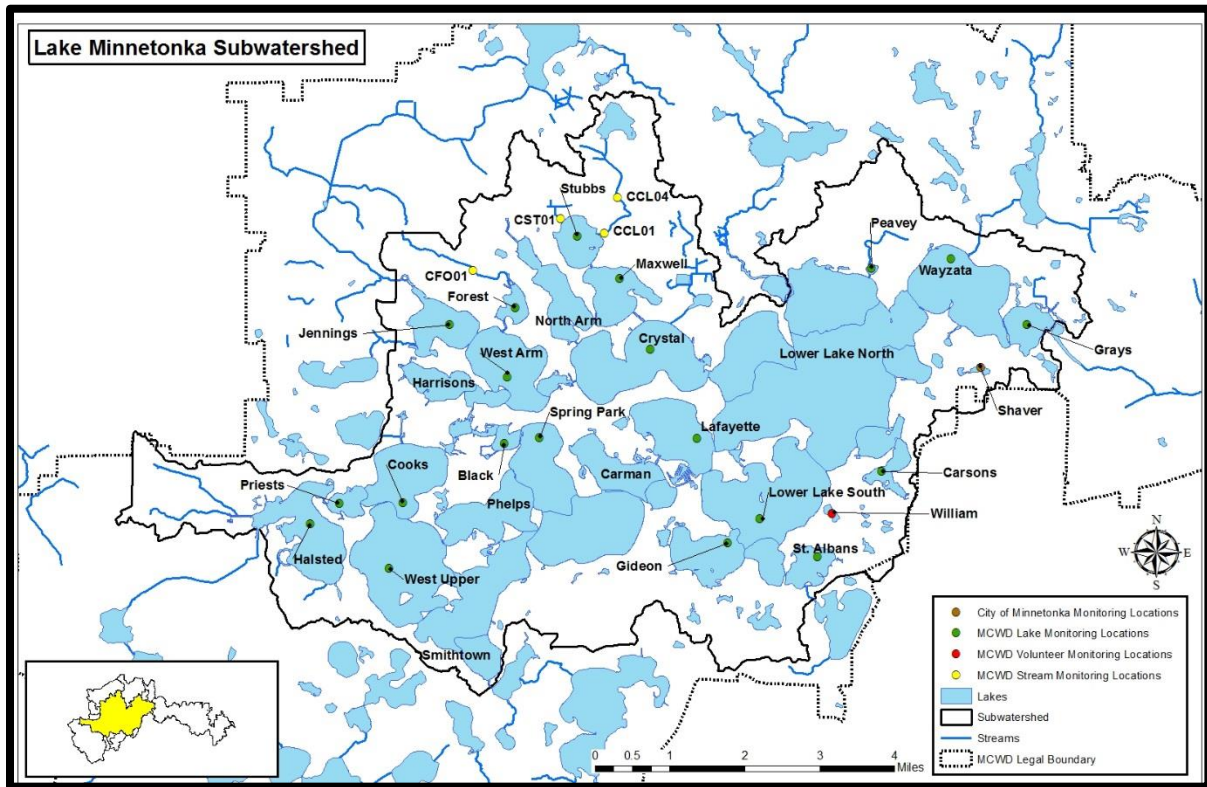
*Multiply Load by 1000

Table 19. The Number of DO Readings that Exceed the Standard in the Gleason Lake Subwatershed Stream Sites

Month - 2014	CGL03	CGL01
May	0	0
June	0	0
July	0	2
August	0	
September	0	
Total	0	2
Total # of Samples	21	13
Total % of Samples Exceeded DO Standard	0%	15%

Subwatershed Diagnosis: The Gleason Lake Creek: Gleason Lake inlet is a hot spot for TP, SRP, TN, TSS and Cl loading, though there was a reduction in TP, SRP, and TSS this year when compared to the previous year. Gleason Lake has an internal phosphorus loading issue that involves the plant and algal community. MCWD conducted a statistical analysis in 2014 which revealed that from 1997-2012 there was statistically significant declining trend in phosphorus concentrations at the bottom of the Gleason Lake. Lower phosphorus concentrations in the hypolimnion, theoretically indicates lower amounts of phosphorus to recycle during mixing events. However, the phosphorus is most likely being stored in the coontail and algae, and then released into the water upon decay.

3.4 Lake Minnetonka Subwatershed



Lake Water Quality: There are about 35 bays on Lake Minnetonka, and prior to 2014, the Water Quality Program was monitoring 26 of the 35 bays. In 2013, statistical analysis of the water quality data on Lake Minnetonka indicated that six bays (Carman, Harrison, Lower Lake North, North Arm, Phelps and Smithtown) had statistically similar water quality to adjacent bays. Based on this analysis, the Water Quality Program dropped monitoring those six bays in 2014. Those six bays will be monitored every three years, starting again in 2016, to assure their water quality is remaining statistically similar to the adjacent bays (Table 20).

Table 20. Lake Minnetonka Bays with Statistically Similar Water Quality

Carman Bay ≈ Spring Park Bay
Harrison Bay ≈ West Arm
Lower Lake North ≈ Lower Lake South and Wayzata Bay
North Arm ≈ Maxwell Bay
Phelps Bay ≈ Spring Park Bay and West Upper Lake
Smithtown Bay ≈ West Upper Lake

Nine of the 20 bays met the NCHF ecoregion eutrophication standards, and received an A (including A-) water quality grade in 2014. The eastern bays of Carsons, Gideon, Grays, Lafayette, Lower Lake South, St. Albans, Wayzata and the western bays of Spring Park and West

Upper Lake have clear water with little to no algae issues that inhibit recreational activity. The TSI scores indicate that Grays and St. Albans bays have oligotrophic characteristics. Both bays trophic state have improved since 2013. The other bays that received an A grade have mesotrophic characteristics according to their TSI scores (Table 21).

Black Lake and Maxwell Bay met the NCHF ecoregion eutrophication standards, and received a B (including B+) water quality grade in 2014. The TSI scores supports the mesotrophic characteristics of these bays - moderately clear water, but increased chance of anoxia in the hypolimnion. Cooks and Crystal bays received B- water quality grade in 2014, but water quality in these two bays exceeded the CHLA standard for deep lakes. The TSI scores supports the eutrophic characteristics of these bays - decreased water clarity and anoxia in the hypolimnia throughout the summer (Table 21).

A MCWD trained volunteer monitors Lake William. In 2014, the water quality in Lake William met the NCHF ecoregion eutrophication standards for shallow lakes, and received a C+ water quality grade. The TSI scores characterizes the lake as eutrophic, and the TP levels and limited water clarity in Lake William support that trophic state. Peavey Lake and Priests Bay on Lake Minnetonka also received a C water quality grade (including C-) in 2014. Peavey Lake did not meet the TP standard, where Priests Bay did not meet the CHLA and TP standards. The TSI scores supports the eutrophic condition of these five bays - the elevated TP concentrations and green water (indication of high levels of algae) from middle of summer to late fall support that trophic state (Table 21).

Forest Lake, Halsted Bay, Jennings Bay, Stubbs Bay and West Arm on Lake Minnetonka, located in the west and northwest area of the lake, did not meet the three NCHF ecoregion eutrophication standards in 2014. These bays also received a D (including D+) water quality lake grade. These bays are have severe algae issues that can inhibit recreational activity. Based on the TSI scores, the five bays are eutrophic. These five bays have high algal abundance leaving the surface waters with a brown or green color for most of the summer. Large algal blooms occur too, mostly blue greens, which lead to light limitations and reduce aquatic plant growth (Table 21).

All the lakes and bays in the Lake Minnetonka Subwatershed, except for Peavey Lake, have Cl concentrations that are below the Cl standard. Peavey Lake is already on the 303 (d) List of Impaired Waters for chloride.

High water and elevated nutrient loading impacted Lake Minnetonka this open-water season. High water affected recreation on the lake throughout most of the summer as no-wake zone was implemented to protect the shoreline from erosion. Unfortunately, Long Lake Creek, Painter Creek, and Six Mile Creek delivered nutrient-rich waters to the northwestern bays (i.e., Forest, Jennings, Halsted, and Stubbs) on Lake Minnetonka from May to July. TP concentrations increased in June-July for Priests, Cooks and Crystal bays. The water quality in the eastern bays (i.e., Lower Lake North, Gideon, Wayzata, and Grays) did not appear to have been affected, as there was no elevated nutrient concentrations during June-July as seen in the other bays' data.

The sources of nutrients entering the eastern bays from the surrounding subwatersheds is less compared to the western bays.

Table 21. 2014 Lake Grades, Means and TSI Values for the Lakes in the Lake Minnetonka Subwatershed

Lake Grade	Lake/Bay	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
A	St. Albans (Lake Minnetonka)	5.77	1.25	14.25	37
A	Grays (Lake Minnetonka)	5.57	2.00	14.13	38
A	Lower Lake South (Lake Minnetonka)	5.14	2.75	14.75	40
A	Gideon (Lake Minnetonka)	5.21	2.63	14.88	40
A	Carsons (Lake Minnetonka)	5.18	2.50	15.25	40
A	Wayzata (Lake Minnetonka)	4.95	3.25	16.00	41
A	Lafayette (Lake Minnetonka)	4.94	3.00	17.25	41
A	Spring Park (Lake Minnetonka)	4.99	2.63	18.88	41
A-	West Upper (Lake Minnetonka)	3.86	5.50	25.00	46
B+	Maxwell (Lake Minnetonka)	2.71	9.00	25.75	50
B	Black (Lake Minnetonka)	3.30	6.75	27.75	48
B-	Crystal (Lake Minnetonka)	3.66	19.00	33.50	52
B-	Cooks (Lake Minnetonka)	2.49	17.75	34.00	54
C+	Lake William*	1.21	7.75	36.13	55
C	Priests (Lake Minnetonka)	1.71	27.25	47.75	58
C-	Peavey (Lake Minnetonka)	1.90	8.00	124.50	58
D+	Stubbs (Lake Minnetonka)	1.15	47.13	79.38	65
D	Forest (Lake Minnetonka)	1.26	43.75	83.13	64
D	West Arm (Lake Minnetonka)	1.15	65.25	89.00	66
D	Halsted (Lake Minnetonka)	0.99	73.88	102.94	68
D	Jennings (Lake Minnetonka)	0.87	77.43	123.75	70

Note: Red indicates not meeting the Standard; *Shallow lake

Zebra mussels are present in Lake Minnetonka. The infestation was found in 2010, but most likely have been in the lake 2 to 3 years prior. The population is the densest in the eastern bays. The mussels are known to deplete phytoplankton from the food web. The absence of phytoplankton may positively affect water clarity, and may negatively affect the food supply of aquatic organisms such as fish and native mussels (MacIlsac, 1996). The data from the past four years is indicating a change in water clarity and algal abundance, mostly in the eastern bays, but it is too soon to discern if results are from the impact of zebra mussels or other environmental factors.

Stream Water Quality and Discharge: *Classen Lake Creek:* In 2014, temperature and TSS concentrations in Classen Lake Creek upstream site (CCL04) and Classen Lake Creek: Stubbs Bay

inlet (CCL01) were within NCHF ecoregion guidelines in 2014, while TP mean exceeded the guidelines at both sites.

Classen Lake Creek: upstream site had a mean annual flow of 1.02 cfs, and a mean annual flow at the Stubbs Bay inlet site of 0.80 cfs (Table 22). At the upstream site, the 2014 TN loading increased by 9%, the TSS loading increased by 40%, and the CI loading increased by 91% compared to 2013. At the Stubbs bay inlet site, the TSS loading increased by 28% and the CI increased by 109% compared to 2013.

The DO readings at the Classen Lake Creek: upstream site had five violations between June and September. The Stubbs Bay inlet site had enough DO to support aquatic life throughout 2014 open water season (Table 23).

Classen Wetland Creek: The Classen Wetland Creek: Stubbs Bay inlet site (CST01) was within the NCHF ecoregion guidelines for temperature and TSS, while TP exceeded the guidelines at 621 µg/L.

The mean annual flow at Classen Wetland Creek: Stubbs Bay inlet's annual time weighted flow was 0.42 cfs. The loading increased at this site for the following parameters: TN loading by 40%, TSS loading by 173%, and CI loading by 62% compared to the previous year.

From May to June, 100% of the DO readings violated the standard at the second Stubbs Bay inlet site. The site became stagnant or had backflow from Stubbs Bay by the beginning of June (Table 23).

Forest Lake Creek: Temperature and TSS concentrations at the Forest Lake Creek inlet (CFO01) were within the NCHF ecoregion guidelines in 2014, while TP exceeded the guidelines at 226 µg/L.

Forest Lake inlet had a mean annual flow of 0.62 cfs (Table 22). The 2014 TSS loading for Forest Lake Creek inlet increased by 50%, and the CI loading increased by 76% compared to the previous year.

In 2014, there were seven DO violations in 2014, until the site went dry at the end of June (Table 23).

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

Table 22. 2014 Concentration and Load Summary for Lake Minnetonka Subwatershed Stream Sites

Station	Classen Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	Cl (mg/L)	TP	SRP	TN	TSS*	Cl*
CCL04	Upstream	773.77	1.02	138	86	1.56	3	62	278	172	3131	7	124
CCL01	Stubbs Lk Inlet	219.57	0.80	164	110	1.42	14	59	260	175	2241	23	94
	Classen Wetland Creek												
CST01	Stubbs Lk Inlet	506.55	0.42	222	168	1.32	3	25	182	138	1078	3	21
	Forest Lake Creek												
CFO01	Inlet	294.96	0.62	177	155	0.75	2	42	216	189	916	3	51

*Multiply Load by 1000

Table 23. The Number of DO Readings that Exceed the Standard in the Lake Minnetonka Subwatershed Stream Sites

Month - 2014	CCL04	CCL01	CST01	CFO01
May	0	0	3	2
June	1	0	1	5
July	2	0		
August	1	0		
September	1	0		
Total	5	0	4	7
Total # of Samples	17	16	4	9
Total % of Samples Exceeded DO Standard	29%	0%	100%	78%

Subwatershed Diagnosis: Harrisons Bay* is currently not on the 303 (d) List of Impaired Waters, and evaluation for nutrient impairment is recommended. Reducing loading into Lake Minnetonka from the adjacent subwatersheds would be the first step in improving water quality in the western bays. Protecting the entire lake from additional infestations of AIS is important in preserving the lake ecosystem for aquatic life and recreational enjoyment.

The E-Grade Program will be assessing the Lake Minnetonka Subwatershed from 2019-2021. Classen Lake Creek is the only creek that resides completely in the boundary of the Lake Minnetonka Subwatershed. Since Classen Lake Creek is a major contributor of nutrients to Stubbs Bay, MCWD will be investigating additional monitoring in this area to pinpoint nutrient sources. MCWD also plans to monitor Galpin Lake to complete a data gap.

*Note: Harrisons Bay was not monitored in 2014, but West Arm was monitored. West Arm and Harrisons Bay have statistically similar water quality. West Arm did not meet the standards in 2014. Harrisons Bay and West Arm did not meet the eutrophication standards from 2012-2013 as well.

Grays Bay Dam - Lake Minnetonka Elevation and Discharge: Grays Bay Dam, the Headwaters Control Structure, is an adjustable structure that controls Lake Minnetonka levels and lake

discharge into Minnehaha Creek. Staff in the Project Maintenance and Land Management Program operate the dam in accordance with operating procedures approved by the MnDNR. The operating range for the control of discharges at the Grays Bay Dam is when the lake levels are between 928.6 and 930.0 FAMS. The elevation 928.6 FAMS marks the legal, natural run-out elevation for Lake Minnetonka. The elevation 930.0 FAMS is the crest of the 202-foot long fixed-elevation emergency spillway located north of the dam structure itself. MCWD staff began operation of the Grays Bay Dam on April 28, 2014 with a Lake Minnetonka elevation of 929.57 FAMS and discharge out of the Dam at 25 cfs (Figure 5).

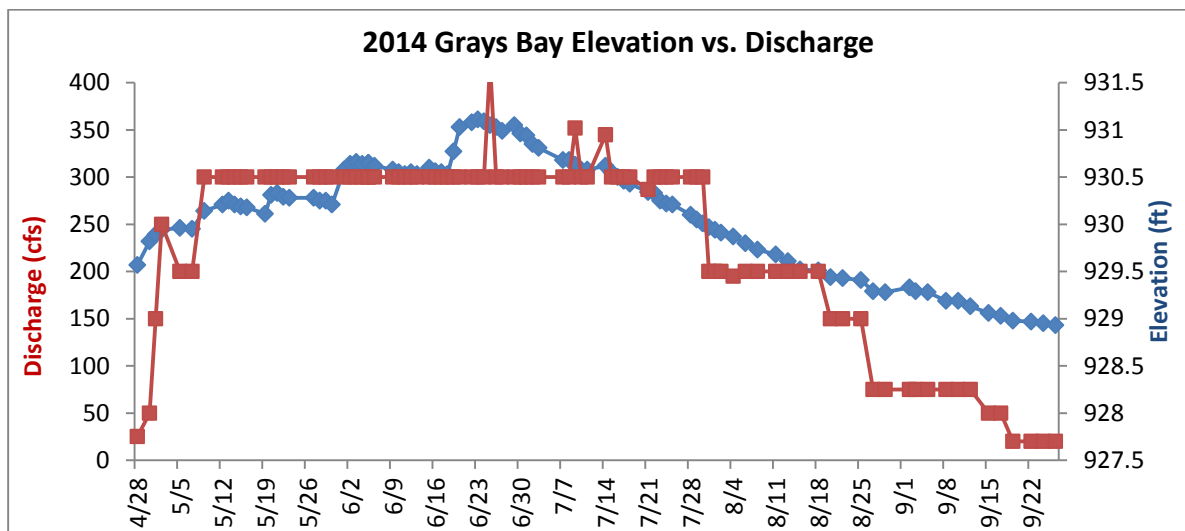


Figure 5. Lake Minnetonka Elevation and Grays Bay Dam Discharge During 2014 Open-Water
 Note: Lake Elevation (diamonds) and Discharge (squares); Run Out Elevation is 928.60 ft; 100-year flood elevation is 931.5 ft

Early high water levels and intense storm activity raised the lake level to record high elevations causing severe flooding. On May 9, 2015, Lake Minnetonka’s water level rose above 930.14 FAMS, which caused water to flow over the 202-foot emergency spillway. On June 19, 2014, the Minnetonka area received over four-inches of rain causing the level of Lake Minnetonka to reach 930.88 FAMS and the tailwater elevation of Minnehaha Creek to reach 930.82 FAMS. This meant that the available head differential between the lake and the creek was less than one-inch. This ultimately led to the emergency spillway becoming submerged by the creek tailwater elevation. The emergency spillway was submerged for approximately 40-days from June 19 until July 31.

Under these circumstances, it was nearly impossible and certainly impractical to estimate or measure flow out of the Grays Bay Dam structure. At this point, staff began monitoring discharge at the pinch point downstream of the Grays Bay Dam at McGinty Road. The highest measured discharge at McGinty Road occurred on June 20, 2014 at 503 cfs. Discharge at the Grays Bay Dam was reduced to 200 cfs on July 31, 2014 when the Lake Minnetonka water elevation fell below 930.0 FAMS. Lake Minnetonka did not return to below ordinary high water levels (929.4 FAMS) until August 26, 2014. The Dam’s discharge was gradually reduced until it was officially closed on October 27, 2014. The last lake elevation reading was recorded on

November 12, 2014 at 928.46 FAMS L (Figure 5). During the 2014 period of record, the average lake elevation was 929.92 FAMS L with an overall fluctuation of 31.8 inches. Annual lake evaporation in the vicinity is normally about 31 inches.

The 24-year average discharge or runoff from the upper watershed to the Grays Bay Dam is 4.73 inches. This value is the average volume that passes through the dam per year. In 2014, the calculated mean discharge through the Grays Bay Dam was 97.44 cfs (Figure 6), which is equivalent to 10.73 inches of runoff from the upper watershed (79,277 acres) (Figure 7).

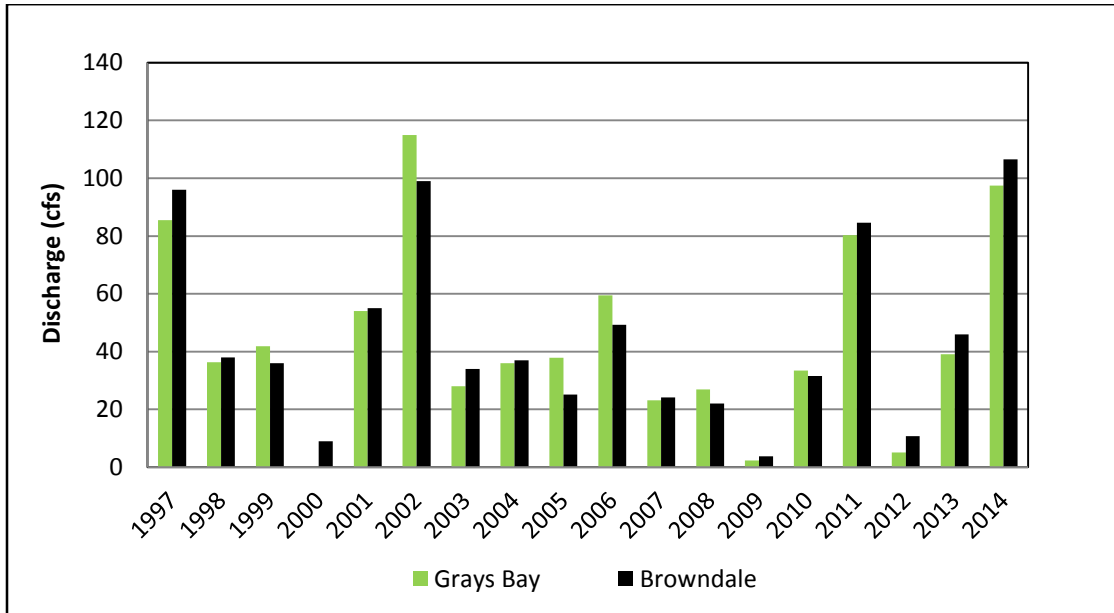


Figure 6. Annual Average Discharge at Grays Bay Dam and Browndale Dam

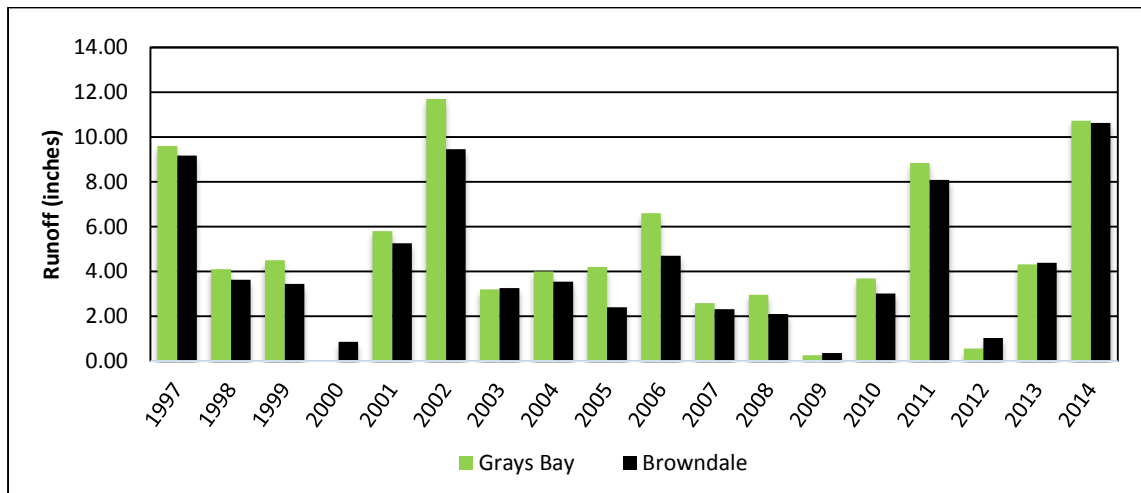
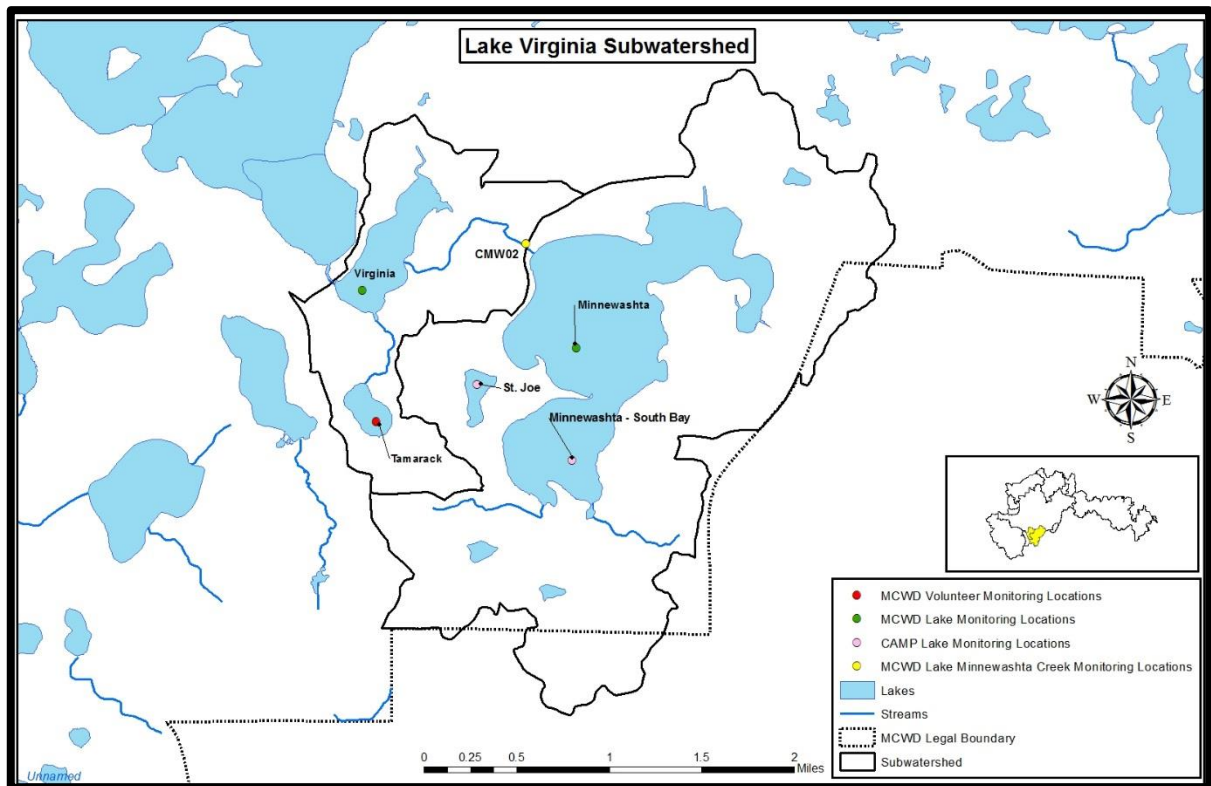


Figure 7. Runoff from Upper Watershed to Grays Bay Dam and Browndale Dam

There was 6.00 more inches of runoff passing through the dam in 2014, than on an average year. Now, comparatively at the Browndale Dam in Edina, located 12 miles downstream from Grays Bay Dam, the 18-year average discharge is 4.31 inches (Figure 7). In 2014, the calculated discharge was 106.49 cfs (Figure 6), which is equivalent to 10.63 inches of runoff from an area that includes the upper watershed, Grays Bay Dam and the adjacent lower watershed (87,051 acres). In 2014, there was 6.32 more inches passing through the Browndale Dam than on an average year.

3.5 Lake Virginia Subwatershed



Lake Water Quality: St. Joe and Lake Minnewashta – South Bay are monitored by CAMP volunteers. In 2014, both lakes met all three NCHF eutrophication standards and received an A-lake grade. Both lakes have mesotrophic characteristics - moderately clear, and anoxia occurs in the hypolimnion late in the summer, which the 2014 TSI score supports (Table 24).

A MCWD trained volunteer monitors Tamarack Lake. In 2014, an increase in TP occurred during the high water period in Tamarack Lake. Overall, the water quality in Tamarack Lake exceeded the CHLA standard and received a B- water quality grade (Table 19). The water quality in Lake Minnewashta, at the deepest site, exceeded the CHLA standard and received a B- water quality grade in 2014. The TSI scores for both lakes indicate eutrophic conditions, but observations characterize both waterbodies are on the cusp between mesotrophic and eutrophic states (Table 24).

In 2014, TP concentrations in Lake Virginia were elevated in mid-May, late June and late October, most likely coinciding with ice-out and precipitation events. The mean water quality for Lake Virginia exceeded the TP standard and received a C+ water quality grade. Lake Virginia is eutrophic, which supports the observations of extensive algae and aquatic plants (Table 19). Recreational activity, except for fishing, may be undesirable at certain times of the year due to extensive lily pad beds, and other aquatic plants and algae. Many anglers stand adjacent to the public access to fish in Lake Virginia (Table 24).

Recreational activities may shift in Lake Virginia due to the discovery of zebra mussels in 2014. The mussels are known to deplete phytoplankton from the food web. The absence of phytoplankton may positively affect water clarity, and may negatively affect the food supply of aquatic organisms such as fish and native mussels (MacIsaac, 1996).

Chloride was not monitored in St. Joe Lake and Lake Minnewashta – South Bay in 2014. The Cl concentrations in the remaining lakes in the Lake Virginia Subwatershed did not exceed the Cl standard in 2014.

Table 24. 2014 Lake Grades, Means and TSI Values for Lakes in the Lake Virginia Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
A-	Minnewashta - South Bay	2.49	8.20	15.00	47
A-	St. Joe	2.57	6.18	21.17	48
B-	Minnewashta	2.05	16.63	27.00	53
B-	Tamarack	2.69	18.25	34.50	53
C+	Virginia	1.86	12.88	43.88	55

Note: Red indicates not meeting the Standard

Stream Water Quality and Discharge: In 2014, temperature, TSS, and TP in Lake Minnewashta Creek: Lake Minnewashta outlet (CMW02) were within the NCHF ecoregion guidelines.

Lake Minnewashta Creek: Lake Minnewashta outlet had a mean annual flow of 3.46 cfs, until the creek went dry in late September (Table 25). Compared to 2013, the 2014 loading increased at this site for the following parameters: TP by 264%, SRP by 100%, TN by 85%, TSS by 67% and Cl by 90%.

There were two DO violations that occurred in August at the Lake Minnewashta outlet (Table 26). The remainder of the open water season, the outlet site had enough DO to support aquatic life.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

Table 25. 2014 Concentration and Load Summary for Lake Virginia Subwatershed Stream Sites

Station	Minnewashta Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	Cl (mg/L)	TP	SRP	TN	TSS*	Cl*
CMW02	Outlet	2985.30	3.46	34	0	0.61	3	31	229	1	4145	20	213

*Multiple Load by 1000

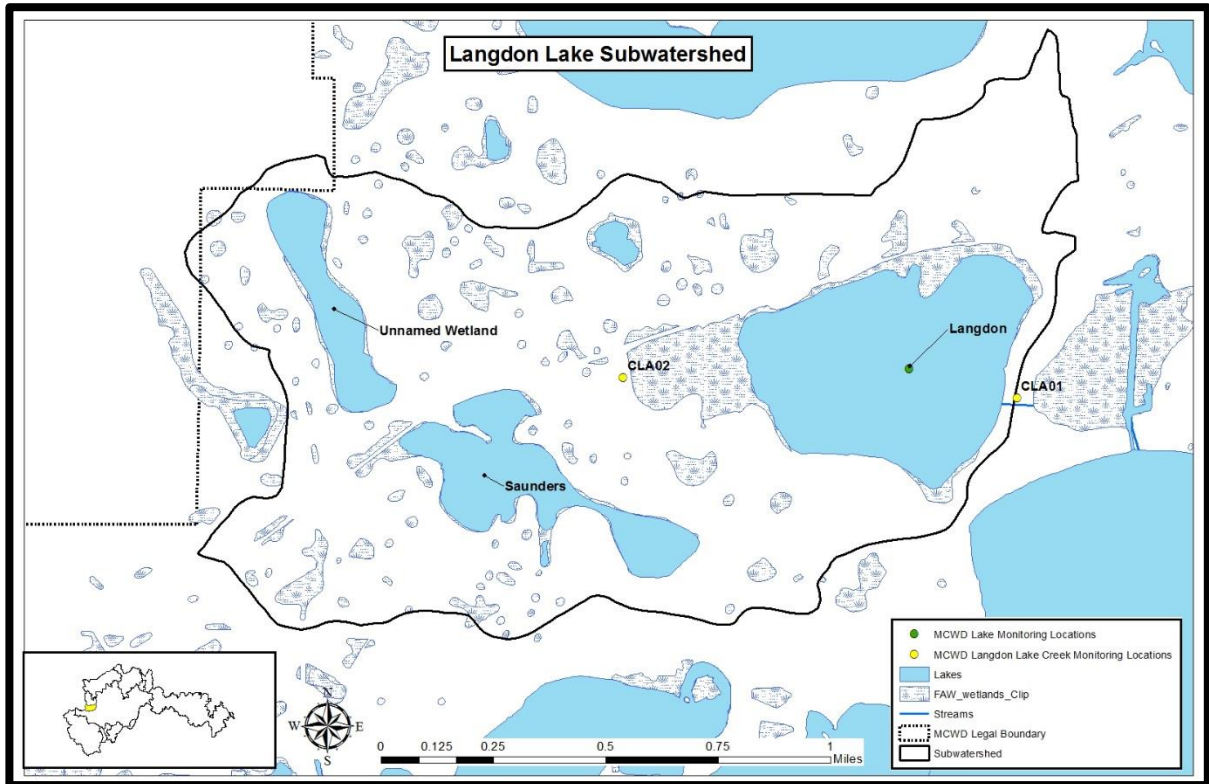
Table 26. The Number of DO Readings that Exceed the Standard in the Lake Virginia Subwatershed Stream Sites

Month - 2014	CMW02
May	0
June	0
July	0
August	2
September	0
Total	2
Total # of Samples	21
Total % of Samples Exceeded DO Standard	10%

Subwatershed Diagnosis: Depending on flow and concentration, the Lake Minnewashta Creek: Lake Minnewashta outlet historically has relatively lower TP concentrations and loading, though loading does show increase during higher flow years. The TN and Cl loading have been elevated for the site since 2010. The elevated loading from Lake Minnewashta outlet flows into Lake Virginia and may affect the lake’s water quality. Protecting Lake Virginia from additional AIS infestations is important for aquatic life and preserving recreational enjoyment.

The E-Grade Program will be assessing the Lake Virginia Subwatershed from 2019-2021. MCWD will be investigating the effect Tamarack Lake has on Lake Virginia by scouting new monitoring sites at the outlet of Tamarack Lake. MCWD will also be investigating the locations of the inlets to Lake Minnewashta, and monitor if feasible, to complete data gaps.

3.6 Langdon Lake Subwatershed



Lake Water Quality: In 2014, TP concentrations were elevated in Langdon Lake in mid-May, late June and late October, most likely coinciding with ice-out and heavy precipitation events. Langdon Lake did not meet the three NCHF ecoregion eutrophication standards in 2014. The water quality of the lake also received a C- water quality grade. The productivity state in Langdon Lake has improved since 2013, shifting from hypereutrophic to a eutrophic state (Table 27). The poor water clarity in Langdon Lake does inhibit swimming activities as blue greens and filamentous algae dominate the lake surface waters. None of the Cl concentrations in Langdon Lake exceeded the acute and chronic Cl standard in 2014.

Table 27. 2014 Lake Grades, Means and TSI Values for Lakes in the Langdon Lake Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
C-	Langdon	1.39	39.00	83.00	63

Note: Red indicates not meeting the Standard

Stream Water Quality and Discharge: Temperature, TSS, and TP in Langdon Lake Creek: Langdon Lake inlet (CLA02) were within the NCHF ecoregion guidelines in 2014. Langdon Lake

Creek: Langdon Lake outlet (CLA01) for temperature and TSS met the NCHF ecoregion guidelines in 2014, while TP was above the guideline at 180 µg/L.

In 2014, Langdon Creek inlet site had a mean annual flow that was very slow at 0.52 cfs. The mean annual flow for the outlet site was a little faster at a rate of 1.22 cfs (Table 28). Langdon Lake discharged water throughout the open-water season, which typically dries up late spring/early summer months, meaning there was constant connection between Langdon Lake and Lake Minnetonka in 2014. The 2014 TP loading at the Langdon Lake inlet site increased by 46% compared to 2013. The 2014 SRP loading increased at the inlet site by 10% and increased at the outlet site by 450% compared to the previous year. The 2014 TN, TSS and CI loading increased at the inlet site by a significant amount, though it is important to note that in 2013 the loading values were near zero and there was only two samples collected for TN and CI compared to seven samples in 2014. At the outlet site, the 2014 TN loading increased by 103% and the CI loading increased by 42% compared to the previous year.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

The DO concentrations at the Langdon Lake Creek: Langdon Lake inlet fully supported aquatic life in 2014. The DO concentrations at the Langdon Lake Creek: Langdon Lake had four violations throughout May-September (Table 29).

Table 28. 2014 Concentration and Load Summary for Langdon Lake Subwatershed Stream Sites

Station	Langdon Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	CI (mg/L)	TP	SRP	TN	TSS*	CI*
CLA02	Inlet	508.10	0.52	63	22	1.22	15	32	64	23	1250	15	33
CLA01	Outlet	547.35	1.22	73	5	2.06	7	59	175	11	4955	16	143

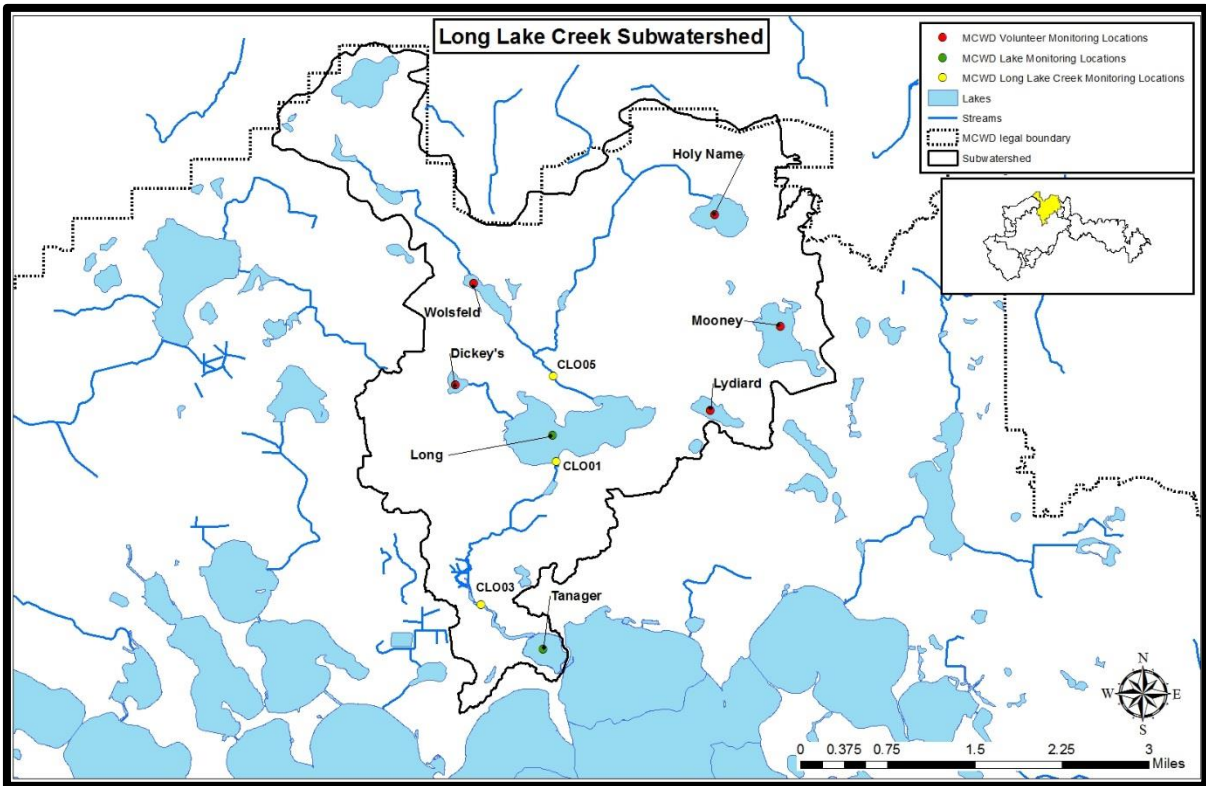
*Multiply Load by 1000

Table 29. The Number of DO Readings that Exceed the Standard in the Langdon Lake Subwatershed Stream Sites

Month - 2014	CLA02	CLA01
May	0	1
June	0	0
July	0	0
August	0	1
September	0	2
Total	0	4
Total # of Samples	22	21
Total % of Samples Exceeded DO Standard	0%	19%

Subwatershed Diagnosis: The loading at the Langdon Lake Creek: Langdon Lake inlet is dependent on flow. Langdon Lake Creek: Langdon Lake outlet impacts Lake Minnetonka with elevated TP, TN and CI loading. The E-Grade Program will be assessing the Langdon Lake Subwatershed in 2016-2018. MCWD will be investigating monitoring sites between the Langdon Lake Creek: lake inlet (CLA02) and the holding pond west of Langdon Lake to complete data gaps.

3.7 Long Lake Creek Subwatershed



Lake Water Quality: MCWD trained volunteers monitor the majority of the lakes in the Long Lake Creek Subwatershed. Their dedication to monitoring has helped MCWD gain a better understanding of the water quality issues in this subwatershed.

The high water in 2014 impacted majority of the lakes in the Long Lake Creek Subwatershed. Elevated water levels persisted due to the heavy precipitation received during the early summer months. Lydiard Lake remained high throughout the season as the rest of the lakes' waters receded. Dickey's, Wolsfeld and Tanager lakes had increases in TP during the June-July high water period. Long Lake had increases in TP, but only near the end of the open water season. Even with the impacts from high water, the water quality for the lakes in the Long Lake Creek Subwatershed were within range to the concentrations observed in previous years.

Lydiard Lake met the three NCHF ecoregion eutrophication standards and received a B+ water

quality grade in 2014. The TSI score classifies Lydiard Lake as mesotrophic, which observations of moderately clear water support. Lily pads and a fringe wetland have been encroaching on the open water for the past decade (Table 30).

Holy Name Lake met the two of three NCHF ecoregion eutrophication standards in 2014. The Secchi data was insufficient to calculate means in 2014 due to the obstruction of aquatic plants, mostly Curlyleaf pondweed near the bottom of the lake. The TSI score for Holy Name Lake indicates a mesotrophic state, which observations of moderately clear water support (Table 30).

Dickey's and Mooney lakes did not meet the NCHF ecoregion eutrophication standards in 2014. Dickey's Lake exceeded the TP standard for deep lakes, while Mooney Lake did not meet both Secchi (SECC) and CHLA standards for shallow lakes. Both lakes received a C (including C-) water quality grade in 2014. The productivity state in these two lakes is eutrophic, which supports observations of algal and aquatic plant issues (Table 30). As a result, recreational activities, such as swimming, may be undesirable at certain times of the year.

Long and Tanager lakes did not meet the three NCHF ecoregion eutrophication standards for deep lakes in 2014, and both received a D (including D+) water quality grade. The TSI scores classifies both lakes as eutrophic (Table 30). Both lakes have severe algal problems, like blue green blooms, which limits recreational activities. The surface waters in Long Lake by middle to late summer are often green from blue green algae blooms. Long Lake outlets into Long Lake Creek then flows into Tanager Lake. Tanager Lake is turbid and brown for most of the open-water season. Tanager Lake is the last lake in the Long Lake Creek Subwatershed before flowing into Lake Minnetonka.

Wolsfeld Lake did not meet two of three NCHF ecoregion eutrophication standards in 2014. Insufficient CHLA data was collected, so CHLA means and a water quality grade could not be calculated. The TSI score for Wolsfeld Lake classifies the lake as hypereutrophic (Table 30). Poor water clarity and high algal concentrations dominate the surface waters Wolsfeld Lake.

In 2014, the Cl concentrations in the lakes of the Long Lake Creek Subwatershed did not exceed the Cl acute and chronic standard.

Table 30. 2014 Lake Grades, Means and TSI Values for Lakes in the Long Lake Creek Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
B+	Lydiard	2.73	1.00	22.50	42
N/A	Holy Name*	N/A	5.00	24.25	48
C	Dickey's	2.45	13.88	93.38	58
C-	Mooney*	0.95	22.50	56.00	61
D+	Tanager (Lake Minnetonka)	1.26	26.75	95.50	63
D	Long	1.11	54.50	87.50	66
N/A	Wolsfeld	0.65		133.75	71

Note: Red indicates the parameter did not meet the Standard; *Shallow lake

Stream Water Quality and Discharge: In 2014, temperature and TSS were within the NCHF guidelines for Long Lake Creek: Long Lake inlet (CLO05), while TP exceeded the guidelines. At the Long Lake Creek: Long Lake outlet (CLO01) and Long Lake Creek: Tanager lake inlet (CLO03) temperature, TSS and TP were within the NCHF ecoregion guidelines in 2014.

In 2014, Long Lake Creek: Long Lake inlet's annual time weighted flow was 2.68 cfs and at the Long Lake Creek Tanager Lake inlet it was 12.84 cfs. Tanager Lake flows directly into Lake Minnetonka. The flow at the Long Lake Creek outlet was 7.33 cfs (Table 31). Long Lake Creek: Long Lake inlet had increase in TN loading by 31% and an increase in Cl loading by 19% compared to the previous year. The Long Lake Creek: Long Lake outlet had an increase in TP loading by 56%, SRP loading by 149%, TN loading by 45% and Cl loading by 99% compared to the previous year. The Long Lake Creek: Tanager Lake inlet had an increase in both TP and SRP loading by 27%, TN by 15%, TSS by 6% and Cl by 25% compared to 2013.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

The Long Lake Creek: Long Lake inlet had 11 violations of the DO standard that occurred between July and September. The outlet site (CLO01) had enough DO to support aquatic life throughout the 2014 open water season. At the Long Lake Creek: Tanager Lake inlet, DO was insufficient to support aquatic life.

Table 31. 2014 Concentration and Load Summary for Long Lake Creek Subwatershed Stream Sites

Station	Long Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	Cl (mg/L)	TP	SRP	TN	TSS*	Cl*
CLO05	Long Lake: Inlet	1632.79	2.68	170	91	2.16	8	43	897	478	11401	41	225
CLO01	Long Lake: Outlet	3563.15	7.33	86	12	1.55	5	63	1247	167	22419	69	914
CLO03	Tanager Lake: Inlet	892.88	12.84	104	50	0.70	3	29	2630	1262	17707	75	730

*Multiply Load by 1000; Red indicates below the DO standard

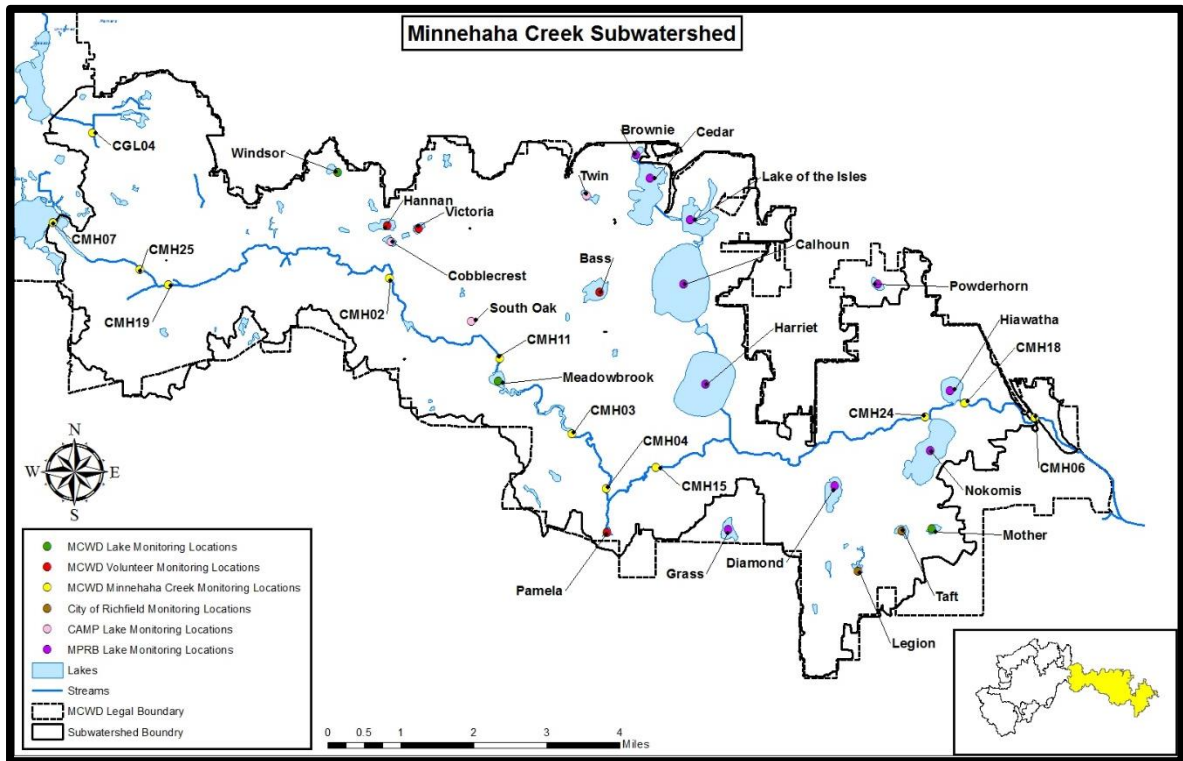
Table 32. The Number of DO Readings that Exceeded the Standard in the Long Lake Creek Subwatershed Stream Sites

Month - 2014	CLO05	CLO01	CLO03
May	0	0	3
June	0	0	4
July	4	0	3
August	3	0	
September	4	0	
Total	11	0	10
Total # of Samples	16	21	11
Total % of Samples Exceeded DO Standard	69%	0%	91%

Subwatershed Diagnosis: All three sites along Long Lake Creek are hot spots for loading across all five parameters. MCWD conducted a statistical analysis in 2014 which revealed that from 1997-2012 there was statistically significant increasing trend in phosphorus concentrations at the bottom of the Long Lake. The internal loading issues with TP in Long Lake most likely lead to the severe blue green algal blooms that occur late in the summer.

The E-Grade Program will be assessing the Long Lake Creek Subwatershed in 2016-2018. MCWD will be investigating new monitoring sites that are potential nutrient sources for Long Lake, such as sites west of the lake and stream connections between the lakes - Dickey's and Long and Lydiard and Long.

3.8 Minnehaha Creek Subwatershed



Lake Water Quality: Several agencies and trained volunteers monitor the water quality of the lakes throughout the Minnehaha Creek Subwatershed. Minneapolis Parks and Recreation Board staff monitor Brownie, Calhoun, Cedar, Diamond, Grass, Harriet, Hiawatha, Isles, Nokomis and Powderhorn lakes. Metropolitan Council Environmental Services’ Citizen Assisted Monitoring Program (CAMP) has trained volunteers monitoring Cobblecrest, South Oak and Twin lakes. MCWD staff monitors Mother, Meadowbrook and Windsor lakes, while MCWD trained volunteers monitor Bass, Hannan, Pamela and Victoria lakes.

Majority of the lakes in the Minnehaha Creek Subwatershed were impacted by the high water in 2014. Grass and Hannan lakes had an increase in TP in June. Bass wetland (see note), Cedar, Hiawatha, Meadowbrook, Mother, Pamela, South Oak and Twin lakes had an increase in TP from July through August. Diamond wetland (see note) had an increase in TP from August to September. Powderhorn Lake had elevated TP concentrations throughout most of the summer. The major lakes in the Chain did not have noticeable impact to the surface nutrient levels, but there was an impact to water level. Many of the lakes in the Chain of Lakes as well as Meadowbrook, Hiawatha, and Nokomis had elevated water levels due to heavy precipitation and flooding from Minnehaha Creek. High water prevented recreational activities for most of the summer.

Lake Calhoun met the NCHF ecoregion eutrophication standards in 2014 and is the only lake in the Minnehaha Creek Subwatershed to receive an A water quality grade. Lake Calhoun has

clear water with little to no algae issues that inhibit recreational activity. The TSI scores for Lake Calhoun classifies the lake as mesotrophic, moderately clear water and oxygen depletion in the hypolimnion in late summer (Table 33).

Brownie, Cedar, Harriet, and Nokomis lakes met the three NCHF ecoregion eutrophication standards in 2014 and received a B (including B+/B-) water quality grades. Lake Hiawatha did not meet the TP standard, but did receive a B- water quality grade in 2014. The water quality is generally clear, but algae can limit swimming activities towards the end of summer. The trophic state for Cedar and Harriet lakes is mesotrophic, while the trophic state in Brownie, Hiawatha, and Nokomis lakes is eutrophic (Table 33).

Lake of the Isles exceeded the CHLA standard and Hannan Lake exceeded the CHLA and TP standards in 2014. Both lakes received C water quality grade (including C+/C-). The water quality in Hannan and Isles is average until late summer. Algal blooms decrease the water quality and may hinder recreational activities on the lake. Both lakes are eutrophic with limited water clarity, dense aquatic plants coverage and decreased oxygen in the hypolimnion (Table 33).

Grass, Meadowbrook and Mother Lakes did not meet the NCHF ecoregion standards for shallow lakes in 2014. Grass Lake exceeded the TP standard, while both Meadowbrook and Mother exceeded CHLA standard. Water quality grades could not be calculated for all three lakes due to insufficient SECC data; however, the TSI scores for all three classifies the lakes as eutrophic (Table 33).

Pamela and Windsor lakes did not meet two of the three NCHF ecoregion eutrophication standards in 2014. Windsor Lake did not meet the CHLA and TP standards as there was insufficient SECC data to calculate a summer mean. Pamela Lake did not meet the SECC and CHLA standards. There was insufficient data to calculate the TP summer mean for Pamela Lake. Pamela and Windsor are classified as hypereutrophic (Table 33).

Powderhorn, Twin, South Oak and Victoria lakes did not meet all three NCHF ecoregion eutrophication standards in 2014. These lakes also received D (including D+) water quality grades, and usually have severe algae blooms throughout the open water season. The trophic state for Twin, South Oak and Victoria are eutrophic, while TSI score for Powderhorn classifies the lake as hypereutrophic (Table 33).

Chloride was not monitored in Cobblecrest, South Oak and Twin lakes in 2014. Diamond wetland, Pamela and Powderhorn lakes exceeded the Cl chronic standard in 2014, where Brownie Lake exceeded the acute standard for Cl. The exceedances in all four lakes occurred early in the open water season. The rest of the lakes in the Minnehaha Creek Subwatershed had Cl concentrations that ranged between 19.90 mg/L and 173 mg/L.

Note: Bass and Diamond lakes have been reclassified, by the MPCA, as wetlands due to its depth and percentage of littoral zone. At this time, there is no eutrophication standards to

assess the water quality in the Diamond and Bass wetlands.

Table 33. 2014 Lake Grades, Means and TSI Values for the Lakes in the Minnehaha Creek Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
A	Calhoun	3.94	3.40	15.13	42
B+	Harriet	2.39	3.49	25.25	47
B	Cedar	1.91	6.50	24.13	50
B-	Nokomis	1.76	10.21	33.75	53
B-	Hiawatha	1.82	5.21	50.38	53
B-	Brownie*	1.49	9.83	35.00	54
C+	Isles	1.51	14.28	34.75	55
N/A	Grass*	N/A	5.19	80.00	57
N/A	Meadowbrook*	N/A	23.63	45.38	60
N/A	Mother *	N/A	14.25	59.13	60
C-	Hannan*	1.35	41.75	73.75	63
D+	Victoria*	0.78	41.25	105.75	67
D+	Twin*	0.83	45.78	101.78	67
D+	South Oak*	0.81	27.13	155.89	68
D	Powderhorn*	0.49	43.18	134.38	71
N/A	Pamela*	0.61	119.50	N/A	72
N/A	Windsor*	N/A	73.00	160.75	75
N/A	Cobblecrest*				N/A
N/A	Bass**	0.90	33.25	133.00	N/A
N/A	Diamond**	N/A	30.94	101.25	N/A

Note: Red indicates not meeting the Standard; * Shallow lake; **Wetland

Stream Water Quality and Discharge: *Gleason Lake Creek*: The wetland outlet adjacent to Gleason Lake (CGL04) site was previously thought to be in the Gleason Lake Subwatershed. In 2014, through updated mapping, the Gleason wetland outlet was identified to reside within the Minnehaha Creek Subwatershed. Temperature and TSS at Gleason wetland outlet was within the NCHF guidelines, but TP mean exceeded the guideline at 206 µg/L.

The mean annual flow at the wetland outlet site is slow at a rate of 0.90 cfs (Table 34). The 2014 TN annual loading increased by 113% and the CI loading increased by 146% at this site compared to the previous year. This site had 14 DO violations from June through September indicating not enough DO to fully support aquatic life (Table 35).

Minnehaha Creek: At all sites in Minnehaha Creek, temperature, DO, TSS, and TP were within the NCHF ecoregion guidelines in 2014. Chloride levels peaked during the winter and early spring months in 2014 coinciding with road salt application on surrounding streets. Chloride levels on Minnehaha Creek decreased throughout the remainder of the year.

In 2014, the mean annual flow in Minnehaha Creek ranged from 66.80 cfs to 130.70 cfs (Table 34). During high water periods, Minnehaha Creek has one of the highest flows throughout MCWD. The 2014 TN and Cl loading increased from previous year for all sites along Minnehaha Creek. Excelsior Blvd (CHM11) had the smallest increase (TN=29%; Cl=31%) and Williston Rd site (CMH25) had the largest increase (TN=235%; Cl=208%).

The 2014 TP loading increased from the previous year for all sites along Minnehaha Creek except for Excelsior Blvd site (CMH11) which saw a reduction of 4%. Browndale Dam site (CMH03) had the smallest increase in TP loading at 32% and W 34th St (CMH02) had the largest increase in TP loading at 209%. The 2014 SRP loading increased from the previous year at Grays Bay Dam outlet (CMH07) and at sites beginning at Browndale Dam (CMH03) all the way downstream to Hiawatha Avenue (CMH06). There was a reduction in SRP loading for Williston Rd (CMH25), I494 (CMH19), W 34th St (CMH02), and Excelsior Blvd (CMH11). Grays Bay outlet increased 100% compared to 2013, most likely due to the high water period. Browndale Dam (CMH03) had the smallest increase in SRP at 14%, and 28th Ave site (CMH18) had the largest increase in SRP at 111%.

The 2014 TSS loading increased from the previous year for Williston Rd site (CMH25), W. 34th St. site (CMH02), and for sites beginning at the Browndale Dam (CMH03) site all the way downstream to Hiawatha Avenue (CMH06). Browndale Dam (CMH03) had the smallest increase in TSS loading at 35% and 28th Ave site (CMH18) had the largest increase in TSS loading at 272%.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

More water and faster flow usually means more available DO in a waterway. However, the past two years, the same four sites have had DO violations. Most of the violations occur in August and September after the high waters receded. Williston Rd site (CMH25) had five DO violations, I-494 Ramps sites (CMH19) had seven DO violations, W. 34th St site (CMH02) had nine DO violations and Excelsior Blvd site (CMH11) had eight DO violations. Sites on Minnehaha Creek starting at Browndale Dam (CMH03) downstream to Hiawatha Ave site (CMH06) had enough DO to fully support aquatic life in 2014.

Table 34. 2014 Concentration and Load Summary for Minnehaha Creek Subwatershed Stream Sites

Station	Gleason Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	Cl (mg/L)	TP	SRP	TN	TSS*	Cl*
GGL04	Wetland Outlet	714.14	0.90	115	34	0.75	2.0	210.0	204	60	1336	3	372
	Minnehaha Creek												
CMH07	Grays Bay Dam	79276.81	97.44	13	0.02	0.52	0.3	43.7	2440	3	99590	60	8391
CMH25	Mntka Ice Arena	81186.11	100.80	21	1	0.72	1.5	58.0	4194	117	142071	302	11509
CMH19	I-494	81843.24	92.84	36	4	0.48	1.4	39.3	6616	670	86852	260	7180
CMH02	W 34th St.	85182.50	95.84	34	9	0.70	3.6	63.4	6378	1760	132670	670	11962
CMH11	Excelsior Blvd	86238.45	66.80	38	13	0.62	2.4	63.0	4983	1680	81399	316	8287
CMH03	Browndale Dam	87050.69	106.49	38	15	0.69	1.7	65.7	8037	3248	145446	361	13767
CMH04	W 56th St.	87352.64	97.28	45	17	0.67	4.5	66.6	8643	3180	127536	869	12752
CMH15	Xerxes Ave.	87794.45	102.46	49	18	0.73	6.0	65.1	9829	3586	147752	1216	13130
CMH24	21st Ave.	93218.04	96.60	55	17	0.59	10.3	57.9	10423	3227	111366	1967	11019
CMH18	28th Ave.	94286.50	120.16	55	16	0.81	6.7	71.1	12935	3803	191405	1576	16812
CMH06	Hiawatha Ave.	94568.90	130.72	64	17	0.80	11.6	69.4	16524	4434	206082	2977	17863

*Multiply Load by 1000

Table 35. The Number of DO Readings that Exceeded the Standard in Minnehaha Creek Subwatershed Stream Sites

Month - 2014	CGL04	CMH07	CMH25	CMH19	CMH02	CMH11	CMH03	CMH04	CMH15	CMH24	CMH18	CMH06
May	0	0	0	0	0	0	0	0	0	0	0	0
June	2	0	0	0	3	2	0	0	0	0	0	0
July	4	0	0	2	2	2	0	0	0	0	0	0
August	4	0	4	4	4	4	0	0	0	0	0	0
September	4	0	1	1	0	0	0	0	0	0	0	0
Total	14	0	5	7	9	8	0	0	0	0	0	0
Total # of Samples	21	22										
Total % of Samples Exceeded DO Standard	67%	0%	23%	32%	41%	36%	0%	0%	0%	0%	0%	0%

Stream *E. coli*: Data collected for *E. coli* indicates that eight out of ten locations on Minnehaha Creek met the acute *E. coli* standard in 2014. Exceedances occurred at two locations 21st Ave (CMH24) and Hiawatha Ave (CMH06) with *E. coli* concentrations ranging from 1414 cfu/100 mL to greater than 2420 cfu/100 mL (Table 36).

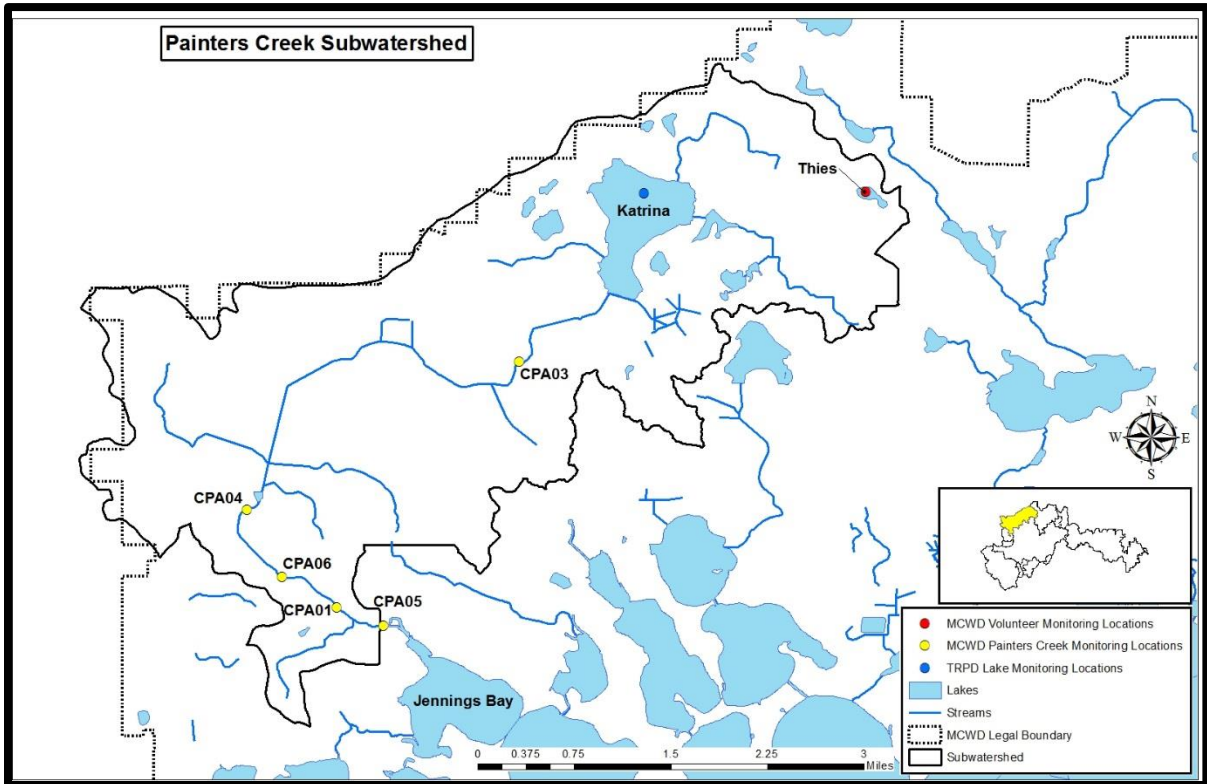
Table 36. The Number of *E. coli* Samples that Exceed the Acute Standard in Minnehaha Creek

Month - 2014	CMH07	CMH19	CMH02	CMH11	CMH03	CMH04	CMH15	CMH24	CMH18	CMH06
April	0	0	0	0	0	0	0	1	0	0
May	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0
August	0	1	0	0	0	0	0	1	0	1
September	0	0	0	0	0	0	0	1	0	1
October	0	0	0	0	0	0	0	2	1	2
Total	0	1	0	0	0	0	0	5	1	4
Total # of Samples	26	30								
Total % of Samples Exceeded Chronic <i>E. Coli</i> Standard	0%	3%	0%	0%	0%	0%	0%	17%	3%	13%

Subwatershed Diagnosis: Pamela Lake should be evaluated for chloride impairment; where Windsor Lake should be evaluated for nutrient impairment. Bass, Hannan, Meadowbrook, Pamela and Victoria lakes will continued to be monitored closely.

The Gleason Creek wetland site, has elevated TP, TN and Cl loading. For Minnehaha Creek, a noticeable increase in TP, SRP, TN, TSS and Cl loading begins at the Browndale Dam site (CMH03) continuing through to the Hiawatha Ave site (CMH06). The highest loading observed in Minnehaha Creek is at Hiawatha Ave site (CMH06). Sites along Minnehaha Creek west of Hwy 100 have been found to be contributing to the downstream loading. The past three years, MCWD has remeandered and stabilized Minnehaha Creek in St. Louis Park, near Methodist Hospital and Reach 20, upstream of Louisiana Ave, in order to improve: green space, connectivity between the community and the water, and reduce nutrient loading to protect downstream Minnehaha Creek.

3.9 Painter Creek Subwatershed



Lake Water Quality: A MCWD trained volunteer and Three Rivers Park District staff monitored the waterbodies in the Painter Creek Subwatershed in 2014.

The water quality in Thies Lake did not meet any of three NCHF ecoregion eutrophication standards in 2014 and received a D+ water quality grade. The lake had increases in TP from May-June, most likely due to heavy precipitation. Thies Lake is eutrophic with severe algae blooms which prevents recreational activities (Table 37). The CI level in Thies Lake did not exceed the chronic or acute CI standard in 2014.

Lake Katrina has been reclassified, by the MPCA, as Katrina wetland due to its depth and percentage of littoral zone. At this time, there is no eutrophication standards to assess the water quality in the Katrina wetland.

Table 37. 2014 Lake Grades, Means and TSI Values for the Lakes in the Painter Creek Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
D+	Thies	0.78	39.13	73.88	65
N/A	Katrina**	1.02		205.86	N/A

Note: Red indicates not meeting the Standard; **wetland

Stream Water Quality and Discharge: Temperature and TSS levels were within the NCHF guidelines for all Painter Creek sites in 2014, whereas the TP means exceeded the guidelines at all sites. The TP concentrations increased in Painter Creek from upstream site, Katrina Wetland Outlet site (CPA03) at 217 µg/L to downstream site, Jennings Bay inlet site (CPA05) at 310 µg/L.

The mean annual flow in Painter Creek ranged from 7.32 cfs to 13.18 cfs throughout 2014 (Table 38). Flow decreased back to normal levels by middle to late August. The 2014 TP, TN and TSS loading increased for all sites in Painter Creek compared to the previous year. The upstream – W. Branch Rd site (CPA01) had the smallest increase for TP and TN loading (TP=3%; TN=13%) and the Jennings Bay inlet site (CPA05) had the smallest increase for TSS loading at 55%. The Katrina wetland outlet site (CPA03) had the largest increase for all three parameters (TP=82%; TN=96%; TSS=373%). The 2014 SRP loading increased for all sites in Painter Creek except the upstream – W. Branch Rd site (CPA01) which was reduced by 3%. Jennings Bay inlet site had the smallest increase in SRP at 15% and the Katrina wetland outlet site (CPA03) had the largest increase in SRP loading at 74%. The 2014 Cl loading increased for all sites in Painter Creek. The upstream – W. Branch Rd site (CPA01) had the smallest increase in Cl loading at 23% and the Painter Marsh Outlet site (CPA04) had the largest increase in Cl loading at 71%.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

The DO readings at all sites in Painter Creek, except the Jennings Bay inlet site (CPA05), were below the DO standard in 2014. The number of DO violations ranged between 16 and 21 violations, mostly occurring between June-September. Painter Creek does not fully support aquatic life (Table 39).

Table 38. 2014 Concentration and Load Summary for Painter Creek Subwatershed Stream Sites

Station	Painter Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	Cl (mg/L)	TP	SRP	TN	TSS*	Cl*
CPA03	Katrina Wetland Outlet	3502.58	7.32	212	145	1.31	4	41	3064	2097	18824	52	597
CPA04	Painter Marsh Outlet	3907.78	13.18	300	204	1.40	3	39	7786	5284	36294	75	1022
CPA06	Upstream (Painter Ck Dr)	225.94	11.92	338	213	1.26	4	40	7929	4990	29681	101	944
CPA01	Upstream (W Branch Rd)	174.78	11.54	318	195	1.51	13	42	7226	4433	34318	286	951
CPA05	Jennings Bay: Inlet	314.48	9.85	324	199	1.39	14	40	6289	3864	26967	275	770

*Multiply Load by 1000

Table 39. The Number of DO Readings that Exceed the Standard in the Painter Creek Subwatershed Stream Sites

Month - 2014	CPA03	CPA04	CPA06	CPA01	CPA05
May	3	3	1	1	1
June	4	4	4	5	5
July	5	5	5	4	4
August	2	4	4	4	4
September	4	5	4	3	2
Total	18	21	18	17	16
Total # of Readings	19	22	21	21	21
Total % of Readings Exceeded DO Standard	95%	95%	86%	81%	76%

Stream *E. coli*: Data is collected for *E. coli* concentrations at three of the five Painter Creek monitoring sites (CPA04, CPA01, and CPA05). In 2014, the *E. coli* concentrations ranged from 2 cfu/100 mL to 435 cfu/100 mL. All three locations met the requirement of 10 of the values not to exceed 1,260 cfu/100 ml (Table 40).

Table 40. The Number of *E. coli* Samples that Exceed the Acute Standard in Painter Creek

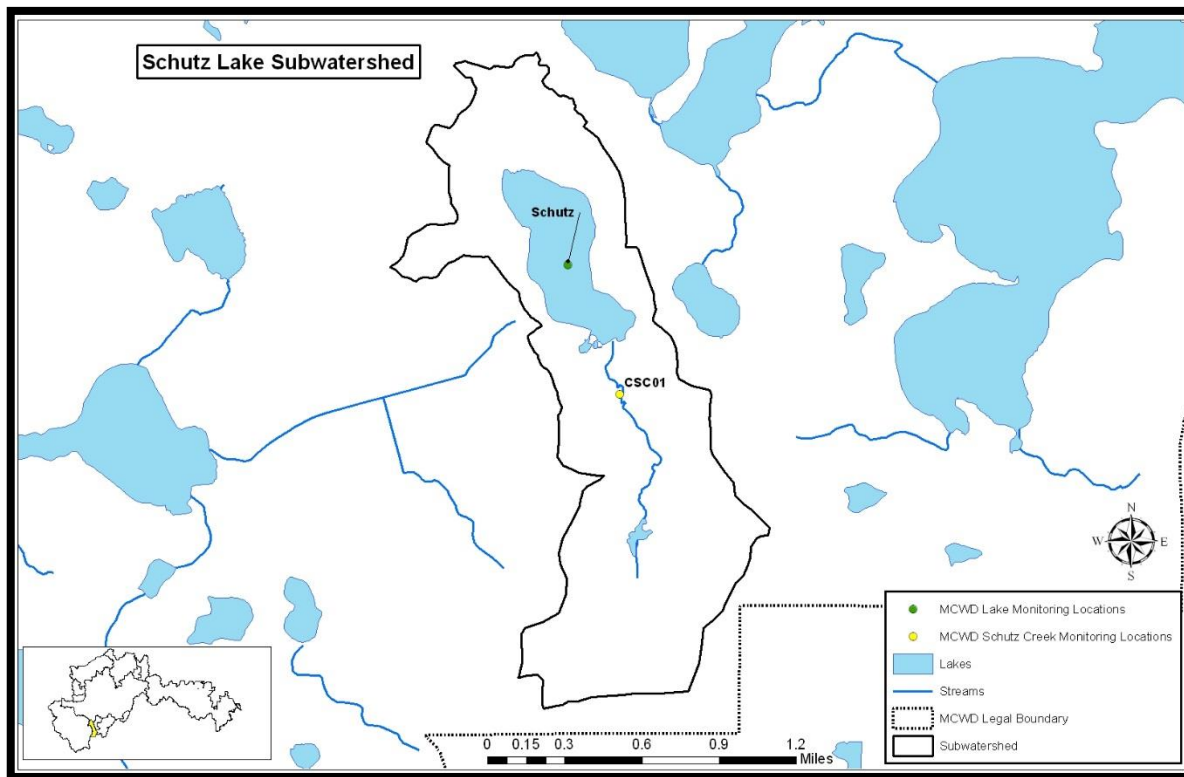
Month - 2014	CPA04	CPA01	CPA05
April	0	0	0
May	0	0	0
June	0	0	0
July	0	0	0
August	0	0	0
September	0	0	0
October	0	0	0
Total	0	0	0
Total # of Samples	30		
Total % of Samples Exceed Chronic <i>E. Coli</i> Standard	0%	0%	0%

Subwatershed Diagnosis: Painter Creek has the following issues: elevated *E. coli* concentrations at most of the sites, insufficient DO concentrations, and almost every site is a hot spot for nutrient, TSS and CI loading. Many of the lakes/wetlands in the Painter Creek Subwatershed have elevated nutrient levels as well.

A 2013 macroinvertebrate study revealed a poor macroinvertebrate community in Painter Creek. The study suggested re-meandering the creek to increase habitat and dissolved oxygen to support aquatic life. The challenge with this stream is that it is intermittent and tends to either go dry or stagnant mid to late summer.

The E-Grade Program will be assessing the Painter Creek Subwatershed in 2016-2018. MCWD will be investigating new monitoring sites that are potential nutrient and *E. coli* sources. MCWD will also be monitoring the additional Jennings Bay inlets to complete data gaps.

3.10 Schutz Lake Subwatershed



Lake Water Quality: In 2014, Schutz Lake exceeded the CHLA and TP NCHF ecoregion eutrophication standards. Schutz Lake also received a C water quality grade indicating the recreational activity may be undesirable at certain times of the year. There was no noticeable changes in nutrient concentrations during the high water period in Schutz Lake. The lake is eutrophic, which observations of greenish-brown water (indication of algae) and moderate aquatic plants supports (Table 41). None of the concentrations exceeded the acute and chronic CI standard.

Table 41. 2014 Lake Grades, Means and TSI Values for Lakes in the Schutz Lake Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
C	Schutz	1.67	23.63	46.88	58

Note: Red indicates not meeting the Standard

Stream Water Quality and Discharge: Temperature and TSS in Schutz Lake Creek: Schutz Lake inlet (CSC01) was within the NCHF ecoregion guidelines in 2014. TP was higher than the guidelines at 160 µg/L.

The mean annual flow in the Schutz Lake Creek: Schutz Lake inlet is slow at a rate of 1.84 cfs, though this was the highest recorded rate since 2006 when this site was established. Annual loading for TP, SRP, TN, TSS, and Cl at the site was increased from the previous year (Table 42). The TP loading increased by 194%, SRP loading increased by 140%, TN loading increased by 70%, TSS loading increased by 169% and Cl loading increased by 4%.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

The DO readings at the lake inlet were above the standard throughout 2014 indicating full support of aquatic life (Table 43).

Table 42. 2014 Concentration and Load Summary for Schutz Lake Subwatershed Stream Sites

Station	Schutz Lake Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	Cl (mg/L)	TP	SRP	TN	TSS*	Cl*
CSC01	Inlet	457.58	1.84	229	110	1.25	12	26	831	400	4548	43	93

*Multiply by 1000

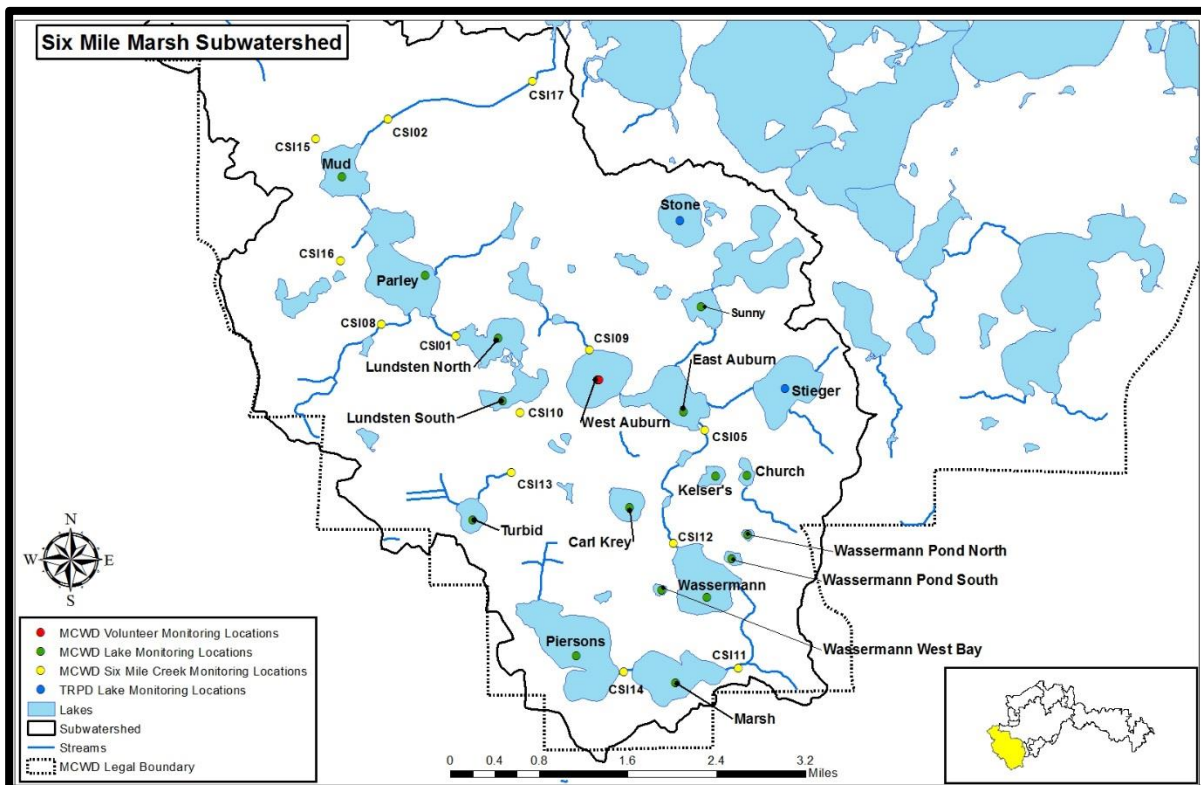
Table 43. The Number of DO Readings that Exceeded the Standard in the Schutz Lake Subwatershed Stream Sites

Month - 2014	CSC01
May	0
June	0
July	0
August	0
September	0
Total	0
Total # of Readings	22
Total % of Readings Exceeded DO Standard	0%

Subwatershed Diagnosis: Schutz Lake will be continued to be closely monitored for nutrients and algal abundance. 2014 was the first year since 2004 that both TP and CHLA exceeded the standards.

The E-Grade Program is currently assessing the Schutz Lake Subwatershed. In 2015, MCWD will be monitoring an unnamed lake upstream of Schutz Lake as potential source for nutrients.

3.11 Six Mile Marsh Subwatershed



Lake Water Quality: MCWD staff, Three Rivers Park District staff, Wenck Associates, on behalf of MCWD, and MCWD trained volunteers monitored the lakes within Six Mile Marsh Subwatershed.

Water quality in the Six Mile Marsh Subwatershed in 2014 showed an increase in TP during the month of June for the following lakes: Church, East Auburn, Sunny (Zumbra-Sunny), Stone and Wassermann. Turbid Lake had increases in TP from May-July, where Mud, Parley and Lundsten lakes had increases in TP from July to September. The smaller and more isolated lakes in this subwatershed had no noticeable increases to the surface nutrient levels. Elevated water levels occurred at Mud, Lundsten and Zumbra-Sunny lakes due to heavy precipitation.

Carl Krey met all three NCHF ecoregion eutrophication standards for shallow lakes and received an A- water quality grade in 2014. Lakes with an A grades are clear and can be used all season for recreational activities; however, Carl Krey has no public access. The TSI score classifies Carl Krey Lake as mesotrophic (Table 44).

Wassermann South pond, Steiger, Stone and Marsh Lake all met the NCHF ecoregion eutrophication standards in 2014. Wassermann South pond, Steiger, and Stone Lake received B (including B+) water quality grade, while Marsh had insufficient data to calculate the water quality grade. Kelsers, Wassermann North pond, Piersons, and West Auburn lakes did not meet one of the three NCHF ecoregion eutrophication standards, but all four lakes did receive a B (including B-) water quality grade. These lakes usually have clear water, but algal blooms often limit recreation in the late summer. The TSI score indicates that Wassermann South pond is mesotrophic, where the other seven lakes are eutrophic (Table 44).

Church, East Auburn, Lundsten North, Sunny (Zumbra-Sunny), and Wassermann West did not meet two of the three NCHF ecoregion standards in 2014. Wassermann Lake did not meet all three NCHF ecoregion eutrophication standards in 2014 (Table 33). All five bays/lakes received C (including C+/-) water quality grade. These five bays/lakes are eutrophic, with occasional algal blooms that limit recreation activities. Blue green algae blooms have been observed on Wassermann Lake (Table 44).

Parley Lake did not meet two of the three NCHF ecoregion eutrophication standards for shallow lakes in 2014. Turbid did not meet any of the three NCHF ecoregion standards. Both lakes received D (including D+/-) water quality grade (Table 33). The TSI scores for Parley and Turbid classify these lakes as eutrophic, which supports observations of extensive algae and aquatic plants.

In 2014, Lundsten Lake South did not meet all three NCHF ecoregion eutrophication standards and received an F water quality grade. Recreational activity, such as swimming, is severely limited on Lundsten Lake South. Lundsten Lake South has TSI score that classifies the lake as hypereutrophic, which is supported by heavy algal blooms and turbid waters (Table 44).

Mud Lake has been reclassified, by the MPCA, as Mud wetland due to its depth and percentage

of littoral zone. At this time, there is no eutrophication standards to assess the water quality in the Mud wetland.

Chloride was not monitored in Wassermann South and North ponds, Wassermann West Bay, and Sunny Lake in 2014. The remaining lakes in the Six Mile Marsh Subwatershed did not exceed the Cl standard in 2014.

Table 44. 2014 Lake Grades, Means and TSI Values for Lakes in the Six Mile Marsh Subwatershed

Lake Grade	Lake	Mean SECC (m)	Mean CHLA (µg/L)	Mean TP (µg/L)	TSI
May-Sept		June-Sept			
A-	Carl Krey*	2.86	4.25	18.25	45
B+	Wassermann South Pond	3.21	2.75	19.63	44
B	Stone	2.54	6.04	35.13	50
N/A	Marsh*	N/A	7.75	25.71	51
B	Kelser's	1.83	14.25	30.25	54
B	Steiger	2.94	10.95	30.66	61
B-	Wassermann North Pond	2.63	6.75	43.00	51
B-	Piersons	1.81	14.50	25.00	53
B-	West Auburn	1.88	16.38	27.63	54
C+	Sunny (Zumbra-Sunny)	2.11	16.13	45.63	55
C	East Auburn	1.40	31.25	43.75	59
C	Church	1.41	18.50	84.38	61
C	Lundsten - North Bay*	1.39	20.13	85.63	64
C-	Wassermann	0.97	40.50	78.75	65
C-	Wassermann - West Bay	1.52	19.50	368.00	68
D+	Parley*	1.09	54.50	113.63	67
D	Turbid	1.30	49.75	130.13	66
F	Lundsten - South Bay*	0.87	87.63	232.38	79
N/A	Mud**	0.64	87.50	133.44	N/A

Note: Red indicates not meeting the Standard; *Shallow lake; **Wetland

Stream Water Quality and Discharge: In Six Mile Creek, temperature, TSS, and TP were within the NCHF ecoregion guidelines at the following sites: at Piersons Lake outlet (CSI14), Wassermann Lake outlet (CSI12), East Auburn Lake inlet (CSI05), Lundsten Lake North inlet (CSI09), Lundsten Lake North outlet (CSI01) and Mud Lake outlet (CSI02). Wassermann Lake inlet (CSI11) site was in range for temperature and TP, but exceeded the TSS guideline. Turbid Lake outlet (CSI13), Parley Lake inlet (CSI08), Lundsten Lake South inlet (CSI10), Mud wetland inlet (CSI15), Parley Lake inlet at Crown College (CSI16), and Halsted Bay inlet (CSI17) were in range for temperature and TSS in 2014, but exceeded the mean TP guideline.

The mean annual flow in Six Mile Creek was slow to moderate with rates that ranged from 0.73 cfs to 17.29 cfs (Table 45).

The 2014 TP loading increased from the previous year at all the Six Mile Creek sites, except Mud wetland inlet (CSI15), Parley Lake inlet at Crown College (CSI16), and Halsted Bay inlet (CSI17). Mud Lake outlet site (CSI02) had the smallest increase in TP loading at 26%. Piersons Lake outlet site (CSI14) had the largest TP loading at 429%. The 2014 SRP loading increased from the previous year at all the Six Mile Creek sites, except Piersons Lake outlet (CSI14), Mud wetland inlet (CSI15), Parley Lake inlet at Crown College (CSI16). Halsted Bay inlet site (CSI17) had the smallest increase in SRP loading (5%), where Wassermann Lake outlet (CSI12) had the largest increase in SRP loading at 2,420%.

The 2014 TN and CI loading increased from the previous year at all the Six Mile Creek sites. Parley Lake inlet at Crown College (CSI16) had the smallest increase in TN loading at 25%, where Piersons Lake outlet (CSI14) had the largest increase in TN loading at 379%. Halsted Bay inlet site (CSI17) had the smallest increase in CI loading at 68%, and Wassermann Lake inlet (CSI11) had the largest increase in CI loading at 374%.

The 2014 TSS loading increased from the previous year at all the Six Mile Creek sites except East Auburn Lake inlet (CSI05), Parley Lake inlet at Crown College (CSI16), and Halsted Bay inlet (CSI17). The smallest increase in TSS loading occurred at both Parley Lake inlet (CSI08) and Mud Lake outlet (CSI02) at 7%. The largest increase in TSS loading occurred at Piersons Lake outlet (CSI14) at 1900%. Six Mile Creek site Lundsten Lake South Inlet (CSI10) had no data to compare to the previous year for all parameters.

It is important to note that the amount of samples collected for each parameter vary year to year depending on climatic conditions. This variation makes it difficult to accurately compare loading. Refer to subwatershed chapters for historical concentration and load summaries.

There were violations of the DO standard at all sites in Six Mile Creek, except at Turbid Lake outlet (CSI13) and Lundsten Lake North inlet (CSI09) in 2014. There was a wide range in the number of DO violations, but most of the violations occurred June-September. Four sites had violations from May-September - Lundsten Lake North outlet (CSI01), East Auburn Lake inlet (CSI05), Mud wetland inlet (CSI15), Halsted Bay inlet (CSI17). Six Mile Creek, depending on the site, does not have enough DO to support aquatic life (Table 46).

Table 45. 2014 Concentration and Load Summary for Six Mile Marsh Subwatershed Stream Sites

Station	Six Mile Creek	Contributing Watershed Area (acre)	Mean Flow (cfs)	Flow-Weighted Mean Concentration					Load (pound)				
				TP (µg/L)	SRP (µg/L)	TN (mg/L)	TSS (mg/L)	Cl (mg/L)	TP	SRP	TN	TSS*	Cl*
CSI14	Piersons Lk Outlet	1297.23	2.38	35	0	1.13	17	28	164	0	5291	80	129
CSI11	Wassermann Lk Inlet	392.95	2.94	53	11	1.06	11	27	309	62	6127	61	157
CSI12	Wassermann Lk Outlet	1199.68	5.63	73	11	1.57	7	31	806	126	17436	83	344
CSI13	Turbid Lk Outlet	622.04	1.17	215	98	2.45	19	24	495	226	5638	43	56
CSI08	Parley Lk Inlet	1880.04	1.23	207	112	2.77	7	17	499	270	6698	16	40
CSI05	East Auburn Lk Inlet	775.46	4.87	91	33	1.01	3	25	877	320	9627	24	244
CSI09	Lundsten Lk North Inlet	1086.99	8.81	34	0.8	1.12	3	35	584	14	19392	58	609
CSI10	Lundsten Lk South Inlet	164.42	1.27	371	289	4.76	6	**	928	722	11900	14	**
CSI01	Lundsten Lk North Outlet	924.48	15.56	77	12	1.21	5	29	2356	382	36948	154	878
CSI16	Parley Lk Inlet	1454.81	0.73	213	118	1.62	10	28	308	169	2332	14	40
CSI15	Mud Wetland Inlet	656.09	1.56	327	195	2.56	9	47	1004	597	7865	27	143
CSI02	Mud Wetland Outlet	1021.69	17.29	137	24	1.94	18	29	4661	805	65894	598	972
CSI17	Halsted Bay: Inlet	1700.22	12.40	155	60	1.38	6	24	3780	1456	33747	153	588

*Multiply Load by 1000

Table 46. The Number of DO Readings that Exceeded the Standard in the Six Mile Marsh Subwatershed Stream Sites

Month - 2014	CSI14	CSI11	CSI12	CSI13	CSI08	CSI05	CSI09	CSI10	CSI01	CSI16	CSI15	CSI02	CSI17
May	0	1	0	0	0	3	0	0	0	0	1	0	1
June	0	3	0	0	2	5	0	1	3	4	7	3	5
July	0	4	2	0	1	4	0	0	0	3	4	3	4
August	0	4	3	0	2	4	0	0	1	4	4	4	4
September	1	2	4	0	3	5	0	0	0	5	5	4	4
Total	1	14	9	0	8	21	0	1	4	16	21	14	18
Total # of Readings	19	22	21	20	22	22	22	8	22	22	25	21	21
Total % of Readings Exceeded DO Standard	5%	64%	43%	0%	36%	95%	0%	13%	18%	73%	84%	67%	86%

Stream *E. coli*: Data was collected for *E. coli* concentrations on one location on Six Mile Creek at Highland Rd. (CSI02). This location met the requirement of 10% of the values not to exceed 1,260 cfu/100 ml (Table 47).

Table 47. The Number of *E. coli* Readings that Exceed the Acute Standard in Six Mile Creek

Month - 2014	CSI02
April	0
May	0
June	0
July	0
August	0
September	0
October	0
Total	0
Total # of sample	30
Total % of Samples Exceed Chronic <i>E. Coli</i> Standard	0%

Subwatershed Diagnosis: Church, Lundsten North, and Sunny lakes exceeded the eutrophication standards in 2014, and could be evaluated for impairment, if the water quality exceeds the standards in 2015. MCWD will be continue to monitor these lakes closely. Majority of the stream sites in Six Mile Creek have elevated nutrient loading; however, in high water years, the nutrient loading is exacerbated at Lundsten Lake North outlet (CSI01), Mud wetland outlet (CSI02), and Halsted Bay inlet (CSI17). In 2014, flooding was an issue in the Six Mile Marsh Subwatershed in 2014. Major flooding was observed at Mud wetland inlet/outlet, Zumbra-Sunny Lake, and Lundsten: North and South Bays.

MCWD, with Wenck Associates, conducted a diagnostic study to identify the issues plaguing the health and function of the waterbodies in the Six Mile Marsh Subwatershed. The sources of nutrients have been found to be from over-populated carp, degraded wetlands, lakes with internal nutrient loading, and elevated nutrient sources from a mix of agricultural and development (<http://www.minnehahacreek.org/project/six-mile-marsh-diagnostic-study>). The E-Grade Program is currently monitoring the Six Mile Marsh Subwatershed in part as a follow-up to the diagnostic study and in part as test subwatershed for developing the new E-Grade system.

4. WATERSHED WIDE WATER QUALITY SUMMARY

In order to better summarize the water quality in 2014, this section is divided into upper and lower watersheds. West of the Grays Bay Dam is considered the upper watershed of MCWD and includes Lake Minnetonka, Christmas Lake, Lake Virginia, Schutz Lake, Six Mile Marsh, Langdon Lake, Dutch Lake, Painter Creek, Long Lake Creek, and Gleason Lake subwatersheds. East of Grays Bay Dam is considered the lower watershed of MCWD and is comprised of the Minnehaha Creek Subwatershed.

The upper watershed land use and cover within the Lake Minnetonka Subwatershed consists mainly of single-family homes adjacent to Lake Minnetonka. The land use and cover in the remaining upper watershed has historically been undeveloped or in agricultural use; though growth of single-family developments in the upper watershed continues to be on the rise. Several large parks (i.e., Three Rivers Park District, Lake Minnewashta Regional Park) are prominent throughout, and the undeveloped areas are a mix of forest, woodland, grasslands, and wetlands. Currently, the percentage of impervious surface area remains low in the upper watershed compared to the lower watershed (MCWD, 2007).

In the upper watershed, the Christmas Lake Subwatershed is the only subwatershed that all the waterbodies meet the NCHF eutrophication standards in 2014. Painter Creek, Long Lake Creek, and Six Mile Creek showed an increase in nutrient loading from the previous years. In these upper subwatersheds, all or most of the waterbodies are not meeting the NCHF standards. In 2014, heavy precipitation affected majority of the waterbodies in upper subwatersheds, but nutrient loading from previous years may also be contributing to the impairments.

Internal nutrient cycling or internal loading releases stored nutrients from the past into a lake's open water. Often the nutrient cycling process occurs during turnover in the spring and fall, but in shallow lakes (i.e., Halsted Bay) mixing can occur during a storm event (Missaghi and Honszo, 2010). Remnants from inactive sewage treatment plants on Lake Minnetonka and Langdon Lake, and other nutrient-rich deposits are sources of internal phosphorus (MCWD, 2007). Historically, sediment records in some of the upper watershed lakes have indicated that they were eutrophic even in pre-European times (Edlund et. al, 2009). Another factor is the watershed to lake area ratio. The larger the ratio the greater the contribution of external nutrient loading can be to a lake (Shaw et. al, 2004). A resource of best management practices to reduce external nutrient loading to the lakes and streams can be found at www.minnehahacreek.org/education.

The lower watershed land use and land cover is almost completely developed. The single-family homes and apartment complexes dominate the subwatershed with scattered industrial and commercial zones. Parks and open space are distributed throughout the cities' neighborhoods. The restoration of Minnehaha Creek in Hopkins and St. Louis Park is increasing park and open space in the lower watershed. The lower watershed, being highly developed, has a higher percentage of impervious surface areas than the upper watershed (MCWD, 2007).

In the Minnehaha Creek Subwatershed, high water period increased the nutrient loading at the majority of the stream sites on Minnehaha Creek from the previous years. More than half of the lakes did not meet the NCHF eutrophication standards as well. The waterbodies in Minnehaha Creek Subwatershed are not meeting the eutrophication standards due to heavy precipitation and runoff that occurred in early spring and summer months of 2014 and the impact from past loading events.

Staff in the Research and Monitoring Department will continue to work closely with the staff in Planning, Permitting, and Project Maintenance and Land Management Programs to identify impaired waters within each of the subwatersheds. These programs permit, develop and maintain projects that focus on protecting and restoring the water quality in MCWD's lakes and streams. However, the E-grade program will shift data collection towards wetlands, terrestrial, groundwater, and hydrological features in addition to lakes and streams. Management strategies in the coming years will shift in response to widen protection and restoration efforts in priority subwatersheds throughout the MCWD. Staff will continue to convey the health of the resources to engage and empower communities to better protect the quality of water throughout Minnehaha Creek Watershed District, as it is the quality of life.

5. FUTURE INITIATIVES

2016

- Continue working with consultant(s) and Technical Advisory Committee in the process, design, and implementation of the Ecosystem Evaluation Program (E-Grade)
- Focus increased monitoring of streams, lakes and wetlands within the Dutch Lake, Gleason Lake, Langdon Lake, Long Lake, Painter Creek and Upper Minnehaha Creek subwatersheds as part of our three year monitoring rotation
- Research and continue to upgrade monitoring equipment

2017

- Publish the first Subwatershed E-Grade Reports as part of the Ecosystem Evaluation Program (See E-Grade Report Schedule below)

E-Grade Report Schedule			
2017	2019	2022	2023
<u>Subwatersheds</u> Lower Minnehaha Creek Schutz Lake Six Mile Marsh	<u>Subwatersheds</u> Dutch Lake Gleason Lake Langdon Lake Long Lake Creek Painter Creek Upper Minnehaha Creek	<u>Subwatersheds</u> Christmas Lake Lake Minnetonka Lake Virginia	Watershed-Wide

6. REFERENCES

- Anderson, P. and M. Lindon. 2010. *Standard Operating Procedures: Lake Water Quality Sampling*. Minnesota Pollution Control Agency. St. Paul, MN.
- Carlson, R.E. 1977. *A Trophic State Index for Lakes*. *Limnology and Oceanography* 22:361-369.
- Edlund, M.B., A.L.C. Shinneman, and J.M. Ramstack, 2009. *Diatom-Inferred TP in MCWD Lakes. Phase II*. St. Croix Watershed Research Station, Science Museum of Minnesota, St. Croix, MN pp 50.
- Emmons and Olivier Resources, Inc. 2003. Minnehaha Creek Watershed District's Hydrologic Hydraulic and Pollutant Loading Study Report.
- MacIssac, H.J., 1996. Potential Abiotic and Biotic Impacts of Zebra Mussels on the Inland Waters of North America. *American Zoology* 36:287-299.
- McCullor and Heiskary. 1993. *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions*. Minnesota Pollution Control Agency Water Quality Division.
- Minnehaha Creek Watershed District, (MCWD), 2007. Comprehensive Water Resources Management Plan: 2007-2017.
- Minnesota Pollution Control Agency (MPCA), 2014. *Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment, 305(b) Report and 303 (d) List*.
- Missaghi, S. and M. Hondzo. 2010. Evaluation and application of a three-dimensional water quality model in a shallow lake with complex morphometry. *Ecological Modelling* 221:1512-1525.
- Moore, L and K. Thorton, Ed. 1998. *Lake and Reservoir Restoration Guidance Manual*. USEPA, EPA 440/5-88-002.
- Osgood, R.A. 1989. *A 1989 Study of the Water Quality of 20 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 590-89-129.
- Shaw, B., C. Mechenich, and L. Klessig. 2004. *Understanding Lake Data*. University of Wisconsin: Extension. Pp 3-4.
- Standard Methods for the Examination of Water and Wastewater. 2005. Joint Editorial Board, American Public Health Association, American Water Works Association, Water Environmental Fed., 21st ed. Washington, DC.
- US EPA. 1979. *Methods for chemical analysts of water and waste*. US EPA Environmental Monitoring and Support Laboratory. Cincinnati, OH.
- Laboratory. Cincinnati, OH.

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Minnehaha Creek Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	4
Guidelines and Standards	6
Executive Summary	7
Subwatershed Facts and Map	8
Minnehaha Creek Subwatershed - Lake Monitoring Sites Information.....	10
Bass Lake.....	12
Brownie Lake	13
Cedar Lake	14
Cobblecrest Lake.....	16
Diamond Wetland.....	17
Grass Lake	19
Hannan Lake	20
Lake Calhoun.....	21
Lake Harriet	23
Lake Hiawatha	25
Lake of the Isles	27
Meadowbrook Lake	29
Mother Lake.....	30
Lake Nokomis.....	31
Pamela Lake	33
Powderhorn Lake.....	34
South Oak Lake	36
Twin Lake	38
Victoria Lake	40

Table of Contents (Cont.)

Windsor Lake	41
Minnehaha Creek Subwatershed - Additional Lake Information	42
Minnehaha Creek Subwatershed - Stream Monitoring Sites Information	45
Gleason Lake Creek: Gleason Wetland Outlet	46
Minnehaha Creek: Grays Bay Dam	48
Minnehaha Creek: Williston Rd	50
Minnehaha Creek: I-494 Ramps	52
Minnehaha Creek: W 34th St	54
Minnehaha Creek: Excelsior Blvd	56
Minnehaha Creek: Browndale Dam	58
Minnehaha Creek: W 56th St	60
Minnehaha Creek: Xerxes Ave	62
Minnehaha Creek: 21st Ave	64
Minnehaha Creek: 28th Ave	66
Minnehaha Creek: Hiawatha Ave	68
Minnehaha Creek Subwatershed - <i>E. coli</i> Concentrations	69
Minnehaha Creek Subwatershed - Additional Stream Information	70

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second.

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

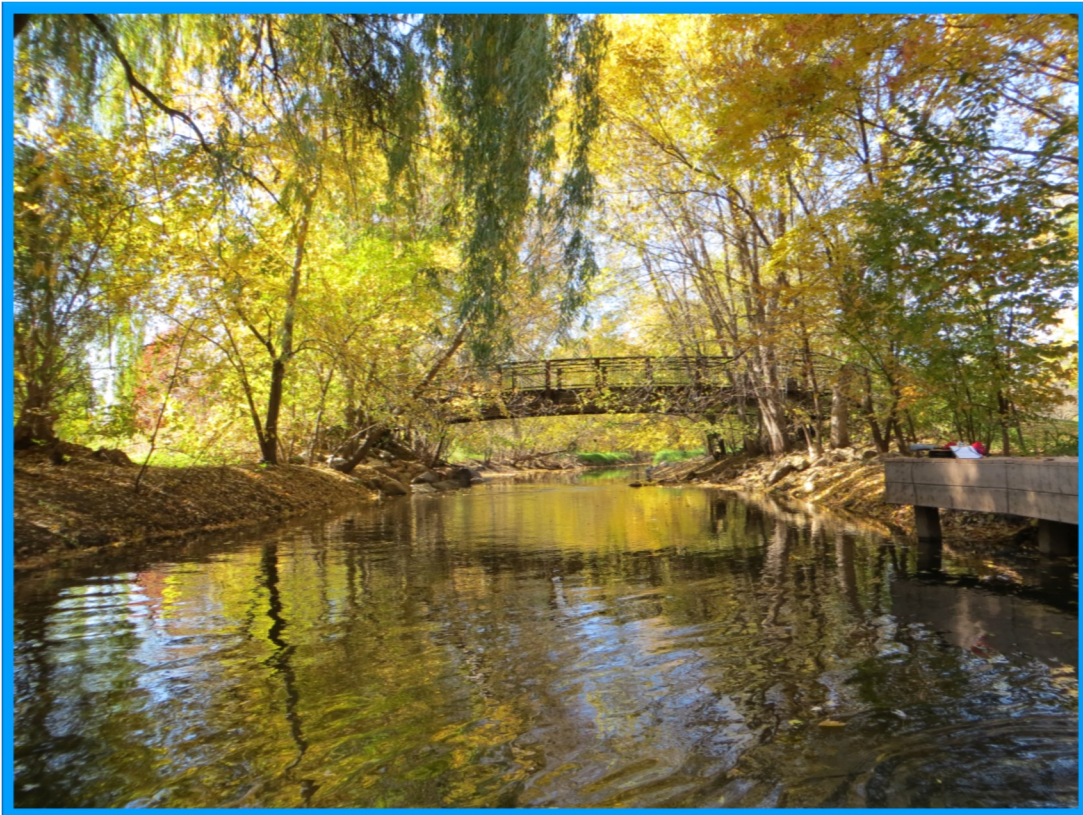
Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A low TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.



Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see the 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%; Lake Nokomis has a site-specific standard for CHLA (< 20) and TP (< 50); Lake Hiawatha has a site-specific standard for TP (< 50).

Executive Summary

The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary. The 2014 monitoring season is summarized for the Minnehaha Creek Subwatershed in this report.

In Minnehaha Creek Subwatershed, there were 11 sites on Minnehaha Creek, 1 wetland and 19 lakes monitored in 2014. The Gleason Lake Creek: wetland outlet site was below the North Central Hardwood Forest (NCHF) dissolved oxygen standard and above the total phosphorus guideline in 2014. The table below displays the lakes monitored within the Minnehaha Creek Subwatershed that did not meet the NCHF eutrophication standards. Cobblecrest Lake had insufficient data to determine if the eutrophication standards were met.

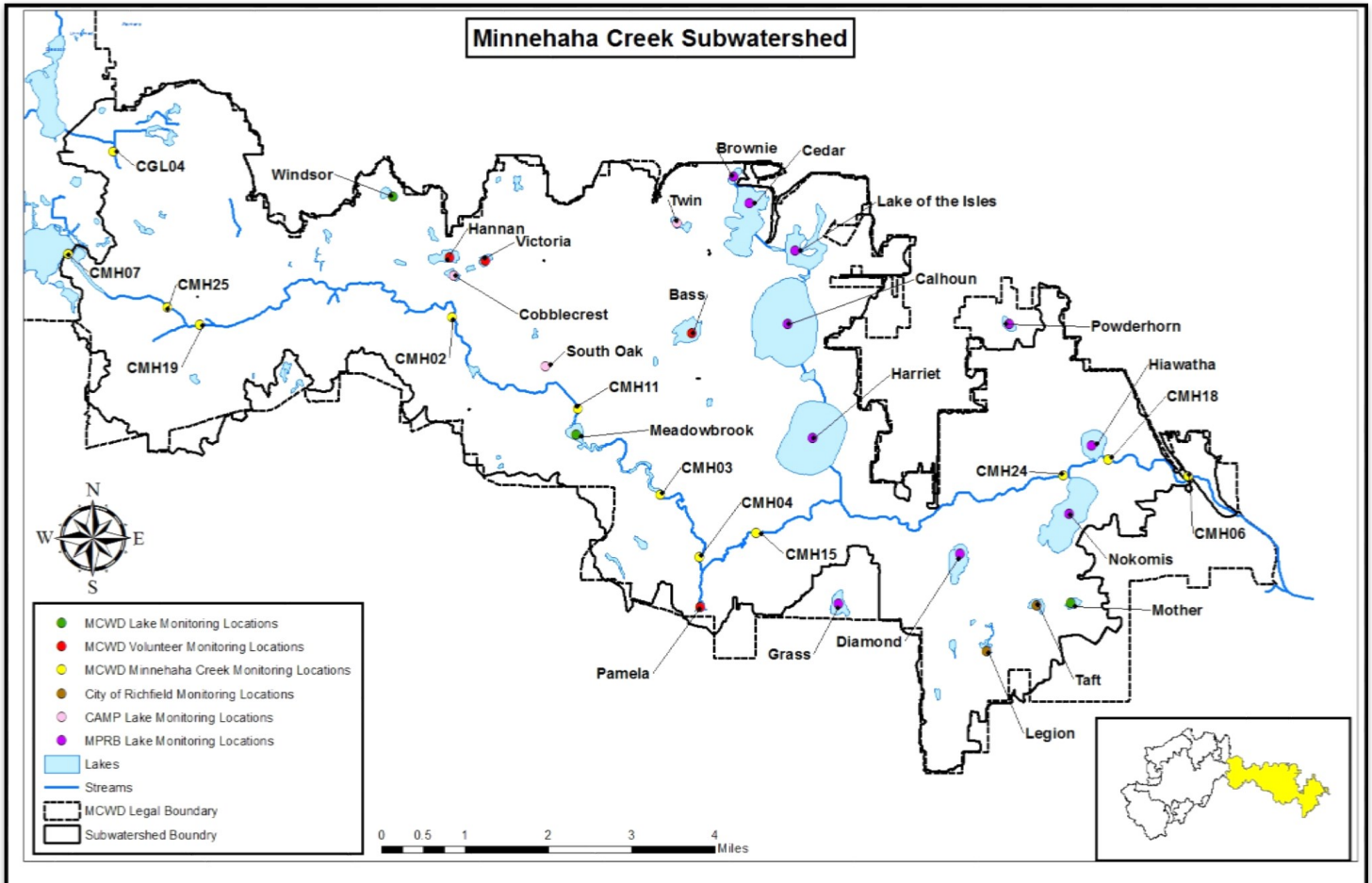
Lake/Wetland**	(X) Indicates Not Meeting the Standard in 2014																				
	Bass**	Brownie	Calhoun	Cedar	Cobblecrest	Diamond**	Grass	Hannan	Harriet	Hiawatha*	Isles	Meadowbrook	Mother	Nokomis*	Pamela	Powderhorn	South Oak	Twin	Victoria	Windsor	
SECC					N/A										X	X	X	X	X	X	N/A
CHLA					N/A			X			X	X	X		X	X	X	X	X	X	X
TP					N/A		X	X		X					N/A	X	X	X	X	X	X
CI		X			N/A	X									X	X		X			

*Site-Specific Standards; N/A means insufficient data to assess if standards have been met; no eutrophication standards to assess the water quality in wetland, represented in the tables as black

Subwatershed Facts and Map

Municipalities	Edina, Hopkins, Minneapolis, Minnetonka, Plymouth, Richfield, St. Louis Park, and Wayzata
Area	About 30,920 acres
Population	Edina = 49,376 people (2013) Hopkins = 18,025 people (2013) Minneapolis = 400,070 people (2013) Minnetonka = 51,368 people (2013) Plymouth = 70,576 people (2013) Richfield = 36,175 people (2013) St. Louis Park = 47,411 people (2013) Wayzata = 4,217 people (2013)
Ecoregion	North Central Hardwood Forest
Groundwater	Minneapolis and St. Louis Park MnDNR Wells Monitored
District Goals	<ul style="list-style-type: none"> • Reduce in-lake TP concentrations to levels identified in the Hydrologic, Hydraulic, and Pollutant Loading Study (HHPLS) plan • Reduce chlorophyll-<i>a</i> concentration to below 14 µg/L and increase Secchi depth to above 1.4 m • Maintain TP concentration to below 80 µg/L and other nutrients at or below the ecoregion average

Subwatershed Facts and Map



Minnehaha Creek Subwatershed - Lake Monitoring Sites Information

Lake	MNDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Water-shed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Bass	27-0015-00	LBA01	Henne-pin	No	48.0					3.3	1285.61	27:1	44.88315	-93.63574
Brownie	27-0038-00	LBR01	Henne-pin	Limited	18.0		67	404	22	50	391.26	22:1	44.96670	-93.32390
Calloun	27-0031-00	LCA01	Henne-pin	Yes	415.0		31	14593	35	90	5529.93	13:1	44.94306	-93.31139
Cedar	27-0039-00	LCE01	Henne-pin	Yes	168.0		37	3454	20	51	2683.01	16:1	44.95972	-93.32111
Cedar Manor*	27-0713-00	LCM02	Henne-pin	No	6.1						435.88	71:1	45.0680	-93.63722
Cobble-crest	27-0053-00	LCB01	Henne-pin	No	10.0					6	1029.54	103:1	44.95020	-93.39320
Diamond	27-0022-00	LDI01	Henne-pin	Yes	51.0		100	57	3	6.9	743.42	15:1	44.90056	-93.26911
Grass	27-0681-00	LGR01	Henne-pin	No	27.0					4.9	414.86	15:1	44.89310	-93.29860
Hannan	27-0052-00	LHN02	Henne-pin	No	27.0					6	192.98	7:1	44.95338	-93.39450
Harriet	27-0016-00	LHA01	Henne-pin	Yes	339.0		25	10134	29	82	8681.28	26:1	44.92222	-93.30444
Hiawatha	27-0018-00	LHI01	Henne-pin	Limited	54.0		26	726	15	23	29506	546:1	44.92083	-93.23633
Isles	27-0040-00	LIS01	Henne-pin	Yes	113.0		89	900	9	31	3628.36	32:1	44.95556	-93.30722
Lamp-lighter*	27-0710-00	LAM01	Henne-pin	No	7.5					5.5	520.5	69:1	44.22280	-93.55500
Legion [^]	27-0024-00	LEGN	Henne-pin	No	9.16						1196.06	131:1		
Meadow-brook	27-0054-00	LMB01	Henne-pin	No	33.0					7	11383	345:1	44.92280	-93.36330
Melody*	27-0669-00	LMY01	Henne-pin	No	7.8					5.1	152.83	20:1	44.91500	-93.43490

Minnehaha Creek Subwatershed - Lake Monitoring Sites Information (Continued)

Lake	MNDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Water-shed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Mother	27-0023-00	LMO01	Hennepin	No	11.0					3	484.18	44:1	44.89317	-93.24226
Nokomis	27-0019-00	LNK01	Hennepin	Yes	201.0		51	2886	14	33	2485.06	12:1	44.90833	-93.24194
Pamela	27-0675-00	LPA01	Hennepin	No	7.0					6	153.89	22:1	44.89230	-93.33228
Powder-horn	27-0014-00	LPO01	Hennepin	Yes	12.0		99	73	4	20	331.67	28:1	44.94167	-93.25722
South Oak	27-0661-00	SOAK	Hennepin	No	3.1					22	460	148:1	44.93420	-93.37050
Taft^	27-0683-00	LTF01	Hennepin	No	14.0					45	1839.08	131:1	44.8932	-93.24942
Twin	27-0656-00	TWIN	Hennepin	No	13.0					7	1715.39	132:1	44.00280	-93.33840
Victoria	27-0051-00	LVA01	Hennepin	No	10.0					4.3	174.67	17:1	44.00280	-93.40080
Westling Pond*	27-0714-00	LWT02	Hennepin	No	3.6					3	23.55	7:1	44.95115	-93.38910
Windsor	27-0082-00	LWD01	Hennepin	Yes	10.0					5	197.56	20:1	44.96435	-93.40996

*Not Monitored in 2014

^Monitored by the City of Richfield, data not included in this report



Bass Lake

(DNR ID: 27-0015-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	N/A	C	F	N/A
2014	D	C	D	D+

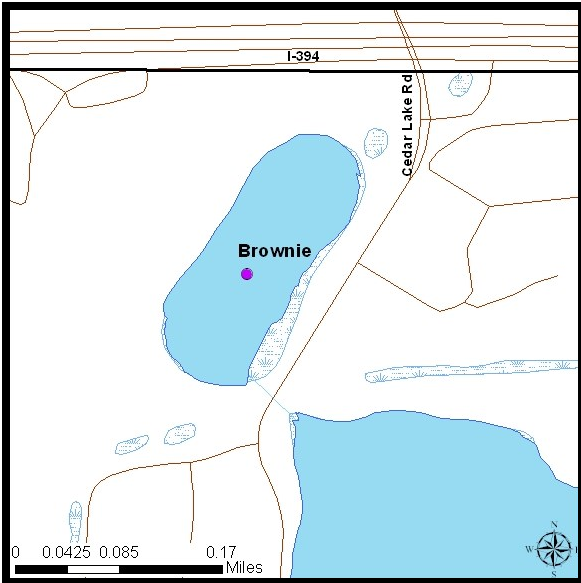
Note: Data collected at a different site in 2013

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	N/A	26.5	214	72
2014	0.90	33.25	133	67

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl	TSS
5/20/2014	12.50	0.55	3	83	1.05	0.799	0.248	38	10
6/18/2014	23.90	0.70	3	78	1.04	0.782	0.255	12	6
7/31/2014	20.60	1.00	10	122	3.34	2.830	0.513	138	4
8/26/2014	20.20	1.00	64	189	4.40	3.900	0.495	99	11
9/29/2014	17.10	0.90	56	143	1.66	1.480	0.184	185	7



Brownie Lake
(DNR ID: 27-0038-00)
- Monitored by MPRB -

**Ten-Year Lake Grade Record
 (May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007				
2008	N/A	N/A	N/A	N/A
2009				
2010	D	C	C	C-
2011				
2012	D	C	C	C-
2013				
2014	C	A	C	B-

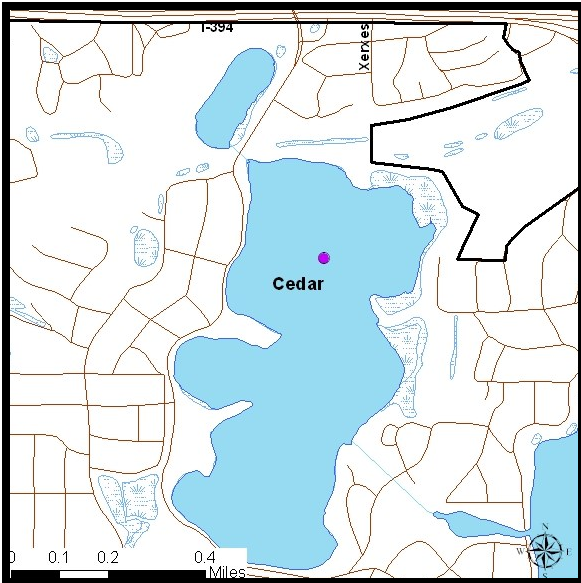
**Ten-Year Water Quality Means
 (June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	1.42	11.63	42	57
2007				
2008	N/A	10.87	N/A	N/A
2009				
2010	1.08	26.35	55	61
2011				
2012	0.87	23.36	51	61
2013				
2014	1.49	9.83	35	54

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
3/20/2014	0.46	2.07	1150	7.22		3.72	74/5199	7/144	1.730	1.610	<0.030	344/859
5/5/2014	10.27	14.20		8.37	0.84	4.71	26/5314	<3/11	0.865	0.750	0.112	221/929
6/11/2014	23.04	9.88	722	7.88	2.40	3.30	37/5629	<3/34	0.738			192/961
7/7/2014	25.26	12.00	963	8.61	1.17	14.90	39/4830	<3/22	0.733	0.660	0.034	242/946
8/5/2014	25.02	11.30	1214	8.44	1.44	5.70	29/5492	4/30	<0.500			398/901
9/9/2014	20.73	10.09	1187	8.29	0.95	15.41	35/5974	4/19	0.587			313/881
10/20/2014	12.77	9.24	1517	7.79	1.62	8.30	38/6015	<3/19	0.598	0.520	0.075	338/832

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Cedar Lake
(DNR ID: 27-0039-00)
- Monitored by MPRB -

**Ten-Year Lake Grade Record
 (May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	B	A	B	B+
2006	C	B	B	B-
2007	B	A	B	B+
2008	C	A	B	B
2009	B	A	B	B+
2010	B	B	B	B
2011	B	A	B	B+
2012	B	A	B	B+
2013	C	B	C	C+
2014	C	A	B	B

**Ten-Year Water Quality Means
 (June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.24	7.54	25	50
2006	1.17	15.73	23	55
2007	2.25	7.40	23	49
2008	2.00	7.69	22	50
2009	1.93	7.38	26	51
2010	1.69	14.20	28	54
2011	2.21	8.27	25	50
2012	2.35	7.92	26	50
2013	1.65	13.09	32	54
2014	1.91	6.50	24	50

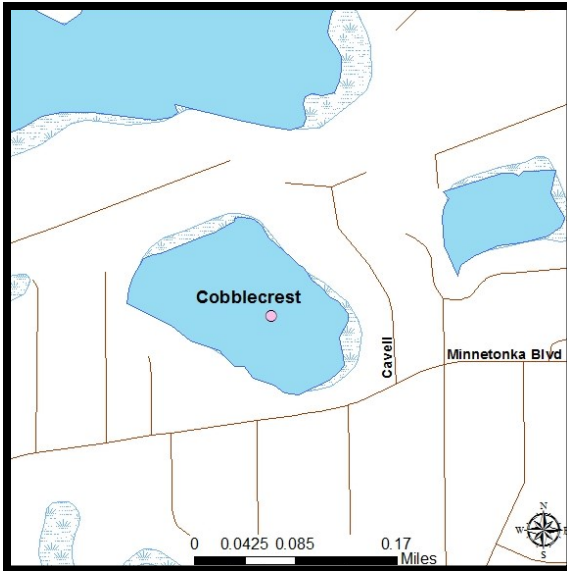
Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Cedar Lake (DNR ID: 27-0039-00)
- Monitored by MPRB -

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
3/12/2014	0.30	6.18	717	7.39		<0.50	135/192	3/59	0.792	1.370	0.577	129/138
5/5/2014	8.99	12.60		8.64	1.41	5.47	52/114	3/25	1.180	1.000	0.144	162/162
5/20/2014	13.94	13.40	680	9.03	1.10	3.30	52/96	<3/12	0.964			133/148
6/11/2014	22.63	9.68	651	8.11	3.85	2.40	20/103	<3/30	0.855			131/152
6/25/2014	24.35	12.60	570	8.94	2.17	8.20	28/111	<3/47	0.657			103/133
7/7/2014	24.30	9.72	588	8.79	1.60	7.20	24/153	<3/93	0.660	0.760	<0.030	109/144
7/21/2014	24.50	8.01	614	8.37	2.16	6.00	27/149	<3/89	0.778			116/146
8/5/2014	25.71	8.78	627	8.66	1.95	4.03	23/177	4/144	0.562			118/138
8/20/2014	25.11	9.08	651	8.57	1.42	12.00	27/229	3/181	0.629			124/144
9/9/2014	21.53	7.76	667	8.44	1.08	14.20	26/306	3/230	0.763			129/150
9/22/2014	18.20	9.02	672	8.60	1.05	1.00	18/262	4/222	0.725			173/139
10/21/2014	12.17	8.21	716	8.19	1.80	7.00	25/365	<3/342	0.823	0.700	0.210	123/133

Note: Surface/Bottom Results



Cobblecrest Lake

(DNR ID: 27-0053-00)

- Monitored by CAMP -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	F	F	F	F
2006	F	F	D	F
2007	F	F	F	F
2008	F	F	F	F
2009	F	F	F	F
2010	F	F	D	F
2011	F	C	D	D
2012	N/A	N/A	N/A	N/A
2013	F	C	C	D+
2014	N/A	N/A	N/A	N/A

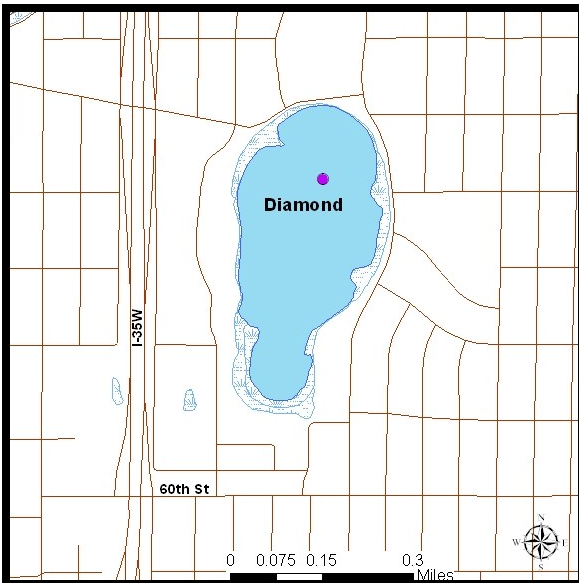
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	0.29	159.14	174	79
2006	0.38	117.63	162	76
2007	0.27	135.56	175	79
2008	0.25	169.38	179	80
2009	0.25	146.67	183	80
2010	0.27	130.33	135	77
2011	N/A	N/A	N/A	N/A
2012	N/A	N/A	N/A	N/A
2013	0.64	27.40	55	64
2014	N/A	N/A	N/A	N/A

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TKN
6/22/2014	22.1	0.6		72	0.98
6/26/2014	25.2	0.6	47	64	1.20
8/21/2014	25.0	0.4	56	94	1.60
11/3/2014	9.1	0.5	46	102	1.40

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Diamond Wetland (DNR ID: 27-0022-00) - Monitored by MPRB -

Note: Diamond Lake has been reclassified, by the MPCA, as Diamond wetland due to its depth and percentage of littoral zone. At this time, there is no eutrophication standards to assess the water quality in the Diamond wetland.

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/7/2014	13.77	10.60	1127	7.76		13.20	72	19	1.540	1.460	0.142	314
5/21/2014	15.80	8.27	808	7.91	0.66	8.44	82	3	1.020			217
6/10/2014	21.12	12.70	574	9.59		2.20	99	43	0.671			152
6/26/2014	23.76	8.39	270	8.89	1.13	7.40	70	6	0.613			58
7/8/2014	23.15	10.50	360	9.46		10.10	66	16	0.668	0.520	<0.030	85
7/24/2014	22.93	5.99	305	8.16		81.00	183	4	1.640			72
8/6/2014	23.26	9.87	342	8.85		33.70	108	3	1.270			70
8/19/2014	23.02	5.17	389	7.71		73.20	143	4	1.330			78
9/8/2014	19.00	5.27	351	7.32	0.65	37.60	77	7	1.110			73
9/24/2014	17.76	4.20	478	7.34		2.35	64	9	0.852			105
10/23/2014	11.37	9.01	566	8.07		51.00	92	6	1.260	0.800	0.491	113



Grass Lake

(DNR ID: 27-0681-00)
- Monitored by MPRB -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	B	D	N/A
2007				
2008	N/A	A	C	N/A
2009				
2010	N/A	B	D	N/A
2011				
2012	N/A	D	D	N/A
2013				
2014	N/A	A	D	N/A

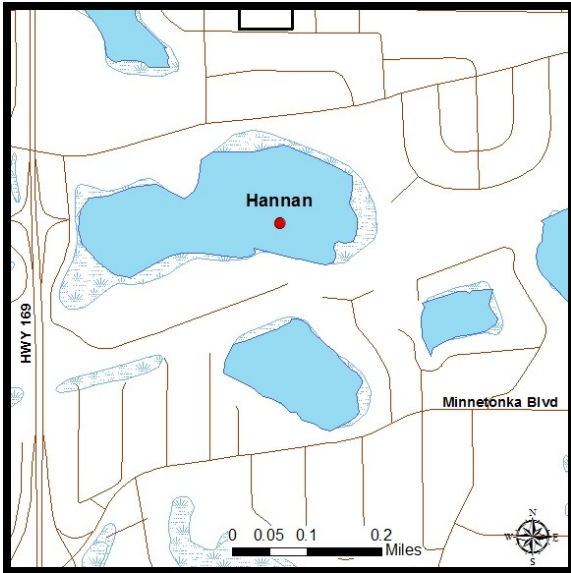
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	13.61	111	64
2007				
2008	N/A	6.23	55	55
2009				
2010	N/A	9.4	82	60
2011				
2012	N/A	43.35	80	67
2013				
2014	N/A	5.19	80	57

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/8/2014						1.65	45	3	0.625	0.670	0.131	68
6/10/2014						<0.50	102	32	0.583			46
7/8/2014						4.85	76	13	0.716	0.670	<0.030	31
8/6/2014	25.24	7.06	225	8.50		5.49	77	4	1.220			35
9/8/2014	20.30	9.77	251	8.54		10.40	65	6	1.050			47
10/23/2014	11.33	10.94	305	9.55		5.30	94	31	1.030	0.870	0.143	54

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Hannan Lake

(DNR ID: 27-0052-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010	N/A	C	D	N/A
2011	D	C	C	C-
2012				
2013	N/A	N/A	N/A	N/A
2014	C	C	D	C-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010	N/A	49.38	151	73
2011	0.96	29.50	63	63
2012				
2013	N/A	N/A	N/A	N/A
2014	1.35	41.75	74	63

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl	TSS
5/13/2014	13.50	1.25	17	49	0.816	0.816	<0.03	100	3
6/23/2014	26.90	1.65	11	108	0.869	0.869	<0.03	69	1
7/22/2014	27.10	1.50	3	34	0.761	0.761	<0.03	70	2
8/25/2014	24.80	1.05	14	39	0.902	0.902	<0.03	76	2
9/21/2014	17.60	1.20	139	114	1.150	1.150	<0.03	77	8

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Lake Calhoun
(DNR ID: 27-0031-00)
- Monitored by MPRB -

**Ten-Year Lake Grade Record
 (May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	A	A
2006	A	A	A	A
2007	A	A	B	A-
2008	A	A	A	A
2009	A	A	A	A
2010	A	A	A	A
2011	A	A	A	A
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

**Ten-Year Water Quality Means
 (June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	5.58	1.68	14	38
2006	3.41	3.25	13	42
2007	3.28	3.76	34	48
2008	2.88	3.23	16	44
2009	4.55	2.79	18	42
2010	3.21	3.53	17	44
2011	3.00	4.21	18	45
2012	2.72	6.92	20	48
2013	3.94	3.62	17	43
2014	3.94	3.40	15	42

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

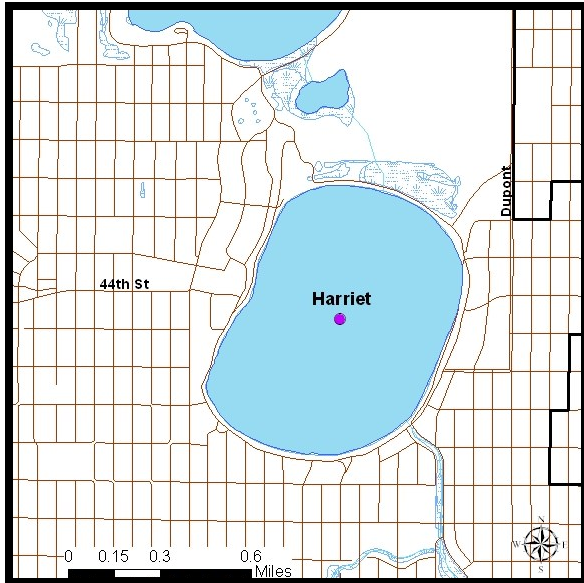
Lake Calhoun (DNR ID: 27-0031-00)

- Monitored by MPRB -

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
2/18/2014	0.44	13.50	735	8.33		<0.50	15/42	6/21	0.661	0.910	0.305	137/132
5/5/2014	7.61	11.00	713	7.99	2.92	2.60	26/17	<3/<3	0.746	0.720	0.087	152/152
5/20/2014	13.26	10.30	702	8.13	7.95	0.70	19/31	<3/6	0.774			143/153
6/11/2014	21.44	9.66	704	8.42	6.13	0.77	10/35	<3/25	0.818			152/157
6/25/2014	23.92	9.77	660	8.58	4.74	1.60	13/77	<3/33	0.701			133/143
7/7/2014	23.37	9.34	670	8.67	4.27	3.60	15/64	<3/47	0.623	<0.500	0.229	129/158
7/21/2014	23.48	9.51	672	8.79	3.00	4.60	16/76	<3/57	<0.500			136/156
8/5/2014	25.02	9.62	666	8.87	3.35	1.68	18/97	5/72	<0.500			140/151
8/20/2014	24.99	9.09	671	8.82	3.10	2.30	15/101	3/81	0.397			139/149
9/9/2014	21.42	8.36	679	8.61	2.60	11.80	17/149	6/114	<0.500			140/150
9/22/2014	17.94	9.13	683	8.71	4.30	0.82	17/141	15/114	<0.500			144/149
10/20/2014	12.53	9.67	717	8.52	4.05	3.10	20/167	<3/139	0.659	<0.500	0.155	142/147

Note: Surface/Bottom Results



Lake Harriet

(DNR ID: 27-0016-00)

- Monitored by MPRB -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	A	A
2006	B	A	B	B+
2007	B	A	A	A-
2008	B	A	B	B+
2009	A	A	A	A
2010	A	A	A	A
2011	A	A	A	A
2012	A	A	B	A-
2013	A	A	B	A-
2014	B	A	B	B+

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	4.47	2.34	17	40
2006	2.13	6.20	22	49
2007	2.20	5.69	21	48
2008	1.86	9.05	25	51
2009	3.25	4.48	21	46
2010	2.22	6.37	21	49
2011	2.81	4.73	22	47
2012	2.94	6.41	23	47
2013	3.64	3.56	23	45
2014	2.39	3.49	25	47

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

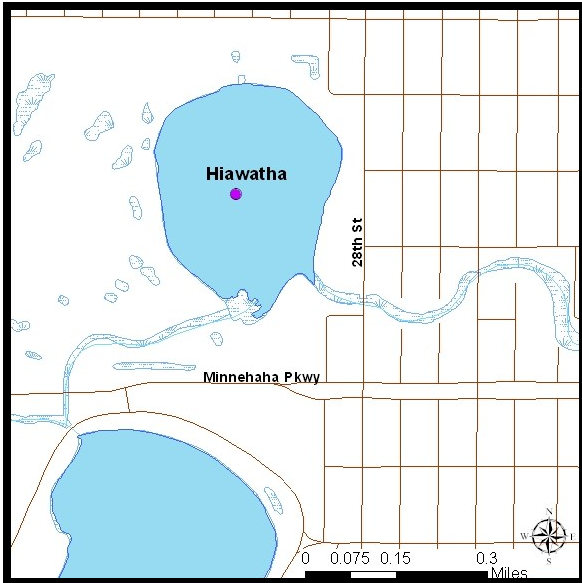
Lake Harriet (DNR ID: 27-0016-00)

- Monitored by MPRB -

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
3/5/2014	0.44	11.30	640	7.80		0.63	78/223	66/207	0.738	0.920	0.245	129/129
5/6/2014	8.08	15.00	613	8.71	2.00	5.65	60/70	15/18	0.951	0.920	0.064	122/118
5/22/2014	13.48	11.00		8.73	7.14	0.66	29/87	7/63	0.664			118/128
6/9/2014	20.88	9.74	607	8.72	3.59	2.00	24/155	<3/124	0.561			121/126
6/25/2014	24.02	9.79	579	8.87	2.39	3.00	23/161	<3/141	0.609			110/118
7/9/2014	22.85	8.96	587	8.73	1.64	3.30	31/214	<3/178	0.624	0.610	<0.030	129/129
7/23/2014	24.39	9.13	583	9.03	1.93	4.00	26/252	<3/231	0.546			126/126
8/4/2014	25.60	9.17	597	8.83	2.50	2.26	33/307	3/239	0.554			120/120
8/21/2014	24.89	9.26	596	8.97	1.55	6.70	22/326	3/304	0.532			124/124
9/11/2014	19.60	7.93	602	8.53	2.49	6.00	22/368	5/330	0.501			140/135
9/23/2014	18.19	9.50	613	8.84	3.05	0.65	21/360	4/335	<0.500			124/119
10/21/2014	12.28	9.59	629	8.53	2.32	6.90	27/356	<3/357	0.593	<0.500	0.197	118/123

Note: Surface/Bottom Results



Lake Hiawatha

(DNR ID: 27-0018-00)

- Monitored by MPRB -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	A	C	B-
2006	C	B	C	C+
2007	D	C	D	D+
2008	C	B	D	C
2009	D	C	D	D+
2010	C	B	C	C+
2011	C	A	C	B-
2012	C	C	D	C-
2013	C	A	C	B-
2014	C	A	C	B-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.88	7.58	66	55
2006	1.23	15.25	64	60
2007	0.90	32.69	96	65
2008	1.44	22.16	75	61
2009	0.81	62.96	44	67
2010	1.60	17.51	64	59
2011	1.52	10.66	59	57
2012	1.12	33.12	91	64
2013	1.99	8.69	60	55
2014	1.82	5.21	50	53

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Lake Hiawatha (DNR ID: 27-0018-00)

- Monitored by MPRB -

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/8/2014	13.98	11.40	567	8.21	1.29	2.92	31	5	1.120	0.870	0.247	98
5/23/2014	18.60	10.20	496	7.52	1.60	3.56	29	<3	0.722			69
6/13/2014	22.04	6.97	472	7.70	2.00	2.60	49	9	0.815			71
7/2/2014	21.67	5.82	464	7.51	2.35	1.40	67	66	0.818			58
7/10/2014	23.60	6.84	459	7.71	2.55	1.00	54	21	0.744	0.700	0.071	70
7/25/2014	24.07	6.50	461	7.82	1.78	4.10	53	22	0.778			72
8/8/2014	25.16	8.74	476	7.62	1.90	6.40	44	6	0.711			60
8/22/2014	24.52	6.80	464	7.74	1.31	10.90	44	10	0.718			57
9/15/2014	16.51	9.15	483	8.24	1.24	12.80	48	5	0.785			78
9/26/2014	18.86	9.88	528	8.43	1.40	2.50	44	5	0.681			81
10/24/2014	11.83	10.28	604	8.37	1.52	16.10	42	3	0.725	0.750	0.408	93



Lake of the Isles
(DNR ID: 27-0040-00)
- Monitored by MPRB -

**Ten-Year Lake Grade Record
 (May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	B	B	C	B-
2006	C	C	C	C
2007	C	C	C	C
2008	C	C	C	C
2009	C	B	C	C+
2010	C	C	C	C
2011	C	B	C	C+
2012	C	C	C	C
2013	C	B	C	C+
2014	C	B	C	C+

**Ten-Year Water Quality Means
 (June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.96	22.83	37	56
2006	1.01	42.51	53	63
2007	1.08	32.51	51	61
2008	1.13	25.02	44	60
2009	1.95	17.96	34	55
2010	1.60	24.59	41	58
2011	1.37	20.20	42	58
2012	0.72	43.59	55	65
2013	1.23	23.49	39	59
2014	1.51	14.28	35	55

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Lake of the Isles (DNR ID: 27-0040-00)

- Monitored by MPRB -

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
3/11/2014	0.08	7.99	569	7.22		<0.500	98/155	21/31	1.320	1.61	0.526	153/162
5/5/2014	10.54	12.80	690	8.53	1.10	5.20	23/16	<3/5	0.877	0.80	0.060	157/157
5/20/2014	15.21	12.00	673	8.88	1.05	2.29	48/27	<3/<3	0.690			143/146
6/11/2014	22.15	10.30	661	8.32	3.28	1.60	27/57	<3/15	0.715			142/162
6/23/2014	25.31	11.00	584	8.76	2.07	6.00	31/58	<3/11	0.715			113/148
7/7/2014	24.84	10.10	574	8.92	1.40	13.00	48/82	<3/28	0.756	0.83	<0.030	119/163
7/21/2014	24.76	9.42	571	8.66	2.08	26.20	41/92	<3/41	0.688			116/166
8/5/2014	25.80	11.20	566	9.08	1.10	14.70	40/110	4/70	1.220			115/161
8/20/2014	25.43	10.10	587	8.98	0.72	17.30	44/164	3/112	0.815			119/160
9/9/2014	21.19	8.55	585.5	8.74	0.61	32.70	27/168	3/107	1.170			119/160
9/22/2014	18.14	9.35	594.7	8.80	0.78	2.70	20/206	11/111	1.050			115/158
10/20/2014	12.20	8.58	654.2	8.20	2.95	3.93	45/52	<3/<3	1.240	1.01	0.205	128/128

Note: Surface/Bottom Results



Meadowbrook Lake (DNR ID: 27-0054-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	N/A	B	C	N/A
2014	N/A	B	C	N/A

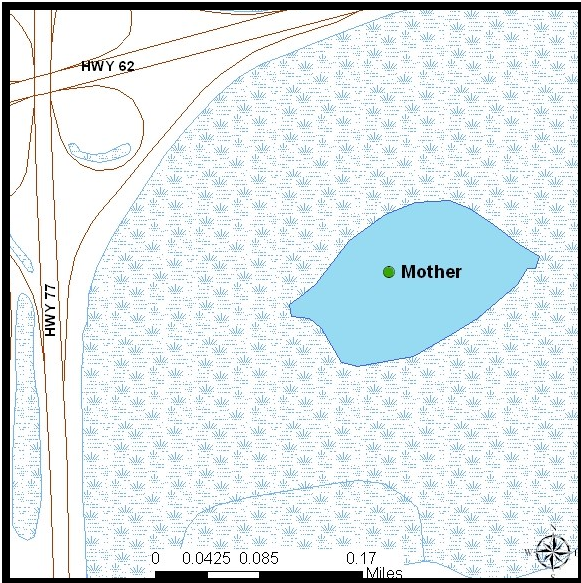
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	N/A	3.75	46	51
2014	N/A	23.63	45	60

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/8/2014	12.29	9.25	515	7.66	2.50	5	33	<3	0.814	0.770	0.044	75	3
6/5/2014	22.08	6.49	464	7.55	3.00	3.5	34	7	0.627	0.627	<0.03	60	1
7/10/2014	24.49	8.22	442	8.03	3.40	3	28	9	0.664	0.664	<0.03	58	<1
8/7/2014	24.53	7.51	442	8.05	2.00	85	82	8	1.250	1.250	<0.03	52	44
9/11/2014	16.96	7.77	489	7.80		3	38	8	0.825	0.825	<0.03	63	2

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Mother Lake

(DNR ID: 27-0023-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011	N/A	N/A	D	N/A
2012	N/A	C	D	N/A
2013	N/A	C	D	N/A
2014	N/A	B	C	N/A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011	N/A	N/A	87	N/A
2012	N/A	25.75	70	64
2013	N/A	43.50	92	69
2014	N/A	14.25	59	60

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/8/2014					1.15	11.00	39	<3	0.572	0.572	<0.03	92
6/5/2014	22.39	10.29	465	7.95	1.10	3.00	41	8	0.546	0.546	<0.03	76
7/10/2014	22.49	7.21	443	8.45	1.10	27.00	101	13	1.100	1.100	<0.03	79
8/7/2014	22.71	4.21	500	6.77	0.48	8.33	61	3	1.055	1.055	<0.03	77
9/4/2014	20.66	2.44	540	7.48		3.00	34	3	0.815	0.815	<0.03	74

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Lake Nokomis
(DNR ID: 27-0019-00)
- Monitored by MPRB -

**Ten-Year Lake Grade Record
 (May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	B	C	C+
2006	D	C	C	C-
2007	D	C	C	C-
2008	D	B	C	C
2009	D	C	C	C-
2010	C	C	C	C
2011	C	B	C	C+
2012	D	C	C	C-
2013	C	B	C	C+
2014	C	A	C	B-

**Ten-Year Water Quality Means
 (June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.40	18.45	56	59
2006	0.88	35.73	67	64
2007	1.01	29.32	56	62
2008	1.03	12.42	44	58
2009	0.78	28.9	61	64
2010	0.99	26.44	47	61
2011	1.28	14.56	35	56
2012	0.91	22.49	48	61
2013	1.33	18.18	53	59
2014	1.76	10.21	34	53

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Lake Nokomis (DNR ID: 27-0019-00)

- Monitored by MPRB -

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
3/14/2014	0.14	8.45	580	7.65		<0.500	25/44	9/18	0.927	1.17	0.337	100/172
5/8/2014	12.32	11.10		8.18	1.30	4.40	30/44	<3/3	1.016	0.94	0.084	103/98
5/23/2014	17.09	11.00	585	8.49	1.96	2.07	34/31	4/4	0.627			94/98
6/13/2014	21.01	10.20	556	8.59	2.55	6.60	17/56	<3/<3	0.591			101/106
6/27/2014	24.23	9.07	523	8.13	2.51	10.30	27/31	<3/<3	0.583			78/98
7/15/2014	22.57	7.86	532	8.31	1.94	10.50	35/66	<3/9	0.668	0.60	0.043	95/100
7/25/2014	24.49	8.07	540	8.45	2.23	5.60	32/58	<3/13	0.621			97/97
8/8/2014	26.00	11.70	508	8.65	1.40	8.60	32/73	3/9	0.696			95/100
8/22/2014	25.15	10.30	505	8.64	1.28	12.20	23/205	3/23	0.815			88/98
9/15/2014	18.34	8.41	492	8.55	1.20	25.10	51/52	3/4	0.815			93/93
9/26/2014	19.09	9.88	508	8.88	0.97	2.80	53/58	5/11	0.666			90/90
10/24/2014	12.36	11.00	519	8.97	1.16	25.70	44/43	<3/<3	0.878	0.70	0.207	93/93

Note: Surface/Bottom Results



Pamela Lake (DNR ID: 27-0675-00) - Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011	N/A	B	C	N/A
2012	N/A	F	D	N/A
2013	D	C	D	D+
2014	F	F	N/A	N/A

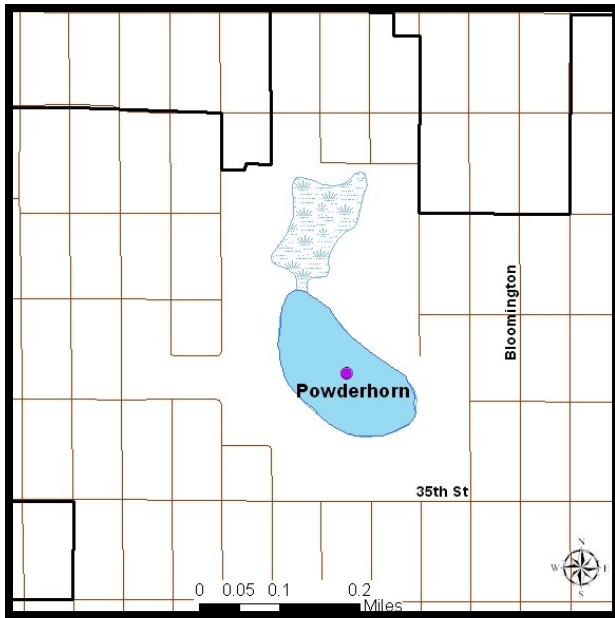
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011	N/A	11.88	58	59
2012	N/A	52.25	144	73
2013	0.83	14.50	127	65
2014	0.61	119.50	N/A	72

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl	TSS
5/14/2014	14.90	0.60	20	75	0.732	0.732	<0.03	231	5
6/16/2014	19.40	1.00	24	74	0.441	0.441	<0.03	130	5
7/14/2014	21.30	0.60	28	189	1.060	1.060	<0.03	94	8
8/12/2014	22.50	0.40	157		3.130	3.130	<0.03	137	30
9/23/2014	20.10	0.45	269	266	3.290	3.290	<0.03	134	24

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Powderhorn Lake
(DNR ID: 27-0014-00)
- Monitored by MPRB -

**Ten-Year Lake Grade Record
 (May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	B	D	C
2006	C	C	D	C-
2007	C	B	D	C
2008	D	B	D	C-
2009	C	A	D	C+
2010	C	B	D	C
2011	D	C	D	D+
2012	D	C	D	D+
2013	F	C	F	D-
2014	F	C	D	D

**Ten-Year Water Quality Means
 (June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.30	14.22	95	61
2006	1.35	25.99	86	62
2007	1.80	16.95	72	59
2008	1.02	14.31	100	62
2009	2.06	6.64	90	56
2010	1.30	12.48	147	63
2011	0.93	14.55	94	63
2012	0.94	23.51	114	65
2013	0.55	47.43	160	71
2014	0.49	43.18	134	71

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

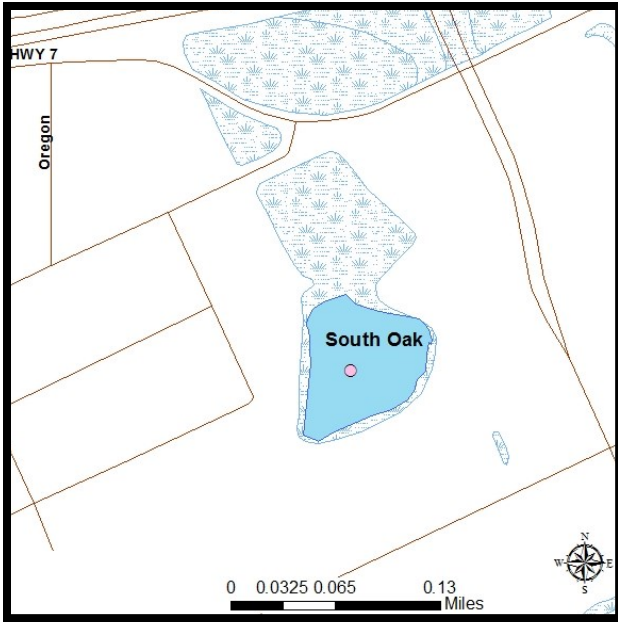
Powderhorn Lake (DNR ID: 27-0014-00)

- Monitored by MPRB -

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
3/7/2014	0.31		559	7.32		38.20	120/312	16/162	1.695	1.59	0.015	110/262
5/7/2014	11.45	10.50	896	7.68	0.66	9.00	92/84	9/15	1.640	1.49	0.212	245/240
5/21/2014	14.65	8.91	730	7.63	0.49	19.30	91/119	8/9	1.590			192/192
6/10/2014	21.88	0.88	630	6.97	0.77	13.90	107/120	24/30	1.340			167/172
6/26/2014	24.09	3.87	452	6.92	0.51	22.60	161/161	21/24	1.550			103/108
7/8/2014	24.53	8.48	424	7.73	0.43	83.90	173/153	4/3	2.090	1.75	0.030	109/114
7/24/2014	25.21	6.71	391	7.32	0.48	39.60	143/141	13/6	1.460			102/97
8/6/2014	25.77	6.16	392	7.21	0.45	45.60	133/136	3/8	1.250			90/90
8/19/2014	25.26	6.79	392	7.33	0.45	62.80	150/130	4/4	1.420			88/93
9/8/2014	22.20	7.14	342	7.34	0.42	64.40	83/88	5/5	1.600			83/83
9/24/2014	18.66	8.69	339	7.86	0.39	12.60	125/124	4/5	1.030			81/81
10/23/2014	11.93	10.86	334	8.44	0.55	59.20	120/124	<3/<3	1.660	1.28	0.471	78/78

Note: Surface/Bottom Results



South Oak Lake
(DNR ID: 27-0661-00)
- Monitored by CAMP -

**Ten-Year Lake Grade Record
 (May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	D	C	D	D+
2007	F	F	F	F
2008	F	F	F	F
2009	N/A	C	C	N/A
2010	N/A	B	C	N/A
2011	D	B	C	C
2012	F	C	D	D
2013	F	C	D	D
2014	D	C	D	D+

**Ten-Year Water Quality Means
 (June-Sept)**

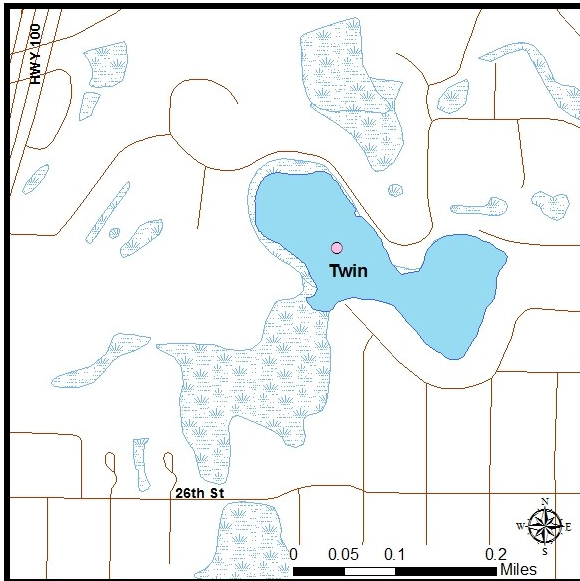
Year	SECC	CHLA	TP	TSI
2005				
2006	0.80	27.96	107	66
2007	0.38	121.83	252	79
2008	0.48	182.25	277	79
2009	N/A	30.48	40	61
2010	N/A	14.77	64	61
2011	0.78	13.34	62	61
2012	0.58	28.71	114	68
2013	0.70	38.01	76	66
2014	.81	27	156	68

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

South Oak Lake
(DNR ID: 27-0661-00)
- Monitored by CAMP -

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TKN
5/5/2014	14.4	0.6	1	72	1.1
5/17/2014	12.8	0.9	150	81	1.2
6/3/2014	22.9	0.7	44	59	0.93
6/23/2014	25.4	0.8	34	71	1.3
7/3/2014	21.7	0.8	3.1	28	1
7/17/2014	20.6	0.8	2.8	14	0.89
8/3/2014	22.3	0.8	10	49	1.2
8/19/2014	26.4	0.8	35	137	1.9
9/2/2014	24.5	0.9		62	0.92
9/11/2014	16.2	0.9		94	1.4
9/26/2014	21.3	0.8	61	889	7.3
10/8/2014	15.0	0.7	51	67	1.3
10/21/2014	13.7	0.8	28	61	1.9



Twin Lake
(DNR ID: 27-0656-00)
- Monitored by CAMP -

**Ten-Year Lake Grade Record
 (May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	F	C	F	D-
2006	F	C	D	D
2007	F	D	F	F
2008	F	D	D	D-
2009	F	F	F	F
2010	F	D	D	D-
2011	F	F	F	F
2012	D	D	F	D-
2013	F	D	D	D-
2014	D	C	D	D+

**Ten-Year Water Quality Means
 (June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	0.63	45.43	168	71
2006	0.55	24.13	155	69
2007	0.50	67.17	152	73
2008	0.51	77.75	137	73
2009	0.60	96.43	189	74
2010	0.68	65.50	146	71
2011	0.55	91.17	166	74
2012	0.55	69.75	208	74
2013	0.65	82.12	150	72
2014	0.83	45.78	101.78	67

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Twin Lake
(DNR ID: 27-0656-00)
- Monitored by CAMP -

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TKN
5/4/2014	12.5	2	1.8	54	0.99
5/17/2014	12.8	1.1	26	52	1.4
6/3/2014	23.6	1	29	112	1.1
6/23/2014	26.8	0.8	58	115	1.4
7/3/2014	22.9	0.8	24	101	1.8
7/17/2014	22	0.85	33	81	1.1
8/3/2014	24.9	0.7	43	120	1.8
8/19/2014	25.6	0.9	42	87	1.4
9/2/2014	24.8	0.9	15	72	0.69
9/11/2014	18.3	0.85	110	169	1.2
9/26/2014	20.2	0.7	58	59	1.1
10/8/2014	10.6	1.1	41	43	0.94
10/21/2014	11.9	0.9	41	47	1.2



Victoria Lake (DNR ID: 27-0051-00) - Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009	F	F	F	F
2010	F	D	D	D-
2011				
2012				
2013				
2014	D	C	D	D+

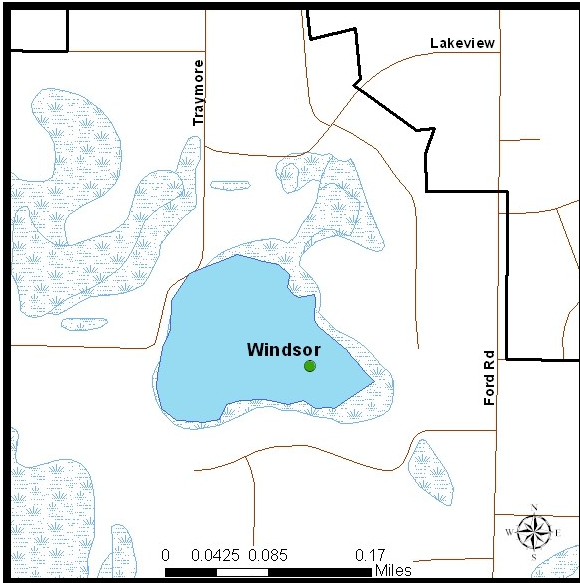
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009	0.21	130.2	261	82
2010	0.53	50.00	126	71
2011				
2012				
2013				
2014	0.78	41.25	106	67

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl	TSS
5/5/2014	15.30	0.75	25	63	0.720	0.720	<0.03	169	5.5
6/9/2014	21.50	0.68	54	127	1.140	1.140	<0.03	105	9
7/8/2014	25.70	0.85	28	86	1.110	1.110	<0.03	61	8
8/6/2014	25.50	0.80	43	109	1.340	1.340	<0.03	59	11
9/18/2014	16.30	0.78	40	101	1.370	1.370	<0.03	52	12

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Windsor Lake

(DNR ID: 27-0082-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011	F	D	F	F
2012	F	C	D	D
2013	N/A	C	D	N/A
2014	N/A	D	D	N/A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011	0.46	80.25	179	75
2012	0.48	25.00	122	69
2013	N/A	25.50	147	69
2014	N/A	73.00	161	75

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/8/2014	14.31	9.18	247	7.60	1.50	9	57	<3	0.813	0.813	<0.03	37	2
6/5/2014	23.51	10.49	243	8.24	1.40	4	68	19	0.772	0.772	<0.03	36	1
7/10/2014	21.66	5.75	184	7.03	0.55	17	126	21	0.998	0.998	<0.03	19	4
8/7/2014	21.25	0.89	183	6.48	0.40	61	253	<3	1.850	1.850	<0.03	20	14
9/4/2014	19.48	0.59	191	6.17	0.38	210	196	<3	1.990	1.990	<0.03	20	20

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Minnehaha Creek Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Bass	1978						
Brownie	1907 - 2004	Yes (DNR)				Mercury in Fish Tissue	Aquatic Consumption
Calhoun	1883 - 2012	Yes (DNR)		2009	2012	Mercury in Fish Tissue, Perfluorooctane Sulfonate in Fish Tissue, Chloride	Aquatic Consumption
Cedar	1905 - 1983	Yes (DNR)		2009	2012	Mercury in Fish Tissue	Aquatic Consumption
Cedar Manor							
Cobblecrest							
Diamond	1928 - 2014			1993		Chloride	Aquatic Recreation
Grass	1995 - 2005					Nutrient/Eutrophication Biological Indicators	
Hannan		Yes (DNR)					
Harriet	1899 - 2005	Yes (DNR)		2009	2012	Mercury in Fish Tissue	Aquatic Consumption
Hiawatha	1926 - 2012	2009		2007	2012	Chloride, Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Isles	1900 - 1982			2009	2007	Mercury in Fish Tissue, Perfluorooctane Sulfonate in Fish Tissue	Aquatic Consumption
Lamplighter					2012		
Legion							
Meadowbrook	1929 - 1970					Chloride	
Melody							
Mother	1931 - 1996					None	None

*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mc-wd-lakes

Minnehaha Creek Subwatershed - Additional Lake Information (Continued)

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Nokomis	1906 - 2013	2009		2010	2012	Mercury in Fish Tissue, PCB in Fish Tissue, Nutrient/Eutrophication Biological Indicators	Aquatic Consumption and Recreation
Pamela	1997					None	None
Powderhorn	1925 - 2005	Yes (DNR)		2012	2012	Mercury in Fish Tissue, Chloride	Aquatic Consumption
South Oak						None	None
Taft	2005	Yes (DNR)					
Twin	1995					Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Victoria							
Westling Pond							
Windsor	2000					Nutrient/Eutrophication Biological Indicators	Aquatic Recreation

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Bass							
Brownie				X			
Calhoun		X		X	X		
Cedar		X		X	X		
Cedar Manor							
Cobblecrest							
Diamond		X		X			

*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mc wd-lakes

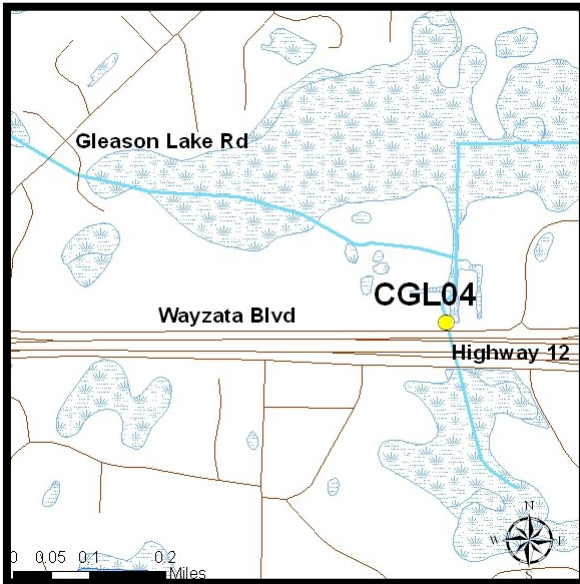
Minnehaha Creek Subwatershed - Additional Lake Information Continued)

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Brazilian Elodea	Zebra Mussels
Grass							
Hannan							
Harriet		X	X	X			
Hiawatha		X	X	X			X
Isles		X	X	X			
Lampighter							
Legion							
Meadowbrook		X	X				X
Melody							
Mother							
Nokomis		X	X	X			
Pamela							
Powderhorn	X		X				
South Oak							
Taft			X				
Twin							
Victoria							
Westling Pond							
Windsor							

Minnehaha Creek Subwatershed - Stream Monitoring Sites Information

Name	MCWD Site ID	Weekly Flow Gauging	Automated Stage	Water Quality Automated	Drainage Area (ac)	Latitude	Longitude
Gleason Lk Ck: Wetland Outlet	CGL04	Yes	No	No	714.14	44.9713	-93.4766
Minnehaha Creek::							
Grays Bay Outflow	CMH07	Yes	Yes	No	79276.81	44.9529	-93.4871
Mntka Ice Arena	CMH25	Yes	No	No	1909.30	44.9441	-93.4634
I-494 Ramps	CMH19	Yes	Yes	Yes	657.13	44.9412	-93.4551
West 34th St.	CMH02	Yes	No	No	3339.26	44.9427	-93.3935
Excelsior Blvd	CMH11	Yes	No	No	1055.95	44.9269	-93.3625
Browndale Dam	CMH03	Yes	Yes	Yes	812.24	44.9119	-93.3423
West 56th St.	CMH04	Yes	No	No	301.95	44.9014	-93.3323
Xerxes Ave.	CMH15	Yes	No	No	441.81	44.9053	-93.3186
21st Ave	CMH24	Yes	No	No	5423.59	44.9156	-93.2433
28th Ave.	CMH18	Yes	No	No	1068.46	44.9178	-93.2326
Hiawatha Ave.	CMH06	Yes	Yes	Yes	282.40	44.9147	-93.2134





Gleason Lake Creek: Gleason Wetland Outlet (CGL04)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	4
Total Suspended Solids (mg/L)	6
Total Phosphorus (µg/L)	206
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

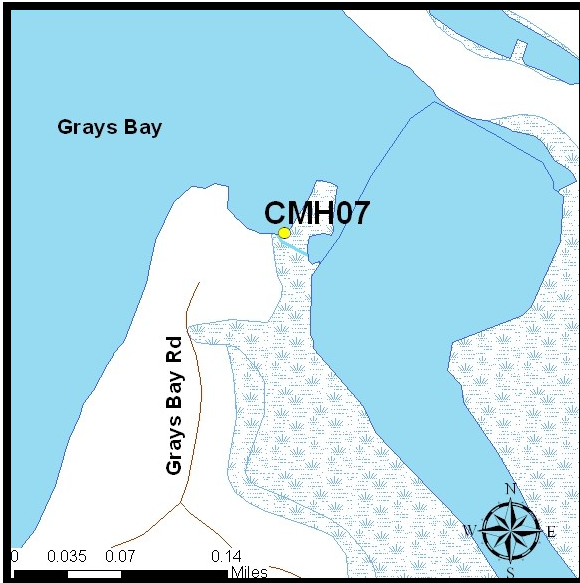
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006											
2007	0.62	217	179	46	38	1389	1.15	9	8		
2008	0.24	81	169	17	36	983	2.07	6	12	184	387
2009	0.19	58	152	16	42	356	0.94	5	13	113	297
2010	0.56	185	167	64	57	1163	1.05	4	3	329	296
2011	0.67	140	107	31	24	1165	0.89	4	3	296	225
2012	0.43	101	125	31	39	798	0.99	4	4	587	729
2013	0.89	378	217	118	67	627	0.40	9	5	151	86
2014	0.90	204	115	60	34	1336	0.75	3	2	372	210

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CGL04

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	1.16	4.80	5.90	1534	7.34	124	10	1.460	5	379
4/16/2014	1.50	2.43	6.11	1731	5.85	77	11			
4/23/2014	1.02	7.60	7.53	2043	7.21	71	9		2	
4/30/2014	13.21	5.26	9.46	1551	7.51	74	3			
5/7/2014	1.49	13.47	10.47	1498	7.39	56	5	1.910	2	360
5/14/2014	2.84	11.53	8.68	1592	7.43	46.5	4			
5/21/2014	4.68	16.61	10.19	1585	7.55	54	6		2	
5/29/2014	0.39	22.63	6.28	1632	7.30	115	60.5			
6/4/2014	4.85	21.92	2.43	1332	7.11	109	56	0.809	2	303
6/10/2014	0.75	23.54	11.52	1436	7.44	68	52			
6/17/2014	4.31	23.26	6.39	1214	7.23	68	35		<1	
6/24/2014	7.88	22.90	1.13	760	7.05	264	91			
7/1/2014	1.11	21.37	2.60	1013		211	109	0.952	5	200
7/8/2014	0.52	21.60	5.07	1093		173	67			
7/16/2014	0.97	21.77	4.16	1073		94	59		1	
7/22/2014	0.11	28.50	1.23	1171	7.14	358	161			
7/30/2014	0.05	25.61	3.71	1338	7.09	287.5	82	1.350	4	278
8/6/2014	0.02	20.52	1.10	1486	7.02	302	52			
8/13/2014	0.01	20.13	1.01	1564	7.00	271	33		7	
8/20/2014	0.01	20.75	0.61	1616	7.23	483	12			
8/26/2014	0.05	19.18	1.23	1561	7.30	418	87	1.800	8	352
9/3/2014	0.50	20.27	1.61	1378		268	116			
9/9/2014	0.05	20.54	0.51	1489		406	80		10	
9/17/2014	0.03	17.01	1.67	1522		197	35			
9/24/2014	0.01	15.78	2.06	1599	6.96	280	69	2.380	8	367
10/1/2014	0.04	12.63	0.56	1484	6.89	258	41			
10/8/2014	0.29	8.84	3.77	1478	7.44	154	34.5		6	
10/15/2014	0.07	7.35	1.44	1548	7.26	226.5	27			
10/22/2014	0.04	9.67	0.69	1638	7.54	232	18	2.920	13	371
10/27/2014	0.03	10.70	1.53	1618	7.16	321	12			
11/5/2014	0.01	6.72	3.04	1539	7.63	331	12		14	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: Grays Bay Dam (CMH07)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	19
Dissolved Oxygen (mg/L)	10
Total Suspended Solids (mg/L)	0
Total Phosphorus (µg/L)	14
<i>E. coli</i> (cfu/100 mL)*	3
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	38	1759	24	59	1	54064	0.72	13	0		
2006	59	3186	27	355	3	80346	0.69	238	2		
2007	23	1043	23	303	7	74539	1.63	299	7		
2008	27	976	18	57	1	27887	0.53	129	2	1624	31
2009	2	108	24	0	0	3273	0.73	2	0	182	41
2010	33	1213	18	0	0	43612	0.66	123	2	2958	45
2011	80	2349	15	48	0	91526	0.58	461	3	7536	48
2012	5	214	21	3	0.3	7800	0.78	22	2	512	51
2013	39	1281	17	0	0	38337	0.50	105	1	3892	51
2014	97	2440	13	3	0.02	99590	0.52	60	0	8391	44

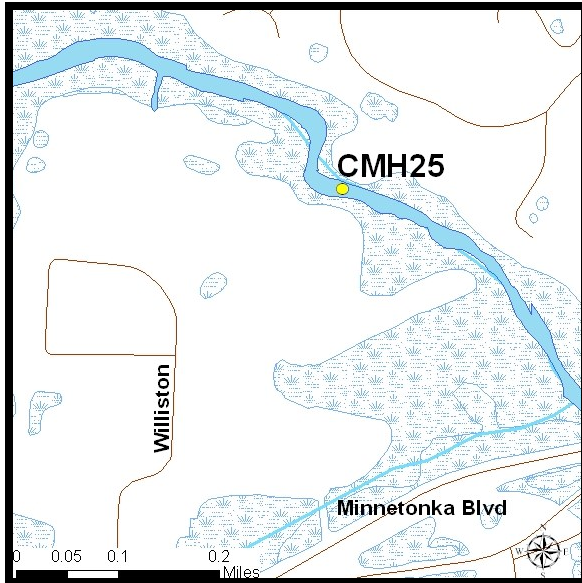
Note: Revised means and loads for 2009-2013

2014 Water Quality Data - CMH07

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/29/2014	25	6.88	12.01	407	6.22	17	<3			
5/5/2014	200	8.50	14.01	436	7.96	11	<3	0.572	<1	52
5/12/2014	300	11.21	11.86	432	7.42	12	<3			
5/19/2014	300	12.10	11.20	439	8.01	9.5	<3		1.5	
5/27/2014	300	18.05	11.12	433	7.95	11	<3			
6/2/2014	300	20.16	8.79	429	8.04	14	<3	0.592	1	52
6/11/2014	300	20.82	9.93	424	8.37	11	<3			
6/18/2014	300	20.28	10.17	423	8.31	11	<3		<1	
6/25/2014	421	23.19	10.46	424	8.60	12	<3			
7/1/2014		22.45	9.62	430	8.48	15	<3	0.669	1	51
7/9/2014	352	22.98	9.90	416		16	<3			
7/14/2014	345	22.86	9.14	412		17	<3		<1	
7/21/2014	287	23.29	8.69	409	8.59	12	<3			
7/28/2014	248	23.44	7.78	413	8.49	11	<3	0.61	<1	48
8/4/2014	195	25.92	9.12	433	8.61	12	<3			
8/11/2014	200	24.41	7.86	424	8.28	14	<3		<1	
8/18/2014	200	24.62	6.66	419	8.22	14	<3			
8/25/2014	150	24.52	6.53	432	8.17	13	<3	0.599	<1	50
9/2/2014	75	22.91	6.97	431	7.95	16	<3			
9/8/2014	75	21.11	7.57	421	8.10	13	<3		<1	
9/15/2014	50	16.56	8.66	426	7.90	14	<3			
9/22/2014	20	17.58	8.65	437	7.86	13	<3	0.586	<1	50
9/29/2014	20	20.22	7.82	400	8.00	14	<3			
10/6/2014	20	9.86	11.10	433	8.05	14	<3		1	
10/13/2014	20	11.63	10.31	433	7.86	15	<3			
10/20/2014	20	13.39	9.95	430	7.98	16	3	0.726	<1	51
10/27/2014	20	11.36	11.71	442	7.95	19	3			

Estimated flow not including spillway discharge.

Flow measured at McGinty Culvert



Minnehaha Creek: Williston Rd (CMH25)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	7
Total Suspended Solids (mg/L)	2
Total Phosphorus (µg/L)	25
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

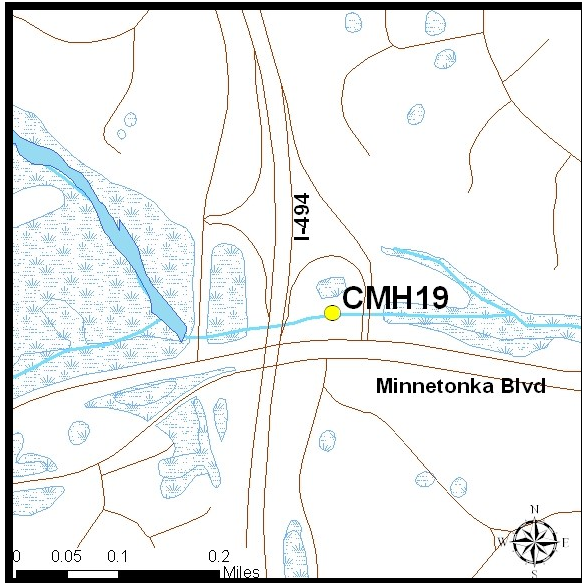
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006											
2007											
2008											
2009											
2010											
2011											
2012											
2013	34	2581	39	501	7	42369	0.63	215	3	3733	56
2014	101	4194	21	117	1	142071	0.72	302	2	11509	58

Note: Revised means and loads for 2013

2014 Water Quality Data - CMH25

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	Cl
3/13/2014		0.47	2.03		5.18					93
3/17/2014		0.42	1.54		4.78					86
3/28/2014		0.62								86
4/7/2014	9.91	2.15	6.37	1231	5.37			1.430	4	298
4/14/2014	5.96	3.94	4.88	1047	6.13	118	19			
4/21/2014	5.24	8.73	0.36	1250	6.87	54	7		2	
4/29/2014	71.26	4.18	8.95	620	5.84	42	4			
5/5/2014	185.40	8.75	12.97	485	7.84	45	5	0.639	1	68
5/12/2014	202.87	11.04	9.95	450	7.66	17	<3			
5/19/2014	194.05	12.16	10.05	456	7.85	14	<3		1	
5/27/2014	265.05	18.40	9.03	477	7.58	18	<3			
6/2/2014	347.10	20.19	7.06	443	7.64	22	<3	0.656	1	54
6/11/2014	328.42	20.81	7.26	435	7.82	21	<3			
6/18/2014	321.08	21.14	6.85	442	7.72	17	<3			
6/25/2014	505.62	23.15	6.86	436	7.79	19	<3			
7/1/2014	391.14	22.55	6.71	434	7.79	24	<3	0.741	1	53
7/9/2014	343.32	22.56	6.36	422		19	3			
7/14/2014	392.47	22.51	6.48	420		21	<3		1	
7/21/2014	300.68	23.47	5.24	420	7.73	24	3			
7/28/2014	274.80	23.44	7.78	413	8.49	19	<3	0.655	2	50
8/4/2014	217.97	25.36	4.85	431	7.65	22	<3			
8/11/2014	197.95	24.02	4.85	425	7.54	20	<3		4	
8/18/2014	180.67	25.15	4.01	420	7.48	23	<3			
8/25/2014	125.40	24.27	4.12	431	7.58	23	<3	0.718	4	50
9/2/2014	98.58	22.13	4.70	431	7.53	19	<3			
9/8/2014	94.32	20.04	5.42	429	7.65	18	<3		2	
9/15/2014	85.27	15.87	7.38	432	7.66	16	<3			
9/22/2014	28.46	16.18	6.06	461	7.35	12	<3	0.641	1	54
9/29/2014	28.40	20.13	5.41	412	7.64	17	<3			
10/6/2014	27.80	8.41	9.89	456	7.81	17	<3		<1	
10/13/2014	22.62	12.03	7.97	462	7.66	12	<3			
10/20/2014	24.64	11.02	8.18	454	7.62	15	<3	0.681	1	56
10/27/2014	25.95	10.47	10.67	456	7.74	15	<3			
11/3/2014	0.74	6.80	12.28	719	7.46	20	<3		10	
11/12/2014		1.27		794		41	4			88

Blue Highlight = Flow calculated from rating curve.



Minnehaha Creek: I-494 Ramps (CMH19)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	7
Total Suspended Solids (mg/L)	2
Total Phosphorus (µg/L)	30
<i>E. coli</i> (cfu/100 mL)*	43
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	43	2930	35	197	2	60705	0.72	182	2		
2006	52	4047	40	443	4	88181	0.86	484	5		
2007	20	2623	65	322	8	21587	0.60	170	5		
2008	20	1016	25	50	1	23218	0.59	71	2	1887	48
2009	3	188	36	24	5	5014	0.99	14	3	650	128
2010	29	1690	29	215	4	45482	0.79	144	2	4095	71
2011	89	4204	24	228	1	58221	0.33	788	4	5901	34
2012	6	701	59	165	14	7199	0.60	58	5	959	80
2013	37	3250	44	707	10	49822	0.68	440	6	4284	58
2014	93	6616	36	670	4	86852	0.48	260	1	7180	39

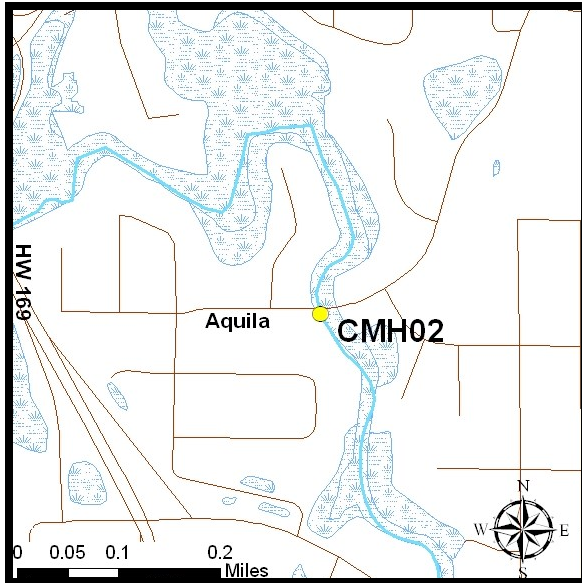
Note: Revised means and loads for 2009-2013

2014 Water Quality Data - CMH19

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	Cl
3/13/2014		0.99	1.70		6.90					148
3/17/2014		0.46	4.08		7.16					417
3/28/2014		0.79								262
4/2/2014	12.223	1.62	6.79	1390	7.03	148	39	1.880	3	323
4/7/2014	11.936	2.36	6.74	1206	6.33	113	18	1.350	4	272
4/14/2014	5.080	3.34	9.90	1118	6.93	56	6			
4/21/2014	5.636	13.12	8.33	1278	7.47	43	3		3	
4/29/2014	69.172	4.41	8.39	624	6.85	56	8			
5/5/2014		8.86	11.94	488	7.85	21	<3	0.612	2	68
5/12/2014		11.22	9.80	463	7.71	18	<3			
5/19/2014		12.19	9.54	461	7.88	14	<3		2	
5/27/2014		18.46	8.65	449	7.65	0	<3			
6/2/2014		20.24	6.70	441	7.61	28	<3	0.638	5	53
6/11/2014		20.79	6.64	438	7.72	25	<3			
6/18/2014		21.26	6.14	445	7.64	21	<3			
6/25/2014	421	23.16	6.46	444	7.80	30	3			
7/1/2014		22.59	6.40	434	7.84	26	4	0.688	1	54
7/9/2014	352	22.48	5.92	424		24	4			
7/14/2014	345	22.40	5.78	423		24	4		1	
7/21/2014	287	23.49	4.93	424	7.00	24	3			
7/28/2014	248	22.95	4.94	419	7.66	24	3	0.679	3	51
8/4/2014	195	25.29	4.70	426	7.62	23	<3			
8/11/2014	169	23.88	4.79	423	7.49	23	<3		4	
8/18/2014	162	24.13	4.04	422	7.33	24	<3			
8/25/2014	133	24.19	4.05	435	7.49	22	<3	0.702	4	51
9/2/2014		22.02	4.72	429	7.55	20	<3			
9/8/2014	79.349	19.99	5.83	427	7.64	15.5	<3		2	
9/15/2014	78.244	15.88	7.45	438	7.90	12	<3			
9/22/2014	28.677	16.16	7.11	469	7.43	18	<3	0.649	1	59
9/29/2014	21.450	20.06	6.20	416	7.66	17	<3			
10/6/2014	21.707	8.45	9.65	463	7.68	14	<3		<1	
10/13/2014	18.185	12.02	9.14	453	7.86	13	<3			
10/20/2014	20.860	11.17	8.94	460	7.64	14	<3	0.653	<1	54
10/27/2014	18.986	10.48	10.86	463	7.84	18	<3			
11/3/2014	0.897	6.60	11.16	783	7.60	36	4		3	
11/12/2014		1.28		911						114

Flow data measured at McGinty Culvert

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: W 34th St (CMH02)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	7
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	40
<i>E. coli</i> (cfu/100 mL)*	59
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005	45.36	4556	51	776	9	71107	0.80	469	5		
2006	49.59	5346	50	670	7	85537	0.88	982	10		
2007	22.64	2586	58	429	11	42514	0.95	315	7		
2008	19.95	1650	42	204	5	31631	0.81	259	7	2088	53
2009	2.98	344	58	66	11	6226	1.06	42	7	800	136
2010	34.39	2529	37	598	9	52829	0.78	254	4	5168	76
2011	77.00	5432	35.6	1184	10	71475	0.47	550	4	7707	51
2012	8.29	1743	107	412	25	9227	0.57	327	20	1263	78
2013	40.88	2066	26	4903	62	53541	0.67	365	5	4630	58
2014	95.84	6378	34	1760	9	132670	0.70	670	4	11962	63

Note: Revised means and loads for 2008-2013

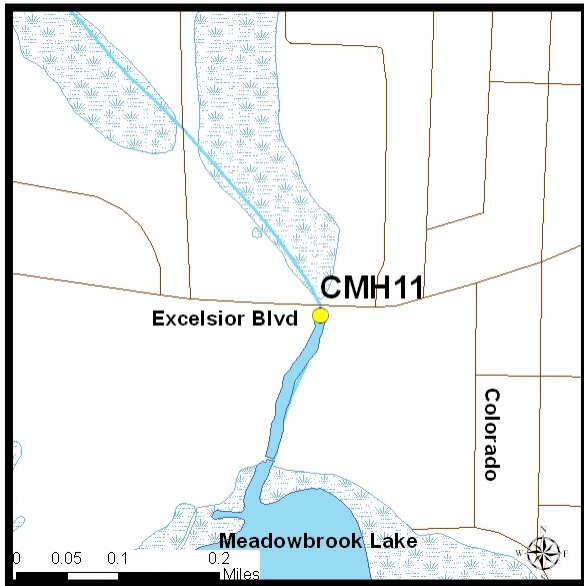
2014 Water Quality Data - CMH02

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	Cl
3/13/2014		0.01	6.70		6.29					265
3/17/2014		0.04	8.05		6.30					194
3/28/2014		1.31								195
4/2/2014	26.96	0.27	9.97	1508	6.25	129	36.5	1.400	3.5	361
4/7/2014	24.00	4.50	8.55	1291	6.81	96	36	1.050	3	294
4/14/2014	11.97	4.11	12.25	1199	7.67	60	7			
4/21/2014	11.08	14.63	10.11	1265	7.74	74	4		10	
4/29/2014	108.00	4.65	9.67	658	7.17	84	12			
5/5/2014	170.22	9.28	11.05	509	7.68	31	<3	0.718	7	73
5/12/2014	195.29	12.09	8.06	479	7.59	29	<3			
5/19/2014	217.66	12.56	8.41	473	7.66	20	<3		5	
5/27/2014	243.99	18.94	6.07	460	7.34	26	<3			
6/2/2014	308.18	20.41	4.95	448	7.42	30	6	0.640	6	58
6/11/2014	304.54	20.72	4.67	445	7.46	33	11			
6/18/2014	317.95	21.74	4.57	450	7.45	35	11			
6/25/2014	441.08	23.29	5.93	450	7.66	44	18			
7/1/2014	413.70	22.55	6.92	438	7.69	38.5	12	0.662	1.5	55
7/9/2014	347.20	22.23	5.20	428		31	10			
7/14/2014	337.00	22.16	5.18	431		32	13		0	
7/21/2014	279.70	23.68	3.74	430	7.46	29	10			
7/28/2014	242.10	22.66	4.27	426	7.46	27	12	0.620		49
8/4/2014	189.00	24.90	3.18	437	7.37	32	15			
8/11/2014	173.00	23.72	3.50	432	7.33	35	11		4	
8/18/2014	159.00	23.76	3.30	436	7.25	36.5	12.5			
8/25/2014	123.50	24.09	4.03	444	7.40	34	9	0.719	7	53
9/2/2014	80.19	21.77	5.26	458	7.45	38	8			
9/8/2014	84.72	19.88	6.28	446	7.65	30	6		8	
9/15/2014	82.36	15.88	8.28	448	7.82	19	3			
9/22/2014	29.14	15.36	6.67	535	7.40	25	7	0.660	0.5	68
9/29/2014	25.83	19.16	5.37	467	6.96	31	4			
10/6/2014	28.89	7.86	9.32	534	7.49	19	4		0	
10/13/2014	24.05	11.43	8.41	515	7.50	19	3			
10/20/2014	23.41	10.44	8.53	515	7.51	23	0	0.670	2	67
10/27/2014	24.90	9.84	10.10	521	7.55	22	0			
11/3/2014	3.49	5.54	11.39	807	7.37	53	3		4	
11/12/2014		0.98		1088						156

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);

Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: Excelsior Blvd (CMH11)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	7
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	45
<i>E. coli</i> (cfu/100 mL)*	127
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005	46	6131	68	1073	12	76512	0.85	1010	11		
2006	63	8073	65	1054	9	101678	0.82	1894	15		
2007	22	2930	69	481	11	41904	0.98	614	14		
2008	20	2016	50	253	6	32223	0.80	395	10	2578	64
2009	4	686	98	81	12	6610	0.94	49	7	880	126
2010	13	1545	61	414	16	32159	1.27	263	10	2571	102
2011	55	3053	28	529	5	25962	0.24	235	2	2387	22
2012	11	2700	130	499	24	17837	0.86	589	28	1746	84
2013	45	5203	59	2233	25	63136	0.71	435	5	6321	71
2014	67	4983	38	1680	13	81399	0.62	316	2	8287	63

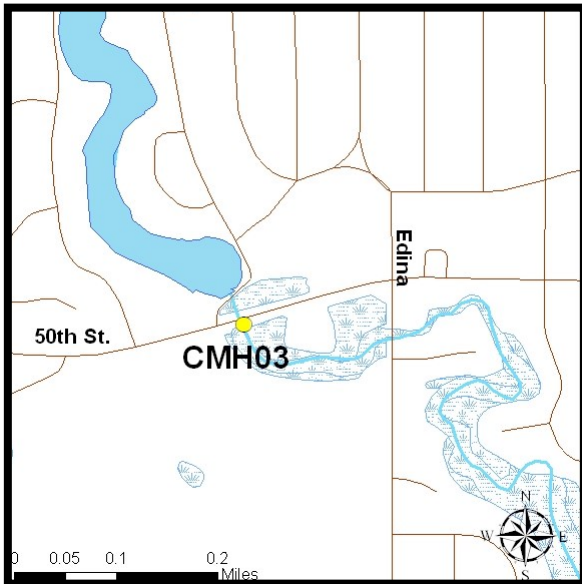
Note: Revised means and loads for 2009-2013

2014 Water Quality Data - CMH11

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	Cl
3/13/2014		0.60	10.82		7.50					714
3/17/2014		0.02	8.12		7.04					468
3/28/2014		0.31								254
4/2/2014	49.07	-0.01	10.01	1218	6.49	220	57	2.210	20	300
4/7/2014	29.81	5.67	9.40	1267	7.02	103	39.5	1.470	6	301
4/14/2014	15.36	3.81	12.95	1254	7.89	56	6			
4/21/2014	17.03	13.25	8.95	1218	7.41	70	4		4	
4/29/2014	121.00	4.88	10.30	652	7.48	86	14			
5/5/2014	90.02	9.95	11.45	517	7.83	36	<3	0.655	6	80
5/12/2014	127.87	12.83	8.31	483	7.71	30	<3			
5/19/2014	104.22	12.81	8.19	479	7.89	22	<3		2	
5/27/2014	130.05	19.29	6.38	470	7.55	22	<3			
6/2/2014	152.72	20.56	4.91	451	7.45	30	8	0.617	3	57
6/11/2014	163.59	20.87	5.04	459	7.40	40	15			
6/18/2014	185.22	21.80	4.70	446	7.48	42	14			
6/25/2014	214.89	23.27	5.13	459	7.65	47	25			
7/1/2014	212.51	22.43	6.07	446	7.59	39	16	0.569	1	57
7/9/2014	201.62	22.28	4.61	438		36	13.5			
7/14/2014	200.20	22.12	5.55	439		34	17		1	
7/21/2014	186.15	23.85	4.62	437	7.51	29	13			
7/28/2014	173.20	22.70	5.17	434	7.50	30	15	0.660	1	53
8/4/2014	232.50	24.95	4.43	460	7.45	35	18			
8/11/2014	169.50	23.39	4.42	441	7.40	36	13		2	
8/18/2014	184.70	23.69	4.05	448	7.35	33	15			
8/25/2014	137.20	24.21	4.48	454	7.50	35	15	0.633	4	55
9/2/2014	97.84	21.82	5.75	468	7.54	38	12			
9/8/2014	87.51	19.74	6.57	461	7.67	32	10		6	
9/15/2014	85.45	15.80	8.30	461	7.80	37	9			
9/22/2014	31.62	16.03	7.75	575	7.68	34	10	0.679	3	79
9/29/2014	28.81	18.98	6.59	502	6.73	28.5	6			
10/6/2014	29.74	8.28	10.52	568	7.68	30	6		4	
10/13/2014	25.11	11.50	8.97	543	7.63	24	3			
10/20/2014	24.10	10.96	9.70	541	7.71	26	4	0.583	2	72
10/27/2014	25.31	9.95	10.86	547	7.73	26	3			
11/3/2014	6.56	5.46	11.81	966	7.86	43	7		3	
11/12/2014		0.16		1438						251

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);
Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: Browndale Dam (CMH03)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	2
Total Phosphorus (µg/L)	45
<i>E. coli</i> (cfu/100 mL)*	77
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005	25	3038	61	361	7	40764	0.82	249	5		
2006	49	5575	58	779	8	77190	0.80	720	7		
2007	24	3483	73	694	15	50785	1.07	403	8		
2008	22	2313	53	219	5	38786	0.90	330	8	2672	62
2009	4	543	74	87	12	8198	1.12	53	7	1388	190
2010	32	2914	47	674	11	54258	0.87	287	5	5250	84
2011	85	5774	35	1440	9	96328	0.58	300	2	9706	58
2012	11	2237	106	352	17	20094	0.95	221	10	1950	92
2013	46	6103	67	2858	32	61431	0.68	268	3	6742	75
2014	106	8037	38	3248	15	145446	0.69	361	2	13767	66

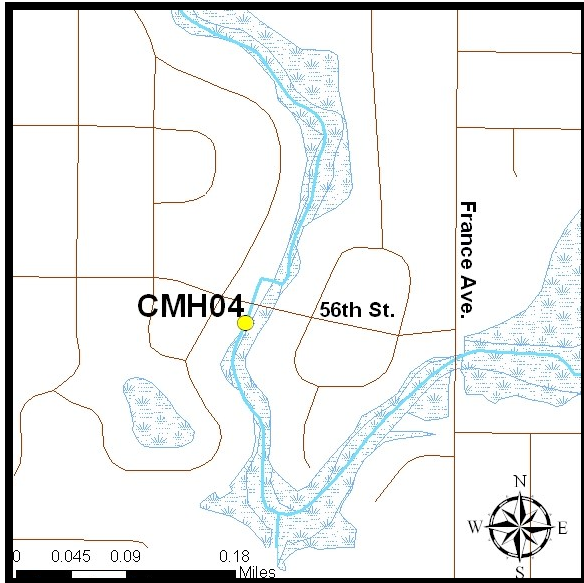
Note: Revised means and loads for 2009-2013

2014 Water Quality Data—CMH03

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	CI
3/17/2014		0.44	9.08		7.44					584
3/28/2014		0.49								323
4/2/2014	24.88	0.17	11.90	1390	7.06	130	29	1.680	4	332
4/7/2014	20.71	1.52	11.33	1234	6.66	102	32	1.510	4	294
4/14/2014	10.48	6.71	11.50	1231	7.96	71.5	7			
4/21/2014	14.52	15.46	10.83	1209	8.44	87	<3		7	
4/29/2014	117.50	5.51	10.95	637	7.55	71	11			
5/5/2014	205.89	10.69	12.00	527	7.70	30	3	0.608	2	82
5/12/2014		13.50	9.14	468	7.71	30	<3			
5/19/2014	244.18	13.76	10.05	483	7.94	21	<3		3	
5/27/2014	319.49	19.90	7.99	476	7.60	22	3			
6/2/2014	395.21	20.79	6.41	446	7.48	36	12.5	0.548	2.5	58
6/11/2014	387.20	21.29	6.59	455	7.51	36	15			
6/18/2014	427.79	21.85	6.35	451	7.49	43	14			
6/25/2014	494.69	23.54	7.11	457	7.71	48	24			
7/2/2014	408.00	20.83	6.36	452	7.55	43	19	0.734	1	55
7/9/2014	397.40	22.89	7.49	442		44	23			
7/14/2014	293.00	22.45	7.57	438		43	24		0	
7/21/2014	262.30	23.80	6.74	440	7.59	40	19			
7/28/2014	258.50	23.10	6.42	440	7.50	42	26	0.674	1	53
8/4/2014	189.00	24.87	6.15	446	7.49	45	29			
8/11/2014	171.70	23.42	6.87	449	7.53	48	22		2	
8/18/2014	172.10	24.01	5.53	433	7.41	45	22			
8/25/2014	126.40	24.18	6.35	455	7.54	42	21	0.715	2	57
9/2/2014	90.50	22.03	7.00	451	7.50	36	15			
9/8/2014	90.42	19.37	7.30	488	7.64	39	10		3	
9/15/2014	82.91	15.47	9.01	473	7.64	21	5			
9/22/2014	40.57	17.40	8.78	520	7.69	34	4	0.700	2	68
9/29/2014	24.25	20.40	8.39	532	7.79	35	3			
10/6/2014	23.82	9.61	11.01	564	7.92	35	6		2	
10/13/2014	21.79	11.39	11.07	560	7.91	23	<3			
10/20/2014	18.09	11.55	10.33	564	7.98	26	<3	0.557	2	77
10/27/2014	20.17	10.88	11.38	574	7.95	31	<3			
11/3/2014	4.06	4.90	14.60	603	8.00	35	<3		2	
11/12/2014		1.05		765						102

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);
Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: W 56th St (CMH04)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	5
Total Phosphorus (µg/L)	49
<i>E. coli</i> (cfu/100 mL)*	91
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	42	4715	57	1014	12	68226	0.83	432	5		
2006	68	8371	63	1076	8	111693	0.84	1106	8		
2007											
2008											
2009	4	519	73	84	12	5956	0.84	54	8	715	101
2010	30	3003	50	696	12	53266	0.89	389	6	4859	81
2011	78	5246	34	1484	10	87370	0.57	593	4	7773	51
2012	10	2247	113	455	23	19497	0.98	241	12	1905	96
2013	34	4630	68	2115	31	47551	0.70	308	5	4617	68
2014	97	8643	45	3180	17	127536	0.67	869	5	12752	67

Note: Revised means and loads for 2009-2013

2014 Water Quality Data—CMH04

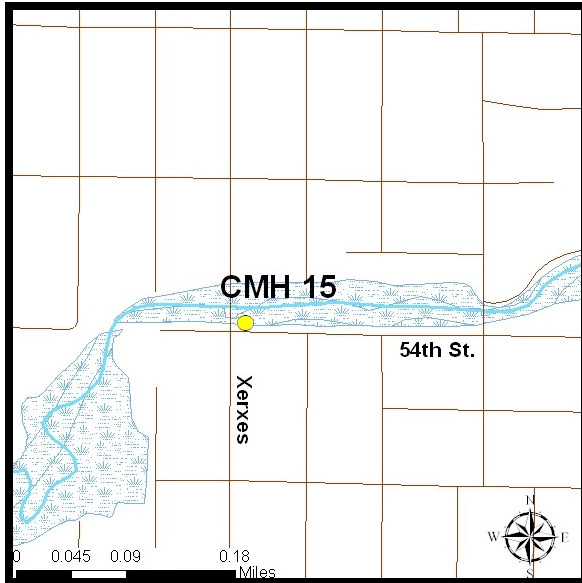
Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
3/17/2014		0.08	11.15		7.61					898
3/28/2014		0.05								346
4/2/2014	24.45	1.09	12.41	1356	7.43	164	28	1.960	12	314
4/7/2014	27.87	2.91	11.89	1248	7.04	101	29	1.480	4	301
4/14/2014	13.79	6.29	13.28	1214	8.17	75	6			
4/21/2014	16.96	14.42	12.68	1188	8.54	100	3		9	
4/29/2014	130.27	5.56	11.13	637	7.59	79	11			
5/5/2014	142.61	10.92	12.10	528	7.88	37	3	0.699	4	80
5/12/2014	191.12	13.52	9.46	468	7.75	36	<3			
5/19/2014	188.97	13.68	9.85	460	7.87	48	8		8	
5/27/2014	232.82	19.95	8.32	477	7.70	24	3			
6/2/2014	312.24	20.96	6.81	447	7.49	48	13	0.542	5	59
6/11/2014	309.56	21.33	6.92	457	7.53	42	16			
6/18/2014	357.99	21.96	6.77	451	7.52	47	16			
6/25/2014	441.63	23.47	7.51	453	7.74	50	22			
7/2/2014	414.00	20.74	6.74	450	7.59	45	19	0.551	4	57
7/9/2014	330.00	22.90	7.46	445		47	22			
7/14/2014	328.50	22.40	7.93	439		44	24		2	
7/21/2014	303.80	23.85	6.65	441	7.62	42.5	19			
7/28/2014	277.50	23.16	6.76	441	7.61	46	26	0.713	5	55
8/4/2014	196.20	24.87	6.69	447	7.58	47	29			
8/11/2014	180.60	23.22	7.55	451	7.55	50.5	23.5		6	
8/18/2014	163.60	24.01	6.22	434	7.46	46	22			
8/25/2014	125.80	24.17	6.81	456	7.60	45	20	0.751	5	56
9/2/2014	89.78	22.05	7.38	466	7.64	41	17			
9/8/2014	81.65	19.39	7.84	501	7.71	42	16		4	
9/15/2014	75.86	15.57	9.65	475	7.70	23	5			
9/22/2014	30.22	17.47	9.41	526	7.88	30	5	0.699	2	69
9/29/2014	24.74	19.56	8.52	536	8.53	41	3			
10/6/2014	28.27	9.42	10.89	568	7.95	27	5		2	
10/13/2014	24.08	11.30	10.51	566	7.91	24	<3			
10/20/2014	23.23	11.57	11.36	566	8.05	24	<3	0.550	2	73
10/27/2014	21.27	10.79	13.16	575	8.03	27	<3			
11/3/2014	4.83	5.43	14.04	630	7.96	29	<3		2	
11/12/2014		0.64		816						120

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);

2014

Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: Xerxes Ave (CMH15)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	6
Total Phosphorus (µg/L)	51
<i>E. coli</i> (cfu/100 mL)*	100
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006											
2007	25	3674	75	561	11	21183	0.43	477	10		
2008	24	2743	59	375	8	41465	0.89	404	9	3115	67
2009	4	729	83	183	21	8339	0.95	41	5	1362	155
2010	34	3601	54	963	14	61630	0.92	464	7	5646	84
2011	83	6435	39	1907	12	94946	0.58	766	5	8025	49
2012	11	2735	122	577	26	23193	1.03	342	15	2311	103
2013	43	6151	73	2951	349	73858	0.87	550	6	7238	85
2014	102	9829	49	3586	18	147752	0.73	1216	6	13130	65

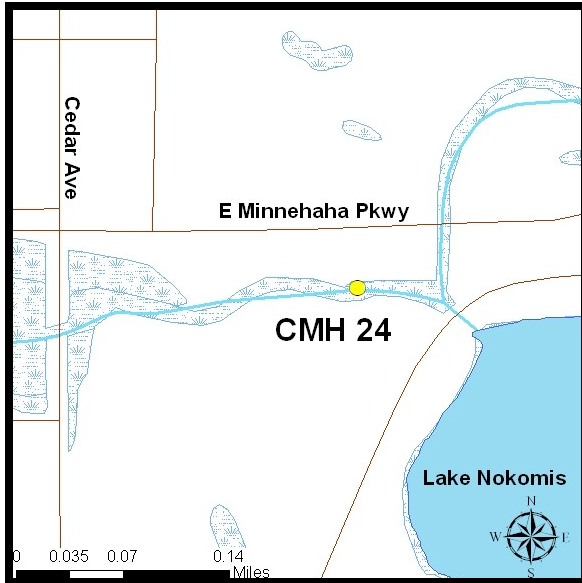
Note: Revised means and loads for 2009-2013

2014 Water Quality Data—CMH15

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	Cl
3/13/2014		0.12	10.99		7.79					747
3/17/2014		-0.05	10.16		7.39					627
3/28/2014		0								363
4/2/2014		0.26	12.99	1344	7.15	182	27	1.980	12	310
4/7/2014	28.06	3.23	11.79	1244	7.13	102	28	1.600	5	298
4/14/2014	13.45	5.64	13.36	1210	8.09	72	5			
4/21/2014	17.78	14.06	12.31	1119	8.36	94	<3		6	
4/29/2014	145.49	5.65	11.13	646	7.74	82	11			
5/5/2014	191.21	11.01	12.35	529	7.95	39	3	0.682	6	78
5/12/2014	239.57	13.57	9.28	472	7.77	38	<3			
5/19/2014	217.20	13.69	9.63	468	7.89	33	4		9	
5/27/2014	266.78	19.98	8.10	478	7.70	29	3			
5/29/2014	336.22									
6/2/2014	351.00	20.97	6.91	450	7.51	77	16	0.604	6	59
6/11/2014	336.14	21.28	6.80	458	7.57	42	17			
6/18/2014	375.01	21.93	6.78	451	7.60	51	17			
6/25/2014	518.08	23.39	7.25	460	7.79	55	25			
7/2/2014	384.30	20.62	7.47	443	7.61	49	25	0.760	6	58
7/9/2014	345.20	22.83	8.18	444		51	24			
7/14/2014	337.80	22.25	8.08	440		48	25		6	
7/21/2014	287.50	23.80	6.71	443	7.63	48	24			
7/28/2014	257.70	23.07	6.95	442	7.60	49	28	0.759	7.5	53
8/4/2014	194.40	24.82	6.83	449	7.58	48	28			
8/11/2014	113.30	23.02	7.80	453	7.50	52	28		7	
8/18/2014	175.70	23.99	6.48	435	7.51	52	24			
8/25/2014	128.80	24.03	6.96	457	7.62	48	22	0.718	7	56
9/2/2014	85.44	21.87	7.42	468	7.64	46	20			
9/8/2014	91.75	19.34	8.08	494	7.75	42	18		4	
9/15/2014	86.36	15.42	9.61	478	7.83	39	13			
9/22/2014	39.70	17.03	9.07	532	7.80	24	5	0.657	2	69
9/29/2014	28.83	18.92	8.44	540	8.02	29	7			
10/6/2014	25.81	9.02	10.49	573	7.85	38	7		2	
10/13/2014	23.51	11.16	10.25	574	7.84	29	8			
10/20/2014	24.37	11.17	10.77	579	7.92	23	3	0.538	2	79
10/27/2014	24.47	10.49	12.35	580	7.87	27	4			
11/3/2014	5.45	6.07	12.98	663	7.85	29	3		1	
11/12/2014		0.45		1170		31	<3			219

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);
 Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: 21st Ave (CMH24)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	11
Total Phosphorus (µg/L)	61
<i>E. coli</i> (cfu/100 mL)*	216
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006											
2007	12	1947	83	369	16	18180	0.78	318	14		
2008	23	2923	65	324	7	35816	0.80	1041	23	3101	69
2009	4	658	78	186	22	7534	0.90	33	4	1333	159
2010	34	4712	70	964	14	64592	0.96	754	11	5757	86
2011	85	7112	43	1798	108	104376	0.63	1619	10	9295	56
2012	15	3415	116	653	22	25044	0.85	874	30	2705	92
2013	46	6796	75	2664	29	84241	0.93	1030	11	7016	77
2014	97	10423	55	3227	17	111366	0.59	1967	10	11019	58

Note: Revised means and loads for 2009-2013

2014 Water Quality Data—CMH24

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
3/13/2014		-0.12	12.22		7.52					1710
3/17/2014		-0.07	11.60		7.58					793
3/28/2014		-0.02								239
4/2/2014		-0.02	12.76	1164	7.62	153	39	1.640	7	272
4/7/2014		0.25	11.55	1096	7.54	122	36	1.640	15	239
4/14/2014	20.12	4.80	12.19	1024	7.89	67	4			
4/21/2014	24.29	11.96	11.42	874	8.16	101	<3		5	
4/29/2014	174.62	5.72	11.70	627	4.60	92	9			
5/5/2014	188.13	10.75	12.58	544	8.00	52	3	0.670	12	81
5/12/2014	228.86	13.58	9.32	484	7.88	49.5	3			
5/19/2014		13.41	9.25	391	7.94	227	42		64	
5/27/2014		19.96	7.93	487	7.82	41	4			
6/2/2014	282.99	20.94	6.67	461	7.62	60	17	0.661	14	64
6/11/2014	269.32	21.13	6.97	467	7.74	50	17			
6/18/2014	441.80	22.02	6.74	445	7.72	64	19			
6/25/2014	336.71	23.22	7.29	464	7.82	60	28			
7/2/2014	318.84	20.57	7.25	455	7.75	58	25	0.802	10	60
7/9/2014	282.27	22.69	8.28	453		58	23			
7/14/2014	284.42	22.06	8.36	447		55	26		12	
7/21/2014	255.62	23.66	7.08	453	7.77	53	20			
7/28/2014		22.86	7.28	450	7.80	54	25	0.754	12	58
8/4/2014	202.71	24.56	7.12	463	7.78	54.5	25.5			
8/11/2014	168.37	28.89	8.30	462	7.77	50	20		10	
8/18/2014	166.90	23.88	6.75	446	7.71	49	19			
8/25/2014	143.35	23.87	7.06	472	7.87	46	18	0.765	10	60
9/2/2014	112.96	21.90	7.69	482	7.97	43	13			
9/8/2014	99.79	19.48	8.13	504	7.96	39	8		6	
9/15/2014	89.93	15.44	9.45	496	8.00	24	3			
9/22/2014	48.35	16.39	9.06	545	7.94	28	<3	0.657	2	82
9/29/2014	38.71	18.29	9.11	522	8.80	75	29			
10/6/2014	37.49	9.57	10.05	581	8.00	25	4		1	
10/13/2014	32.66	11.40	9.93	586	8.00	21	<3			
10/20/2014	32.04	11.23	10.48	594	8.01	23	3	0.526	1	89
10/27/2014	31.08	10.63	11.73	595	8.01	25.5	4			
11/3/2014	8.91	7.32	12.08	660	7.96	30	6		2	
11/12/2014		1.27		825						153

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);
Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: 28th Ave (CMH18)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	8
Total Suspended Solids (mg/L)	6
Total Phosphorus (µg/L)	60
<i>E. coli</i> (cfu/100 mL)*	142
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006											
2007	25	3863	78	530	11	46174	0.93	380	8	N/A	N/A
2008	22	2413	57	272	6	36110	0.85	182	4	2754	65
2009	4	967	112	202	23	12222	1.42	54	6	1325	154
2010	31	3674	61	574	10	64534	1.07	293	5	5370	89
2011	83	7479	46	1526	9	98435	0.60	876	5	10736	66
2012	15	2985	98	579	19	33322	1.09	251	8	3082	101
2013	41	5943	73	2014	25	69542	0.86	424	5	7172	88
2014	120	12935	55	3803	16	191405	0.81	1576	7	16812	71

Note: Revised means and loads for 2009-2013

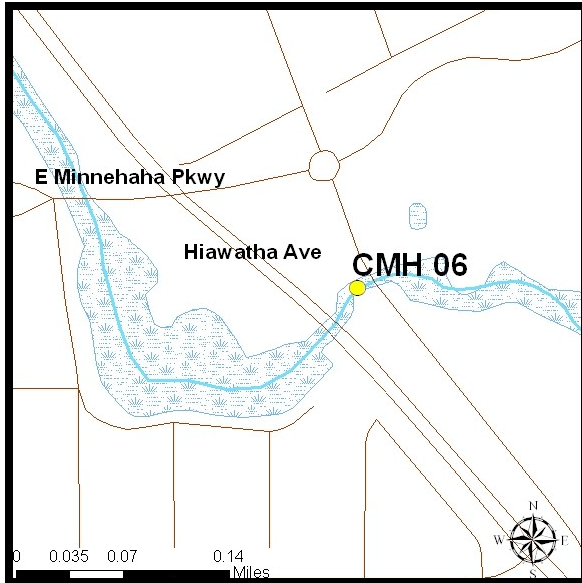
2014 Water Quality Data—CMH18

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	Cl
3/13/2014		1.10	7.13		7.66					262
3/17/2014		2.30	3.13		7.33					249
3/28/2014		1.50								285
4/2/2014	43.15	1.55	7.00	1113	7.20	210	80	2.260	7	246
4/7/2014	45.90	1.47	7.31	1181	7.20	138	53	1.730	6	276
4/14/2014	18.12	4.68	10.70	1027	7.58	99	11			
4/21/2014	27.59	11.8	13.95	983	8.42	124	5		10	
4/29/2014	212.32	6.58	10.77	701	5.48	86	3			
5/5/2014	219.05	9.93	12.87	599	7.90	52	<3	0.808	8	99
5/12/2014		13.76	9.40	487	7.92	51	<3			
5/19/2014	300.54	13.19	10.30	481	8.13	50	<3		12	
5/27/2014	300.54	19.87	7.90	490	7.86	39.5	<3			
6/2/2014	378.79	21.80	6.00	441	7.58	60	18	0.676	6	57
6/11/2014	364.26	20.98	6.43	472	7.64	46	18			
6/18/2014	391.86	21.54	6.35	440	7.61	59	24			
6/25/2014	510.68	23.62	7.16	457	7.81	70	25			
7/2/2014	478.10	21.43	6.08	457	7.72	59	32	0.726	7	60
7/9/2014	412.20	23.23	7.13	460		56	24			
7/14/2014	393.20	22.75	7.26	448		55	27		4	
7/21/2014	334.30	23.40	6.62	458	7.75	48	18			
7/28/2014	291.30	23.57	5.91	455	7.62	53	28	0.853	4	54
8/4/2014	223.20	24.92	7.90	467	7.92	43	12			
8/11/2014	199.30	23.49	7.83	466	7.77	47	12		6	
8/18/2014	196.40	24.02	6.31	454	7.67	50	14			
8/25/2014	159.50	24.57	6.63	476	7.75	46	14	0.822	8	61
9/2/2014	128.80	22.98	7.47	447	7.80	45	9			
9/8/2014	104.34	20.55	7.56	492	7.87	44	5		7	
9/15/2014	94.73	16.22	9.32	510	8.01	33	<3			
9/22/2014	53.21	18.35	9.41	498	8.02	34	<3	0.744	5	74
9/29/2014	39.59	19.12	9.80	524	8.24	33	<3			
10/6/2014	35.79	12.26	7.70	540	7.77	40	9		4	
10/13/2014	35.59	11.42	9.06	580	7.73	33	6			
10/20/2014	34.16	12.27	10.29	596	7.98	36	<3	0.709	4	90
10/27/2014	32.46	11.85	11.57	607	7.95	32	<3			
11/3/2014	10.81	7.59	12.34	636	7.93	38.5	<3		4	
11/12/2014		2.93		688						104
11/13/2014		2.24		686						105

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);

Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Minnehaha Creek: Hiawatha Ave (CMH06)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	9
Total Phosphorus (µg/L)	63
<i>E. coli</i> (cfu/100 mL)*	166
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	55	7497	69	1394	13	100606	0.92	623	6		
2006	77	10452	69	972	6	181377	1.19	1190	8		
2007	29	4837	84	687	12	51760	0.96	653	12		
2008	23	2630	57	376	8	42506	0.93	166	4	2934	64
2009	7	1568	114	322	24	15770	1.15	77	6	1716	125
2010	35	4509	65	938	14	81711	1.18	636	9	6530	94
2011	94	8584	46	2076	11	126623	0.69	874	5	12908	70
2012	16	4321	139	541	17	30778	0.99	390	13	2957	95
2013	41	6255	77	2100	26	86335	1.07	814	10	7036	87
2014	131	16524	64	4434	17	206082	0.80	2977	12	17863	69

Note: Revised means and loads for 2009-2013

2014 Water Quality Data—CMH06

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	Cl
3/13/2014		-0.10	10.67		7.16					1510
3/17/2014		0	10.34		7.00					222
3/28/2014	30.00	1.66								278
4/2/2014	45.90	3.45	10.80	1094	7.44	181	69	2.040	6	244
4/7/2014	49.69	3.53	10.38	1185	7.22	133	55	1.720	4	283
4/14/2014	22.87	4.15	12.25	1028	7.72	97	12	1.400	5	214
4/21/2014	29.54	11.92	12.17	999	8.46	95	4	1.250	7	216
4/29/2014	228	6.57	11.50	690	6.31	92	4	1.090	14	150
5/5/2014	236	10.24	13.04	598	8.05	60	<3	0.851	13	99
5/12/2014	308	13.76	9.43	486	7.95	61	<3	0.923	17	74
5/19/2014	454	12.81	10.15	367	5.52	155	21	1.230	69	52
5/27/2014	344	19.89	8.22	490	7.82	44	<3	1.050	9	69
6/2/2014	437	22.10	6.49	438	7.6	62	19	0.646	7	62
6/11/2014	405	21.35	7.10	472	7.73	44.5	17.5	0.651	4	58
6/18/2014	467	22.03	6.55	441	7.72	61	18	0.704	6	57
6/25/2014	530	23.75	7.51	457	7.87	70	27			
7/2/2014	436	21.54	6.93	457	7.77	61	33	0.935	5	60
7/9/2014	411	23.43	8.31	459		57	28	0.723	5	61
7/14/2014	391	22.75	8.12	448		60	27	0.715	6	59
7/21/2014	335	23.74	7.47	458	7.83	48	18	0	6	59
7/28/2014	301	23.81	6.82	456	7.69	56	28	0.824	7	56
8/4/2014	241	25.08	8.01	467	7.97	48	13	0.770	7	55
8/11/2014	211	23.27	8.77	466	7.84	50	14	0.831	9	59
8/18/2014	211	24.41	7.21	456	7.76	49	15	0.919	10	62
8/25/2014	164	24.98	7.59	476	7.88	61	16	0.819	8	64
9/2/2014	130	23.25	8.35	449	7.92	46	11	0.827	6	59
9/8/2014	104	20.72	8.68	492	7.99	42	7	0.838	6	66
9/15/2014	98	16.40	9.89	512	8.09	33	<3	0.788	4	68
9/22/2014	53	18.29	9.61	520	8.06	35	<3	0.687	4	72
9/29/2014	35.80	18.87	9.99	516		45	4	0.850	4	77
10/6/2014	40.93	11.94	9.57	547	7.89	41	10	0.883	4	91
10/13/2014	35.40	11.61	10.18	582	7.84	34	6	0.821	4	89
10/20/2014	31.53	12.54	10.71	602	8.05	35	<3	0.660	4	85
10/27/2014	36.56	11.93	11.87	610	8.04	34	<3	0.752	4	95
11/3/2014	11.34	7.16	11.83	646	7.92	41	3	0.883	4	95
11/12/2014		1.65		710						108

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);
 Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Minnehaha Creek Subwatershed - *E. coli* Concentrations

Date	CMH07	CMH19	CMH02	CMH11	CMH03	CMH04	CMH15	CMH24	CMH18	CMH06
4/10/2014		58	13	11	4	6	10	15	15	29
4/17/2014		1	20	236	9	20	99	162	199	155
4/24/2014		80	105	1203	67	397	291	1986	308	687
5/1/2014	1	15	61	122	81	112	133	158	91	89
5/8/2014	<1	8	26	57	35	65	56	365	81	102
5/15/2014	<1	2	7	18	156	142	130	176	272	201
5/22/2014	1	5	28	31	40	29	47	78	78	56
5/29/2014	2	16	23	30	42	40	56	81	88	81
6/5/2014	1	10	21	49	41	68	40	36	50	48
6/12/2014	43	9	33	345	579	461	185	127	166	153
6/18/2014	2	16	53	365	816	921	517	475	308	205
6/26/2014	<1	11	50	79	28	42	44	84	47	
7/2/2014	3	19	82	125	42	45	107	124	74	77
7/10/2014	1	36	60	125	54	79	82	86	93	64
7/17/2014	548	50	86	66	57	54	72	118	68	71
7/24/2014	3	72	51	64	79	76	96	152	61	72
7/31/2014	<1	99	74	146	119	115	122	130	38	87
8/7/2014	2	219	52	91	152	131	117	138	54	86
8/14/2014	1	194	77	108	73	70	76	90	78	102
8/21/2014	2	1733	217	228	435	214	365	1414	1203	1414
8/28/2014	2	166	124	71	74	172	77	148	91	65
9/4/2014	3	201	111	96	159	150	111	435	219	291
9/11/2014	13	326	162	411	461	212	240	727	727	649
9/18/2014	<1	194	194	184	76	72	71	272	115	147
9/25/2014	<1	235	135	1046	770	436	547	1516	816	1553
10/2/2014	3	146	167	770	579	613	517	1414	1484	2420
10/9/2014	5	51	81	199	24	28	46	74	142	115
10/16/2014	4	49	82	114	24	28	70	194	33	69
10/23/2014	5	40	63	291	46	155	155	>2420	>2420	>2420
10/29/2014		56	54	121	16	20	16	435	206	192

Duplicate samples that have been averaged are bolded

Minnehaha Creek Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey*	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
CGLO04— Gleason Wetland Outlet		Chloride	Aquatic Life
Minnehaha Creek:			
Grays Bay Outflow			
City of Minnetonka Community Center			
I-494 Ramps			
West 34th St.			
Excelsior Blvd	2013	Aquatic Macroinvertebrate Bioassessments; Chloride;	Aquatic Life and Aquatic Recreation
Browndale Dam		Fishes Bioassessments; Dissolved Oxygen;	
West 56th St.		Fecal Coliform	
Xerxes Ave.			
21st Ave			
28th Ave.			
Hiawatha Ave.			

* The Macroinvertebrate Survey Report is available on the district website at <http://minnehahacreek.org/project/stream-assessment-2013>

Minnehaha Creek Subwatershed - Additional Stream Information

Stream	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
GGL04-- Gleason Wetland Outlet							
Minnehaha Creek:							
Grays Bay Outflow							X
City of Minnetonka Community Center							X
I-494 Ramps							X
West 34th St.							X
Excelsior Blvd							X
Browndale Dam							X
West 56th St.							X
Xerxes Ave.							X
21st Ave							X
28th Ave.							X
Hiawatha Ave.							X

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Painter Creek Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	3
Guidelines and Standards	5
Executive Summary	6
Subwatershed Facts and Map	7
Painter Creek Subwatershed - Lake Monitoring Sites Information.....	8
Katrina Wetland.....	9
Thies Lake	10
Painter Creek Subwatershed - Additional Lake Information.....	11
Painter Creek Subwatershed - Stream Monitoring Sites Information	12
Painter Creek: Upstream - Katrina Wetland Outlet.	13
Painter Creek: Painter Marsh Outlet	15
Painter Creek: Upstream - Painter Creek Dr	17
Painter Creek: Upstream - W Branch Rd	19
Painter Creek: Jennings Bay Inlet	21
Painter Creek Subwatershed - <i>E. coli</i> Concentrations.....	23
Painter Creek Subwatershed - Additional Stream Information	24

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.

Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see the 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%.

Executive Summary

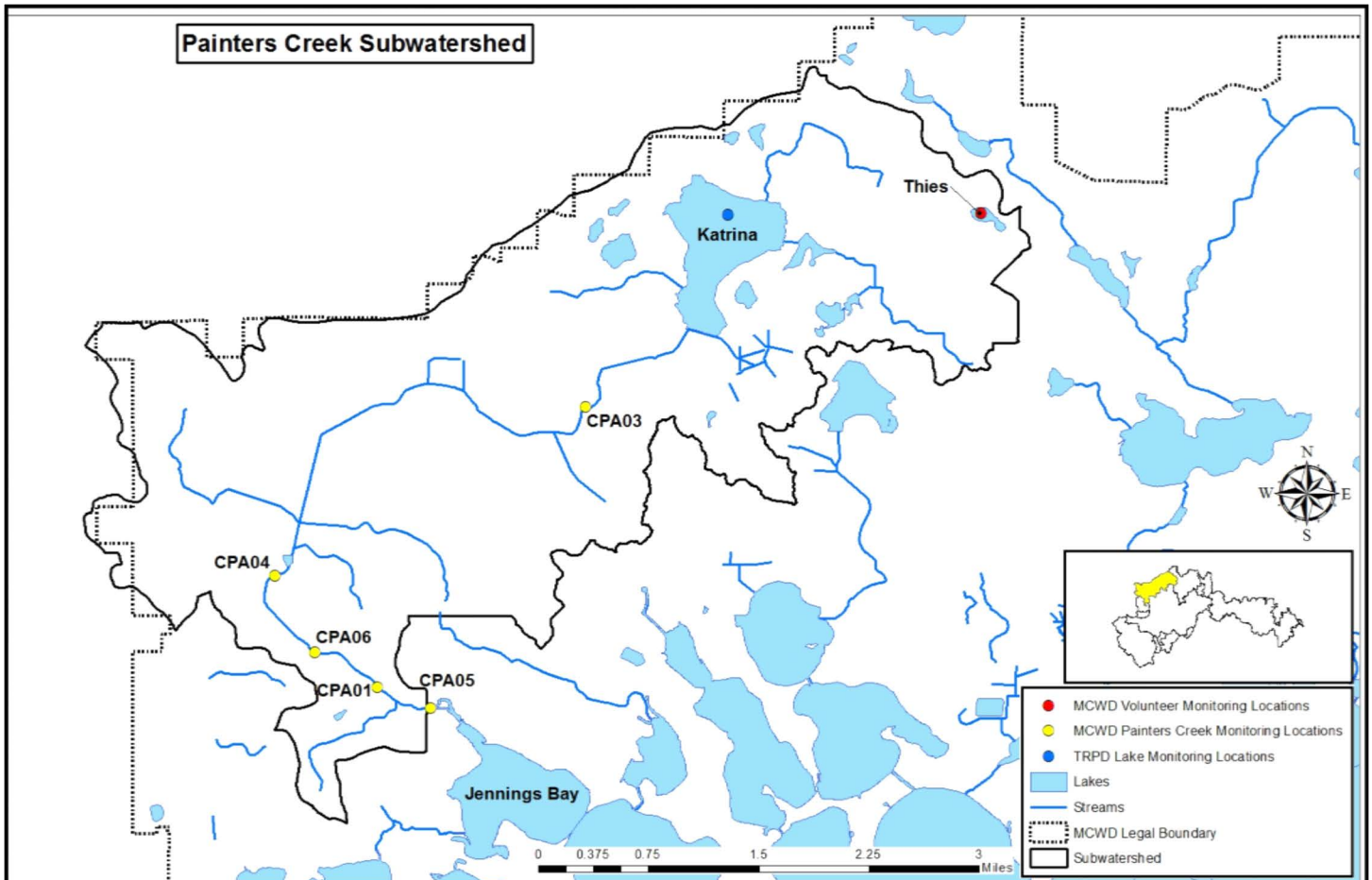
The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

The 2014 monitoring season is summarized for Painter Creek Subwatershed in this report. There were two lakes and five stream sites on Painter Creek monitored in 2014. Painter Creek: Katrina Wetland outlet, Painter Marsh outlet and upstream site at Painter Creek Rd did not meet the North Central Hardwood Forest (NCHF) dissolved oxygen standard and total phosphorus (TP) guideline in 2014. Painter Creek: Upstream site at W Branch Rd and Jennings Bay inlet exceeded the TP guideline in 2014. The table below displays the lakes monitored within the Painter Creek Subwatershed that did not meet the NCHF eutrophication standards.

Lake/Wetland**	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Katrina**				N/A
Thies	X	X	X	

Subwatershed Facts and Map

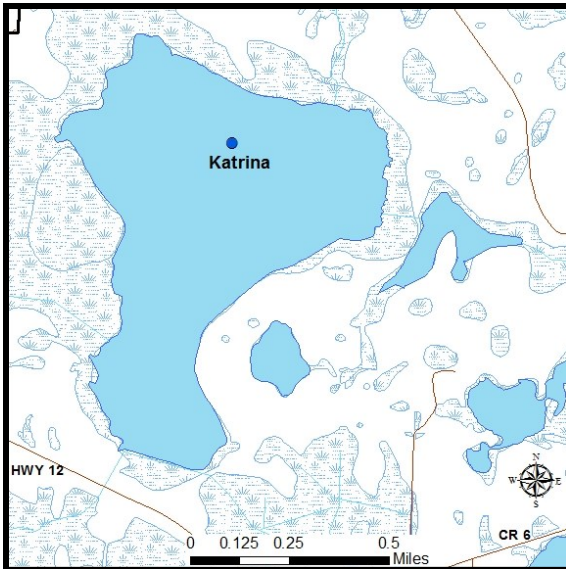
Municipalities	Independence, Maple Plain, Medina, Minnetrista and Orono
Area	About 8,667 acres
Population	Independence = 3,645 people (2013) Maple Plain = 1,808 people (2013) Medina = 5,221 people (2013) Minnetrista = 6,778 people (2013) Orono = 7,796 people (2013)
Ecoregion	North Central Hardwood Forest
Groundwater	No MnDNR wells monitored
District Goals	<ul style="list-style-type: none"> Reduce nutrient loading into Jennings Bay by reducing TP and TSS concentrations in Painter Creek. Increase DO levels in Painter Creek



Painter Creek Subwatershed - Lake Monitoring Sites Information

Lake	M/DNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Watershed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Academy Marsh*	27113600	LAM02	Hennepin	Limited	7.0					7	880.18	126:1	44.96637	-93.37797
Katrina	27015400	LKA01	Hennepin	Yes	290.0						3210.40	11:1	45.01095	-93.62420
Thies	27015600	LTS01	Hennepin	No	11.0					29	462.22	42:1	44.18500	-93.67610

* Not monitored in 2014

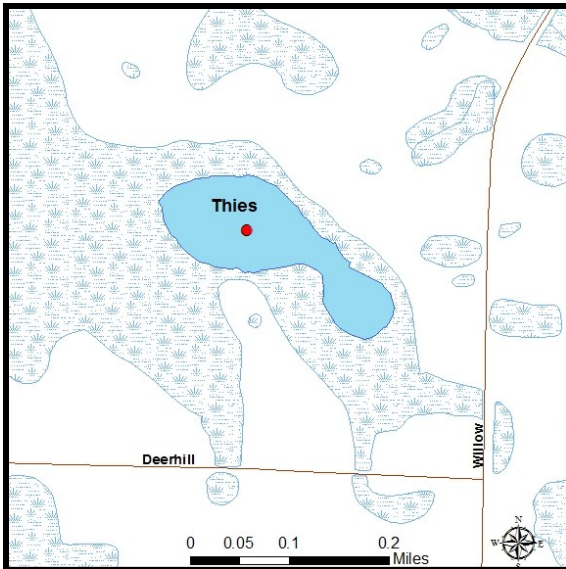


Katrina Wetland (DNR ID: 27-0154-00) - Monitored by TRPD -

Note: Katrina Lake has been reclassified, by the MPCA, as Katrina wetland due to its depth and percentage of littoral zone. At this time, there is no eutrophication standards to assess the water quality in the Katrina wetland.

2014 Water Quality

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP
5/5/2014	12.26	17.59	0.317	9.80	0.65		94	3.3
5/21/2014	14.81	9.04	0.355	7.89	1.65	18.23	61	4.2
6/3/2014	21.49	5.41	0.341	7.78	2.00	2.87	152	118.5
6/17/2014	23.96	7.22	0.344	7.74	1.86	2.23	167	151.6
7/15/2014	21.04	13.57	0.295	8.81	1.69		196	98.0
7/29/2014	22.58	11.35	0.275	9.07	0.60		151	19.5
8/12/2014	24.24	10.38	0.306	8.42	0.82		110	52.3
8/26/2014	24.53	13.31	0.328	8.09	0.35		282	48.6
9/9/2014	20.20	11.80	0.335	9.12	0.29		315	29.1
9/23/2014	18.49	13.80	0.325	8.34	1.50		221	107.7



Thies Lake

(DNR ID: 27-0156-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009	B	B	C	B-
2010	C	C	C	C
2011				
2012				
2013				
2014	D	C	D	D+

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009	2.18	6.75	28	50
2010	1.50	15.75	41	57
2011				
2012				
2013				
2014	0.78	39.13	74	65

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl
5/26/2014	25.1	0.50	28.0	104	1.76	1.76	<0.03	38
6/30/2014	24.3	0.50	81.0	126	2.01	2.01	<0.03	29
7/28/2014	25.4	0.60	36.0	69	1.71	1.71	<0.03	30
8/24/2014	26.8	1.10	23.0	57	1.47	1.47	<0.03	33
9/29/2014	20.3	0.90	16.5	44	1.21	1.21	<0.03	34

Painter Creek Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Academy Marsh							
Katrina	1983 - 1997					Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Thies							

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Academy Marsh							
Katrina							
Thies							

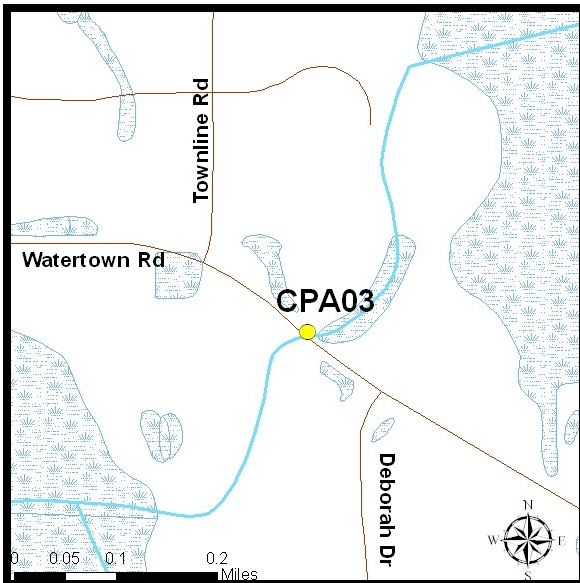
*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcawd-lakes

Painter Creek Subwatershed - Stream Monitoring Sites Information

Stream	MCWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Painter Ck: Katrina Wetland Outlet	CPA03	Yes	Yes	3502.58	44.9918	-93.6436
Painter Ck: Painter Marsh Outlet	CPA04	Yes	No	3907.78	44.9749	-93.6870
Painter Ck: Upstream (Painter Creek Dr)	CPA06	Yes	No	225.94	44.9674	-93.6811
Painter Ck: Upstream (W Branch Rd)	CPA01	Yes	Yes	174.78	44.9640	-93.6724
Painter Ck: Jennings Bay Inlet	CPA05	Yes	No	314.48	44.9619	-93.6644





Painter Creek: Katrina Wetland Outlet (CPA03)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	2
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	217
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

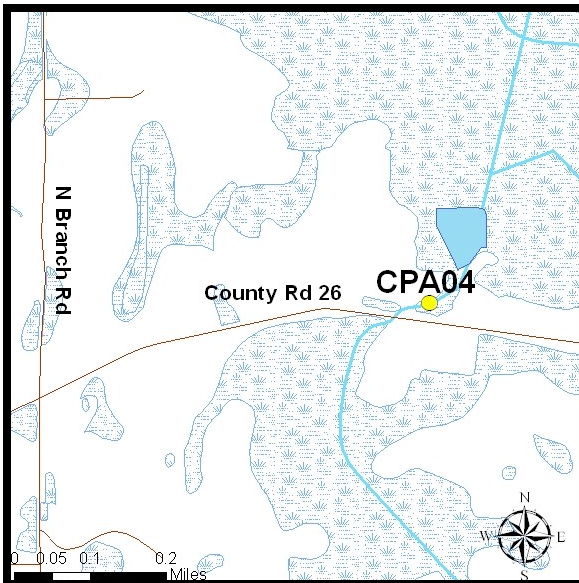
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005	2.51	1296	262	618	125	8448	1.71	35	7		
2006	3.05	789	132	232	39	1621	0.27	27	4		
2007	2.09	981	238	305	74	2627	0.64	22	5		
2008	1.91	890	236	541	143	5704	1.51	11	3	166	44
2009	0.55	226	208	77	71	2338	2.16	3	3	66	61
2010	2.31	961	212	644	142	8237	1.81	11	3	333	73
2011	3.80	631	84	347	46	5852	0.78	26	3	318	43
2012	1.88	596	161	287	78	4813	1.30	12	3	189	51
2013	3.86	1685	222	1203	158	9609	1.27	11	2	351	46
2014	7.32	3064	212	2097	145	18824	1.31	52	4	597	41

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CPA03

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	5.16	1.79	5.04	495	7.32	159	78	2.070	3	68
4/16/2014	7.18	2.19	5.82	434	7.18	177	81			
4/22/2014	7.70	6.18	6.77	461	7.17	137	39		2	
4/30/2014	14.15	4.70	5.11	399	7.23	108	13			
5/7/2014	15.19	6.24	7.06	381	7.34	67	7	0.998	4	48
5/13/2014	14.69	8.68	3.48	390	7.27	70	23			
5/21/2014	14.71	10.54	3.05	401	7.30	88	45		2	
5/28/2014	13.24	17.24	1.75	406	7.14	146	90			
6/4/2014	23.68	20.27	1.41	359	7.13	182	137	0.856	6	37
6/10/2014	25.28	18.96	0.88	379	6.98	211	169			
6/17/2014	22.59	18.67	0.94	374	7.02	208	163		2	
6/24/2014	23.52	21.69	1.57	356	7.14	238	186			
7/1/2014	23.20	20.35	1.29	368	6.95	305	208	1.020	3	34
7/8/2014	22.22	20.26	0.61	376		243.5	177			
7/16/2014	22.95	19.66	0.52	381		264	184		2	
7/22/2014	19.90	21.46	0.63	382	7.03	225	163			
7/30/2014	18.74	20.42	0.48	375	6.98	247	175	1.300	2	35
8/6/2014	17.12	20.15	0.72	363	6.85	235	154			
8/27/2014	13.09	21.22	1.07	437	7.18	294	212	1.840	3	40
9/3/2014	6.20	20.10	2.27	425		274	189			
9/9/2014	6.61	19.40	1.32	424		276	181.5		22	
9/17/2014	4.34	16.29	1.59	427		228	173			
9/24/2014	4.77	15.64	1.61	429	6.61	274	226	2.210	2	39
10/1/2014	2.83	14.14	1.53	442	7.00	334	265			
10/8/2014	1.67	11.00	2.07	453	7.09	275	224		1	
10/14/2014	1.60	12.32	1.95	450	7.36	278	227			
10/22/2014	1.04	10.91	1.09	459	7.18	279	211	2.180	3	41
10/27/2014	0.86	10.82	0.83	466	7.11	283	193			
11/5/2014	0.79	6.99	2.58	463	7.42	194	151.5		1	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Painter Creek: Painter Marsh Outlet (CR 26) (CPA04)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	2
Total Suspended Solids (mg/L)	3
Total Phosphorus (µg/L)	284
<i>E. coli</i> (cfu/100 mL)*	67
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

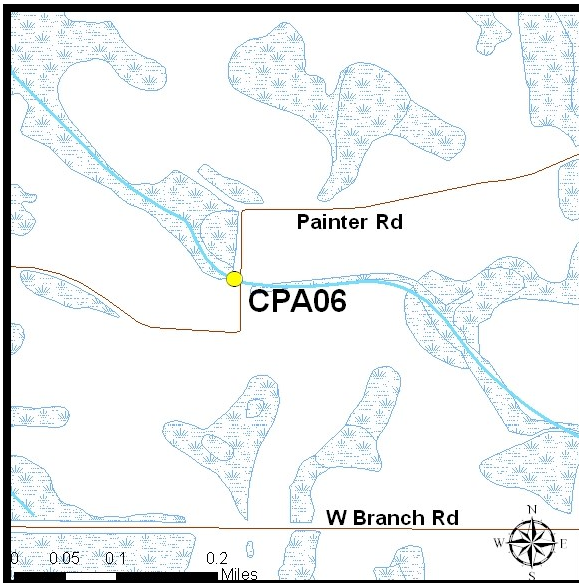
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	3.72	1945	265	813	111	11664	1.59	49	7		
2006	9.37	2846	154	1275	69	4792	0.26	43	2		
2007	4.02	1785	226	967	122	13084	1.65	29	4		
2008	3.06	1814	301	1323	219	9004	1.49	12	2	217	36
2009*											
2010	4.21	1778	215	1122	135	12167	1.47	15	2	497	60
2011	7.23	2287	161	1093	77	7018	0.49	27	2	426	30
2012	3.75	2221	301	1201	163	9057	1.23	29	4	286	39
2013	7.27	5953	416	4457	311	19555	1.37	38	3	596	42
2014	13.18	7786	300	5284	204	36294	1.40	75	3	1022	39

* Not enough data to calculate; Note: Revised means and loads for 2008, 2010-2013

2014 Water Quality Data - CPA04

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	22.518	1.68	2.21	554	7.00	168	87	2.870	3	63
4/16/2014	13.461	2.59	4.09	548	6.96	135	56			
4/23/2014	12.032	5.20	4.51	551	7.01	91	65		2	
4/30/2014	96.314	3.74	5.71	422	7.22	204	140			
5/7/2014	33.432	6.07	5.64	438	7.10	109	73.5	1.195	2	46
5/14/2014	37.050	7.56	3.41	473	7.23	118	74			
5/21/2014	50.340	9.09	2.59	462	7.23	156	100		2	
5/28/2014	30.171	13.09	0.80	468	7.13	289	166			
6/4/2014	73.764	16.80	0.37	394	6.98	459	317	1.260	5	31
6/10/2014	33.968	16.16	0.48	433	6.88	444	319			
6/17/2014	40.055	16.70	0.44	432	6.86	313	240		2	
6/24/2014	50.716	19.49	0.48	410	6.92	493	368			
7/1/2014	29.494	19.54	0.52	417	6.86	471	326.5	1.085	3	31
7/8/2014	22.054	19.38	0.53	413		332	223			
7/16/2014		19.60	0.32	429		351	239		2	
7/23/2014		19.53	0.55	426	6.80	314	215			
7/30/2014		20.29	0.48	436	6.86	406	275	1.220	2	36
8/6/2014	19.057	19.67	0.55	425	6.68	304	209			
8/13/2014	15.184	19.75	0.43	419	6.64	374	235		2	
8/20/2014	15.359	19.95	0.30	426	6.51	377	235			
8/27/2014	12.730	20.29	0.25	447	6.66	395	245	1.230	4	40
9/3/2014	10.556	19.51	1.18	455		353	197			
9/10/2014	7.063	18.04	1.46	470		321	200		3	
9/17/2014	4.411	15.12	0.36	477		288	186			
9/24/2014	2.906	15.40	0.18	476	6.50	284	154	1.370	4	42
9/30/2014	2.237	15.24	1.22	472	7.02	243	118			
10/7/2014	2.282	11.37	1.32	487	6.98	230	145		2	
10/15/2014	1.322	10.48	1.34	499	7.31	222	129			
10/22/2014	1.438	10.40	0.67	508	7.07	200	109	1.380	3	44
10/27/2014	1.353	10.28	1.23	511	7.06	214	101			
11/5/2014	1.118	6.61	5.62	510	7.66	159	64		12	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Painter Creek: Upstream (Painter Creek Dr) (CPA06)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	3
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	341
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

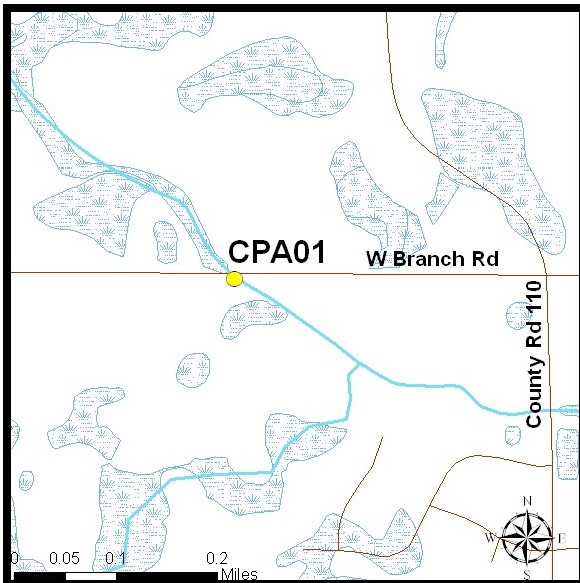
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	2.32	1410	308	638	139	8029	1.75	45	10		
2006	7.45	2747	187	1048	72	3914	0.27	141	10		
2007	3.53	1402	202	728	105	11508	1.66	27	4		
2008	2.20	1159	267	839	193	7286	1.68	24	6	132	30
2009	0.58	229	201	152	133	2193	1.92	1	1	65	57
2010	9.36	4229	230	2741	149	26083	1.42	39	2	1016	55
2011	10.91	3780	176	2038	95	16349	0.76	46	2	812	38
2012	4.16	2449	299	1436	176	11486	1.41	31	4	368	45
2013	7.34	6193	429	4172	289	21996	1.52	34	2	644	45
2014	11.92	7929	338	4990	213	29681	1.26	101	4	944	40

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CPA06

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	17.540	1.58	3.05	552	7.25	155	66	2.560	2	63
4/16/2014	13.180	2.38	4.43	558	7.00	112	44			
4/22/2014	13.685	9.98	10.16	543	7.25	81	50		1	
4/30/2014	67.700	3.95	8.50	390	7.17	187	122			
5/6/2014	29.560	8.71	11.83	410	7.35	90	60	1.240	2	46
5/13/2014	12.473	8.79	8.44	450	7.28	100	63			
5/21/2014	43.530	10.27	7.31	455	7.31	123	79		2	
5/28/2014	23.960	16.88	4.23	455	7.10	208	148			
6/4/2014	82.815	17.29	0.64	401	7.00	534	318	1.030	9	33
6/10/2014	42.182	16.61	0.65	432	6.89	495	325			
6/17/2014	43.988	17.66	1.20	447	6.93	382	271		3	
6/24/2014	59.815	19.92	0.56	408	6.92	541	342			
7/1/2014	23.760	19.39	2.38	415	6.88	510	364	0.973	4	31
7/8/2014	22.840	19.25	0.68	413		465	297			
7/16/2014	24.196	19.26	1.28	423		334	225		2	
7/22/2014	16.650	23.21	1.81	426	6.96	227	155			
7/30/2014	5.640	20.84	1.25	436	6.88	320	222	1.150	2	35
8/6/2014	13.600	19.28	1.72	415	6.62	356	214			
8/13/2014	11.140	19.33	1.16	411	6.51	398	239		3	
8/19/2014	10.115	22.41	2.16	398	6.69	269	161			
8/27/2014	15.557	21.24	1.37	445	6.42	291.5	185.5	1.245	3	38
9/3/2014	12.611	19.71	2.97	457		328	199			
9/9/2014	8.649	19.31	0.84	476		354	212		2	
9/17/2014	4.972	14.22	0.75	483		358	214			
9/24/2014	0.984	15.92	1.08	477	6.77	420	199	1.530	6	44
10/1/2014	0.885	13.93	0.29	481	7.06	1170	128			
10/14/2014	4.228	10.26	3.62	501	7.13	348	142			
10/22/2014	3.059	8.79	3.62	510	7.17	398	130	1.510	6	45
10/27/2014	1.072	9.01	5.49	514	7.20	398.5	117.5			
11/5/2014	6.029	5.58	6.64	517	7.22	268	93		6	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Painter Creek: Upstream (W Branch Rd) (CPA01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	5
Total Suspended Solids (mg/L)	8
Total Phosphorus (µg/L)	305
<i>E. coli</i> (cfu/100 mL)*	46
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

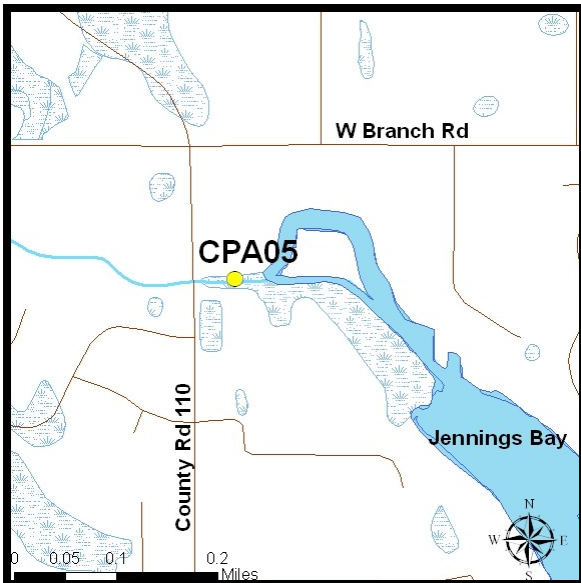
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	6.33	4644	372	1826	146	22758	1.83	264	21		
2006	6.04	2290	193	867	73	3825	0.32	147	12		
2007	3.05	1257	209	703	117	8858	1.47	26	4		
2008	2.40	1389	294	1020	216	6627	1.401	46	10	163	34
2009	0.36	142	197	92	128	2073	2.885	2	3	53	73
2010	3.23	1572	247	1019	160	11696	1.840	53	8	416	65
2011	5.32	1961	187	1044	100	5692	0.544	104	10	335	32
2012	3.30	2038	314	1180	182	7961	1.224	91	14	240	37
2013	8.35	6987	425	4591	279	30445	1.852	134	8	774	47
2014	11.54	7226	318	4433	195	34318	1.51	286	13	951	42

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CPA01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	19.31	4.35	5.29	559	7.19	174	71	2.430	7	62
4/16/2014	9.70	2.38	6.66	560	7.13	119	51			
4/22/2014	8.17	9.69	11.39	547	7.39	87	42		3	
4/30/2014	86.83	3.89	7.14	430	7.30	213	121			
5/6/2014	36.20	8.70	11.37	440	7.48	108	62	1.300	12	45
5/13/2014	39.52	8.76	7.77	465	7.29	141	66			
5/21/2014	43.79	9.90	5.56	472	7.34	131	85		10	
5/28/2014	22.38	16.96	4.40	472	7.23	227	144			
6/4/2014	78.00	17.09	1.49	394	7.07	547	320	1.250	22	31
6/10/2014	34.45	16.17	1.95	434	6.97	500	331			
6/17/2014	29.95	17.05	1.94	437	7.05	394	279		18	
6/24/2014	47.60	19.63	1.79	407	7.04	598.5	369			
6/30/2014	25.28	20.49	2.07	417		402	285	1.130	7	30
7/7/2014	16.34	22.23	2.87	417		303	203			
7/16/2014	19.18	18.45	2.67	428		373	240		9	
7/22/2014	12.89	22.77	2.81	426	7.02	268	173			
7/30/2014	13.40	20.14	2.25	438	7.03	368	244	1.190	6	34
8/5/2014	14.05	21.47	2.96	429	6.82	277	163			
8/12/2014	13.03	20.71	3.52	425	6.86	293	181		5	
8/19/2014	11.81	21.95	2.55	421	6.84	302	177			
8/27/2014	9.69	20.37	2.58	445	6.09	338	210	1.360	7	40
9/3/2014	8.71	19.12	3.63	458		361	222			
9/9/2014	5.77	18.93	2.88	474		380	225		7	
9/17/2014	3.83	14.22	4.50	474		328	204			
9/24/2014	0.75	15.05	5.50	479	7.18	345	193	1.620	5	42
10/1/2014	0.96	12.79	3.56	491	7.52	463	201			
10/7/2014	1.30	10.48	6.31	495	7.50	342	174		4	
10/14/2014	1.09	10.55	6.54	502	7.71	261	140			
10/21/2014	0.88	9.12	6.99	514	7.52	309	163.5	1.495	3	44
10/27/2014	0.87	8.77	6.58	519	7.43	292	135			
11/5/2014	0.92	5.17	9.89	408	7.79	212	93		2	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Painter Creek: Jennings Bay Inlet (CR 110) (CPA05)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	5
Total Suspended Solids (mg/L)	9
Total Phosphorus (µg/L)	310
<i>E. coli</i> (cfu/100 mL)*	48
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005	5.26	3585	346	1323	128	17408	1.68	336	32		
2006	6.91	2610	192	998	73	14443	1.06	241	18		
2007	3.51	1484	214	858	124	13409	1.98	57	8		
2008	3.30	1852	285	1370	211	10319	1.59	169	26	326	50
2009	0.53	209	201	141	136	2405	2.31	4	4	64	62
2010	4.64	2155	236	1491	163	16826	1.84	115	13	562	61
2011	5.63	2092	189	1126	101	5133	0.46	105	9	340	31
2012	2.85	1820	324	1029	183	6060	1.08	87	16	202	36
2013	6.43	5164	408	3359	265	19321	1.53	177	14	499	39
2014	9.85	6289	324	3864	199	26967	1.39	275	14	770	40

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CPA05

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	18.86	4.40	6.23	559	7.15	190	79	2.500	18	65
4/15/2014	10.64	4.97	8.45	568	7.23	144	62			
4/22/2014	10.78	9.43	10.93	550	7.42	92	44		5	
4/30/2014	65.84	3.87	7.41	422	7.25	227	123.5			
5/6/2014	24.80	8.61	11.21	441	7.44	114	68	1.280	12	46
5/13/2014	26.47	8.76	8.07	464	7.34	118	67			
5/21/2014	39.91	9.87	6.14	472	7.63	133.5	84.5		15	
5/28/2014	21.84	16.47	4.95	463	7.25	234	152			
6/4/2014	60.71	17.05	1.94	395	7.05	542	313	1.170	26	31
6/10/2014	29.99	16.01	2.45	435	7.03	487	329			
6/17/2014	31.63	16.81	2.68	435	7.03	395	275		14	
6/24/2014	43.38	19.43	2.16	408	7.07	616	384			
6/30/2014	21.08	20.42	2.88	418	7.89	403	282	1.210	7	30
7/7/2014	15.05	22.10	3.15	418		345	218			
7/16/2014	15.99	17.97	3.15	439		398	254		11	
7/22/2014	12.05	22.09	2.94	427	7.03	291	181			
7/29/2014	13.04	21.52	2.95	419	6.87	305	210	1.090	4	35
8/5/2014	13.15	21.16	3.38	430	6.99	286.5	172.5			
8/12/2014	12.14	20.95	3.85	418	6.89	313	182		6	
8/19/2014	11.24	21.49	3.06	422	6.99	298	175			
8/27/2014	8.34	19.91	3.12	445	7.08	361	218	1.340	8	39
9/3/2014	7.62	18.90	4.70	461	7.88	356	212			
9/9/2014	4.62	18.58	3.75	473		373	238		5	
9/17/2014	3.17	14.22	5.49	485		307	188			
9/24/2014	0.79	15.11	5.57	480	7.30	365	200	1.740	6	44
10/1/2014	1.03	12.79	3.87	498	7.64	392	189			
10/1/2014	1.03	12.79	3.87	498	7.64	392	189			
10/7/2014	0.70	9.70	7.17	497	7.64	340	177		3	
10/14/2014	0.58	9.45	7.30	505	7.95	252	145			
10/21/2014	0.58	7.35	7.63	523	8.14	302	170	1.440	2	45
10/27/2014	0.66	8.08	6.29	526	7.68	277	134			
11/5/2014	0.49	4.60	10.94	564	9.05	276	95		9	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Painter Creek Subwatershed - *E. coli* Concentrations

Date	CPA04	CPA01	CPA05
4/10/2014	3	38	35
4/17/2014	18	46	42
4/24/2014	25	28	26
5/1/2014	206	96	128
5/8/2014	20	18	19
5/15/2014	17	11	12
5/22/2014	68	18	30
5/29/2014	84	32	46
6/5/2014	176	81	75
6/12/2014	83	48	44
6/18/2014	47	27	49
6/26/2014	148	61	59
7/2/2014	72	31	43
7/10/2014	50	34	37
7/17/2014	80	36	44
7/24/2014	111	38	37
7/31/2014	103	71	82
8/7/2014	167	74	104
8/14/2014	130	68	93
8/21/2014	225	435	461
8/28/2014	167	133	118
9/4/2014	238	140	276
9/11/2014	299	173	166
9/18/2014	112	122	201
9/25/2014	248	69	75
10/2/2014	68	40	75
10/9/2014	21	12	12
10/16/2014	73	30	10
10/23/2014	24	48	12
10/29/2014	7	7	2

Duplicate samples that have been averaged are bolded

Painter Creek Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey*	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Painter Ck: Katrina Wetland Outlet	2013		
Painter Ck: Painter Marsh Outlet		Escherichia Coli	Aquatic Recreation
Painter Ck: Upstream (Painter Ck Dr)		Escherichia Coli	Aquatic Recreation
Painter Ck: Upstream (W Branch Rd)		Escherichia Coli	Aquatic Recreation
Painter Ck: Jennings Bay Inlet		Escherichia Coli	Aquatic Recreation

* The Macroinvertebrate Survey Report is available on the district website at <http://minnehahacreek.org/project/stream-assessment-2013>

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Schutz Lake Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	3
Guidelines and Standards	5
Executive Summary	6
Subwatershed Facts and Map	7
Schutz Lake Subwatershed - Lake Monitoring Sites Information.....	8
Schutz Lake	9
Schutz Lake Subwatershed - Additional Lake Information.....	10
Schutz Lake Subwatershed - Stream Monitoring Sites Information	11
Schutz Lake Creek: Schutz Lake Inlet.....	12
Schutz Lake Subwatershed - Additional Stream Information	14

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ion (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.

Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see the 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%.

Executive Summary

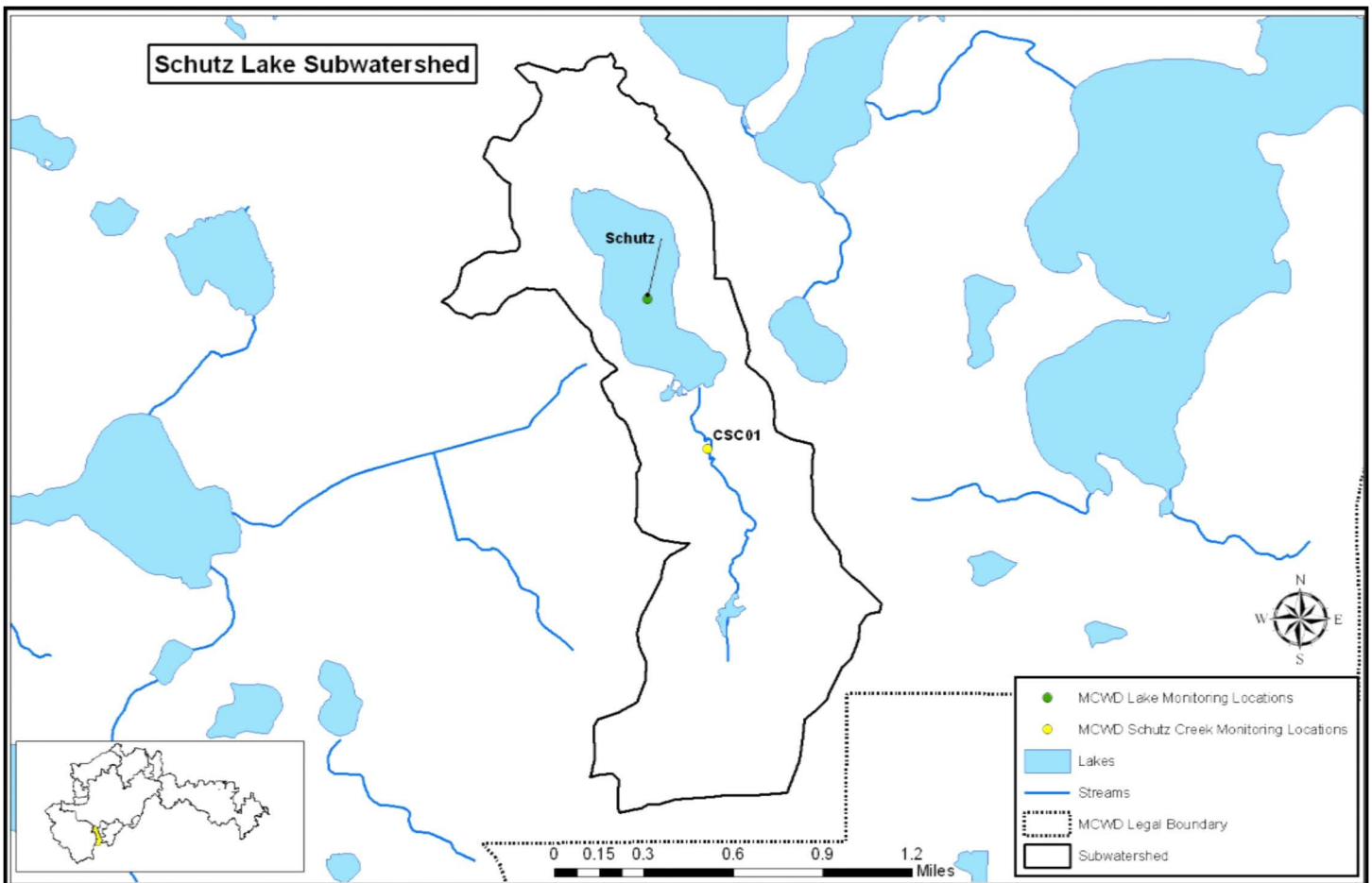
The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

The 2014 monitoring season is summarized for Schutz Lake Subwatershed in this report. There was one lake and one stream site on Schutz Lake Creek monitored in 2014. Schutz Lake Creek inlet site exceeded the North Central Hardwood Forest (NCHF) guideline for total phosphorus in 2014. The table below displays the lakes monitored within the Schutz Lake Subwatershed that did not meet the NCHF eutrophication standards.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Schutz		X	X	

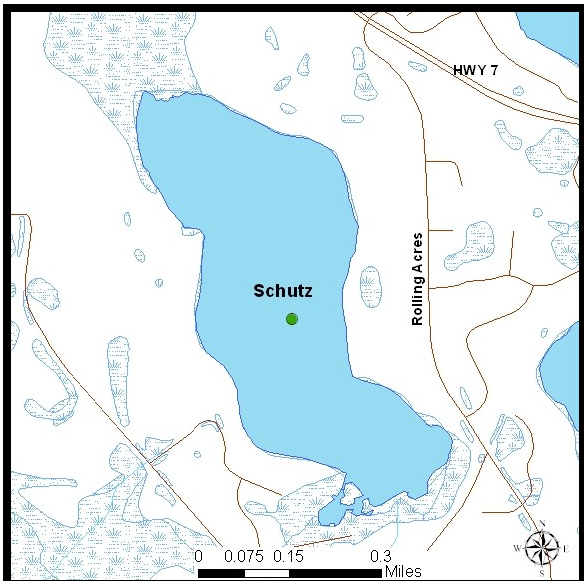
Subwatershed Facts and Map

Municipalities	Victoria
Area	969 acres
Population	Victoria = 8,030 people (2013)
Ecoregion	North Central Hardwood Forest
Groundwater	No MnDNR wells monitored
District Goals	<ul style="list-style-type: none"> • Achieve TP concentrations of < 40 µg/L • Secchi depth greater than 1.4 m • Chlorophyll-<i>a</i> concentrations of 1.4 µg/L in Schutz Lake



Schutz Lake Subwatershed - Lake Monitoring Sites Information

Lake	MnDNR ID	MCCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Watershed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Schutz	10-0018-00	LSC01	Carver	No	107.0	40	38.1	2100	20	50	861.52	8:1	44.87585	-93.64636



Schutz Lake

(DNR ID: 10-0018-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	C	C	C
2006	C	B	C	C+
2007	C	B	C	C+
2008	C	C	C	C
2009	B	B	C	B-
2010	C	C	C	C
2011	C	C	C	C
2012	D	C	C	C-
2013	C	C	C	C
2014	C	C	C	C

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.93	26.50	40	57
2006	1.27	16.18	39	57
2007	1.73	17.67	356	56
2008	2.13	16.61	32	54
2009	2.20	17.56	38	55
2010	1.62	28.50	38	58
2011	1.66	21.94	37	57
2012	0.95	23.31	39	60
2013	1.67	26.50	35	57
2014	1.67	23.63	47	58

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/13/2014	12.15	13.13	489	8.74	1.23	20	64	<3	1.210	0.897	0.311	59/59
6/11/2014	22.40	11.04	437	8.41	1.80	19	70	6	2.690	2.690	<0.03	49/60
7/16/2014	22.15	9.44	403	8.74	1.40	23	49	<3	0.937	0.937	<0.03	41/58
8/12/2014	24.21	8.10	402	8.41	1.70	16	30	<3	0.948	0.948	<0.03	45/61
9/15/2014	17.64	9.12	415	8.25	1.78	36.5	39	<3	0.946	0.944	<0.03	46/56
10/23/2014	11.60	7.56	452	7.66	2.35	18	93	54	1.340	1.340	<0.03	49/162

Note: Surface/Bottom Results

Schutz Lake Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Schutz	1955 - 2007	2008		1991		None	None

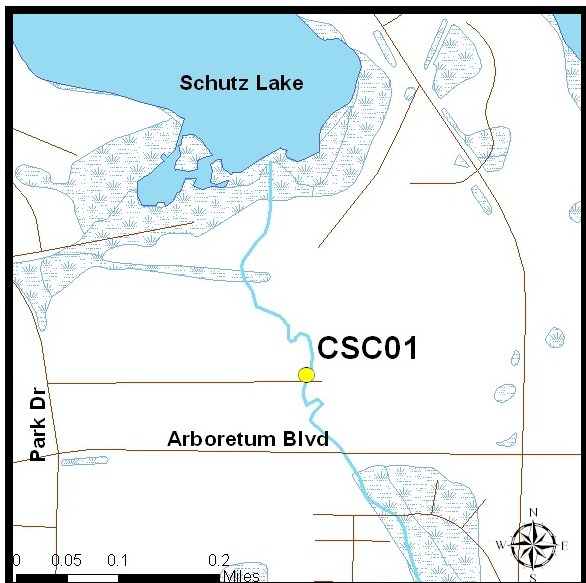
Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Schutz		X		X			

*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcawd-lakes

Schutz Lake Subwatershed - Stream Monitoring Sites Information

Stream	MICWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Schutz Lake Ck: Lk Inlet (Parkview Ln)	CSC01	Yes	No	457.58	44.8681	-93.6416



Schutz Lake Creek: Lake Inlet (CSC01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	8
Total Suspended Solids (mg/L)	7
Total Phosphorus (µg/L)	160
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	0.49	177	182	79	81	160	0.16	2	2		
2007	0.67	237	180	125	94	1745	1.32	20	15		
2008	0.50	116	119	72	74	1585	1.63	5	5	56	58
2009	0.61	206	171	104	86	1165	0.97	3	2	77	64
2010	0.48	173	182	116	122	1204	1.26	5	5	66	69
2011	0.90	299	169	174	98	3912	2.21	8	5	107	60
2012	0.63	208	169	119	97	1056	0.86	10	8	57	46
2013	0.81	283	177	167	104	2674	1.67	16	10	90	56
2014	1.84	831	229	400	110	4548	1.25	43	12	93	26

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, CI, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report).

2014 Water Quality Data - CSC01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	2.546	2.58	11.36	625	7.74	109	85	2.710	6	85
4/15/2014	0.627	1.92	12.21	863	7.80	75	61			
4/21/2014	1.324	14.37	11.00	835	7.84	86	72		2	
4/28/2014	40.788	5.93	10.88	422	7.72	301	114			
5/5/2014	0.859	13.39	11.77	707	7.86	90	77	2.060	4	78
5/12/2014	11.534	13.45	8.31	536	7.69	124	73			
5/20/2014	4.629	12.65	10.37	595	7.89	128	42		11	
5/27/2014	9.093	18.95	6.65	490	7.69	180	92			
6/2/2014	14.488	21.13	5.73	383	7.53	251	157	1.640	33	27
6/9/2014	0.938	16.69	7.24	617	7.70	165	143			
6/16/2014	3.820	17.49	6.84	520	7.64	161.5	126		10	
6/23/2014	2.211	19.92	7.79	497	7.68	236	186			
6/30/2014	0.691	20.20	6.86	581	7.76	274	191	1.120	3	43
7/7/2014	0.206	18.82	7.94	720		251	94			
7/15/2014	0.641	17.12	8.32	543		210	153		3	
7/22/2014	0.190	20.33	6.30	716	7.68	302	134			
7/29/2014	0.171	17.20	7.62	692	7.70	280	122	1.250	4	61
8/5/2014	0.292	18.00	7.29	758	7.64	323	93			
8/12/2014	0.109	17.34	8.14	769	7.80	145	78		6	
8/19/2014	1.386	20.87	6.17	536	7.57	171	122			
8/26/2014	0.140	17.10	6.59	716	7.55	144	85	1.210	2	64
9/2/2014	0.482	18.58	6.73	560	8.61	152	110			
9/9/2014	0.106	16.52	6.75	694	7.61	107	73		3	
9/16/2014	0.184	10.42	8.70	737		84	53			
9/23/2014	0.116	12.67	8.37	644	7.45	96	60	0.764	2	63
9/30/2014	0.033	11.24	6.38	899	7.91	97	79			
10/7/2014	0.121	9.42	9.24	725	7.76	76	45		22	
10/13/2014	0.118	10.84	8.38	865	7.80	91	44			
10/21/2014	0.061	7.20	9.47	850	7.84	82	50	0.685	2	79
10/27/2014	0.039	7.93	7.51	867	8.12	83	48			
11/3/2014	0.083	5.99	8.64	816	7.78	77	46		2	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report).

Schutz Lake Subwatershed - Additional Stream Information

	Macroinvertebrate Survey*	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Stream Schutz Lake Ck: Lk Inlet (Parkview Ln)	2013	None	None

* The Macroinvertebrate Survey Report is available on the district website at <http://minnehahacreek.org/project/stream-assessment-2013>

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Six Mile Marsh Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	4
Guidelines and Standards	6
Executive Summary	7
Subwatershed Facts and Map	8
Six Mile Marsh Subwatershed - Lake Monitoring Sites Information.....	9
Carl Krey Lake	10
Church Lake	11
East Auburn Lake	12
West Auburn Lake	13
Kelser's Pond.....	14
Sunny Lake (Zumbra-Sunny).....	15
Lundsten Lake - North Bay.....	16
Lundsten Lake - South Bay.....	17
Marsh Lake	18
Mud Wetland.....	19
Parley Lake.....	20
Piersons Lake	22
Steiger Lake.....	23
Stone Lake.....	25
Turbid Lake	26
Wassermann Lake.....	27
Wassermann Lake - West Bay	29
Wassermann Pond - North	30

Table of Contents (Cont.)

Wassermann Pond - South	31
Six Mile Marsh Subwatershed - Additional Lake Information.....	32
Six Mile Marsh Subwatershed - Stream Monitoring Sites Information	34
Six Mile Creek: Piersons Lake Outlet	35
Six Mile Creek: Wassermann Lake Inlet	37
Six Mile Creek: Wassermann Lake Outlet	39
Six Mile Creek: Turbid Lake Outlet	41
Six Mile Creek: Parley Lake Inlet (SOB Lake Outlet)	43
Six Mile Creek: East Auburn Lake Inlet.....	45
Six Mile Creek: Lundsten North Lake Inlet (West Auburn Outlet)	47
Six Mile Creek: Lundsten South Lake Inlet	49
Six Mile Creek: Lundsten North Lake Outlet	51
Six Mile Creek: Parley Lake Inlet.....	53
Six Mile Creek: Mud Wetland Inlet.....	55
Six Mile Creek: Mud Wetland Outlet.....	57
Six Mile Creek: Halsted Bay Inlet	59
Six Mile Marsh Subwatershed - <i>E.coli</i> Concentrations.....	61
Six Mile Marsh Subwatershed - Additional Stream Information	62

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river



Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%.

Executive Summary

The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

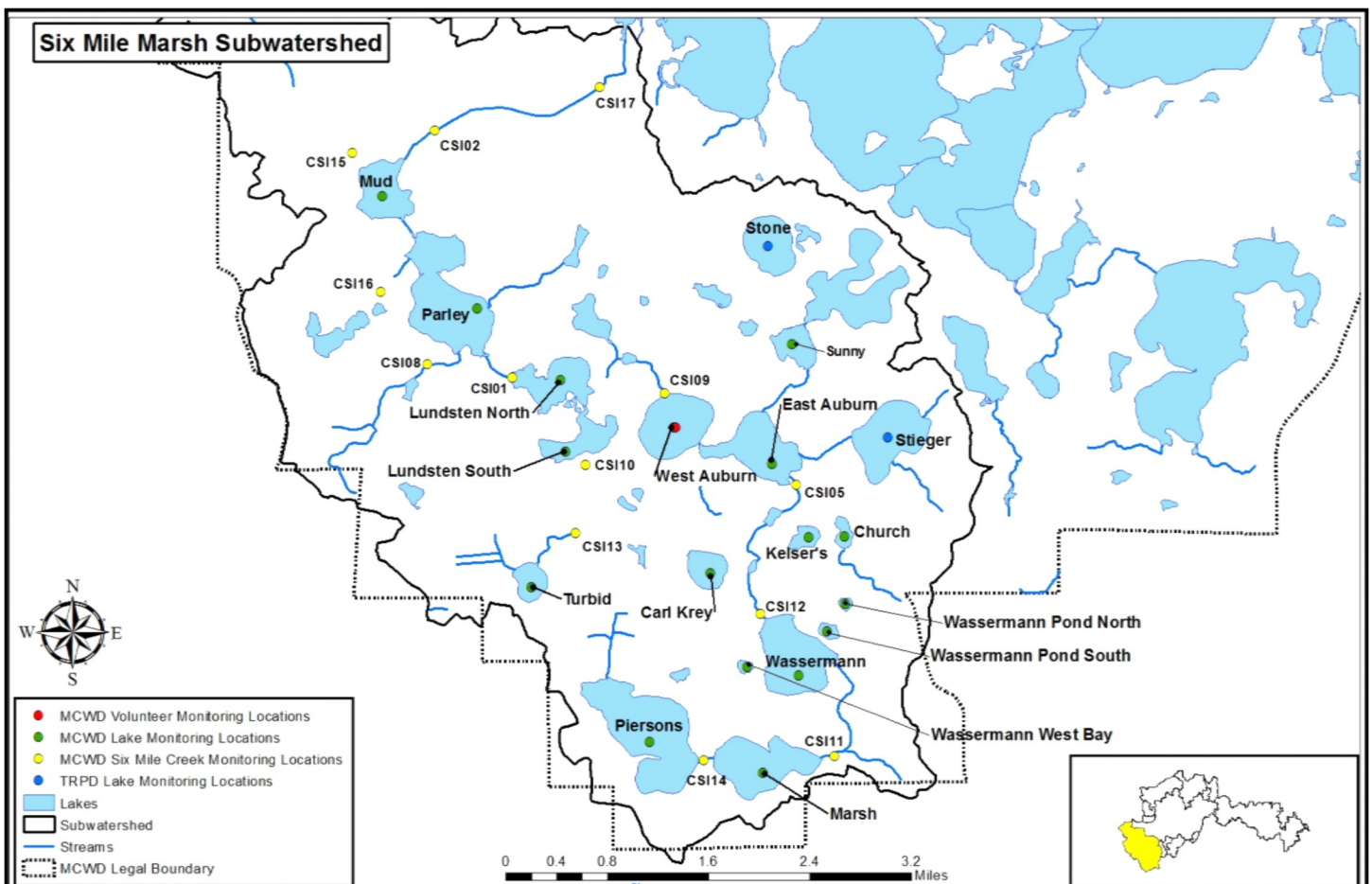
The 2014 monitoring season is summarized for Six Mile Marsh Subwatershed in this report. There were 19 lakes, 1 wetland and 12 stream sites on Six Mile Creek monitored. Six Mile Creek: Wassermann Lake inlet exceeded the North Central Hardwood Forest (NCHF) guideline for total suspended solids in 2014. Six Mile Creek: East Auburn inlet was below the NCHF standard for dissolved oxygen (DO) in 2014. Six Mile Creek: Turbid Lake outlet, Parley Lake inlets, and Lundsten Lake South inlet exceeded the NCHF guideline for total phosphorus (TP) in 2014. Six Mile Creek: Mud inlet and Halsted Bay inlet did not meet the NCHF guideline for TP and the DO standard in 2014. The table below displays the lakes monitored within the Six Mile Marsh Subwatershed that did not meet the NCHF eutrophication standards.

(X) Indicates Not Meeting the Standard in 2014																			
Lake/Wetland**	Carl Krey	Church	East Auburn	West Auburn	Kelsers	Lundsten: North	Lundsten: South	Marsh	Mud**	Parley	Piersons	Steiger	Stone	Sunny (Zumbra-Sunny)	Turbid	Wassermann	Wassermann - West Bay	Wassermann Pond: North	Wassermann Pond: South
SECC							X								X	X			
CHLA		X	X	X	X	X	X			X	X			X	X	X	X		
TP		X	X			X	X			X				X	X	X	X	X	
CI																			

No eutrophication standards to assess the water quality in wetland, represented in the tables as black

Subwatershed Facts and Map

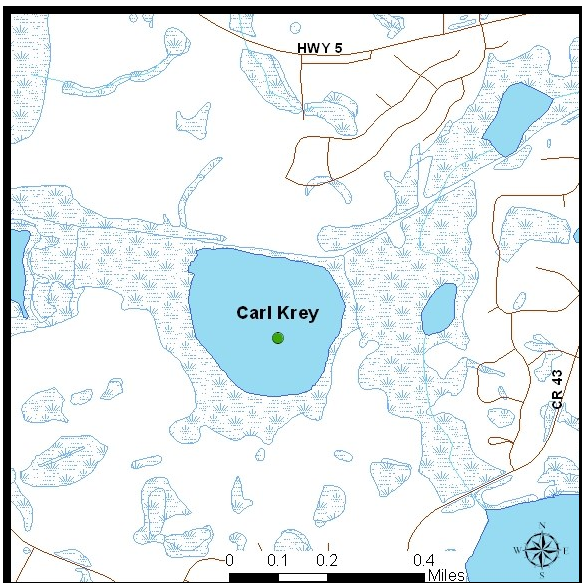
Municipalities	Laketown, Minnetrista, St. Bonifacius, Victoria, and Watertown
Area	About 17,000 acres
Population	Laketown = 2,331 (2000) Minnetrista = 6,788 people (2013) St. Bonifacius = 2,337 (2013) Victoria = 8,030 people (2013) Watertown = 3,029 (2000)
Ecoregion	North Central Hardwood Forest
Groundwater	St. Bonifacius MnDNR Well Monitored
District Goals	<ul style="list-style-type: none"> Minimizing nutrient loads to Halsted Bay Reaching MPCA standards in lakes and streams Improving TP concentrations as identified in the Hydrologic, Hydraulic, and Pollutant Loading Study (HHPLS) report



Six Mile Marsh Subwatershed - Lake Monitoring Sites Information

Lake	MNDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Watershed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Carl Krey	10-0050-00	LCK01	Carver	No	48.0	50	100		5.7	15	370.51	8:1	44.85102	-93.68809
Church	10-0046-00	LCU01	Carver	No	12.0	7.3	59		54	54	330.73	28:1	44.85553	-93.66656
East Auburn	10-0044-02	LAU03	Carver	No	136.0			1800	15	34	7628.95	56:1	44.8639	-93.6796
West Auburn	10-0044-01	WAUB 02	Carver	Yes	142.0			3294	23	84	7792.34	55:1	44.86830	-93.69470
Kelser's Pond	10-0047-00	LKZ01	Carver	No	20.0	13	65		34	34	58.10	3:1	44.85538	-93.67205
Zumbra*	10-0041-00		Carver	Yes	221.0	89	55		14	58	523.56	2:1	44.88910	-93.66320
Sunny	10-0041-00	LSY01	Carver	No	51.6			2268		18	1968.21	38:1	44.87826	-93.67445
Lundsten North	10-0043-00	LLU03	Carver	No	182.0	114	100		4.4	10	9721.71	53:1	44.87154	-93.71412
Lundsten South	10-0043-00	LLU01	Carver	No	182.0	77	100	341	3.5	10	1220.1	7:1	44.87307	-93.71137
Marsh	10-0054-00	LMR03	Carver	No	161.0	143	100	341	2.8	4.5	1592.63	10:1	44.82960	-93.68005
Mud	27-0186-00	LMDD01	Hennepin	No	102.0	144	100		3.5	5.5	15097.85	148:1	44.89392	-93.74137
Parley	10-0042-00	LPR01	Carver	Yes	256.0	231	90		7	18	12428.61	49:1	44.88010	-93.72710
Plersons	10-0053-00	LPI01	Carver	Yes	292.0	119	41	1701	16	40	1199.68	4:1	44.83230	-93.69769
Steiger	10-0045-00		Carver	Yes	153.0	103	65	3760	13	37	829.30	5:1	44.86770	-93.65930
Stone	10-0056-00		Carver	No	94.0	71	74	2054	10	29	880.47	9:1	44.88800	-93.67790
Turbid	10-0051-00	CTU01	Carver	No	40.0	26	65	1063		27	532.87	13:1	44.84919	-93.71707
Wassermann	10-0048-00	LWS01	Carver	Yes	166.0	112	67		10	41	2889.86	17:1	44.84100	-93.67371
Wassermann West Bay	10-0048-02	LRW01	Carver	No	6.4					20	2889.86	452:1	44.84061	-93.68250
Wassermann Pond North	10-0200-01	LRN01	Carver	No	5.4			1530		60	2889.86	535:1	44.84761	-93.66621
Wassermann Pond South	10-0200-02	LRS01	Carver	No	10.0					36	2889.86	289:1	44.84460	-93.66886

* Not monitored in 2014



Carl Krey Lake

(DNR ID: 10-0050-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

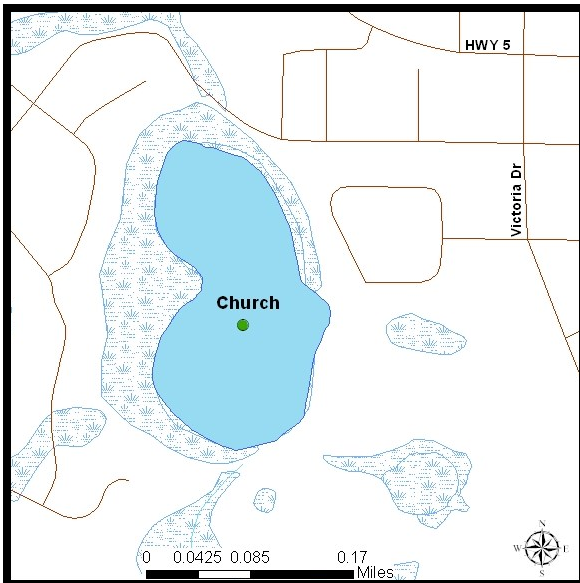
Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	B	A	A	A-
2009				
2010				
2011				
2012	B	A	C	B
2013	C	A	B	B
2014	B	A	A	A-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	2.45	6.50	21	48
2009				
2010				
2011				
2012	2.25	8.38	36	52
2013	2.18	9.00	29	51
2014	2.86	4.25	18	45

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/20/2014	14.31	9.28	247	7.95	2.33	5	20	<3	0.654	0.654	<0.03	7	1
6/16/2014	21.54	8.64	241	7.91	3.50	5	25	<3	0.884	0.884	<0.03	5	2
7/22/2014	25.92	12.70	162	9.54	2.40	6	16	<3	0.630	0.630	<0.03	3	<1
8/19/2014	24.61	8.15	157	9.25	2.60	4	16	<3	0.511	0.511	<0.03	4	<1
9/22/2014					2.93	2	16	<3	0.660	0.660	<0.03	4	<1



Church Lake

(DNR ID: 10-0046-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

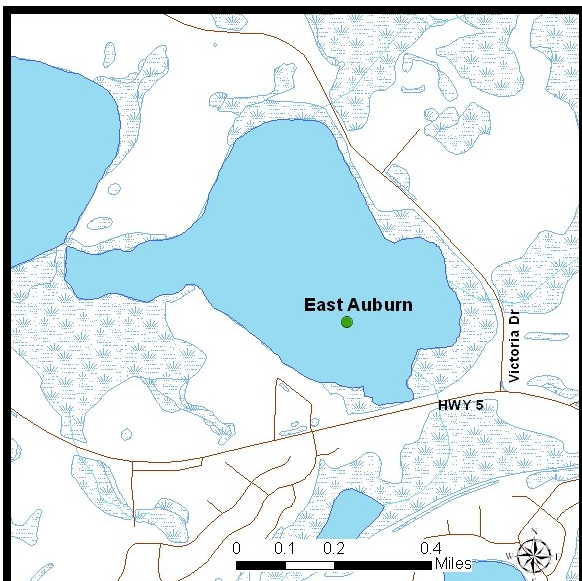
Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	A	B	D	B-
2009				
2010				
2011				
2012	C	B	D	C
2013	B	B	C	B-
2014	C	B	D	C

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	2.70	16.75	77	57
2009				
2010				
2011				
2012	1.30	18.00	74	60
2013	2.60	14.00	49	54
2014	1.41	18.50	84	61

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/20/2014	14.19	10.44	522	8.61	1.60	19	76	6	1.470	1.470	<0.03	71
6/16/2014	20.49	9.07	423	7.96	2.15	8	132	82	0.702	0.702	<0.03	45
7/21/2014	25.88	12.14	345	8.87	1.45	15	83	23	0.766	0.766	<0.03	32
8/18/2014	25.60	7.28	323	8.66	0.93	33	67	<3	1.280	1.280	<0.03	36
9/22/2014	18.61	12.02	373	8.73	1.10	18	56	<3	1.030	1.030	<0.03	45



East Auburn Lake (DNR ID: 10-0044-02)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	C	C	C	C
2009				
2010	C	C	C	C
2011				
2012	C	C	C	C
2013	C	C	C	C
2014	C	C	C	C

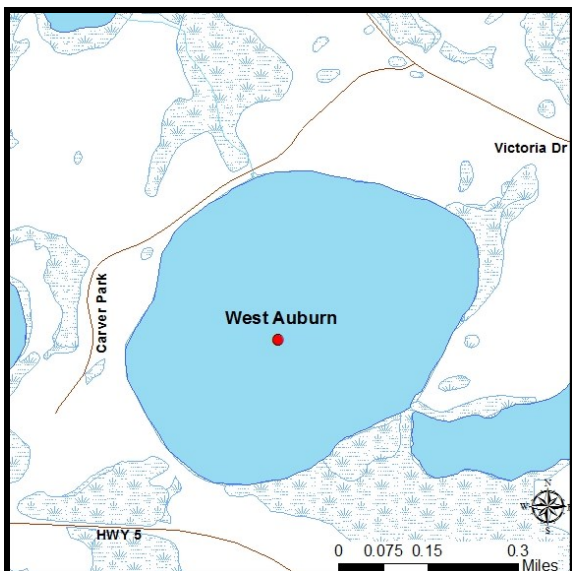
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	1.45	56.00	61	63
2009				
2010	1.04	33.25	41	61
2011				
2012	0.93	37.75	50	63
2013	1.48	28.38	53	60
2014	1.40	31.25	44	59

Note: Data collected at a different site prior to 2013

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/21/2014	14.76	10.70	375	8.14	1.85	6	23	<3	2.160	2.160	<0.03	38
6/16/2014	19.88	9.00	347	7.80	1.55	31	52	<3	0.978	0.978	<0.03	32
7/22/2014	24.78	10.66	311	8.25	1.20	52	57	33	1.290	1.290	<0.03	25
8/19/2014	24.50	7.68	300	8.04	1.45	20	34	<3	1.080	1.080	<0.03	23
9/23/2014	17.75	10.08	306	8.37	1.40	22	32	<3	1.160	1.160	<0.03	24



West Auburn Lake

(DNR ID: 10-0044-01)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

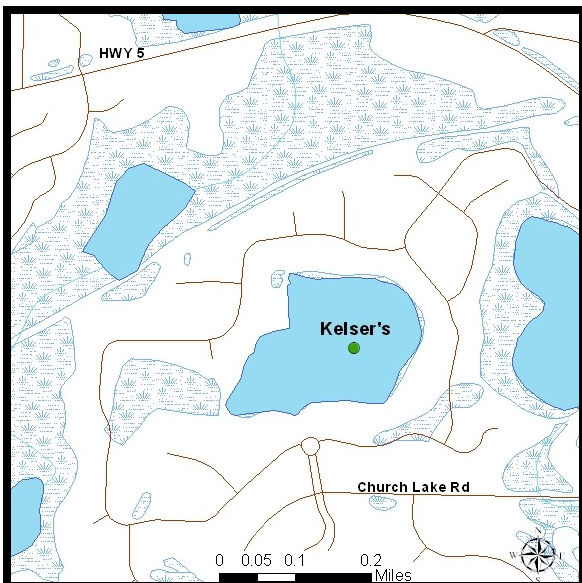
Year	SECC	CHLA	TP	Lake Grade
2005	B	B	C	B-
2006	A	A	B	A-
2007	B	A	C	B
2008	B	A	B	B+
2009	B	A	C	B
2010	B	A	B	B+
2011	B	B	C	B-
2012	A	A	B	A-
2013	B	B	C	B-
2014	C	B	B	B-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.64	17.56	33	55
2006	2.79	11.71	29	51
2007	2.26	8.06	33	51
2008	3.06	5.91	24	48
2009	2.94	5.15	36	49
2010	2.42	7.19	29	50
2011	2.60	14.13	35	53
2012	2.59	11.33	23	50
2013	3.00	16.28	32	52
2014	1.88	16.38	28	58

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl	TSS
5/21/2014	14.60	2.05	5	20	0.872	0.872	<0.03	37	2
6/16/2014	20.16	2.05	25.5	39	0.935	0.935	<0.03	34	
7/16/2014	23.50	1.75	16	26	0.889	0.889	<0.03	26	
8/20/2014	26.11	1.50	14	25	1.060	1.060	<0.03	27	
9/22/2014	18.33	2.20	10	21	0.899	0.899	<0.03	27	



Kelser's Pond

(DNR ID: 10-0047-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

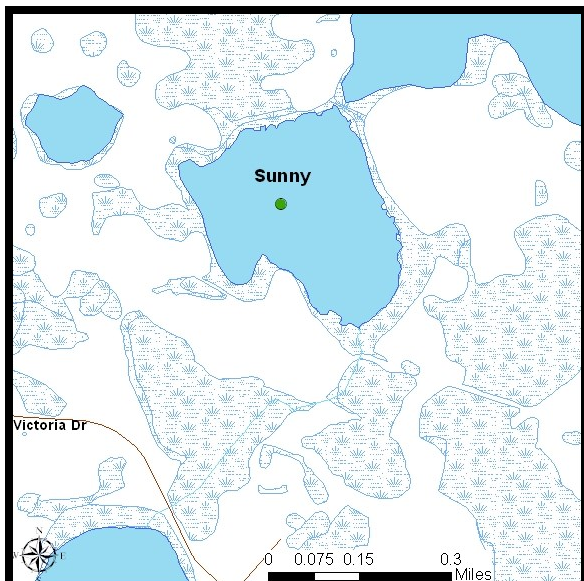
Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009	C	B	C	C+
2010	C	B	C	C+
2011	C	B	C	C+
2012	C	B	C	C+
2013	C	B	B	B-
2014	B	B	B	B

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009	1.36	23.75	37	58
2010	1.48	22.33	36	57
2011	1.33	20.38	37	58
2012	1.84	13.75	35	54
2013	2.18	10.75	26	51
2014	1.83	14.25	30	54

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/19/2014	14.13	10.97	246	8.41	3.73	4	24	<3	0.914	0.812	0.102	28
6/16/2014	20.72	10.10	231	8.79	1.75	18	26	<3	1.920	1.920	<0.03	27
7/21/2014	25.30	12.22	211	9.30	1.50	8	26	<3	0.000	0.000	<0.03	24
8/18/2014	25.50	9.68	216	9.19	2.20	13	34	<3	0.857	0.857	<0.03	28
9/22/2014	18.42	9.27	226	8.74	1.88	18	35	<3	1.040	1.040	<0.03	27



Sunny Lake (Zumbra-Sunny)

(DNR ID: 10-0041-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012	N/A	N/A	N/A	N/A
2013	C	B	N/A	N/A
2014	C	B	C	C+

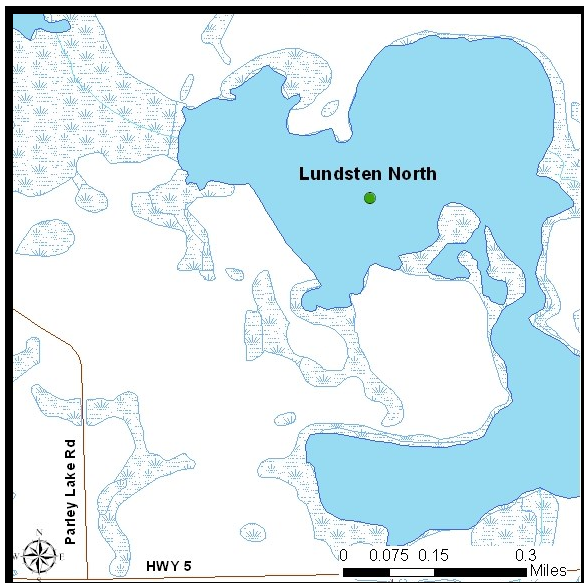
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012	N/A	N/A	N/A	N/A
2013	1.45	13.50	N/A	55
2014	2.11	16.13	46	55

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	TSS
5/21/2014	15.42	9.53	289	7.76	1.73	7	36	<3	0.881	0.881	<0.03	2
6/17/2014	21.99	6.48	289	7.48	1.85	15	57	9	1.240	1.240	<0.03	2
7/22/2014	26.92	9.56	261	7.89	1.90	7.5	42	5.5	0.955	0.955	<0.03	1.5
8/19/2014	24.69	4.98	248	7.60	2.08	8	48	5	0.908	0.908	<0.03	2
9/23/2014	17.47	9.92	250	8.32	2.60	34	36	3	0.973	0.973	<0.03	2

Note: Surface/Bottom Results



Lundsten Lake - North Bay

(DNR ID: 10-0043-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	C	A	C	B-
2009				
2010	N/A	N/A	N/A	N/A
2011	N/A	B	C	N/A
2012	C	B	C	C+
2013	N/A	B	C	N/A
2014	C	B	D	C

**Ten-Year Water Quality Means
(June-Sept)**

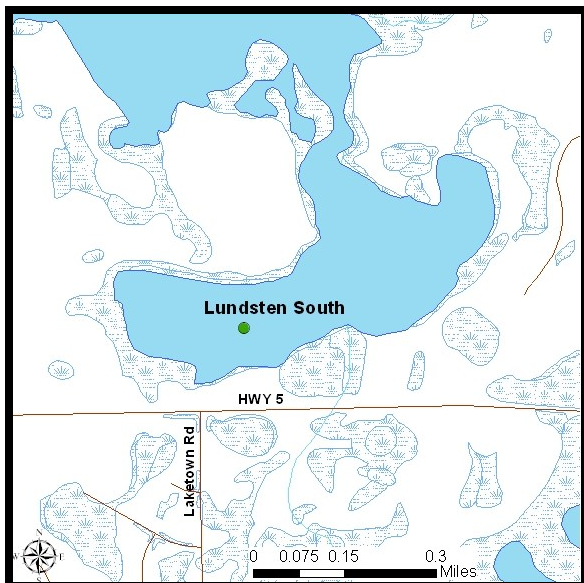
Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	2.00	7.25	29	51
2009				
2010	N/A	N/A	N/A	N/A
2011	N/A	14.5	60.25	60
2012	1.24	12.14	50	58
2013	N/A	8.29	47	55
2014	1.39	20.13	86	64

Note: Data collected at a different site prior to 2013

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/13/2014	12.62	6.78	379	7.83	1.68	14	41		1.06	1.06	<0.03		3
5/19/2014	14.63	8.98	393	8.07	1.70	7	41	<3	1.19	1.19	<0.03	35	3
6/5/2014	23.53	7.93	361	7.97	1.37	9	56		0.93	0.93	<0.03		3
6/17/2014	20.48	8.51	365	7.98	1.30	57	87	<3	1.16	1.16	<0.03	32	6
7/2/2014	21.85	2.25	340	7.38	1.22	22	123		1.27	1.27	<0.03		3
7/22/2014	25.13	9.59	343	8.12	1.80	24	85	3	1.23	1.23	<0.03	22	6
7/29/2014	23.55	7.34	337	8.05	0.91	26	111		1.21	1.21	<0.03		3
8/19/2014	23.91	3.17	303	7.99	1.00	8	65	36	0.83	0.83	<0.03	28	1
9/3/2014	21.82	3.09	298	8.15	1.68	9	99		1.45	1.45	<0.03		12
9/23/2014	16.72	6.94	288	8.51		6	59	27	1.01	1.01	<0.03	28	1

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (μS/cm); SECC (m); CHLA, TP, and SRP (μg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Lundsten Lake - South Bay (DNR ID: 10-0043-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012	F	F	F	F
2013	D	F	F	F
2014	D	F	F	F

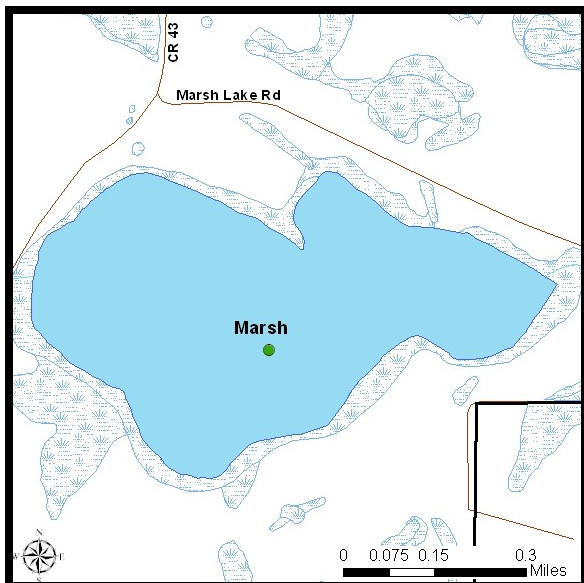
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012	0.28	196.57	445	87
2013	1.08	123.57	224	80
2014	0.87	87.63	232	79

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/13/2014	13.12	8.28	402	8.34	0.46	119	145		2.34	2.22	0.124		20
5/19/2014	15.02	12.42	412	8.69	0.60	85	133	4	2.67	2.67	<0.03	35	16
6/5/2014	23.52	11.44	401	8.50	1.07	25	157		1.46	1.23	0.233		6
6/17/2014	19.89	11.47	396	8.79	0.45	231	209	<3	2.76	2.76	<0.03	31	20
7/2/2014	23.02	2.97	349	7.45	1.37	16	238		1.44	1.44	<0.03		5
7/22/2014	26.81	11.69	384	8.25	1.50	36	184	95	1.79	1.79	<0.03	22	6
7/29/2014	24.23	8.45	396	8.10	0.91	57	184		1.65	1.65	<0.03		6
8/19/2014	25.89	10.11	412	8.38	0.55	102	350	72	2.74	2.74	<0.03	26	18
9/3/2014	23.43	9.22	410	8.47	0.46	132	274		2.38	2.38	<0.03		15
9/23/2014	18.04	10.47	417	8.55	0.65	102	263	40	2.30	2.30	<0.03	27	15

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Marsh Lake

(DNR ID: 10-0054-00)

Ten-Year Lake Grade Record
(May-Sept Means)

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010	N/A	A	B	N/A
2011	N/A	A	B	N/A
2012	N/A	B	C	N/A
2013	N/A	A	C	N/A
2014	N/A	A	B	N/A

Ten-Year Water Quality Means
(June-Sept)

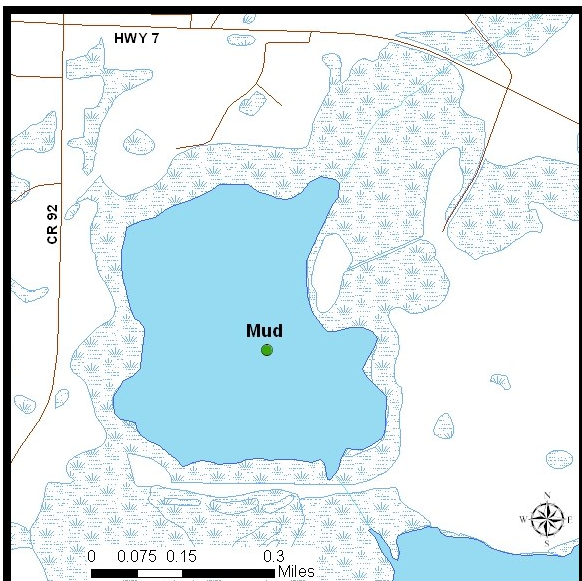
Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010	N/A	3.75	24	47
2011	N/A	4.75	35	51
2012	N/A	13.57	33	55
2013	N/A	6.44	32	52
2014	N/A	7.75	26	51

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/13/2014	12.88	8.29	307	7.95	>0.98	5	23		0.780	0.780	<0.03		2
5/20/2014	13.65	8.15	320	7.79	1.10	2	20	<3	0.713	0.713	<0.03	26	1
6/5/2014	23.14	8.82	310	7.94	>1.22	6	29		0.901	0.869	0.032		2
6/16/2014	19.32	10.09	303	8.36	1.00	16	30	<3	1.940	1.940	<0.03	26	2
7/2/2014	19.67	8.28	305	8.34	>1.13	15	32		1.550	1.550	<0.03		2
7/21/2014	25.31	12.66	257	8.85	1.00	7							
7/29/2014	22.34	10.23	248	8.98	>1.07	6	27		0.892	0.892	<0.03		2
8/18/2014	24.58	7.44	225	9.29	0.50	2	20	<3	0.818	0.818	<0.03	27	1
9/3/2014	22.14	8.57	243	9.15	>1.07	8	26		1.080	1.080	<0.03		4
9/22/2014	16.26	10.53	234	9.28	0.60	2	16	<3	0.875	0.875	<0.03	28	2

Note: Some data contributed by Wenck Associates

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (μS/cm); SECC (m); CHLA, TP, and SRP (μg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

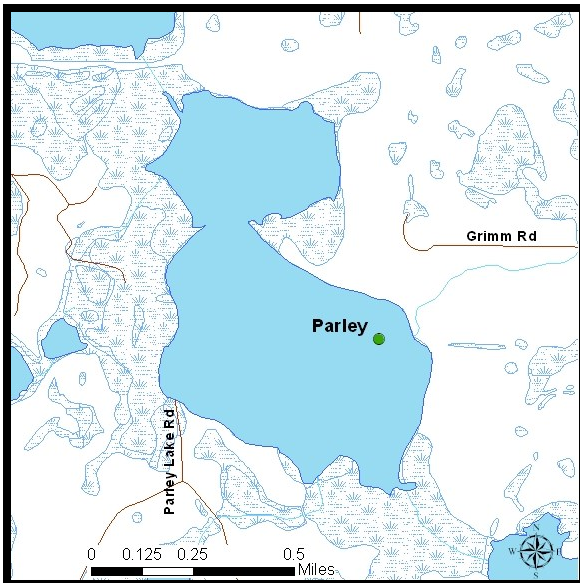


Mud Wetland (DNR ID: 27-0186-00)

Note: Mud Lake has been reclassified, by the MPCA, as Mud Wetland due to its depth and percentage of littoral zone. At this time, there is no eutrophication standards to assess the water quality in the Mud Wetland.

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/13/2014	12.38	10.10	384	8.29	0.61	49	85		1.485	1.455	0.032		16.5
5/20/2014	15.00	11.40	376	8.24	0.70	19	62	<3	1.300	1.300	<0.03	29	8
6/6/2014	23.23	7.80	386	7.92	1.37	18	55	14	1.800	1.700			<5
6/17/2014	21.26	9.83	386	8.11	0.98	39	58	<3	1.410	1.410	<0.03	31	12
7/2/2014	21.83	9.71	355	8.26	0.46	85.5	126		1.785	1.785	<0.03		13
7/22/2014	26.78	15.19	350	8.79	0.50	128	176	6	2.450	2.450	<0.03	26	26
7/29/2014	24.20	14.54	343	9.11	0.46	181	172		2.900	2.900	<0.03		28
8/19/2014	25.28	7.00	341	7.97	0.50	95	141	3	2.380	2.380	<0.03	28	21
9/4/2014	22.58	6.39	347	8.21	0.31	89.5	175		2.715	2.715	<0.03		21
9/23/2014	18.06	10.39	364	8.44	0.55	64	165	5	2.600	2.600	<0.03	29	20



Parley Lake

(DNR ID: 10-0042-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	D	D	D+
2006	D	D	D	D
2007	D	F	D	D-
2008	D	C	D	D+
2009	D	C	C	C-
2010	D	D	C	D+
2011	D	D	D	D
2012	D	C	D	D+
2013	D	C	D	D+
2014	C	D	D	D+

**Ten-Year Water Quality Means
(June-Sept)**

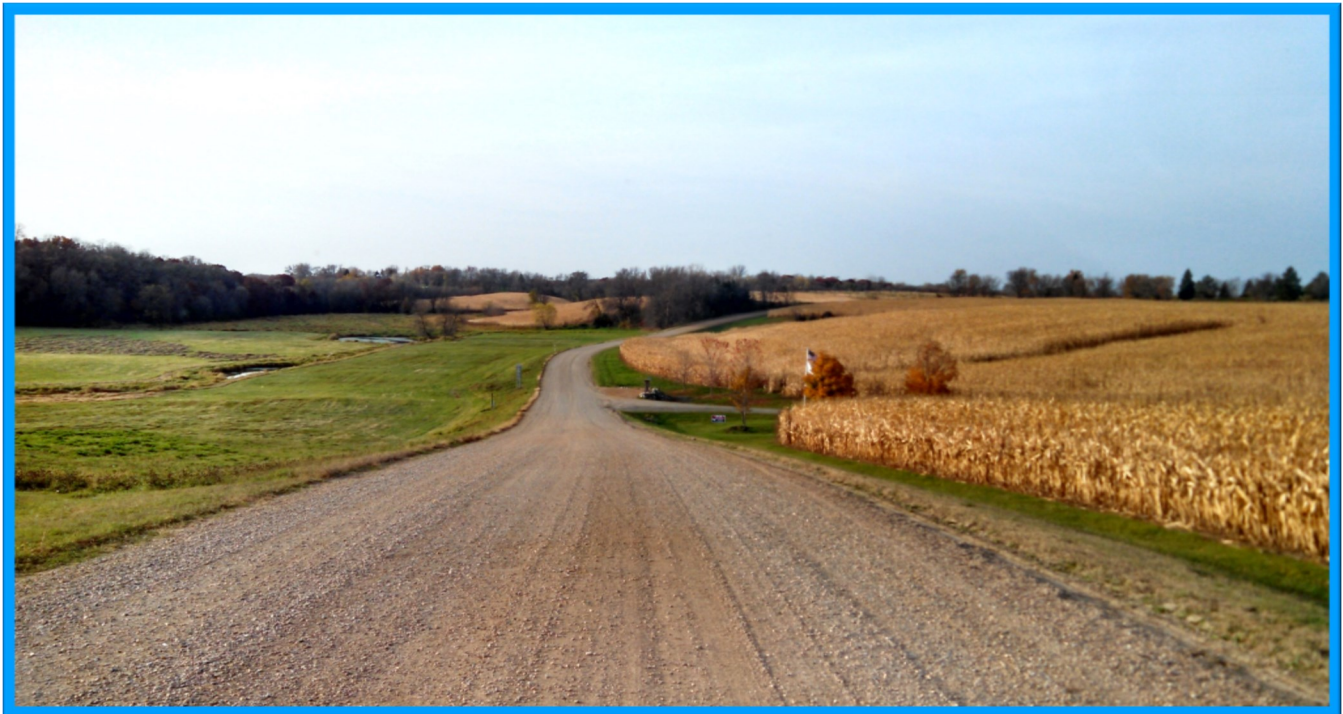
Year	SECC	CHLA	TP	TSI
2005	0.70	68.92	147	71
2006	0.63	101.26	100	71
2007	0.41	119.20	119	74
2008	0.97	48.56	79	65
2009	0.61	51.44	63	67
2010	0.72	69.06	72	68
2011	0.77	69.67	76	68
2012	0.73	51.88	81	67
2013	1.05	40.88	83	65
2014	1.09	54.50	114	67

Parley Lake (DNR ID: 10-0042-00)

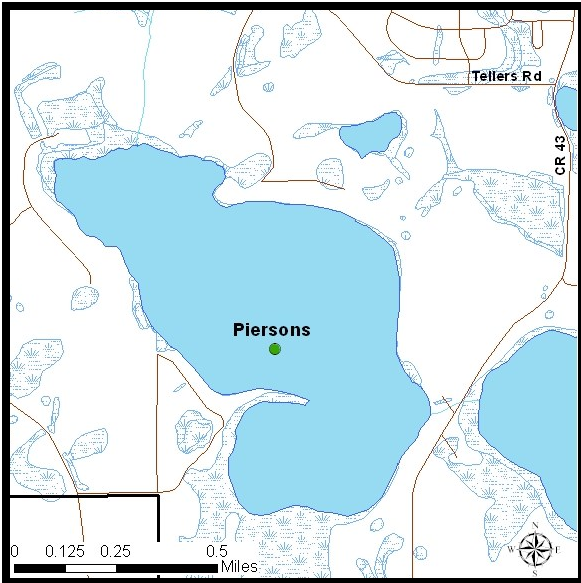
2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/12/2014	13.25	10.47	368	8.34	1.20	24	53	<3/<3	1.18	1.09	0.09	29/29	6
5/27/2014	20.62	8.12	387	8.00	4.45	<1	44/44	9/23	1.01	1.01	<0.03	30/30	
6/9/2014	21.29	7.32	377	7.65	2.90	9	46/99	10/32	0.97	0.97	<0.03	31/30	
6/23/2014	24.00	11.66	336	8.51	1.00	42	88/146	<3/111	1.89	1.89	<0.03	27/28	
7/14/2014	23.03	7.61	342	8.03	1.20	65	121/110	44/43	1.53	1.53	<0.03	25/25	
7/29/2014	23.73	9.67	342	8.56	0.88	102	156/238	40/141	1.83	1.83	<0.03	25/25	
8/12/2014	23.80	4.98	336	7.91	0.55	39	126/357	<3/210	1.91	1.91	<0.03	27/26	
8/26/2014	24.06	5.20	337	7.87	0.90	38	140/241	40/141	1.69	1.69	<0.03	27/28	
9/15/2014	17.24	9.91	327	8.44	0.60	76	105/102	3/3	1.83	1.83	<0.03	27/27	
9/29/2014	19.60	10.52	332	8.52	0.68	65	127/102	<3/42	2.24	2.24	<0.03	28/28	12
10/21/2014	11.64	8.80	353	7.88	1.25	32	86/72	13/13	1.79	1.68	0.113	27/27	

Note: Surface/Bottom Results



Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Piersons Lake

(DNR ID: 10-0053-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

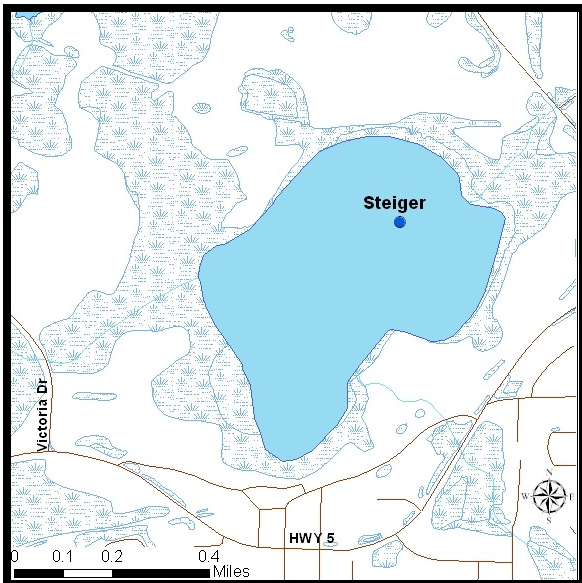
Year	SECC	CHLA	TP	Lake Grade
2005	B	B	C	B-
2006	C	B	C	C+
2007	B	A	B	B+
2008	B	B	A	B+
2009	B	A	B	B+
2010	A	A	B	A-
2011	B	A	A	A-
2012	A	A	B	A-
2013	B	A	C	B
2014	C	B	B	B-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.96	13.81	44	55
2006	1.53	9.60	31	53
2007	2.37	6.03	30	50
2008	2.69	12.22	21	50
2009	2.69	5.33	32	49
2010	2.97	7.22	21	47
2011	2.77	5.56	18	46
2012	3.07	4.50	22	45
2013	2.91	5.13	27	48
2014	1.81	14.50	25	53

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/12/2014	12.32	11.56	342	8.29	2.15	10	30	<3	1.160	0.830	0.332	29
6/9/2014	21.14	11.16	330	8.53	2.00	24	29	<3	1.070	0.829	0.244	28
7/14/2014	22.57	7.77	302	8.60	1.35	14	31	<3	0.990	0.990	<0.03	26
8/12/2014	24.06	8.44	317	8.49	2.10	11	20	<3	0.913	0.913	<0.03	27
9/15/2014	17.69	8.87	313	8.31	1.80	9	20	<3	0.913	0.913	<0.03	28
10/21/2014	11.87	10.26	327	8.05	3.70	10	24	<3	1.130	1.130	<0.03	28



Steiger Lake

(DNR ID: 10-0045-00)
- Monitored by TRPD -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	B	B	C	B-
2006	C	B	C	C+
2007				
2008	C	B	C	C+
2009				
2010	B	A	C	B
2011	B	A	C	B
2012	C	B	B	B-
2013	B	B	B	B
2014	B	B	B	B

**Ten-Year Water Quality Means
(June-Sept)**

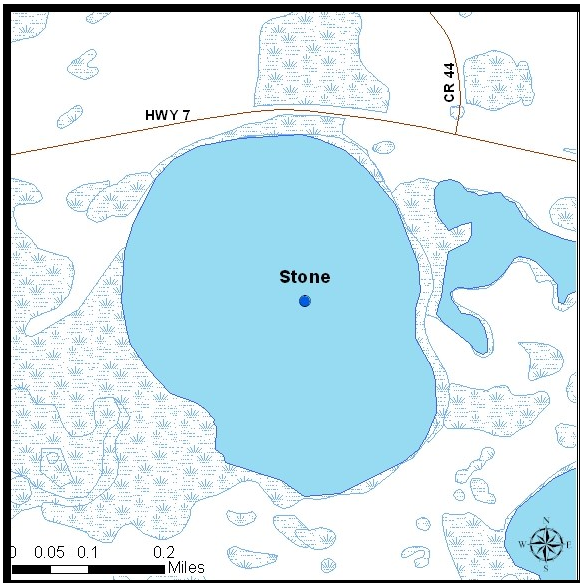
Year	SECC	CHLA	TP	TSI
2005	2.08	19.60	39	55
2006	1.56	15.66	45	57
2007				
2008	1.52	15.31	37	56
2009				
2010	2.23	10.06	37	53
2011	2.64	8.59	35	51
2012	1.82	16.20	29	54
2013	2.71	16.53	28	52
2014	2.94	10.95	31	61

Steiger Lake (DNR ID: 10-0045-00)

- Monitored by TRPD -

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN
5/4/2014	8.18	12.39	0.451	8.57	2.17	22.05	39	3.2	1.14
5/19/2014	13.48	11.18	0.429	9.12	2.15	9.13	26	3.9	0.92
6/2/2014	22.49	9.59	0.428	8.60	3.58	2.39	27	11.1	1.12
6/30/2014	23.96	8.62	0.394	8.32	2.72	14.17	32	30.1	0.93
7/14/2014	23.46	7.97	0.394	8.65	2.15	15.23	38	8.0	0.81
7/28/2014	24.51	8.04	0.384	8.17	2.45	9.99	29	17.2	0.90
8/11/2014	25.23	8.30	0.357	8.01	2.26	15.21	40	7.8	0.97
8/25/2014	25.58	9.15	0.386	7.79	3.20	11.14	27	7.3	0.82
9/8/2014	21.59	8.53	0.387	7.68	3.83	11.15	22	6.5	0.83
9/22/2014	18.70	10.05	0.401	8.65	3.32	8.32	31	12.2	0.86
10/14/2014	12.01	10.19	0.414	7.41	3.05	13.45	42	14.2	1.05



Stone Lake

(DNR ID: 10-0056-00)
- Monitored by TRPD -

**Ten-Year Lake Grade Record
(May-Sept Means)**

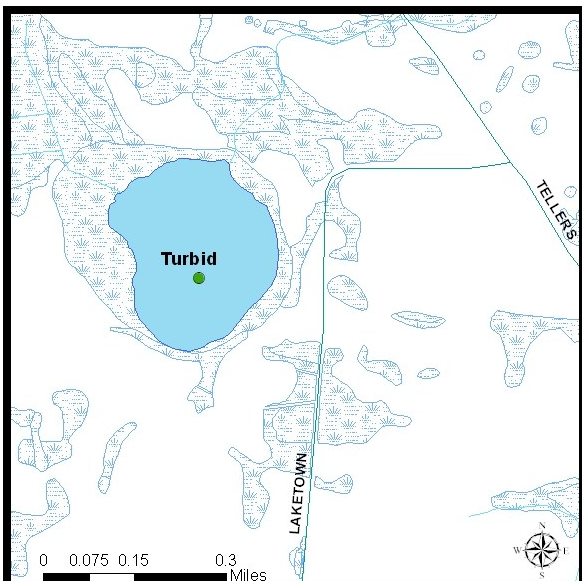
Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007	C	C	C	C
2008	C	B	C	C+
2009				
2010	B	A	B	B+
2011	A	A	B	A-
2012	A	A	B	A-
2013	A	A	B	A-
2014	B	A	C	B

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007	1.40	25.72	43	59
2008	1.76	17.46	39	56
2009				
2010	2.60	7.63	31	50
2011	2.98	6.66	27	48
2012	3.53	3.89	23	45
2013	3.54	2.77	28	45
2014	2.54	6.04	3	50

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN
5/19/2014	14.22	11.42	0.327	8.97	2.67	11.21	19	4.20	0.83
6/2/2014	23.03	10.42	0.315	8.97	0.90	10.18	43	4.80	1.03
6/16/2014	20.02	7.66	0.330	7.80	2.50	9.64	39	11.90	0.98
6/30/2014	24.32	8.69	0.295	8.25	2.76	2.31	49	12.60	0.81
7/14/2014	22.96	6.84	0.290	8.04	2.20	5.03	48	22.80	0.75
7/28/2014	23.60	6.48	0.267	7.89	2.49	4.75	29	8.20	0.98
8/11/2014	24.45	5.48	0.247	7.49	2.11	4.54	36	6.80	1.04
8/25/2014	25.25	8.48	0.277	7.69	3.00	5.80	27	10.50	0.79
9/8/2014	21.43	7.55	0.298	7.68	3.35	6.77	24	9.10	0.68
9/22/2014	18.35	9.47	0.314	8.19	3.55	5.34	23	4.90	0.80



Turbid Lake

(DNR ID: 10-0051-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	C	C	D	C-
2009				
2010	N/A	N/A	N/A	N/A
2011	C	C	C	C
2012	C	C	D	C-
2013	C	C	D	C-
2014	D	D	D	D

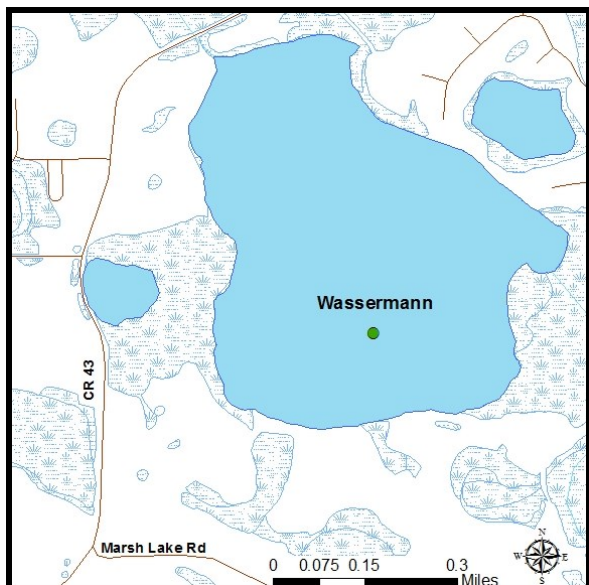
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	1.14	38.50	77	64
2009				
2010	N/A	N/A	N/A	N/A
2011	1.70	30.50	53	59
2012	1.08	43.75	69	64
2013	1.35	36.13	85	63
2014	1.30	49.75	130	66

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/20/2014	13.24	12.19	380	8.75	0.78	83.5	115	<3	2.495	2.495	0.088	30
6/17/2014	20.41	8.76	383	7.98	1.85	21	196	144	1.680	1.410	0.268	27
7/21/2014	24.13	13.58	303	8.92	1.30	103	168	92	0.943	0.943	<0.03	18
8/18/2014	24.97	8.00	281	8.92	0.98	44	92	10	1.490	1.490	<0.03	20
9/22/2014	18.44	11.27	304	8.73	1.08	31	65	<3	1.335	1.335	<0.03	22

Wassermann Lake (DNR ID: 10-0048-00)



**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	D	D	D	D
2006	D	C	C	C-
2007	D	D	D	D
2008	C	D	C	C-
2009	C	C	D	C-
2010	D	D	D	D
2011	C	C	D	C-
2012	D	D	D	D
2013	D	D	D	D
2014	C	C	D	C-

**Ten-Year Water Quality Means
(June-Sept)**

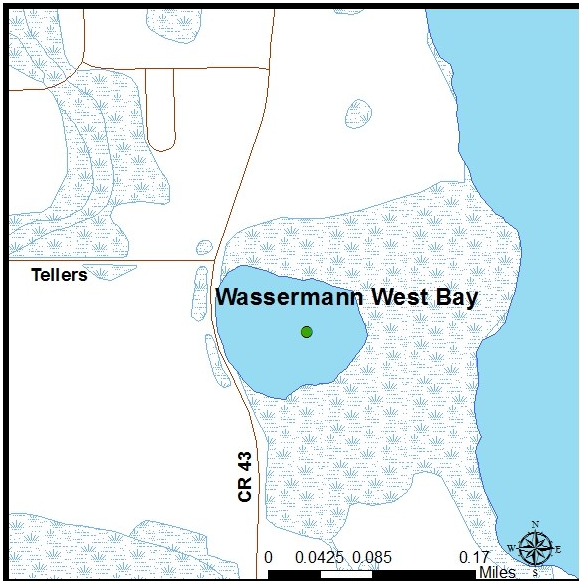
Year	SECC	CHLA	TP	TSI
2005	0.66	62.36	84	68
2006	0.79	49.69	69	66
2007	0.62	63.89	80	69
2008	1.20	59.67	63	64
2009	0.77	51.56	89	67
2010	0.84	57.50	76	67
2011	1.14	37.56	76	64
2012	0.64	60.00	85	69
2013	0.89	53.88	83	66
2014	0.97	40.50	79	65

Wassermann Lake (DNR ID: 10-0048-00)

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/12/2014	12.89	13.19	338	9.03	1.30	32	53/67	<3/<3	1.72	1.34	0.377	29/30
5/27/2014	20.23	9.19	354	8.36	4.23	5	47/106	7/55	1.57	1.32	0.248	29/30
6/9/2014	21.04	11.42	334	8.29	1.75	37	63/275	3/162	1.00	1.00	<0.03	25/29
6/23/2014	24.18	9.37	313	8.03	1.90	14	123/543	19/179	1.29	1.29	<0.03	22/29
7/14/2014	22.61	7.20	305	7.89	1.00	39	76/896	<3/210	1.33	1.33	<0.03	20/28
7/29/2014	23.47	8.90	311	8.36	0.95	51	63/1110	3/208	1.24	1.24	<0.03	21/28
8/11/2014	24.64	8.27	326	8.23	0.85	46	84/1110	<3/276	1.39	1.39	<0.03	21/28
8/26/2014	24.09	7.92	319	8.46	0.58	65	74/1340	<3/182	1.60	1.60	<0.03	22/30
9/16/2014	16.48	8.90	327	8.04	0.65	59	72/1910	<3/32	1.47	1.47	<0.03	24/30
9/29/2014	19.45	10.85	322	8.72	0.65	13	75/1350	<3/211	1.70	1.70	<0.03	24/29
10/21/2014	11.72	12.78	328	8.67	0.78	46	75/83	<3/<3	1.37	1.37	<0.03	24/23

Note: Surface/Bottom Results; Volunteer Secchi data available upon request.



Wassermann Lake - West Bay (DNR ID: 10-0048-02)

**Ten-Year Lake Grade Record
(May-Sept Means)**

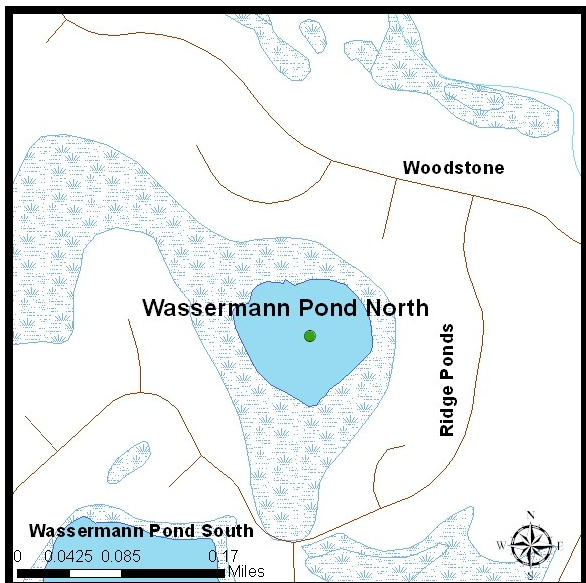
Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	N/A	N/A	N/A	N/A
2014	C	B	F	C-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	N/A	N/A	N/A	N/A
2014	1.52	19.50	368	68

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	TSS
5/19/2014	14.66	8.21	562	8.19	2.35	4	368	287	2.75	1.93	0.817	2
6/16/2014	20.19	5.78	433	7.58	2.30	2	508	450	1.84	1.49	0.349	2
7/22/2014	26.45	10.61	351	7.82	1.15	53	371	222	1.65	1.65	<0.03	10
8/18/2014	24.86	6.44	382	7.44	0.83	14	306	191	1.29	1.29	<0.03	9
9/22/2014	17.36	7.71	436	7.77	1.78	9	287	193	1.41	1.41	<0.03	4



Wassermann Pond - North

(DNR ID: 10-0200-01)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	C	B	C	C+
2014	B	B	C	B-

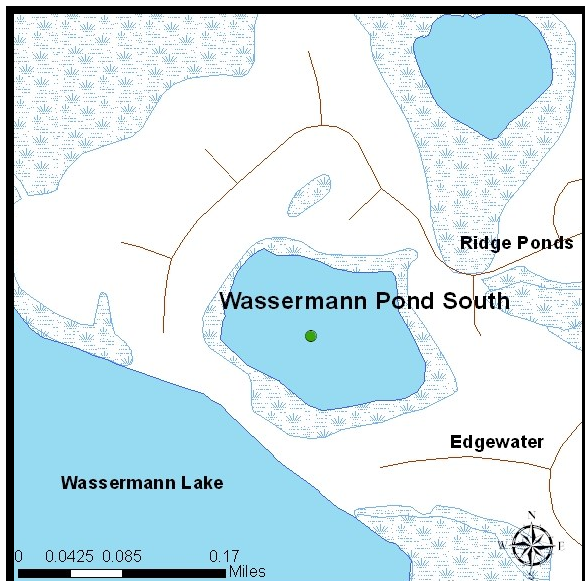
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	1.98	8.25	40	53
2014	2.63	6.75	43	51

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃
5/20/2014	13.97	12.64	422	8.53	0.90	36	73	<3	0.973	0.973	<0.03
6/16/2014	20.91	8.23	360	7.66	2.20	11	58	9	0.953	0.953	<0.03
7/21/2014	26.05	10.02	312	7.74	2.00	5	56	13	0.946	0.946	<0.03
8/18/2014	26.13	7.38	331	7.68	2.70	7	32	<3	0.647	0.647	<0.03
9/22/2014	18.05	8.87	376	7.76	3.60	4	26	<3	0.734	0.734	<0.03

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Wassermann Pond - South (DNR ID: 10-0200-02)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	B	A	B	B+
2014	B	A	B	B+

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013	2.53	3.00	24	46
2014	3.21	2.75	20	44

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃
5/20/2014	14.66	9.15	347	7.75	1.50	7	39	<3	0.807	0.807	<0.03
6/16/2014	22.54	8.29	323	7.76	3.13	2	25	<3	0.493	0.493	<0.03
7/21/2014	26.69	6.30	287	7.76	3.00	2	19	<3	0.612	0.612	<0.03
8/18/2014	25.99	7.18	312	7.50	3.10	4	18	<3	0.547	0.547	<0.03
9/22/2014	18.63	8.07	331	7.64	3.60	3	17	<3	0.818	0.818	<0.03

Six Mile Marsh Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Carl Krey	2002		September 2012			None	None
Church	1998 - 2014	Yes (DNR)	June/September 2013	1994		None	None
East Auburn			May 2012			None	None
West Auburn			August 2011/May 2012			Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Kelser's Pond	1986 - 2014	2013	June/September 2013	2008		None	None
Zumbra	1959 - 2014	1956	June/September 2011	2010		Mercury in Fish Tissue	Aquatic Consumption
Sunny				2010		Mercury in Fish Tissue	Aquatic Consumption
Lundsten North	1981 - 2014		May/September 2012			None	None
Lundsten South	1981 - 2014		May/August 2012			None	None
Marsh			May/August 2012			None	None
Mud	1991 - 2005	Yes (DNR)	May/August 2012			Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Parley	1981 - 2014	2011		2010	2012	Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Piersons	1951 - 2014	2008	July 2011	2007	2012	None	None
Steiger	1981 - 1997	1956	May/August 2010	2009		Mercury in Fish Tissue	Aquatic Consumption
Stone	1998 - 2014	1962	Spring/Fall 2008	2006		Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Turbid	1998 - 2014	2013	June/September 2013	1992		None	None
Wassermann	1964 - 2014	2011	August 2013	2011	2006	Mercury in Fish Tissue Nutrient/Eutrophication Biological Indicators	Aquatic Consumption Aquatic Recreation
Wassermann West Bay						None	None
Wassermann Pond North						None	None
Wassermann Pond South						None	None

Six Mile Marsh Subwatershed - Additional Lake Information (Continued)

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Carl Krey		X					
Church		X	X				
East Auburn		X	X	X			
West Auburn		X	X	X			
Kelser's Pond				X			
Zumbra		X	X	X			
Sunny		X		X			
Lundsten North		X	X				
Lundsten South		X	X				
Marsh		X	X	X			
Mud		X	X				
Parley		X	X	X			
Piersons		X	X	X			
Steiger		X	X	X			
Stone		X	X	X			
Turbid		X	X				
Wassermann		X	X	X			
Wassermann West Bay		X					
Wassermann Pond North							
Wassermann Pond South							

*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcawd-lakes

Six Mile Marsh Subwatershed - Stream Monitoring Sites Information

Stream	MCWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Six Mile Ck: Piersons Lk Outlet	CS114	Yes	No	1199.68	44.8298	-93.6885
Six Mile Ck: Wassermann Lk Inlet	CS111	Yes	No	392.95	44.8302	-93.6679
Six Mile Ck: Wassermann Lk Outlet	CS112	Yes	No	1297.23	44.8464	-93.6800
Six Mile Ck: Turbid Lk Outlet	CS113	Yes	No	622.04	44.8553	-93.7105
Six Mile Ck: Parley Lk Inlet (SOB Lk Outlet)	CS108	Yes	Yes	775.46	44.8747	-93.7340
Six Mile Ck: East Auburn Lk Inlet	CS105	Yes	No	1086.99	44.8612	-93.6744
Six Mile Ck: Lundsten Lk North Inlet (West Auburn Lk Outlet)	CS109	Yes	No	924.48	44.8715	-93.6957
Six Mile Ck: Lundsten Lk South Inlet*	CS110	No	No	164.42	44.8631	-93.7081
Six Mile Ck: Lundsten Lk North Outlet	CS101	Yes	Yes	1021.69	44.8733	-93.7207
Six Mile Ck: Parley Lk Inlet	CS116	Yes	No	656.09	44.8837	-93.7411
Six Mile Ck: Parley Lk Inlet* ^a	CS118	No	No	257.06	44.8847	-93.7157
Six Mile Ck: Mud Wetland Inlet	CS115	Yes	Yes	1454.81	44.8988	-93.7465
Six Mile Ck: Mud Wetland Outlet	CS102	Yes	Yes	1622.98	44.9010	-93.7343
Six Mile Ck: Lake Minnetonka: Halsted Bay Inlet	CS117	Yes	Yes	1700.22	44.9074	-93.7052

* Monitored by Wenck Associates for MCWD

^a Insufficient data-no page in this report



Six Mile Creek: Piersons Lake Outlet (CSI14)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	19
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	10
Total Phosphorus (µg/L)	32
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

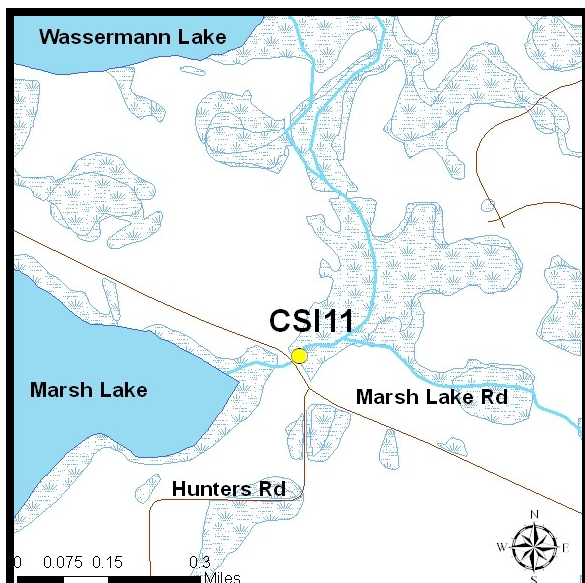
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006											
2007											
2008											
2009											
2010	0.77	45	30	1	1	1610	1.07	10	7	49	32
2011	1.04	59	29	3	1	1575	0.77	26	13	46	22
2012	0.36	20	28	0.44	1	226	0.32	6	8	8	11
2013	0.56	31	28	0	0	1105	1.01	4	3	29	26
2014	2.38	164	35	0.0	0.0	5291	1.13	80	17	129	28

Note: Revised means and loads for 2010-2013

2014 Water Quality Data - CSI14

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/15/2014	0.322	2.87	10.83	221	7.38	24	<3			
4/28/2014	6.884	6.75	10.46	333	7.95	40	<3			
5/6/2014	10.499	9.18	14.57	345	8.20	27	<3	1.030	3	29
5/13/2014	7.897	11.13	11.02	346	8.39	32	<3			
5/20/2014	5.859	13.18	12.96	347	8.50	20	<3		2	
5/27/2014	4.671	20.43	8.35	349	8.08	45	<3			
6/2/2014	14.650	23.33	7.19	334	7.86	85	<3	1.440	65	27
6/9/2014	5.658	21.05	9.49	335	8.44	32	<3			
6/16/2014	7.196	20.71	9.67	324	8.70	27	<3		4	
6/23/2014	25.022	24.13	12.40	312	8.93	25	<3			
6/30/2014	10.673	23.75	8.19	305	8.64	28	<3	0.686	4	24
7/7/2014	5.094	24.40	8.96	302		22	<3			
7/15/2014	8.313	19.97	8.96	285		28.5	<3		4	
7/22/2014	4.003	23.84	6.97	301	8.56	29	<3			
7/29/2014	1.786	22.32	7.63	307	7.74	28	<3	0.879	4	25
8/5/2014	0.983	25.56	7.03	313	8.53	23	<3			
8/12/2014	0.136	21.06	8.25	302	8.40	24	<3		2	
8/19/2014	0.453	23.41	6.39	317	8.03	31	<3			
8/26/2014	0.104	20.80	7.69	313	8.40	29	<3	0.944	6	27
9/2/2014	0.352	20.87	5.41	321	8.09	35	<3			
9/9/2014	0.007	18.02	3.90	359	7.20	38	11		1	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Six Mile Creek: Wassermann Lake Inlet (CSI11)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	5
Total Suspended Solids (mg/L)	19
Total Phosphorus (µg/L)	77
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	2.26	229	51	33	7	413	0.09	8	2		
2007	0.96	84	44	13	7	2105	1.11	9	5		
2008	0.72	94	66	15	10	1362	0.95	13	9	22	16
2009	0.18	11	29	2	5	483	1.35	1	2	13	36
2010	0.77	72	47	13	8	1197	0.79	4	2	39	25
2011	1.32	262	101	23	9	1586	0.61	144	56	35	13
2012	0.59	67	57	14	12	912	0.78	15	13	23	20
2013	0.72	116	82	37	26	1508	1.07	7	5	33	24
2014	2.94	309	53	62	11	6127	1.06	61	11	157	27

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CSI11

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	1.199	0.85	5.69	275	6.70	106	38	2.000	6	21
4/15/2014	1.091	2.31	6.82	223	6.90	84	7			
4/21/2014	0.142	15.02	8.05	359	7.25	95	10		7	
4/28/2014	6.326	4.10	6.88	257	6.92	122	43			
5/6/2014	8.104	10.87	10.12	277	7.34	30	<3	0.651	2	21
5/13/2014	12.755	12.03	6.57	301	7.57	48	<3			
5/20/2014	10.482	12.89	7.72	318	7.49	28	3		3	
5/27/2014	5.134	21.29	4.86	328	7.27	35	12			
6/2/2014	17.760	22.65	3.89	313	7.18	75	18	1.130	22	24
6/9/2014	7.721	19.94	5.05	313	7.27	63	9			
6/16/2014	8.882	19.46	5.48	307	7.25	36	6		9	
6/23/2014	22.967	23.22	4.21	274	7.17	51	9			
6/30/2014	15.222	23.74	2.72	297	7.21	45	8	0.727	4	23
7/7/2014	10.467	23.88	3.15	293		45	5.5			
7/15/2014	10.564	20.36	4.16	276		32	10		6	
7/22/2014	3.616	25.51	2.59	274	7.29	53	13			
7/29/2014	2.572	22.61	3.50	273	6.72	51	16	0.898	18	23
8/5/2014	1.943	24.41	2.35	278	7.25	80	27			
8/12/2014	2.705	22.87	2.45	290	7.04	117	28		36	
8/19/2014	1.501	25.88	2.00	293	6.85	98	33			
8/26/2014	0.690	22.28	2.64	305	7.08	117	37	1.170	40	26
9/2/2014	0.049	19.46	3.24	306	8.31	132	57			
9/9/2014	0.085	18.99	3.92	319	7.26	119	51		23	
9/16/2014	0.018	10.09	6.35	331		87.5	37.5			
9/23/2014	0.032	13.52	5.76	337	7.08	117	38	1.460	49	28
9/30/2014	0.013	11.65	4.15	331	7.52	148	68			
10/7/2014	0.043	9.39	6.97	325	7.40	50	20		5	
10/14/2014	0.047	9.46	6.17	347	7.76	102	39			
10/21/2014	0.005	7.34	8.19	344	7.55	89	26	0.990	28	29
10/27/2014	1.040	8.04	8.23	345	7.80	54	15			
11/3/2014	0.005	5.69	9.10	365	7.78	73	13		39	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Six Mile Creek: Wassermann Lake Outlet (CSI12)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	17
Dissolved Oxygen (mg/L)	7
Total Suspended Solids (mg/L)	7
Total Phosphorus (µg/L)	74
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

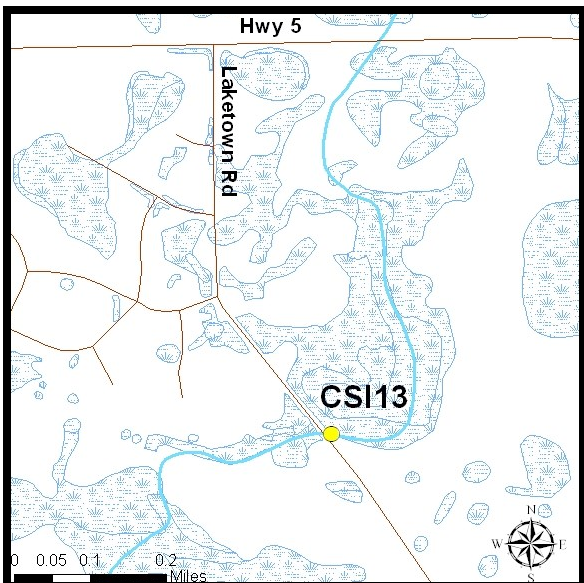
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006	4.83	796	84	48	5	611	0.06	74	8		
2007	2.83	484	87	34	6	6754	1.21	34	6		
2008	1.18	219	95	6	3	3768	1.63	42	18	34	15
2009	1.60	348	110	13	4	5543	1.76	27	9	77	24
2010	2.54	393	79	33	7	8380	1.67	36	7	113	23
2011	3.08	599	99	38	6	7805	1.29	69	11	145	24
2012	3.44	540	80	4	1	11516	1.70	94	14	159	23
2013	1.81	295	83	5	1	5874	1.65	30	8	83	23
2014	5.63	806	73	126	11	17436	1.57	83	7	344	31

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CSI12

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	5.721	4.27	11.19	331	7.83	77	8	1.830	4	32
4/15/2014	4.860	4.95	16.21	331	8.50	121.5	3			
4/21/2014	4.368	8.63	11.81	385	7.75	134	3		18	
4/28/2014	10.480	5.92	10.47	367	7.74	96	4			
5/5/2014	12.857	13.11		356		88	<3	2.250	25	31
5/13/2014	21.810	11.95	12.35	350	8.87	55	<3			
5/20/2014	14.680	13.29	11.77	356	8.84	35	<3		2	
5/27/2014	12.915	20.49	8.48	357	8.34	37	<3			
6/2/2014	41.600	23.08	6.24	337	7.71	52	27	0.957	2	26
6/9/2014	20.626	21.05	10.07	336	8.43	84	4			
6/16/2014	17.762	19.90	7.20	342	7.94	69	8		5	
6/23/2014	42.486	23.84	8.17	320	7.85	76.5	30			
6/30/2014	25.240	24.02	7.10	311	7.96	95	20	1.225	12	21.5
7/7/2014	14.135	24.07	12.03	307		81	3			
7/15/2014	17.343	21.48	5.45	308		85	5		6	
7/22/2014	8.583	25.02	4.47	311	7.96	78	<3			
7/29/2014	5.251	22.58	4.26	317	6.68	71	3	1.270	4	21
8/5/2014	3.812	24.91	5.94	323	8.36	67	<3			
8/12/2014	2.804	22.97	1.59	327	7.47	85	10		5	
8/19/2014	2.499	24.05	3.93	324	7.72	77	<3			
8/26/2014	2.110	22.61	2.82	330	7.64	78	<3	1.600	8	23
9/2/2014	1.692	21.97	1.87	315	8.24	66	<3			
9/9/2014	0.992	20.11	2.84	325	7.51	57	<3		4.5	
9/16/2014	0.550	14.23	3.75	332		71	<3			
9/23/2014	0.343	16.67	5.32	324	7.49	58	<3	1.450	5	24
9/30/2014	0.226	14.11	2.75	335	7.73	78	18			
10/13/2014	0.074	12.05	3.02	339	7.49	83	<3			
10/21/2014	0.060	8.94	5.96	344	7.68	44	3	1.110	1	24
10/27/2014	0.046	8.99	2.62	350	7.79	46	6			

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Six Mile Creek: Turbid Lake Outlet (CSI13)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	8
Total Suspended Solids (mg/L)	15
Total Phosphorus (µg/L)	174
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

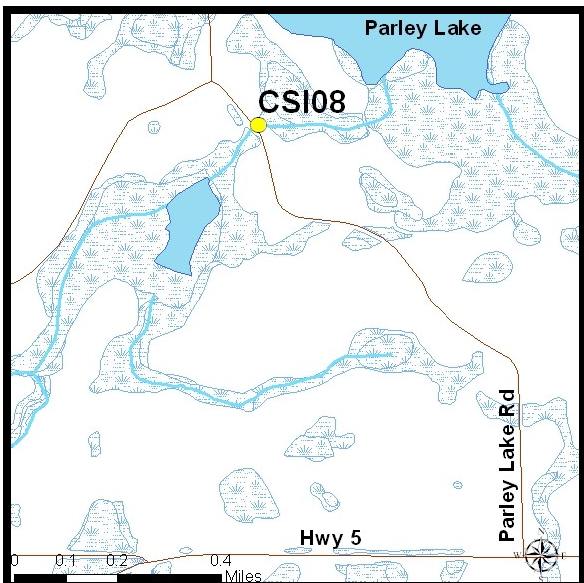
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006											
2007											
2008											
2009	0.29	62	106	19	33	872	1.50	4	7	12	21
2010	0.51	139	139	90	90	2023	2.03	4	4	25	25
2011	0.72	171	120	91	64	5691	4.01	12	8	37	26
2012	0.51	145	143	53	52	683	0.68	8	8	13	13
2013	0.45	136	153	33	38	1347	1.52	7	8	13	15
2014	1.17	495	215	226	98	5638	2.45	43	19	56	24

Note: Revised means and loads for 2009-2013

2014 Water Quality Data - CSI13

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	2.682	3.17	13.10	304	7.98	219	47.5	4.355	12	24
4/15/2014	0.149	1.39	11.21	547	7.67	103	3			
4/22/2014	0.180	7.69	10.32	527	7.85	67	7		5	
4/28/2014	17.084	6.54	10.70	361	8.22	249	55			
5/6/2014	1.360	9.98	10.64	480	7.83	52	29	3.390	2	36
5/13/2014	4.995	10.88	8.88	422	7.77	68	39			
5/20/2014	3.980	13.30	11.07	443	8.14	70	<3		5	
5/27/2014	1.108	20.24	6.36	468	7.75	161	123			
6/3/2014	9.462	19.82	5.86	385	7.65	246	164	2.400	26	27
6/9/2014	2.393	19.65	6.35	406	7.62	251	173			
6/16/2014	5.101	19.92	7.26	428	7.73	222	133		31	
6/23/2014	8.547	23.10	6.30	325	7.57	306	161			
6/30/2014	1.931	22.72	6.49	328	7.78	269	121	2.180	48	20
7/7/2014	0.261	21.34	7.66	429		216	136			
7/15/2014	2.720	19.85	8.39	336		168	117		14	
7/22/2014	0.453	23.48	6.53	405	7.84	175.5	139			
7/30/2014	0.110	19.13	6.68	499	7.89	141	101	2.570	10	31
8/5/2014	0.032	18.80	7.19	640	7.88	142	130			
8/12/2014	0.007	17.61	7.01	635	7.69	195	154		16	
8/19/2014	0.103	19.62	6.48	635	7.64	158	125			
8/26/2014	0.002	16.56	7.16	603	7.66	219	190	1.490	2	39
9/2/2014	0.061	17.87	6.60	533	8.73	139	102			
9/9/2014	0.001	16.44	7.33	352	7.73	148	119		3	
9/16/2014	0.001	10.46	8.13	579		186	156			

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Six Mile Creek: Parley Lake Inlet (SOB Lake Outlet) (CSI08)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	17
Dissolved Oxygen (mg/L)	7
Total Suspended Solids (mg/L)	11
Total Phosphorus (µg/L)	234
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006	1.00	259	130	65	33	493	0.25	6			
2007											
2008											
2009											
2010											
2011											
2012											
2013	0.70	258	188	141	103	1971	1.44	15	11	12	8
2014	1.23	499	207	270	112	6698	2.77	16	7	40	17

Note: Revised means and loads for 2013

2014 Water Quality Data - CSI08

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	4.130	2.75	11.24	527	7.51	170	97	7.160	5	27
4/15/2014	1.050	4.68	12.46	555	7.96	218	61			
4/22/2014	0.870	9.92	19.59	481	8.84	170	<3		29	
4/29/2014	12.479	5.81	11.16	410	7.73	185	56			
5/6/2014	1.392	12.68	14.66	450	8.17	116	48	3.550	7	23
5/13/2014	4.510	12.11	12.50	503	7.55	95	5			
5/20/2014	3.160	13.22	13.59	468	8.82	162.5	7		18	
5/28/2014	1.880	20.15	10.18	498	8.47	57	8			
6/3/2014	7.154	19.62	5.23	446	7.51	233	177	2.940	8	22
6/9/2014	2.830	19.61	4.34	492	7.50	227	172			
6/16/2014	3.400	20.19	5.90	516	7.69	220	162		8	
6/23/2014	17.200	22.26	3.46	315	7.18	287	185			
6/30/2014	1.210	23.92	7.49	426	9.32	173	108	2.740	11	14
7/7/2014	0.360	23.55	5.56	428		87	56			
7/15/2014	2.960	20.02	6.36	432		212	166		3	
7/22/2014	0.580	25.06	6.90	388	8.20	91	20			
7/29/2014	0.250	21.48	4.44	431		121	86	1.495	5.5	16
8/5/2014	0.160	23.71	5.11	459	8.18	108	73			
8/12/2014	0.104	19.98	6.10	448	7.89	135	74		8	
8/19/2014	0.140	22.19	4.35	418	9.11	149	49			
8/26/2014	0.100	19.11	4.49	411	7.88	140	25	1.700	8	18
9/2/2014	0.350	21.40	4.84	392	8.70	132	3			
9/9/2014	0.300	19.81	3.45	433	7.84	159	23		9	
9/16/2014	0.130	13.25	6.66	455		185	94			
9/23/2014	0.070	14.52	3.94	448	7.41	351	252	2.770	4	18
9/30/2014	0.003	11.45	0.38	479	7.63	1310	286			
10/7/2014	0.004	9.71	1.39	656	7.88	812	182		32	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Six Mile Creek: East Auburn Lake Inlet (CSI05)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	3
Total Suspended Solids (mg/L)	5
Total Phosphorus (µg/L)	103
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	0.96	250	132	51	27	2303	1.22	12	7		
2006											
2007	2.26	382	86	51	11	5276	1.19	30	7		
2008	1.14	205	91	62	28	2742	1.23	9	4	42	19
2009	1.40	334	122	161	59	2078	0.76	7	3	48	18
2010	2.01	347	88	140	35	4378	1.11	14	4	106	27
2011	2.64	414	80	115	22	4017	0.77	20	4	148	28
2012	1.43	296	105	115	41	1736	0.62	7	3	38	14
2013	1.75	445	129	179	52	4233	1.23	24	7	103	30
2014	4.87	877	91	320	33	9627	1.01	24	3	244	25

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CSI05

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	6.19	2.97	7.82	384	7.47	133	12	2.020	4	49
4/15/2014	4.22	4.26	7.55	445	7.40	139	15			
4/22/2014	5.23	9.39	11.35	415	7.73	139	5		8	
4/29/2014	28.06	5.18	8.43	401	7.40	101	6			
5/6/2014	15.41	10.82	12.44	381	7.62	67	<3	1.330	8	33
5/13/2014	21.63	11.20	3.94	390	7.32	39	5			
5/20/2014	15.53	12.82	4.88	372	7.41	31	3		1	
5/28/2014	10.93	18.91	2.03	374	7.15	55	25			
6/3/2014	20.23	20.20	0.86	358	7.13	99	53	0.806	1	25
6/9/2014	20.05	19.05	1.07	347	7.01	84	41			
6/16/2014	19.55	19.92	2.20	331	7.04	68	37		2	
6/23/2014	26.50	23.09	0.18	329	7.02	162	72			
6/30/2014	16.26	23.34	0.53	316	7.50	148	72	0.927	3	21
7/7/2014	10.19	23.27	1.36	316		89	44			
7/15/2014	11.69	19.41	1.68	305		57	34		<1	
7/22/2014	7.92	24.77	1.11	327	7.07	138	63			
7/29/2014	4.03	21.66	1.74	330		85	41	0.980	4	20
8/5/2014	3.60	23.64	1.61	374	7.16	78	45			
8/12/2014	2.15	22.69	1.80	336	7.18	71	39		1	
8/19/2014	2.95	23.46	1.31	338	8.77	74	43			
8/27/2014	1.17	22.03	1.10	358	7.05	78	47	1.020	1	24
9/2/2014	1.57	22.18	1.74	340	7.97	75	44			
9/9/2014	1.08	19.50	1.32	362	7.03	93	52		1	
9/16/2014	0.51	13.64	1.50	377		65	46			
9/23/2014	0.32	14.32	1.37	382	6.68	95	53.5	1.265	1	30
9/30/2014	0.41	13.70	0.70	417	7.13	180	88			
10/7/2014	0.26	9.73	1.30	408	6.99	71	47		1	
10/14/2014	0.29	9.20	1.10	430	7.18	137	74			
10/21/2014	0.25	7.39	2.22	432	7.01	141	73	1.810	2	34
10/27/2014	0.29	8.27	1.86	445	7.60	139	78			
11/3/2014	0.05	5.61	2.35	465	7.48	263	64		42	

Blue Highlight = Flow calculated from rating curve.

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);
Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Six Mile Creek: Lundsten Lake North Inlet (West Auburn Lake Outlet) (CSI09)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	18
Dissolved Oxygen (mg/L)	10
Total Suspended Solids (mg/L)	3
Total Phosphorus (µg/L)	30
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

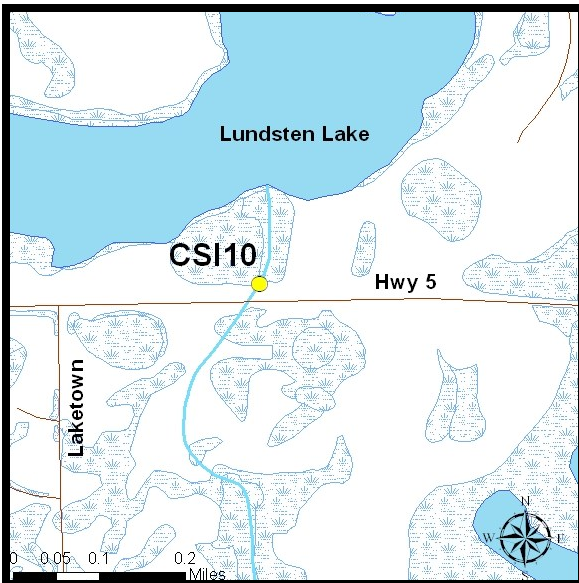
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006	7.11	1014	73	80	6	2586	0.18	35	2		
2007	4.10	304	38	43	5	8906	1.10	34	4		
2008	2.65	140	27	4	0.7	7052	1.35	12	2	134	26
2009	1.63	112	35	11	4	2841	0.89	9	3	70	22
2010	2.88	213	38	16	3	6143	1.09	9	2	194	34
2011	5.10	309	31	32	3	7009	0.70	38	4	258	26
2012	2.66	146	28	4	0.9	3933	0.75	11	2	130	25
2013	2.60	165	32	1	0.3	10228	2.00	10	2	188	37
2014	8.81	584	34	14	0.8	19392	1.12	58	3	609	35

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CSI09

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	11.80	3.50	14.25	302	8.63	26	<3	0.916	<1	24
4/15/2014	6.83	7.27	16.26	304	8.47	48	<3			
4/22/2014	5.93	7.15	18.01	336	8.71	36	<3		9	
4/29/2014	25.56	6.16	11.77	387	8.17	42	<3			
5/6/2014	27.95	10.05	7.75	384	8.64	32	<3	1.060	7	36
5/13/2014	29.35	12.02	11.65	380	8.55	21	<3			
5/20/2014	26.60	14.24	12.68	386	8.51	16	<3		2	
5/28/2014	19.19	20.51	7.85	384	8.02	20	<3			
6/3/2014	43.75	21.76	6.63	369	7.84	27	3	0.930	2	35
6/9/2014	42.38	21.43	7.06	362	7.84	29	<3			
6/16/2014	31.12	21.19	9.27	359	8.31	29	<3		2	
6/23/2014	58.57	24.49	12.51	331	8.66	53	<3			
6/30/2014	36.26	24.04	8.30	328	8.35	41	4	0.940	4	28
7/7/2014	24.34	24.69	12.94	323		40	<3			
7/15/2014	23.20	24.42	8.53	321		39	3		4	
7/22/2014	15.58	25.73	9.01	315	8.73	34	<3			
7/29/2014	12.11	24.74	9.08	311	8.79	36	3	1.350	5	26
8/5/2014	7.96	26.01	10.02	313	8.93	29	<3			
8/12/2014	5.39	25.12	7.14	311	8.47	28	<3		2	
8/19/2014	5.39	25.53	6.92	304	8.89	25	<3			
8/27/2014	2.22	23.83	6.10	320	8.25	23	<3	1.000	2	26
9/2/2014	3.13	24.43	7.66	301	8.96	20	<3			
9/9/2014	2.19	21.08	7.58	310	8.40	22	<3		1	
9/16/2014	0.82	17.48	9.27	320		18	<3			
9/23/2014	0.34	17.59	7.88	316	8.22	24	<3	1.030	2	28
9/30/2014	0.49	15.66	6.04	322	8.31	19.5	<3			
10/7/2014	0.25	12.29	8.65	336	8.43	21	<3		2	
10/14/2014	0.53	11.36	7.05	345	8.00	34	<3			

Blue Highlight = Flow calculated from rating curve.



Six Mile Creek: Lundsten Lake South Inlet (CSI10)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	7
Total Suspended Solids (mg/L)	6
Total Phosphorus (µg/L)	198
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

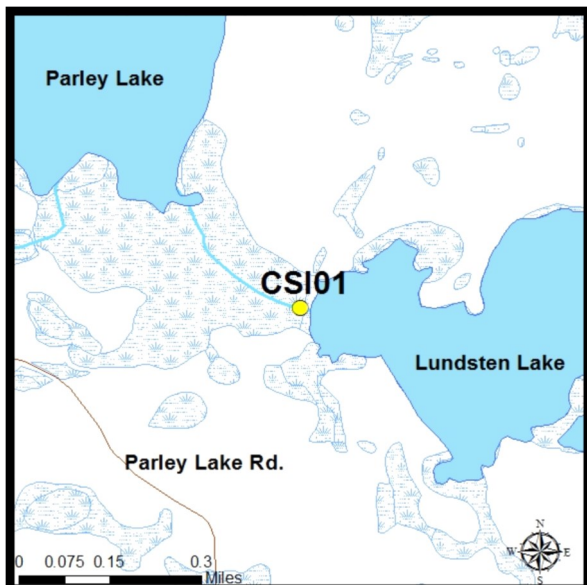
Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006	0.65	175	140	99	77	7605	5.94	10	8		
2007											
2008											
2009											
2010											
2011											
2012											
2013*											
2014	1.27	928	371	722	289	11900	4.76	14	6	*	*

*Not enough data to calculate

2014 Water Quality Data - CSI10

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	1.224	3.65	9.59	439	7.40	206	137	4.000	2	40
4/29/2014						180	110		16	
5/9/2014	3.665	8.99	7.54	495	7.48	230	220	4.800	6.5	
5/13/2014	6.567	10.26	7.39	456	7.56	110	93	2.670	2	
6/5/2014	7.396	20.82	4.59	425	7.43	266	194	2.420	11	
6/18/2014	4.738	20.47	5.45	470	7.44	224	172	2.280	4	
7/16/2014	2.850	17.24	6.12	389	7.44	168	121	1.530	1	
7/29/2014	0.263	17.22	5.92	525	7.33	155	86	1.620	3	
8/12/2014	0.070	16.72	5.43	737	7.59	192	110	1.470	10	
9/3/2014	0.091	16.73	6.65	651	7.68	242	142	1.480	23	



Six Mile Creek: Lundsten Lake North Outlet (CSI01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	18
Dissolved Oxygen (mg/L)	8
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	74
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

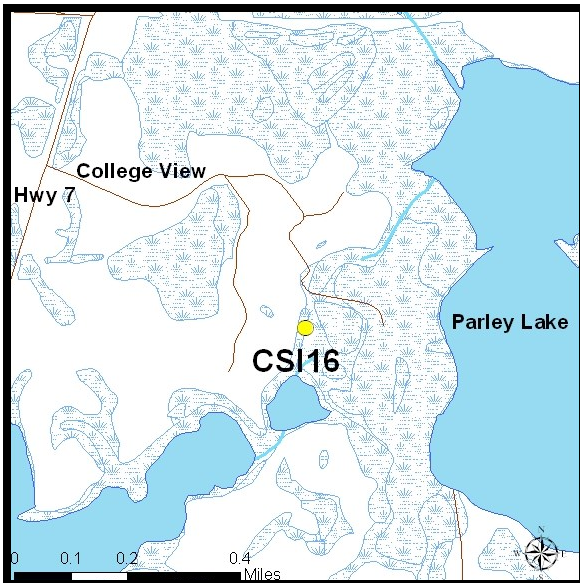
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005	3.25	799	125	153	24	10930	1.71	50	8		
2006	8.90	1190	68	133	8	7322	0.42	34	2		
2007	5.33	868	83	57	5	8346	0.80	516	49		
2008	2.23	226	51	45	10	3061	0.70	11	3	23	5
2009	0.95	107	57	5	3	1196	0.64	2	1	25	13
2010	5.26	1022	99	315	30	12609	1.22	39	4	300	29
2011	8.49	972	58	187	11	12779	0.77	99	6	422	25
2012	3.28	337	52	55	8	5155	0.80	29	4	165	26
2013	5.13	648	64	126	13	19721	1.96	26	3	341	34
2014	15.56	2356	77	382	12	36948	1.21	154	5	878	29

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CSI01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	5.874	3.85	10.09	309	7.69	86	6	1.810	4	24
4/15/2014	9.055	5.39	11.88	342	7.93	66	<3			
4/22/2014	10.032	13.51	11.96	354	8.46	45	<3		6	
4/29/2014	58.586	6.53	11.01	329	8.04	40	<3			
5/6/2014	49.006	12.50	14.20	379	8.52	45	<3	1.260	7	33
5/13/2014	62.640	13.38	7.24	383	7.80	49	<3			
5/20/2014	51.360	14.53	8.63	390	7.89	49	<3		2	
5/28/2014	34.030	21.63	6.40	397	7.85	32	<3			
6/3/2014	68.126	22.45	4.06	356	7.53	89	17	1.290	9	30
6/9/2014	75.963	21.53	4.20	373	7.46	84	18			
6/16/2014	65.175	22.70	10.20	374	8.30	86	<3		7	
6/23/2014	78.884	24.64	10.50	326	8.40	102	<3			
6/30/2014		24.56	3.75	330	7.56	97	36	1.200	6	27
7/7/2014		24.76	7.98	342		106	31			
7/15/2014	38.895	21.84	6.69	339		101	39		3	
7/22/2014	30.057	26.02	5.96	337	8.10	86	54			
7/29/2014	26.208	23.93	6.00	334	7.93	91	50	1.050	2	25
8/5/2014	9.863	25.40	5.34	318	8.18	102	45			
8/12/2014	7.930	24.42	5.96	302	8.07	107	68		1	
8/19/2014	4.870	24.93	4.82	277	8.45	102	68			
8/27/2014	3.640	23.13	5.28	287	8.41	79	49	1.020	1	27
9/2/2014	5.600	23.34	5.15	262		62	35			
9/9/2014	1.850	20.23	7.87	269	9.08	45	18		1	
9/16/2014	1.160	15.31	9.05	266		37	9			
9/23/2014	0.470	17.38	7.67	257	8.88	56	8	1.090	5	28
9/30/2014	0.110	13.98	5.86	260	9.03	73	20			
10/7/2014	0.320	10.55	10.60	283	9.04	47.5	3		3	
10/14/2014	0.050	11.44	6.97	294	8.68	106	43.5			

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Six Mile Creek: Parley Lake Inlet (CSI16)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	18
Dissolved Oxygen (mg/L)	5
Total Suspended Solids (mg/L)	8
Total Phosphorus (µg/L)	233
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

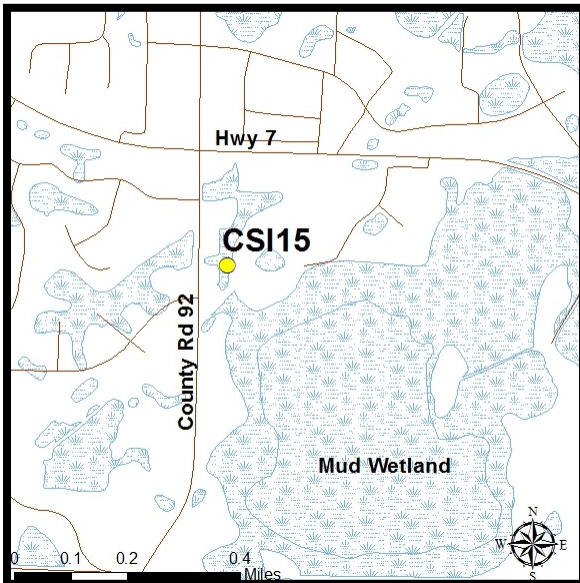
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006											
2007											
2008											
2009											
2010											
2011											
2012											
2013	0.52	579	566	338	331	1867	1.83	18	18	17	17
2014	0.73	308	213	169	118	2332	1.62	14	10	40	28

Note: Revised means and loads for 2013

2014 Water Quality Data - CSI16

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	1.325	3.54	5.40	351	7.16	233	126	2.930	4	20
4/15/2014	0.742	6.41	10.07	392	7.60	246	47			
4/22/2014	1.075	13.38	12.77	427	8.03	123	4		10	
4/29/2014	4.028	5.30	10.91	386	7.97	125.5	15			
5/6/2014	3.397	13.14	14.16	428	7.80	107	4	1.480	12	30
5/13/2014	3.340	12.41	7.47	441	7.55	119	7			
5/20/2014	2.325	15.75	7.56	473	7.65	109	28		13	
5/28/2014	1.296	21.89	6.48	479	7.49	295	147			
6/3/2014	4.217	22.36	2.72	438	7.33	289	202	1.510	19	30
6/9/2014	1.951	20.21	3.32	433	7.31	244	197			
6/16/2014	1.508	23.25	5.52	395	7.55	193	141		10	
6/23/2014	9.208	23.26	3.37	315	7.09	257	185			
6/30/2014	1.440	23.23	3.73	372	7.36	377	256	1.190	5	16
7/7/2014	0.582	25.30	5.31	368		370	200			
7/16/2014	1.192	18.36	2.12	345		276	197		3	
7/22/2014	0.490	26.11	2.68	355	7.44	302	196			
7/29/2014	0.305	23.31	3.02	376	7.26	310	154	1.400	5	17
8/5/2014	0.140	23.87	3.06	364	7.42	388	162			
8/12/2014	0.229	22.16	3.92	375	7.37	255	144		3	
8/19/2014	0.174	23.17	4.19	365	7.64	238	132			
8/27/2014	0.011	20.87	1.30	388	7.41	179	94	2.060	6	17
9/3/2014	0.192	19.09	3.66	375		310	142			
9/9/2014	0.049	20.05	1.82	362	7.49	230	66		7	
9/16/2014	0.026	15.95	3.41	391		143	83			
9/23/2014	0.028	16.92	2.40	410	7.12	254	104	2.880	12	18
9/30/2014	0.001	13.78	3.02	451	7.82	165	69			
10/14/2014	0.010	11.20	4.72	494	7.97	142	61			

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Six Mile Creek: Mud Wetland Inlet (CSI15)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	4
Total Suspended Solids (mg/L)	11
Total Phosphorus (µg/L)	338
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

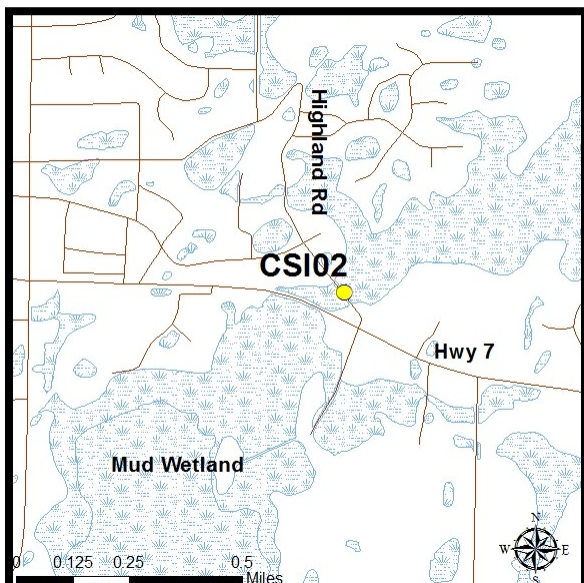
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006											
2007											
2008											
2009											
2010											
2011											
2012											
2013	1.62	1459	457	1066	334	3161	0.99	10	3	55	17
2014	1.56	1004	327	597	195	7865	2.56	27	9	143	47

Note: Revised means and loads for 2013

2014 Water Quality Data - CSI15

Date	Flow	TMP	DO	COND	pH	TP	SRP	TN	TSS	CI
4/8/2014	5.302	6.38	7.08	600	7.52	203	158	5.610	1	55
4/15/2014	1.214	3.91	10.91	753	7.61	139	92			
4/22/2014	1.186	10.73	7.80	772	7.49	149	102.5		3	
4/29/2014						170	140		<5	
5/5/2014	7.685	12.97	11.63	623	7.64	100	79	2.450	<1	51
5/8/2014	7.510	11.62	6.79	7.51		160	71		37	
5/13/2014	8.520	11.67	10.59	594	7.76	124	84			
5/20/2014	5.870	14.92	10.01	510	7.83	154	96		7	
5/28/2014	2.730	19.75	3.57	639	7.43	225	173			
6/3/2014	11.426	20.53	2.87	503	7.36	402	311	1.380	11	26
6/5/2014	6.038	21.04	2.50	505	7.44	535	286	1.510	6	
6/9/2014	3.440	17.49	3.53	610	7.47	390	219			
6/14/2014		17.96	4.48	556	7.42	360	130	1.000	6	43
6/16/2014	7.770	20.68	4.34	564	7.46	267	216		1	
6/23/2014	11.290	22.80	1.63	378	7.20	657	372			
6/30/2014	2.860	21.10	2.08	550	7.37	578	304	1.450	3	26
7/7/2014	1.336	22.40	4.40	598		487	282			
7/16/2014	5.731	15.89	3.28	534		333	184		1	
7/22/2014	1.732	23.01	1.45	713	7.39	694	242			
7/29/2014	0.720	19.62	2.10	864	7.11	432	123	1.580	5	60
8/5/2014	0.420	19.79	3.08	1162	6.94	276	44			
8/19/2014	0.304	20.59	2.14	677	8.36	215	119			
8/27/2014	0.034	18.76	3.07	907	6.97	658	22	1.490	14	58
8/30/2014	0.912	20.60	2.16	612	7.26	1200	250	1.200	97	
9/3/2014	0.507	17.74	2.94	714		264	137			
9/9/2014	0.183	17.54	1.40	896	7.23	882	17		17	
9/16/2014	0.194	12.90	2.63	822		187	52			
9/23/2014	0.040	13.98	2.68	792	6.95	182	43	0.945	2	61
9/30/2014	0.001	14.47	3.53	1066	7.17	442	17			
10/7/2014	0.056	10.53	3.53	876	7.38	168	33		6	
10/14/2014	0.016	9.79	3.85	869	7.49	136	7			
10/21/2014	0.036	10.01	1.57	1018	7.08	99	12	0.606	2	37.4
10/27/2014	0.043	9.43	3.84	944	7.29	123	11			
11/5/2014	0.066	6.56	4.99	865	7.36	93	18		2	

Blue Highlight = Flow calculated from rating curve.



Six Mile Creek: Mud Wetland Outlet (CSI02)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	18
Dissolved Oxygen (mg/L)	6
Total Suspended Solids (mg/L)	14
Total Phosphorus (µg/L)	146
<i>E. coli</i> (cfu/100 mL)*	17
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

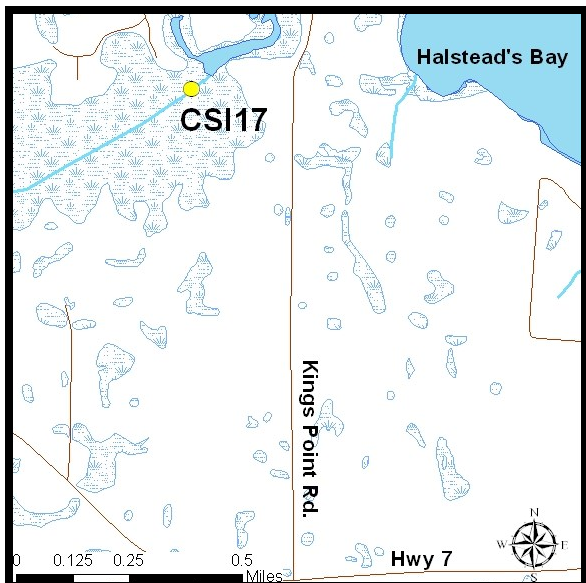
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	3.01	1057	179	59	10	12107	2.05	133	23		
2006	14.66	3325	115	237	8	26942	0.93	414	14		
2007	8.96	2581	146	241	14	42330	2.40	308	17		
2008	5.94	1841	157	157	13	24039	2.06	337	29	243	21
2009	3.78	998	134	81	11	12349	1.66	109	15	221	30
2010	7.36	2177	150	381	26	34077	2.35	192	13	536	37
2011	10.87	2531	118	288	13	43230	2.02	457	21	771	36
2012	5.81	2509	219	472	41	30926	2.70	490	43	388	34
2013	8.90	3697	211	575	33	25919	1.48	561	32	377	22
2014	17.29	4661	137	805	24	65894	1.94	598	18	972	29

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CS102

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	16.840	2.36	7.77	482	7.43	326	233	3.590	3	52
4/15/2014	25.600	3.68	13.93	381	8.19	100	<3			
4/22/2014	8.740	12.78	11.37	411	8.15	154	<3		23	
4/30/2014	102.060	5.21	10.24	389	7.77	127	3			
5/6/2014	54.390	12.47	13.93	404	8.21	134	3	2.240	40	32
5/13/2014	61.780	12.71	8.98	411	8.04	101	<3			
5/20/2014	63.110	13.87	10.03	410	8.02	117	<3		19	
5/28/2014	39.800	20.83	5.94	413	7.65	122	8			
6/3/2014	52.990	21.69	4.14	412	7.43	154	57	1.580	14	31
6/9/2014		20.99	4.59	398	7.44	92	40			
6/16/2014	53.650	20.32	6.80	392	7.65	106	4		24	
6/23/2014	72.160	24.45	6.90	354	7.59	163	58			
6/30/2014	63.800	24.04	4.53	364	7.61	155	42	1.750	16	26
7/7/2014	51.000	24.69	6.01	368		148	35			
7/11/2014									11	
7/15/2014	51.990	21.30	4.69	358		138	50		13	
7/22/2014	43.110	25.97	3.04	364	7.09	154	32			
7/29/2014	28.270	24.46	3.56	377	7.79	143	6	2.400	14	26
8/5/2014	13.850	25.29	0.97	365	7.36	184	36			
8/12/2014	11.030	24.12	2.65	355	7.48	151	3		11	
8/19/2014	14.880	25.92	2.78	353	7.38	131	4			
8/27/2014	7.890	23.01	1.19	413	8.29	138	3	2.190	7	28
9/3/2014						155	8		11	
9/3/2014	9.260	21.77	1.12	709	6.64	165	3			
9/9/2014	3.590	20.49	0.32	374	7.34	140	13		4	
9/16/2014	3.680	15.38	4.09	379		153	47			
9/23/2014	2.480	17.50	2.26	377	7.08	147	35	2.320	4	29
10/7/2014	1.460	9.99	5.38	404	7.81	132	51		11	

Blue Highlight = Flow calculated from rating curve.



Six Mile Creek: Lake Minnetonka: Halsted Bay Inlet (CSI17)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	18
Dissolved Oxygen (mg/L)	3
Total Suspended Solids (mg/L)	7
Total Phosphorus (µg/L)	153
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005											
2006											
2007											
2008											
2009											
2010											
2011											
2012											
2013	8.80	4105	237	1385	80	22171	1.280	289	17	350	20
2014	12.40	3780	155	1456	60	33747	1.382	153	6	588	24

Note: Revised means and loads for 2013

2014 Water Quality Data - CSI17

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/15/2014	24.91	3.01	9.53	405	7.49	101	<3			
4/22/2014	10.35	11.35	9.22	465	7.38	142	<3		19	
4/30/2014	24.62	4.39	8.61	378	7.77	143	7			
5/6/2014	27.94	10.61	7.00	427	7.58	100	<3	1.810	12	30
5/13/2014	31.25	11.97	7.55	407	7.75	82	<3			
5/19/2014						94			13	
5/20/2014	34.15	12.90	6.63	435	7.75	106	<3		13	
5/28/2014	34.15	19.84	1.83	435	7.29	111	29			
6/3/2014	41.20	20.30	2.42	382	7.26	157	78	1.180	7	28
6/9/2014	40.58	20.07	2.64	406	7.34	128	80			
6/16/2014	39.33	19.19	2.46	474	7.02	128	48		6	
6/23/2014	51.77	23.60	1.50	367	7.17	205	102			
6/30/2014	47.62	23.14	1.20	371	7.27	185	85	1.360	5	25
7/7/2014	41.61	23.23	1.27	384		186	86			
7/11/2014									5	
7/15/2014	39.23	21.36	1.37	380		144	84		3	
7/22/2014	34.46	24.49	0.38	378	7.22	185	77			
7/29/2014	28.64	23.09	0.57	422	6.97	165	54	1.930	4	25
8/5/2014	24.11	24.82	0.95	385	7.09	215	73			
8/12/2014	20.69	23.24	0.80	394	6.99	194	66		3	
8/19/2014	14.19	24.84	0.80	389	6.98	183	82			
8/27/2014	13.03	22.21	0.46	476	6.97	170	82	1.920	3	27
9/3/2014	11.58	21.25	0.32	389	7.83	226	88			
9/9/2014	9.92	20.77	0.87	405	6.98	158	76		5	
9/16/2014	6.82	15.39	1.00	511		163	106			
9/23/2014	3.57	17.56	0.14	624	6.31	163	120	1.960	2	28
10/7/2014	3.13	10.38	2.14	471	7.01	136	104		1	

Blue Highlight = Flow calculated from rating curve.

Six Mile Marsh Subwatershed - *E. coli* Concentrations

Date	CSI02
4/10/2014	13
4/17/2014	<1
4/24/2014	12
5/1/2014	10
5/8/2014	3
5/15/2014	6
5/22/2014	9
5/29/2014	11
6/5/2014	7
6/12/2014	13
6/18/2014	6
6/26/2014	8
7/2/2014	8
7/10/2014	4
7/17/2014	3
7/24/2014	5
7/31/2014	16
8/7/2014	41
8/14/2014	42
8/21/2014	86
8/28/2014	47
9/4/2014	50
9/11/2014	178
9/18/2014	291
9/25/2014	186
10/2/2014	88
10/9/2014	29

Duplicate samples that have been averaged are bolded

Six Mile Marsh Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey*	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Six Mile Ck: Piersons Lk Outlet	2013	None	None
Six Mile Ck: Wassermann Lk Inlet		None	None
Six Mile Ck: Wassermann Lk Outlet		None	None
Six Mile Ck: Turbid Lk Outlet		None	None
Six Mile Ck: Parley Lk Inlet (SOB Lk Outlet)		None	None
Six Mile Ck: East Auburn Lk Inlet		None	None
Six Mile Ck: Lundsten Lk North Inlet (West Auburn Lk Outlet)		None	None
Six Mile Ck: Lundsten Lk South Inlet		None	None
Six Mile Ck: Lundsten Lk North Outlet		None	None
Six Mile Ck: Parley Lk Inlet		None	None
Six Mile Ck: Parley Lk Inlet		None	None
Six Mile Ck: Mud Wetland Inlet		None	None
Six Mile Ck: Mud Wetland Outlet		None	None
Six Mile Ck: Lake Minnetonka: Halsted Bay Inlet	None	None	

* The Macroinvertebrate Survey Report is available on the district website at <http://minnehahacreek.org/project/stream-assessment-2013>



May 2015



Water Quality Technical Report 2014

Prepared by

**Minnehaha Creek Watershed District
Research and Monitoring Department: Water Quality Program**

**Water Quality Managers
Yvette Christianson and Kelly Dooley**

**Water Quality Technician
Kailey Kreatz**

**District Representative - Water Quality
Brianna Haugen, William Long, and Emily Sandell-Nelson**

**15320 Minnetonka Boulevard
Minnetonka, MN 55345
952-641-4535
www.minnehahacreek.org**

TABLE OF CONTENTS

Acronyms of Water Quality Terms	v
1. Introduction	1
2. Lake and Stream Monitoring Programs	1
2.1 Lakes Monitored By MCWD.....	1
2.2 Streams Monitored By MCWD.....	4
3. Water Quality Analyses.....	11
3.1 Quality Assurance/Quality Control Summary	11
3.2 Parameter Methods and Reporting Limits	12
3.3 Relative Percent Difference (RPD)	12
3.4 Lake Water Quality Analyses	13
3.5 Stream Water Quality Analyses	17
4. Precipitation and Groundwater Elevations	20
4.1 Precipitation throughout MCWD.....	20
4.2 Groundwater Elevations	22
5. References.....	26

Figures

A-1	Locations of <i>E. coli</i> Monitoring	7
A-2	Locations of Continuous Water Level Monitoring and Storm Water Sampling	9
A-3	Precipitation Monitoring Locations for MCWD	10
A-4	Comparison of Monthly 2014 Precipitation at MSP Airport and Chanhassen NOAA-NWS stations and the Long-term (1981-2010) Mean Precipitation.....	22
A-5	Groundwater Well Elevation for MnDNR Well: Mound (27043).....	23
A-6	Groundwater Well Elevation for MnDNR Well: Orono (27010)	24
A-7	Groundwater Well Elevation for MnDNR Well: St. Louis Park (27041)	24
A-8	Groundwater Well Elevation for MnDNR Well: Minneapolis (27036)	25
A-9	Groundwater Well Elevation for MnDNR Well: St. Bonifacius (27044)	25

Tables

A-1	Lake Minnetonka and Upper Watershed Monitoring Schedule.....	1
A-2	MCWD Monitoring Schedule for the Canoe Lakes and Volunteer Monitored Lakes.....	2
A-3	Links to Other Organizations Water Quality Monitoring Websites	2
A-4	2014 MCWD Monitored Lakes Elevation Summary	4
A-5	MCWD Monitoring Schedule for the Stream Sites	5
A-6	Minnehaha Creek <i>E. coli</i> Monitoring Sites.....	6
A-7	Upper Watershed <i>E. coli</i> Monitoring Sites	6
A-8	Continuous Water Level Monitoring and Stormwater Monitoring Sites	8
A-9	Precipitation Monitoring Locations in MCWD.....	10
A-10	North Central Hardwood Forest Ecoregion Water Quality Guidelines for Lakes	13
A-11	North Central Hardwood Forest Ecoregion and Site-Specific Eutrophication Standards for Shallow, Deep Lakes and Lake Hiawatha and Lake Nokomis	14
A-12	North Central Hardwood Forest Ecoregion Chloride Standard for Lakes	14
A-13	Water Quality Parameters Lake Grade Determination Ranges.....	15
A-14	MCWD Overall Lake Grade Determination Ranges	15
A-15	Lake Water Quality Grade Description	16
A-16	TSI Determination Table	16
A-17	Description of the Carlson's Trophic State Index	17
A-18	North Central Hardwood Forest Ecoregion Guidelines and Standard for Streams.....	18
A-19	Dissolved Oxygen Standard for Streams.....	18
A-20	North Central Hardwood Forest Ecoregion Chloride Standard for Streams	19
A-21	North Central Hardwood Forest Ecoregion <i>E. coli</i> Standard for Streams	19
A-22	2014 Monthly Precipitation (Inches) from Stations in and adjacent to MCWD.....	20
A-23	MCWD Precipitation Totals (Inches) Between January-June 2014	21
A-24	Long-term Groundwater Monitoring MnDNR Wells in MCWD.....	23

ACRONYMS OF WATER QUALITY TERMS

303 (d) List	Minnesota Pollution Control Agency List of Impaired Waters via the Clean Water Act
CAMP	Citizen Assisted Monitoring Program
CFS	cubic feet per seconds
CFU/100 mL	colony forming units per 100 milliliters
CPR	Citizen Precipitation Recorders
DO	dissolved oxygen
CHLA	chlorophyll- <i>a</i>
Cl	chloride
EPA	Environmental Protection Agency
GPS	Global Positioning System
lbs	pounds
LMCD	Lake Minnetonka Conservation District
MCES	Metropolitan Council Environmental Services
MCWD	Minnehaha Creek Watershed District
mg/L (ppm)	milligrams per liter, parts per million
µg/L (ppb)	micrograms per liter, parts per billion
µS/cm	micro Siemens per centimeter
MnDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
MPRB	Minneapolis Park and Recreation Board
MSP	Minneapolis – St Paul International Airport
NCHF	North Central Hardwood Forest (Ecoregion)
NOAA	National Oceanic and Atmospheric Administration
NOHW	normal ordinary high water (level)
NWS	National Weather Service
SECC	Secchi depth
SRP	soluble reactive phosphorus
TMDL	Total Maximum Daily Load
TN	total nitrogen
TP	total phosphorus
TRPD	Three Rivers Park District
TSI	Trophic Status Index
TSS	total suspended solid

1. INTRODUCTION

The Monitoring Program of Minnehaha Creek Watershed District (MCWD) is a cooperative effort with Minneapolis Park and Recreation Board (MPRB), Three Rivers Park District (TRPD), Lake Minnetonka Conservation District (LMCD), Metropolitan Council Environmental Services (MCES), Minnesota Pollution Control Agency (MPCA), and Minnesota Department of Natural Resources (MnDNR). The water quality data of the lakes and streams that was collected by the Monitoring Program and the partners in 2014 is presented in this Technical Appendix.

2. LAKE AND STREAM MONITORING PROGRAMS

2.1 Lakes Monitored By MCWD

Lakes within the MCWD are classified by the MPCA as Class 2B lakes meaning they are protected for aquatic life and recreation. MCWD water quality staff monitored 20 bays on Lake Minnetonka, 12 upper watershed lakes, and 16 canoe lakes in 2014. MCWD's Volunteer Monitoring Program recruited and trained volunteers to monitor an additional 14 lakes throughout the watershed. Monitoring schedules were determined prior to the open-water season (Tables A-1 and A-2).

Table A-1. Lake Minnetonka and Upper Watershed Monitoring Schedule

Parameter	Units	Winter	April	May-Sept	October
Chloride (Cl) (Surface and Bottom Samples)	mg/L	Once	Once	Once	Once
Chlorophyll- <i>a</i> (CHLA)	µg/L	Not Sampled	Once	Once	Once
Conductivity**	µS/cm	Once	Once	Once	Once
Dissolved Oxygen**	mg/L	Once	Once	Once	Once
pH**	--	Once	Once	Once	Once
Secchi Depth (SECC)	m	Once	Once	Once	Once
Temperature**	°C	Once	Once	Once	Once
Total Nitrogen (TN), Total Kjeldahl Nitrogen (TKN), Nitrate (NO ₃)	mg/L	Not Sampled	Once	Once	Once
Total Phosphorus (TP), Soluble Reactive Phosphorus (SRP) (Surface and Bottom samples)	µg/L	Not Sampled	Once	Once	Once
TSS	mg/L	Not Sampled	Once	Once	Once

** Lake Profile

Note: May-Sept Sampling does occur twice a month on Halsted and Jennings Bays

Table A-2. MCWD Monitoring Schedule for the Canoe Lakes and Volunteer Monitored Lakes

Parameter	Units	May-Sept
Cl	mg/L	Once a Month
CHLA	µg/L	Once a Month
Conductivity**	µS/cm	Once a Month
Dissolved Oxygen**	mg/L	Once a Month
pH**	--	Once a Month
Secchi Depth	m	Once a Month
Temperature**	°C	Once a Month
TN	mg/L	Once a Month
TP, SRP	µg/L	Once a Month
TSS*	mg/L	Once a Month

* Only on Shallow Lakes; ** Lake Profile

There are additional lakes within MCWD that are monitored by the Minneapolis Park and Recreation Board, Three Rivers Park District, and the Metropolitan Council Environmental Services’ the Citizen-Assisted lake Monitoring Program. Further information about the lake monitoring conducted by these organizations can be found on their websites (Table A-3).

Table A-3. Links to Other Organizations Water Quality Monitoring Websites

Organization	Link to Monitoring Report Webpage
Minneapolis Park and Recreation Board	https://www.minneapolisparcs.org/park_care__improvements/water_resources/lake_water_resources/
Three Rivers Park District	http://www.threeriversparcs.org/natural-resources/water-resources-management.aspx
Metropolitan Council Environmental Services	http://www.metrocouncil.org/Wastewater-Water/Services/Water-Quality-Management/Lake-Monitoring-Analysis.aspx?source=child

Lake Monitoring: Sampling consists of three major procedures: measuring a lake’s profile with YSI sonde, Secchi disk depth measurements, and water sample collection. MCWD staff use a GPS unit to locate the monitoring site at the deepest point in each lake. Volunteers locate the deepest point on their lakes by using three reference points. MCWD staff monitor the temperature, dissolved oxygen, pH, and specific conductivity at each lake site with a 6820-V2 YSI multi-parameter sonde. Readings are collected from the water surface to the bottom of the lake at one meter increments. Volunteers only measure temperature at the surface of each lake site with a Taylor digital hand-held thermometer.

Water samples were collected within the first two meters of the surface with a 2-meter composite sampling tube. A Van Dorn water sampler collected water samples one meter from the bottom of each lake site. Due to the long record of water quality data collected from the

bottom of the lakes, staff decided to place the future hypolimnion (lake bottom) data collection on a 2-year rotation. Hypolimnion water quality samples for phosphorus will be collected again in 2015. Grab water samples were collected within the first meter of the surface at all the canoe and volunteer monitored lake sites (Table A-2). Data collected for each lake is presented in their respective subwatershed report.

Lake Elevation Monitoring: Lake elevation was monitored on Lake Minnetonka in Grays Bay, just west of the Grays Bay Dam and at 19 lakes throughout MCWD. The lake elevations at the 19 lakes are read on a weekly basis via staff gauges from ice-out to ice-in. MCWD submits the data to the MnDNR. The Grays Bay Dam is operated by MCWD staff in accordance with the Headwaters Control Structure Management Policy and Operating Procedures and Minnesota Department of Natural Resources (DNR) Permit #76-6240. The operating plan was developed by MCWD and approved by local municipalities and the DNR.

The operating range for the control of discharges at the Grays Bay Dam is when the lake level is between 928.6 and 930.0. Elevation 928.6 marks the legal natural runout elevation for Lake Minnetonka, and elevation 930.0 is the crest of the 202-foot long fixed-elevation emergency spillway located north of the dam structure itself. The Dam discharge is reported on the MCWD's website (<http://minnehahacreek.org/data-center/faq-water-levels-lake-minnetonka-and-minnehaha-creek>).

Table A-4. 2014 MCWD Monitored Lake Elevation Summary

Subwatershed	Lake	Lake Elevation			Site Coordinates	
		Minimum (ft, NGVD 29)	OHW (ft, NVGD)	Maximum (ft, NGVD 29)	Latitude	Longitude
Christmas Lake	Christmas	930.98	932.77	932.85**	44.9012	-93.5488
Dutch Lake	Dutch	938.23	939.20	940.19	44.9432	-93.6713
Gleason Lake	Gleason	943.51	944.10	945.80	44.9856	-93.4912
	Snyder (Unnamed East)	968.51	972.30	971.39	45.0003	-93.5008
Lake Minnetonka	Galpin	942.01	943.14	944.54	44.8970	-93.5691
	Shaver	928.82	929.30	931.40	44.9446	-93.5123
Lake Virginia	Minnewashta	943.92	944.50	946.26	44.8859	-93.6164
	St. Joe	945.92	945.20	947.28	44.8755	-93.6209
	Tamarack	966.85	965.50	968.15	44.8749	-93.6371
Langdon Lake	Langdon	931.10	932.10	932.73	44.9329	-93.6697
	Saunders	944.78	944.30	946.72	44.9286	-93.6886
Long Lake Creek	Holy Name	992.89	993.70	994.52	45.0144	-93.5332
	Long	944.23	944.30	946.52	44.9870	-93.5506
	Lydiard	970.73	970.90	973.03	44.9920	-93.5367
Six Mile Marsh	Church	947.78	N/A	950.42	44.8561	-93.6656
	Parley	928.82	930.60	931.63	44.8789	-93.7360
	Kelser's	957.09	956.50	958.62	44.8565	-93.6741
	Lundsten N.*	N/A	N/A	938.45**	44.8737	-93.7200
	Stone	946.93	947.10	948.47	44.8920	-93.6799
	Wassermann	943.74	944.30	946.98	44.8462	-93.6771
	Zumbra*	N/A	943.30	944.86**	44.8801	-93.6629

Blue indicates the lake elevation for that lake exceeded the OHW in 2014

*No zero elevation was measured at the gage; ** Lake level recorded at a flagged location, not at the gage

OHW data available on MnDNR Lake Finder: <http://www.dnr.state.mn.us/lakefind/index.html>)

Note: GPS coordinates found using Google Maps

2.2 Streams Monitored By MCWD

Stream flow was measured and water quality samples were collected at 11 sites along Minnehaha Creek and at 36 sites on 12 tributaries to major streams in the upper watershed, draining to Lake Minnetonka. Sampling schedules were determined prior to the monitoring season (Table A-5).

Table A-5. MCWD Sampling Schedule for the Stream Sites

Parameter	Units	Winter	March - Nov
Cl	mg/L	2-3 Times	Once a Month
CHLA*	µg/L	Not Sampled	Weekly
Conductivity	µS/cm	2-3 Times	Weekly
Dissolved Oxygen	mg/L	Not Sampled	Weekly
<i>Escherichia Coli (E. coli)</i>	CFU/100 mL	Not Sampled	Weekly (April - Oct)
pH	--	Not Sampled	Weekly
Temperature	°C	2-3 Times	Weekly
TN	mg/L	Not Sampled	Once a Month
TP, SRP	µg/L	Not Sampled	Weekly
TDP**	µg/L	Not Sampled	Weekly
TSS	mg/L	Not Sampled	Twice a Month

*Only collected at CS102 and CS117 **Only collected at CMH06

Note: CMH06 collects Cl, TN, and TSS Weekly with other weekly parameters

Stream Monitoring: Stream discharge rates were measured using a SonTek Flow Tracker ADV (Acoustic Doppler Velocimeter). Water temperature, dissolved oxygen (DO), pH, and conductivity were measured using an YSI 556 multi probe meter. The DO measurements are discrete and do not take into account diurnal variation, and do not reflect the minimum daily DO concentrations (Table A-5). Data collected for each stream is presented in their respective subwatershed chapter.

***E. coli* Monitoring:** *E. coli* concentrations are indicators of the potential for human illness contracted through full body contact with surface water. A map and tables of the *E. coli* monitoring sites is presented in Figure A-1 and Tables A-6 and A-7. Water samples are collected and delivered to Three Rivers Parks District Laboratory for analysis.

Table A-6. Minnehaha Creek *E. coli* Monitoring Sites

Name	Site	Latitude	Longitude
Minnehaha Creek: Grays Bay Outflow	CMH07	44.9529	-93.4871
Minnehaha Creek: I-494 Ramp/Minnetonka Blvd	CMH19	44.9412	-93.4551
Minnehaha Creek: West 34th St	CMH02	44.9427	-93.3935
Minnehaha Creek: Excelsior Blvd	CMH11	44.9269	-93.3625
Minnehaha Creek: Browndale Dam	CMH03	44.9119	-93.3423
Minnehaha Creek: West 56th St	CMH04	44.9014	-93.3323
Minnehaha Creek: Xerxes Ave	CMH15	44.9053	-93.3186
Minnehaha Creek: 21st Ave	CMH24	44.9156	-93.2433
Minnehaha Creek: 28th Ave	CMH18	44.9178	-93.2326
Minnehaha Creek: Hiawatha Ave	CMH06	44.9147	-93.2134

Table A-7. Upper Watershed *E. coli* Monitoring Sites

Name	Site	Latitude	Longitude
Six Mile Creek: Highland Rd	CSI02	44.9010	-93.7343
Painter Creek: CR 110/Jennings Bay Inlet	CPA05	44.9619	-93.6644
Painter Creek: W Branch Rd	CPA01	44.9640	-93.6724
Painter Creek: Painter Marsh Outlet	CPA04	44.9749	-93.6870

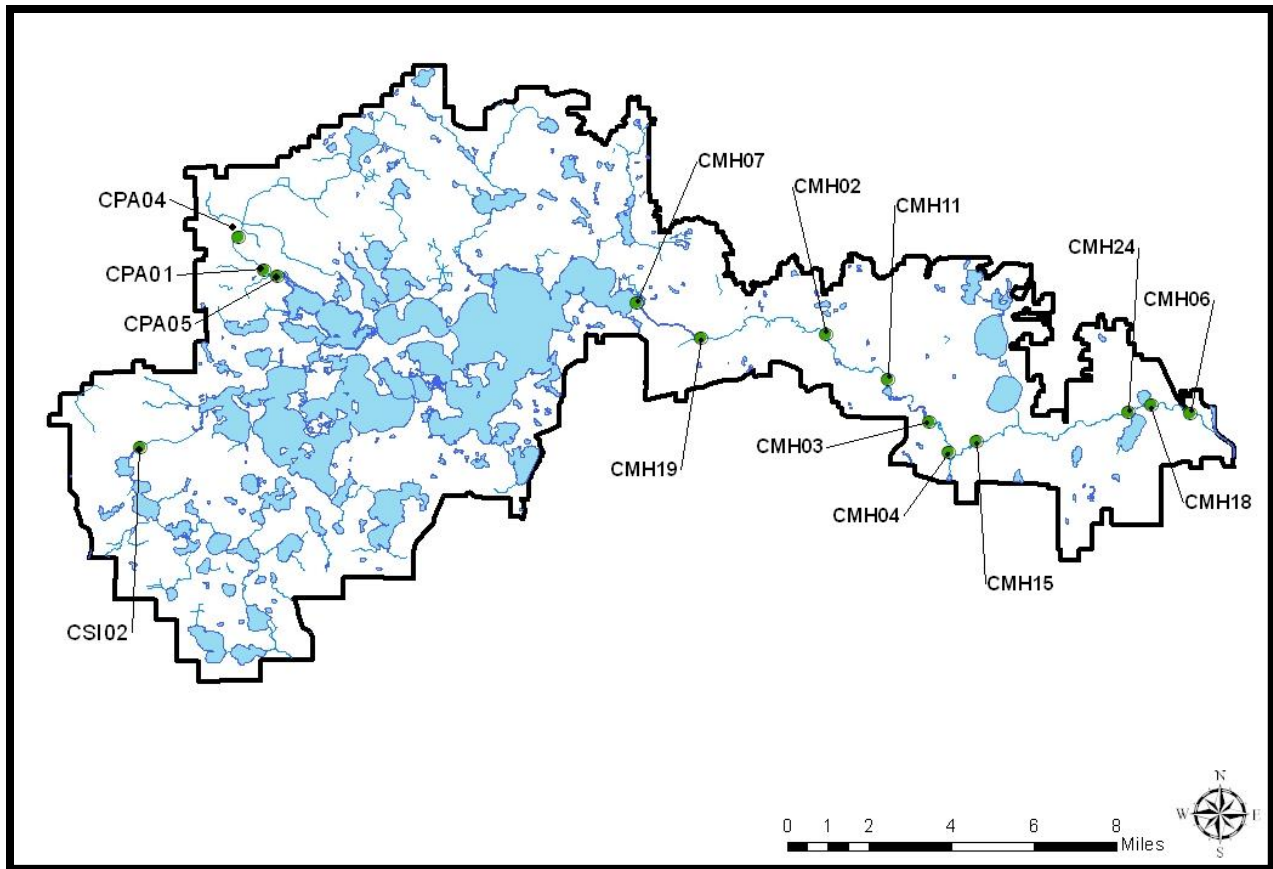


Figure A-1. Locations of *E. coli* Monitoring

Continuous Water Level Monitoring: Continuous water level monitoring, measured at 15 minute intervals by pressure transducers, was conducted at five sites on Minnehaha Creek (CMH07, CMH01, CMH19, CMH03, and CMH06), one site on Long Lake Creek (CLO01), three sites on Six Mile Creek (CSI08, CSI01, and CSI17), two sites on Painter Creek (CPA01 and CPA03), and an additional site at the Halsted’s boat landing. One site on Six Mile Creek (CSI02) was monitored using a SonTek IQ (velocity beams profiler) to measure flow and volume data. Pressure transducers were also setup on Sunny and Zumbra lakes.

Located under the Browndale Avenue Bridge in Edina, the Browndale Dam (CMH03) is roughly at the creek’s midpoint between Lake Minnetonka and the Mississippi River. The small impoundment created by the dam is referred to as Mill Pond. The dam is an ogee-crested weir, which offers a simple and reliable means for calculating stream discharge based on measured water surface elevations upstream of the dam. Two manual elevation readings were recorded weekly during the open water season.

Telemetry (remote data access uploaded to the MCWD office computer) instruments were used to access continuous water level data from 3 sites on Minnehaha Creek (Table A-8, Figure A-2). The collection began in April and May for the upper watershed streams and April for Minnehaha Creek with 2 locations beginning in June. The equipment was stopped and brought

in house October and November 2014. Continuous water level data for the streams is available upon request.

Stormwater Monitoring: Stormwater monitoring equipment was operational at the I-494 (CMH19) and Browndale Dam (CMH03) sites on Minnehaha Creek and at the Highland Rd (CSI02) and Kings Point Rd (CSI17) sites on Six Mile Creek (Table A-8, Figure A-2). Samples were collected for one storm event at the I-494 location. Samples were collected for two storm events at CSI17 on May 19, 2014 and July 11, 2014, and once at CSI02 on July 11, 2014. Due to high water and wave height, the Browndale Dam site had difficulty measuring the water level and initiated false triggering of the equipment much of the 2014 season. The data will be used for defining loads, tracking trends, and modeling for TMDLs for Minnehaha Creek and Mississippi River.

United States Geological Survey (USGS) Continuous Flow Gauging Station: In 2005, MCWD in partnership with the USGS initiated the gauging station project at the Hiawatha Ave stream monitoring site (CMH06). In response to the creek’s chloride impairment, a conductivity and temperature probe were installed in 2010 to collect continuous fifteen minute data (real-time) year-round. In 2012, a stormwater sampler was installed to collect data that will be used for defining loads, tracking trends, and modeling for TMDLs for Minnehaha Creek and Mississippi River (Table A-8, Figure A-2). The continuous water level data is available upon request.

Table A-8. Continuous Water Level Monitoring and Stormwater Monitoring Sites

Name	Site	Latitude	Longitude
Minnehaha Creek: Grays Bay Outflow	CMH07	44.9529	-93.4871
Minnehaha Creek: McGinty Road/Minnetonka Blvd	CMH01	44.9409	-93.4582
Minnehaha Creek: I-494 Ramp/Minnetonka Blvd	CMH19	44.9412	-93.4551
Minnehaha Creek: Browndale Dam	CMH03	44.9119	-93.3423
Minnehaha Creek: Hiawatha Ave (USGS Station)	CMH06	44.9147	-93.2134
Six Mile Creek: Lundsten Lake Outlet	CSI01	44.8733	-93.7207
Six Mile Creek: Highland Rd	CSI02	44.9010	-93.7343
Six Mile Creek: Parley Inlet	CSI08	44.8747	-93.7339
Six Mile Creek: Kings Pt Rd	CSI17	44.9075	-93.7051
Six Mile Creek: Sunny (Zumbra-Sunny Lake)	N/A	44.8798	-93.6736
Six Mile Creek: Zumbra (Zumbra-Sunny Lake)	N/A	44.8799	-93.6735
Halsted Bay: Boat Landing	N/A	44.9165	-93.7029
Painter Creek: W. Branch Rd	CPA01	44.9640	-93.6724
Painter Creek: Deborah Dr	CPA03	44.9918	-93.6436
Long Lake Creek: Outlet	CLO01	44.9850	-93.5606

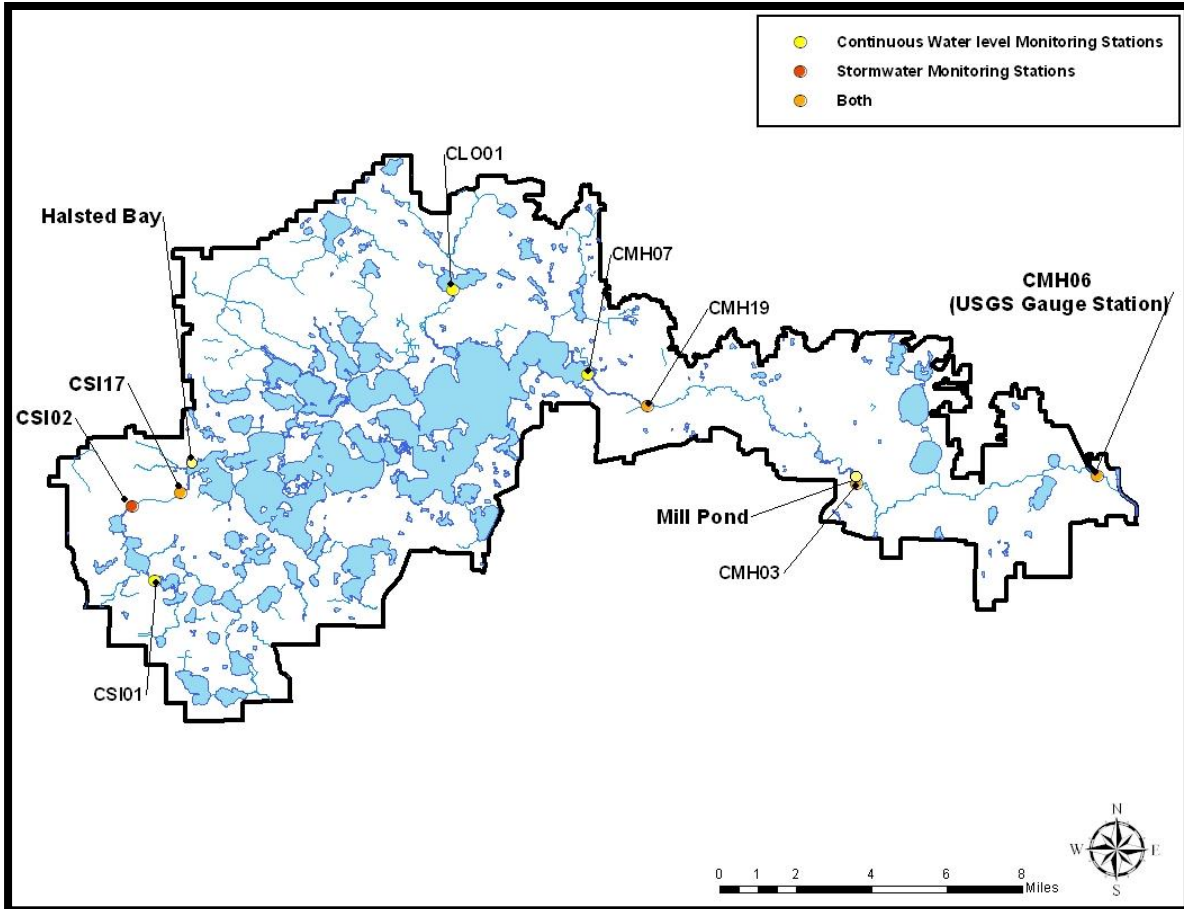


Figure A-2. Locations of Continuous Water Level Monitoring and Storm Water Monitoring Sites

Precipitation Monitoring: MCWD maintained and operated tipping bucket precipitation gauging stations at seven locations in and near the District (Table A-9, Figure A-3). The Deephaven location was dismantled in May 2014. Water quality staff downloads the precipitation data on a weekly basis and performs the required maintenance of precipitation gauges to ensure accurate data collection. There are currently three Citizen Precipitation Recorders partnering with the MCWD (Figure A-3). The Precipitation Recorders monitor daily and the data is submitted to MCWD on a monthly basis. This data is also submitted to the Minnesota Climatology Working Group.

Table A-9. Precipitation Monitoring Locations in MCWD

Name	Location	Site	Latitude	Longitude
Carver Park (MCWD)	TRPD Maintenance Garage	PCA01	44.8721	-93.6928
Chanhassen (NOAA)	NOAA	PCN02	44.8541	-93.5741
Deephaven (MCWD)	18202 Minnetonka Blvd Office	PDH01	44.9422	-93.5146
Long Lake (MCWD)	Long Lk City Public Works Bldg	PLO01	44.9869	-93.5755
Maple Plain (MCWD)	Wenck Office	PME02	45.0113	-93.6690
MSP Airport	MSP Airport	PMP03	44.0740	-93.2218
Minneapolis (MCWD)	Burrough Elementary School	PMP06	44.9116	-93.3004
Minnetonka (MCWD)	City of Minnetonka Public Works	PMA01	44.9471	-93.4273
Shorewood (MCWD)	Former MCWD staff's Home	PSW01	44.9014	-93.6020
Shorewood (CPR)	Shorewood	PSW02	44.9176	-93.5514
Hamel (CPR)	Hamel	PHM01	45.0378	-93.5165
Minneapolis (CPR)	Minneapolis	PMP04	44.9226	-93.2469

Note: (CPR) Citizen Precipitation Recorder; (NOAA) National Oceanic and Atmospheric Administration

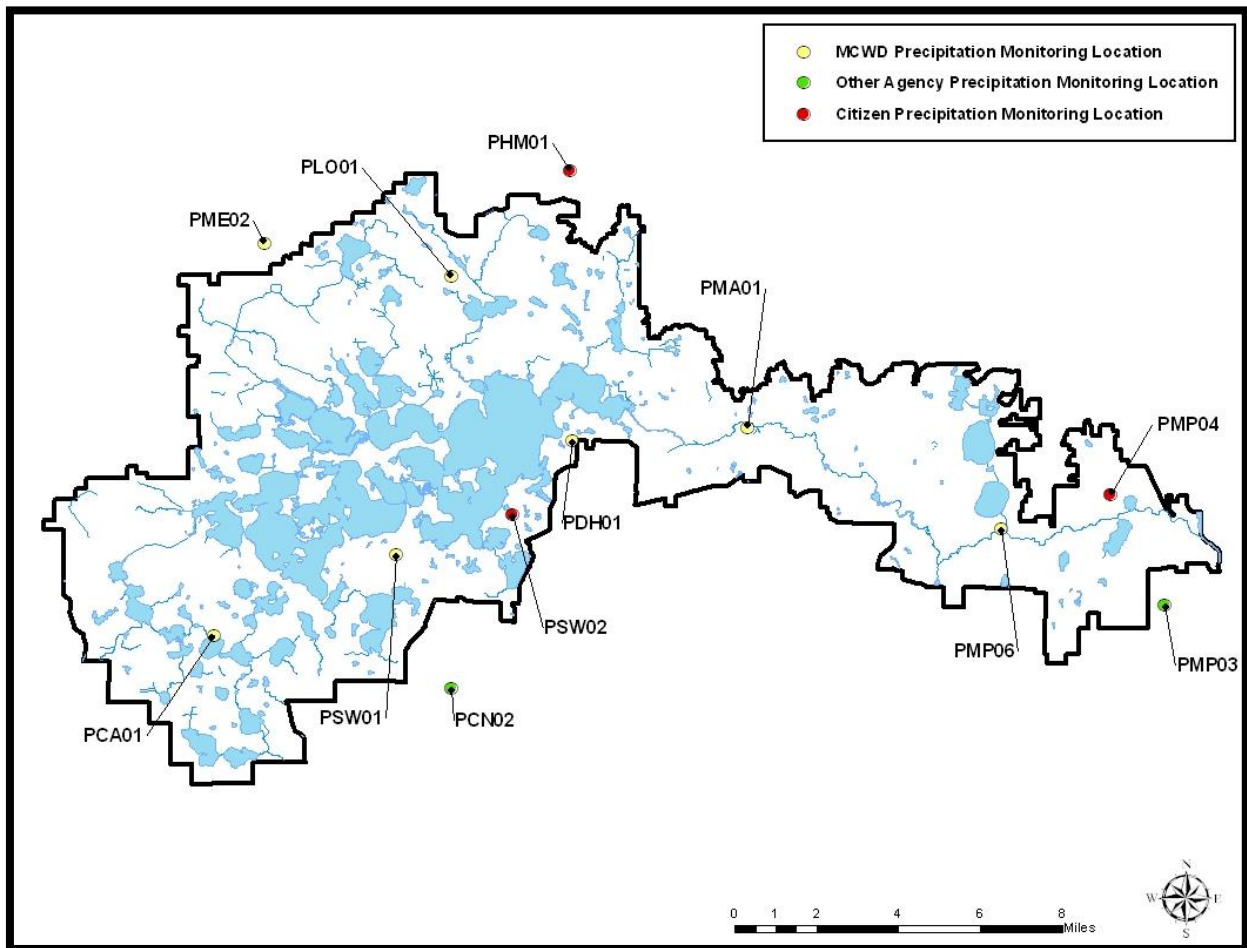


Figure A-3. Precipitation Monitoring Locations for MCWD

3. WATER QUALITY ANALYSES

3.1 Quality Assurance and Quality Control Summary

Sample Type	Description	Function	Frequency
Quality Assurance			
Equipment Blank	Reagent-grade deionized water subject to sample collection, processing, and analysis	Used in estimating background due to sampling collection, processing, and analysis	10% of sampling trips*
Bottle Blank	Reagent-grade deionized water subject to sample processing and analysis	Used in estimating background due to sample processing and analysis	Every sampling trip
Field Duplicate	Duplicate of samples	Used in estimating overall within-batch precision	Every sampling trip or 1 per 10 samples)
Laboratory Audit	Synthetic sample of natural lake or stream	Used in estimating overall within-batch precision	Alternate sampling trips
Blind Standard	Standard solution with fictitious site I.D.	Estimates batch precision	Every sampling trip
Quality Control			
Calibration Blank	Reagent-grade deionized water	Used in identifying signal drift and contamination of samples	One/lab batch
Reagent Blank	Reagent-grade deionized water plus reagents	Used in identifying contamination of reagents	One/lab batch (10% of samples)
Quality Control	Standard solution from source other than calibration standard	Used in determining accuracy and consistency of instrument calibration	One/lab batch
Split Samples	Split of lake sample	Used in determining comparability	2 times per year
Laboratory Duplicate	Split of sample aliquot	Used in determining analytical within-batch precision of analytical lab measurements	One/lab batch (10% of samples)
Matrix Spike/Matrix Spike Duplicate	Known spike of sample	Used in determining percent recovery of parameter analyzed	One/lab batch (10% of samples)

*Sampling trip is defined as a sampling cycle, or one cycle of stream samples or lake samples, and not just one day's sampling

3.2 Parameter Methods and Reporting Limits

Parameter	Method	Reporting Limit
Chloride	SM 4500-CL E-1997	1.0 mg/L
Chlorophyll-a	SM 10200 H-2001	1 µg/L
Conductivity	YSI Multiparameter Sonde (Streams: 556, Lakes: 6820V2)	1 µS/cm
Dissolved Oxygen	YSI Multiparameter Sonde (Streams: 556, Lakes: 6820V2)	0.01 mg/L
<i>Escherichia Coli</i>	EPA 9223B	
Nitrate + Nitrite by Flow Injection	EPA 353.2 Rev 2.0 1993	0.03 mg/L
pH	YSI Multiparameter Sonde (Streams: 556, Lakes: 6820V2)	0.01 units
Soluble Reactive Phosphorus	EPA 365.3 (Issued 1978)	0.003 mg/L
Temperature	YSI Multiparameter Sonde (Streams: 556, Lakes: 6820V2)	0.01 °C
Total Coliform	EPA 9223B	
Total Dissolved Phosphorus	EPA 365.3 (Issued 1978)	0.003 mg/L
Total Kjeldahl Nitrogen	EPA 351.2 Rev 2.0 1993	0.04 mg/L
Total Nitrogen	Calculation of TKN + NO ₃	0.32-0.52 mg/L
Total Phosphorus	EPA 365.3 (Issued 1978)	0.003 mg/L
Total Suspended Solids	SM 2540 D - 1997	1 mg/L
Transparency	Secchi disk depth measurement	0.1 m

Note: MCWD staff followed the sampling procedures, sample preservation, and the holding time procedures described in Standard Operation Procedures (MPCA, 2010), Standard Methods (2005), and the US Environmental Protection Agency (US EPA, 1979 (revised 1983)). All lake and stream water samples were placed on ice in a cooler and stored at approximately 4°C after collection. Samples are then shipped to the contract laboratory for analysis within 48 hours of collection. The contract laboratory that analyzed the water samples for chemical analysis in 2014 was RMB Environmental Laboratories, Inc.

3.3 Relative Percent Difference (RPD)

In accordance with quality assurance guidelines, a duplicate sample is taken for every 10 regular samples. Duplicate samples measure the precision of sampling procedures and lab equipment. To measure the precision between two samples we calculate the Relative Percent Difference (RPD). It is calculated by taking the difference of the sample and the duplicate divided by the average of the two samples.

$$RPD = \frac{|a - b|}{(a + b)/2} * 100$$

The data point is flagged if the RPD is greater than a certain percentage depending on the reporting limit of the parameter and the average of the samples. If the sample average is

greater than 20 times the reporting limit for a parameter, the max RPD is 10%. If the average is less than 20 times the reporting limit, the max RPD is 25%. This reduces the number of flagged samples for smaller values that would be unreasonably flagged. For *E. coli* calculations, the log of the samples is used due to the variability of bacterial sampling.

3.4 Lake Water Quality Analyses

Data Clean-up: The lake data is thoroughly reviewed for any errors before the analysis begins. All duplicate samples are run through the RPD analysis to determine precision. Duplicate samples are flagged to note if they were out of range. Then all duplicate samples are averaged. Any sample that is less than the reporting limit is assumed to be zero for the analysis.

Ecoregion Guidelines and Water Quality Standards for Lakes: The Minnesota Pollution Control Agency (MPCA) has determined that lakes have unique physical and chemical properties depending on where they are located in the state. Lakes within the MCWD reside within the North Central Hardwood Forest Ecoregion (NCHF). This is the transitional area in central Minnesota where the southeastern agricultural area meets the northeastern forested area. This ecoregion is comprised of upland wooded areas, as well as small plains that are used for agriculture. Much of this area has been developed for residential, recreational, urban and agricultural land use. The MPCA provides guidelines based on median water quality data that is characteristic for the lakes within the NCHF ecoregion (Table A-10).

Table A-10. North Central Hardwood Forest Ecoregion Water Quality Guidelines for Lakes

North Central Hardwood Forest Ecoregion	Water Quality Guidelines (25 th – 75 th percentile)
Secchi Depth (m)	1.5 - 3.2
Chlorophyll- <i>a</i> (µg/L)	5 - 22
Total Phosphorus (µg/L)	23 - 50
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2
NO _x (mg/L)	< 0.01
Total Suspended Solids (TSS) (mg/L)	2 - 6
pH	8.6 - 8.8

Ecoregion water quality standards are used for assessing the recreational use of lakes in Minnesota. The data used for determining impairment must be collected from eight or more monitoring events over two consecutive years. If a lake fails to meet two or more of the water quality standards over the two consecutive years, then the MPCA considers listing the lake as impaired for nutrient/eutrophication biological indicators. Different water quality standards have been established for shallow and deep lakes. Shallow lakes are defined as having a maximum depth less than 15 feet and a littoral zone less than 80 percent. The NCHF ecoregion

water quality standards are based on phosphorus, chlorophyll-*a*, and Secchi disc depth observations between June through September (MPCA, 2014) (Table A-11).

Table A-11. North Central Hardwood Forest Ecoregion and Site-Specific Eutrophication Standards for Shallow, Deep Lakes and Lake Hiawatha and Lake Nokomis

North Central Hardwood Forest Ecoregion	Water Quality State Standards (June-Sept Mean)				
	Units	Shallow Lakes	Deep Lakes	Lake Hiawatha	Lake Nokomis
Secchi Depth (SECC)	m	> 1.0	> 1.4	> 1.4	> 1.4
Chlorophyll- <i>a</i> (CHLA)	µg/L	< 20	< 14	< 14	< 20
Total Phosphorus (TP)	µg/L	< 60	< 40	< 50	< 50

Chloride Standard for Lakes: For lakes to be listed as impaired for chloride, the chloride concentrations at the surface or bottom of the lake must exceed the chronic or the acute chloride standard (Table A-12).

Table A-12. North Central Hardwood Forest Ecoregion Chloride Standard for Lakes

North Central Hardwood Forest Ecoregion	Chloride Standard	
	Chronic	Acute
	Impaired: 2 or more exceedances in 3 years	Impaired: 1 or more exceedances of the max standard
Chloride (Cl)	230 mg/L	860 mg/L

Lake Water Quality Grades: MCWD reports lake water quality grades using the Metropolitan Council’s grading system (Osgood, 1989). For each lake, seasonal means are computed for each of the three parameters (surface TP concentration, surface CHLA concentrations, and SECC measurements from data collected from five or more monitoring events between May through September. MCWD then compares these averages to the ranges created from the Metropolitan Council’s grading curves. Each water quality parameter for a lake is assigned a letter grade (Table A-13). MCWD then averages these three grades by converting each to a numerical equivalent of the following: A to 5, B to 4, C to 3, D to 2, and F to 1. The numerical values for each parameter are then averaged to determine an overall letter grade for a lake based on grade ranges in Table A-14.

Table A-13. Water Quality Parameters Lake Grade Determination Ranges

Grade	Total Phosphorus (µg/L)	Grade	Chlorophyll- <i>a</i> (µg/L)	Grade	Secchi Depth (m)
A	< 23	A	< 10	A	> 3
B	23 - 32	B	10-20	B	3.0 - 2.2
C	32 - 68	C	20 - 48	C	2.2 - 1.2
D	68 - 152	D	48 - 77	D	1.2 - 0.7
F	> 152	F	> 77	F	< 0.7

Table A-14. MCWD Overall Lake Grade Determination Ranges

Overall Grade	Numerical Ranges
A	4.667 - 5.000
A-	4.334 - 4.666
B+	4.001 - 4.333
B	3.667 - 4.000
B-	3.334 - 3.666
C+	3.001 - 3.333
C	2.667 - 3.000
C-	2.334 - 2.666
D+	2.001 - 2.333
D	1.667 - 2.000
D-	1.334 - 1.666
F	Below 1.333

For example a water body receives an A grade for total phosphorus, a B grade for chlorophyll-*a*, and a B grade for Secchi depth. The numerical total of these three grades would be (5 + 4 + 4) equaling 13. The average for the three grades would be 4.333, which would translate into a B+ for the overall lake water quality grade for the lake. The lake water quality grades are an indicator of the perceived condition of the open water and are considered average for lakes in a seven-county metro area (Osgood, 1989). An interpretation of the water quality for each letter grade is in Table A-15.

Table A-15. Lake Water Quality Grade Description

Grade	Relative Ranking	Description
A	90% and up	Crystal clear, beautiful. These lakes are exceptional and are enjoyed recreationally without question or hesitation.
B	70 - 90%	These lakes generally have good water quality but algae may limit swimming, particularly toward the end of summer.
C	30 -70%	Average quality. Swimming, boating and fishing may be undesirable relatively early in the season. Algae blooms occasionally.
D	10 - 30%	These lakes have severe algae problems. People are generally not interested in recreation on these lakes.
F	Lowest 10%	Not enjoyable. Such a lake would have several limitations to recreational use.
N/A		Insufficient data to calculate a lake grade (Either < 5 monitoring events and/or the Secchi disk was visible at the bottom of the lake and/or obstructed by vegetation during more than one monitoring event).

Trophic State Index: Carlson’s Trophic State Index (TSI), which measures the productivity level of a lake or trophic state, is calculated from seasonal averages of the same three parameters as used by the Metropolitan Council’s grading system. The seasonal means for the TSI are calculated from the data collected from at least four monitoring events between June through September, and are then used to determine three individual component index numbers: TSIP (phosphorus), TSIC (chlorophyll-*a*), and TSIS (Secchi depth). Each of the component index numbers range from 0 to 100, and are then averaged to determine an overall TSI score (Table A-16) (Carlson, R.E., 1977).

Table A-16. TSI Determination Table

Component	Parameter	Equation
TSIP	Total Phosphorus (µg/L)	$(14.42 * (\ln(TP))) + 4.15$
TSIC	Chlorophyll- <i>a</i> (µg/L)	$(9.81 * (\ln(Chl-a))) + 30.6$
TSIS	Secchi Disc Depth (m)	$60 - (14.41 * (\ln(\text{Secchi})))$
Overall TSI	Mean average of three individual parameters	

If there is an insufficient number of monitoring events for any of the individual component index numbers than no average is calculated. If this occurs, a TSI score can still be calculated with two of the three individual component index numbers. Lakes, to be classified as swimmable in the seven-county metro area, need to have a TSI score less than or equal to 59.

An explanation of the productivity level for a range of TSI scores is in Table A-17 (Moore and Thornton, 1998).

Table A-17. Description of the Carlson’s Trophic State Index

Trophic State	TSI	Description
Oligotrophic	< 30	Clear water, oxygen throughout the year in the hypolimnion. Salmonid fisheries in deep lakes.
	30 - 40	Deeper lakes still exhibit oligotrophic characteristics, but some shallower lakes will become anoxic in the hypolimnion during the summer
Mesotrophic	40 - 50	Water moderately clear, but increasing probability of anoxia in hypolimnion
Eutrophic	50 - 60	Decreased transparency, anoxic hypolimnia during the summer, macrophyte problems evidence, warm-water fisheries only
	60 - 70	Dominance of blue-green algae, algal scum probable, extensive macrophyte problems
Hypereutrophic	70 - 80	Heavy algal blooms possible throughout the summer, dense macrophyte beds, but extent limited by light penetration.
	> 80	Algal scum, summer fish kills, few macrophytes, dominance of rough fish

Long-term Trend Analysis: MCWD is interested in the long-term trends of Secchi depth (water clarity), chlorophyll-*a* concentrations (estimation of algal abundance) and total phosphorus concentrations (nutrient that affects algal growth). To calculate long-term trendlines on the water quality data in any lake, eight to ten consecutive years of data is needed due to climate pattern impacts on the water quality in a lake. The trendline need to be statistically analyzed to determine if the trend is significant. Trendlines without statistical support can be misleading. Statistical analysis of long-term trends for the lakes can be found here - <http://minnehahacreek.org/project/lake-data-statistical-analysis>.

3.5 Stream Water Quality Analyses

Data Clean-up: The stream data is thoroughly reviewed for any errors before the analysis begins. All duplicate samples are run through the RPD analysis to determine precision. Duplicate samples are flagged to note if they were out of range. Then all duplicate samples are averaged. Any sample that is less than the reporting limit is assumed to be zero for further analysis.

Ecoregion Water Quality Standards for Streams: The MPCA collected and summarized water quality data from minimally impacted streams within Minnesota’s seven ecoregions (McCollor and Heiskary, 1993). These data may be used to establish water quality guidelines on ecoregion basis. NCHF ecoregion median data are compared to data collected in MCWD streams. Stream

data is also compared to dissolved oxygen standard developed by the MPCA (MPCA 2014) (Table A-18).

Table A-18. North Central Hardwood Forest Ecoregion Guidelines and Standard for Streams

North Central Hardwood Forest Ecoregion	Water Quality Stream Guidelines (25 th -75 th percentile)	Dissolved Oxygen Standard
		Streams
Temperature (Temp)	2 – 21°C	
Dissolved Oxygen (DO)	N/A	> 5 mg/L
NOx	0.04 – 0.26 mg/L	
Total Suspended Solids (TSS)	4.8 – 16 mg/L	
Total Phosphorus (TP)	60 – 150 µg/L	
pH	7.9 - 8.3	

Dissolved Oxygen Data Analysis: To determine if a stream is able to support aquatic life, at least 20 dissolved oxygen (DO) readings from at least two years in a row is needed. Then from that data set, the standard has to be violated under the following criteria: (1a) more than 10% of the readings collected before 9:00 am May through September or (1b) more than 10% of the total readings from May through September or (1c) more than 10 % of the readings from October through April; and 2) there are at least three violations (Table A-19). MCWD uses the criteria (1b) and (2) to evaluate the DO readings in the streams. Two factors effect DO levels in the watershed district’s streams: intermittent flow and stream stretches classified as ditched. Intermittent streams tend to cease flow occasionally or seasonally. Low flow and/or no water negatively effects DO levels. The MPCA considers ditched streams as streams altered from their natural state, and will evaluate listing these stream sites for DO impairment on a case-by-case basis.

Table A-19. Dissolved Oxygen Standard for Streams

DO Standards	
Dissolved Oxygen (DO)	> 5 mg/L

Chloride Standard for Streams: In streams, chronic exceedances of chloride occurs over a four-day average while acute exceedances of chloride occur over a one-hour duration. The criteria for streams to be evaluated for impairment is found in Table A-20.

Table A-20. North Central Hardwood Forest Ecoregion Chloride Standard for Streams

North Central Hardwood Forest Ecoregion	Chloride Standard	
	Chronic	Acute
	Impaired: 2 or more exceedances in 3 year periods	Impaired: 1 or more exceedances of the maximum standard
Chloride (Cl)	230 mg/L	860 mg/L

Minnehaha Creek Discharge Calculations: Discharge for Grays Bay Dam is calculated by taking into account the month, the lake level, and the stream capacity and applying this information to a discharge formula created by the United States Army Corp of Engineers (USACE). Discharge at Browndale Dam was calculated using automated water surface elevation data collected during the monitoring period and manual readings. Linear interpolation was used to calculate flow between ice out and the first recorded water level of the current year.

Upper Watershed Streams Discharge Calculations: Discharge over the subwatersheds tributary to Lake Minnetonka is calculated in two ways: flow records are developed from continuous stage recorders and stage-discharge relationships, and flow records are developed from weekly manual measurements and stage-discharge relationships. At sites along Painter Creek, Long Lake Creek, and Six Mile Creek, both continuous and weekly measurements are collected; generally, the continuous readings offer a more complete picture of the runoff from a subwatershed.

***E. coli* Data Analysis:** To make a determination of *E. coli* standard violation a minimum of five values per month for at least 3 months between June and September is preferred. The criteria for the *E. coli* standard is shown in Table 6. MCWD uses the acute criteria for determining violation of the *E. coli* standard. The chronic criteria requires five samples within in a month, due to the intermittent streams, staff cannot always meet the sampling requirement (Table A-21).

Table A-21. North Central Hardwood Forest Ecoregion *E. coli* Standard for Streams

North Central Hardwood Forest Ecoregion	Chronic	Acute
	Impaired: Geometric mean of not less than 5 samples within any calendar month	Impaired: Not more than 10% of all samples taken during any calendar month individually exceed
<i>E. coli</i>	126 cfu/100 mL	1,260 cfu/100 mL

4. PRECIPITATION AND GROUNDWATER LEVELS

4.1 Precipitation throughout MCWD

Monthly precipitation data collected by MCWD, MCWD's Citizen Precipitation Recorders (CPR), the Minneapolis-St. Paul (MSP) Airport, and the National Oceanic and Atmospheric Administration in Chanhassen is presented in Table A-22.

Table A-22. 2014 Monthly Precipitation (Inches) from Stations in and adjacent to MCWD

Month/ Monitor	Upper Watershed									Lower Watershed		
	Carver Park	Chan- hassen	Deep- haven	Hamel	Maple Plain	Mntka	Long Lake	Shorewood		Mpls		
	MCWD	NOAA- NWS	MCWD	CPR	MCWD	MCWD	MCWD	MCWD	CPR	MCWD	CPR	MSP Airport
Jan	0.40	1.32	0.35	0.99	0.41	0.83	0.27	0.54	Trace	0.51		1.42
Feb	0.44	1.59	0.32	0.97	0.78	0.46	0.28	0.77	0.50	0.69		1.41
March	0.84	0.69	0.47	0.74	1.12	0.52	0.63	0.60	0.51	0.44		0.82
April	6.84	7.05	6.73	6.37	6.71	6.52	5.88	6.37	6.11	5.02	6.94	6.27
May	7.76	5.25	1.97	8.13	7.93	5.62	6.45	5.92	4.22	4.14	4.23	4.55
June	9.70	10.42		6.90	7.88	10.53	7.50	9.02	11.33	7.73	10.64	11.36
July	3.31	3.33		3.17	2.70	2.07	2.90	2.62	2.89	1.22	1.00	2.27
Aug	3.60	2.86		3.93	3.08	1.50	3.56	3.64	2.80	0.59	3.06	2.90
Sept	1.05	1.15		1.91	1.53	0.27	1.48	1.61	2.03	0.13	1.57	0.92
Oct	0.86	1.07		0.84	0.71	0.41	0.78	0.87	0.75	1.38	1.71	1.75
Nov	0.44	0.73		1.42	0.59	0.42	0.40	0.40	0.13	0.54	0.93	0.87
Dec	0.75	0.97		0.75	0.66	0.40	0.57	0.52	0.82	0.52	0.85	0.86
Subtotal								32.88	32.09	22.91	30.93	35.40
Total	35.99	36.43	9.84	36.12	34.10	29.55	30.70	32.49		29.75		

Note: Deephaven site dismantled Mid-May 2014; Shorewood MCWD station had incomplete data in June 2014 due to equipment failure

Precipitation patterns during the first four months of 2014 were dominated by a heavy winter snow pack, which did not begin to melt until April. The month of April was also coupled with rain that fell consistently until June 19th, when a large rain event occurred (Table A-23).

Table A-23: MCWD Precipitation Totals (Inches) Between January-June 2014

Location	MCWD Station ID	2014			2013	2011
		June 19	June 14 - 19	Jan 1 - June 30	Jan 1 - June 30	Jan 1 - June 30
Carver Park	PCA01	4.87	7.13	25.98	18.21	10.54
Long Lake	PLO01	3.07	5.32	21.01	12.26	9.11
Maple Plain	PME02	2.93	4.51	24.83	17.17	8.66
Minneapolis	PMP06	2.17	4.44	18.53	17.37	14.58
Minnetonka	PMA01	4.70	7.63	24.48	14.58	9.98
Shorewood	PSW01	3.86	6.24	23.22	12.40	9.48

Total rainfall varied across the watershed, with higher precipitation occurring in the upper watershed and less precipitation downstream along Minnehaha Creek (Table A-22). Not only did the upper watershed receive more precipitation during the first six months of 2014, but it also received more rainfall between June 14 - 19th (Table A-23). The precipitation events in June led to record water levels throughout MCWD resulting in damage throughout much of the watershed.

The heavy precipitation events were not isolated to MCWD boundary in 2014. The MSP airport station had 15.6% more precipitation in 2014 than the long-term (1981-2010) annual mean precipitation of 30.61 inches. The Chanhassen NOAA-NWS station had 19% more precipitation in 2014 than the long-term annual mean precipitation. The highest rainfall at both stations also occurred in the month of June (Figure 4).

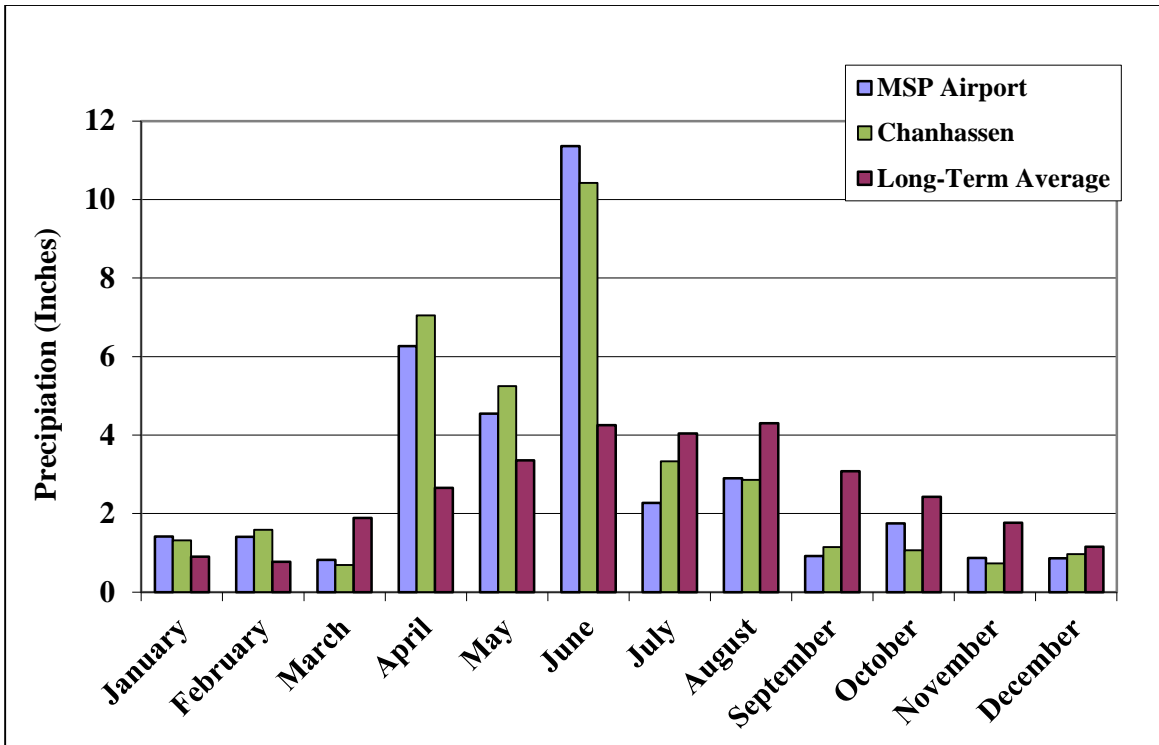


Figure A-4. Comparison of Monthly 2014 Precipitation at MSP and Chanhassen NOAA-NWS stations and the Long-term (1981-2010) Mean Precipitation

4.2 Groundwater Elevations

The Prairie du Chien-Jordan formations serve as major sources of municipal water in the western suburbs and as a major industrial water source in Minneapolis. The MnDNR has monitored groundwater elevations at six deep wells within the watershed. The wells are located in the following cities: Golden Valley, Mound, St. Louis Park, Minneapolis, St. Bonifacius, and Orono (Table A-25). The Golden Valley well was discontinued in May 2009. The data from the remaining five wells are shown in Figures A-5 - A-9.

Table A-24. Long-term Groundwater Monitoring MnDNR Wells in MCWD

MnDNR Well Number	Subwatershed	Location	Ground Elevation (AMSL)	Years Monitored*
27043	Lake Minnetonka	Mound	957 ft	1985-2014
27010	Lake Minnetonka	Orono	931 ft	1945-1952, 2000-2014
27012	Minnehaha Creek	Golden Valley	890 ft	1971-2009
27041	Minnehaha Creek	St. Louis Park	917 ft	1980-2014
27036	Minnehaha Creek	Minneapolis	830 ft	1979-2014
27044	Six Mile Marsh	St. Bonifacius	950 ft	1991-2014

*Not always continuous

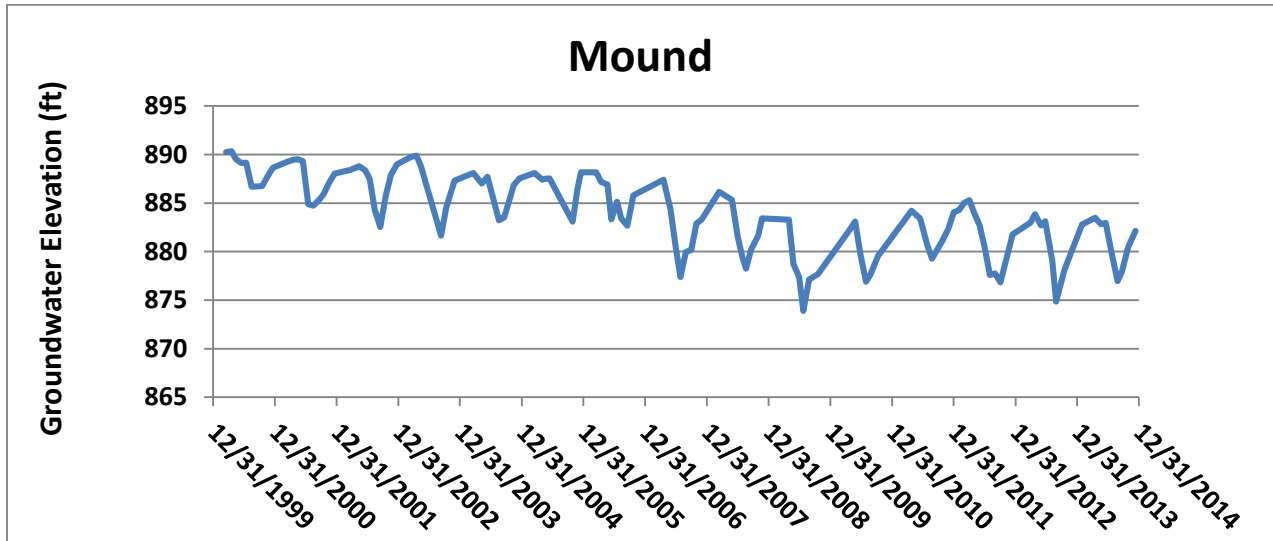


Figure A-5. Groundwater Elevation for MnDNR Well: Mound (27043); Bedrock Aquifers

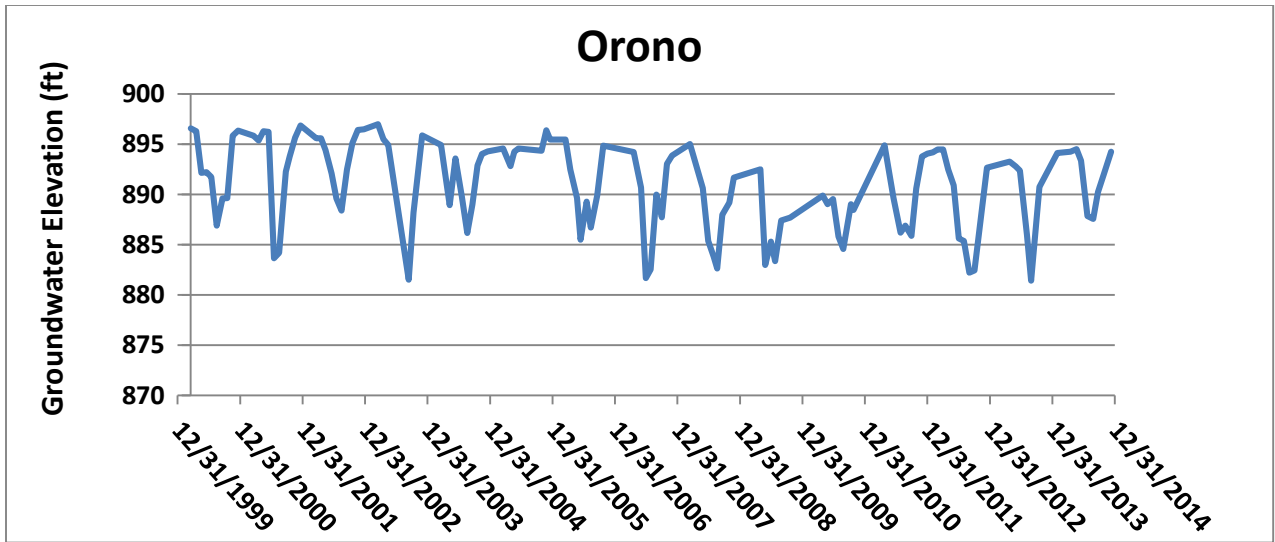


Figure A-6. Groundwater Elevation for MnDNR Well: Orono (27010);
Bedrock Aquifer

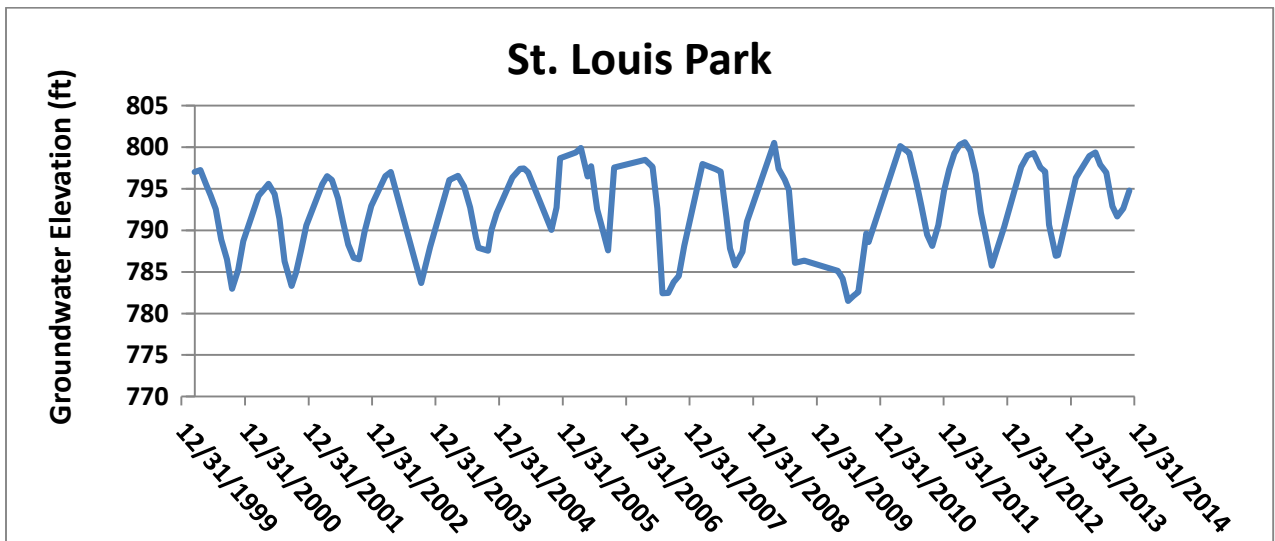


Figure A-7. Groundwater Elevation for MnDNR Well: St. Louis Park (27041);
Bedrock Aquifer

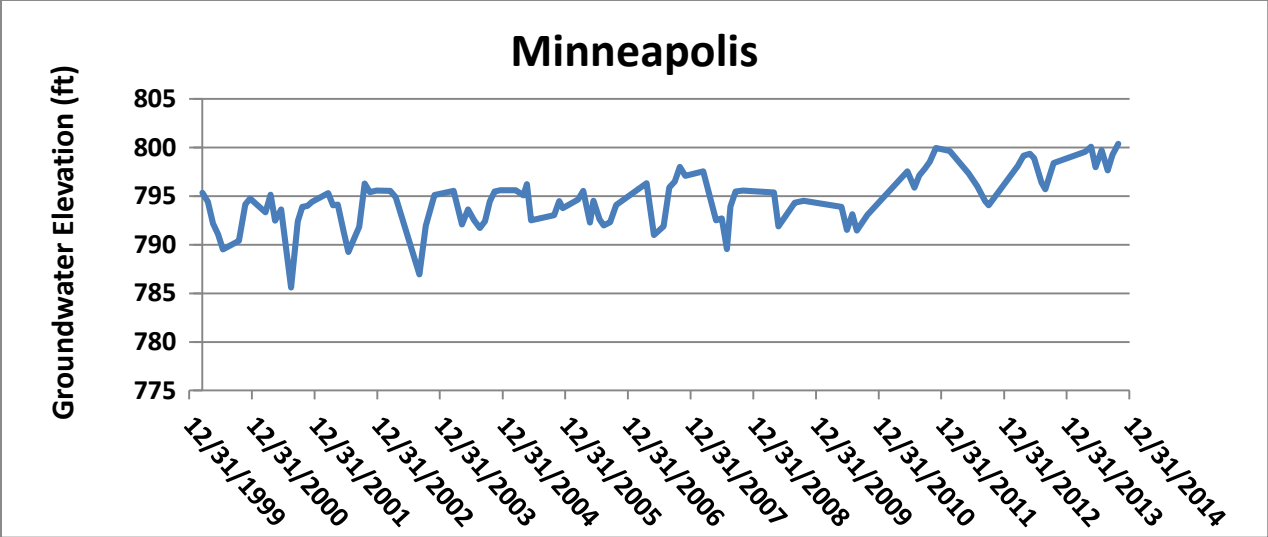


Figure A-8. Groundwater Elevation for MnDNR Well: Minneapolis (27036);
Bedrock Aquifer

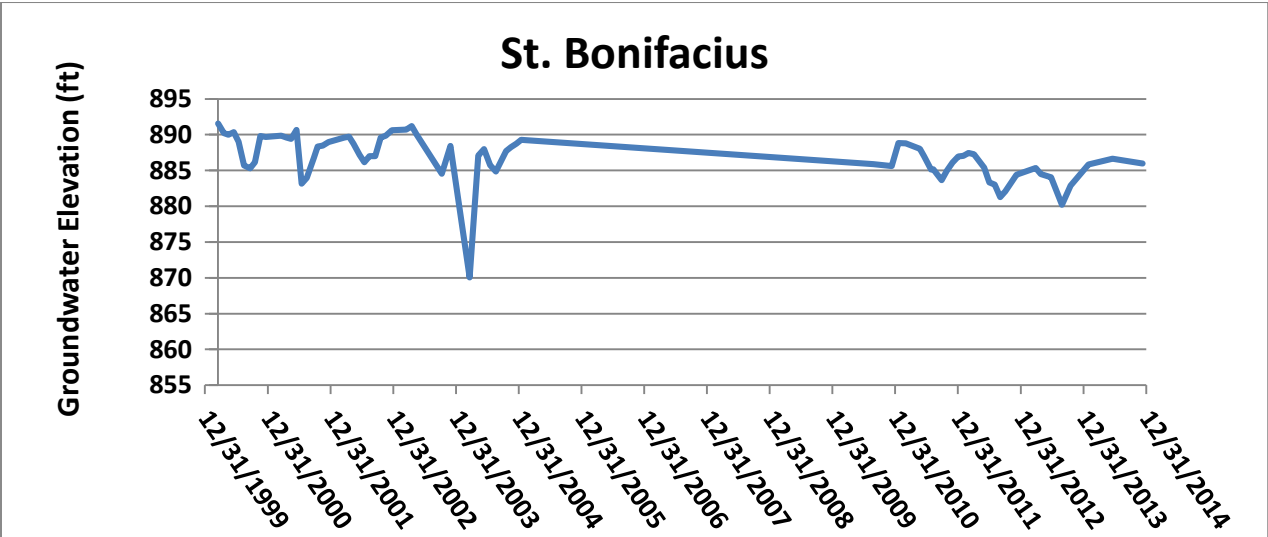


Figure A-9. Groundwater Elevation for MnDNR Well: St. Bonifacius (27044);
Bedrock Aquifer

5. References

- Anderson, P. and M. Lindon. 2010. *Standard Operating Procedures: Lake Water Quality Sampling*. Minnesota Pollution Control Agency. St. Paul, MN.
- Carlson, R.E. 1977. *A Trophic State Index for Lakes*. *Limnology and Oceanography* 22:361-369.
- McCollor and Heiskary. 1993. *Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions*. Minnesota Pollution Control Agency Water Quality Division
- Minnesota Pollution Control Agency (MPCA), 2014. *Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment*, 305(b) Report and 303 (d) List.
- Moore, L. and K. Thornton, Ed 1998. *Lake and Reservoir Restoration Guidance Manual*. USEPA: EPA 440/5-88-002
- Osgood, R.A. 1989. *A 1989 Study of the Water Quality of 20 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 590-89-129.
- Standard Methods for the Examination of Water and Wastewater. 2005. Joint Editorial Board, American Public Health Association, American Water Works Association, Water Environmental Fed., 21st ed. Washington, DC.
- US EPA. 1979. *Methods for chemical analysts of water and waste*. US EPA Environmental Monitoring and Support Laboratory. Cincinnati, OH.

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Christmas Lake Subwatershed Report

2014



Minnehaha Creek Watershed District
Research and Monitoring Department
15320 Minnetonka Blvd
Minnetonka, MN 55345
www.minnehahacreek.org
952-641-4535

Table of Contents

Glossary	3
Guidelines and Standards.....	5
Executive Summary	6
Subwatershed Facts and Map	7
Christmas Lake Subwatershed - Lake Monitoring Sites Information	8
Christmas Lake.....	9
Christmas Lake Subwatershed - Additional Lake Information	10
Christmas Lake Subwatershed - Stream Monitoring Sites Information.....	11
Christmas Lake Creek: Christmas Lake Inlet.....	12
Christmas Lake Creek: Christmas Lake Outlet.....	14
Christmas Lake Subwatershed - Additional Stream Information	16

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.

Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see the 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); Shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80% .

Executive Summary

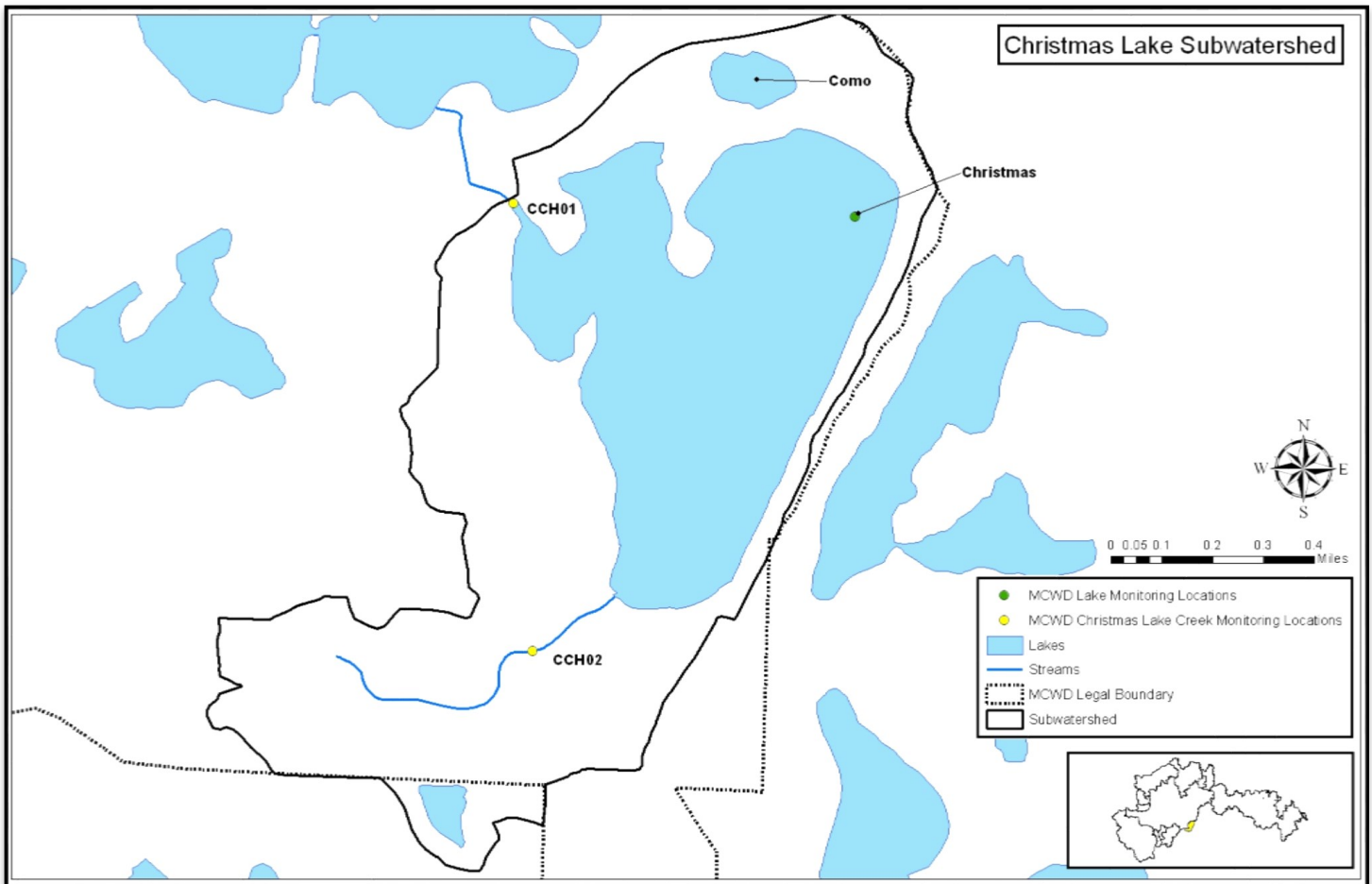
The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

The 2014 monitoring season is summarized for Christmas Lake Subwatershed in this report. There were 2 stream sites and one lake monitored in 2014. Christmas Lake Creek inlet exceeded the North Central Hardwood Forest (NCHF) guidelines for total phosphorus in 2014. The table below displays the lakes monitored within the Christmas Lake Subwatershed that did not meet the NCHF eutrophication standards.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Christmas				

Subwatershed Facts and Map

Municipalities	Chanhassen and Shorewood
Area	About 742 acres
Population	Chanhassen = 23,840 people (2012) Shorewood = 13,196 people (2012)
Ecoregion	North Central Hardwood Forest
Groundwater	No MnDNR wells monitored
District Goals	<ul style="list-style-type: none"> Lakes and streams meet the MPCA water quality standards Christmas Lake's TP concentration goal is 15 µg/L Christmas Lake Creek's TP Loading goal is 35 lbs/year



Christmas Lake Subwatershed - Lake Monitoring Sites Information

Lake	MnDNR ID	MCWCD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Water-shed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Christmas	27-0137-00	LCH01	Hennepin	Yes	268.0	77	28.76	9252	36	88	742.24	3:1	44.8992	-93.5378
Como*	27-0145-00		Hennepin	No	8.74						29.57	3:1		

* Not monitored in 2014





Christmas Lake

(DNR ID: 27-0137-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	A	A
2006	A	A	A	A
2007	A	A	A	A
2008	A	A	A	A
2009	A	A	A	A
2010	A	A	A	A
2011	A	A	A	A
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	6.30	0.40	17	33
2006	6.50	0.00	12	36
2007	5.00	1.23	17	38
2008	5.39	2.61	10	37
2009	6.98	2.61	22	40
2010	5.89	1.72	11	36
2011	5.36	2.00	11	37
2012	5.45	2.88	14	39
2013	6.21	1.75	11	36
2014	6.85	2.00	13	37

2014 Water Quality Data

Date	TMP	DO	SP	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/12/2014	12.23	11.53	360	8.31	4.20	4	28	<3	0.487	0.487	<0.03	35/38
6/9/2014	20.80	9.23	363	8.25	10.80	1	16	<3	0.710	0.710	<0.03	35/38
7/15/2014	22.06	8.70	350	8.59	6.00	3	11	<3	0.575	0.575	<0.03	33/35
8/12/2014	24.88	8.68	364	8.56	6.05	2	14	<3	0.582	0.582	<0.03	35/38
9/17/2014	18.37	9.24	358	8.48	4.55	2	12	<3	0.601	0.601	<0.03	35/38
10/20/2014	12.67	9.50	367	8.18	4.25	3	12	<3	0.597	0.565	0.032	35/38

Note: Surface/Bottom Results

Christmas Lake Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Christmas	1996-2013	2006	August 2013	2007	2012	Mercury in fish tissue	Aquatic Consumption
Como							

Lake	Invasive Species							
	Chinese Mystery Snail	Common Carp	Curtyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels	
Christmas	X	X	X	X			X [†]	
Como								

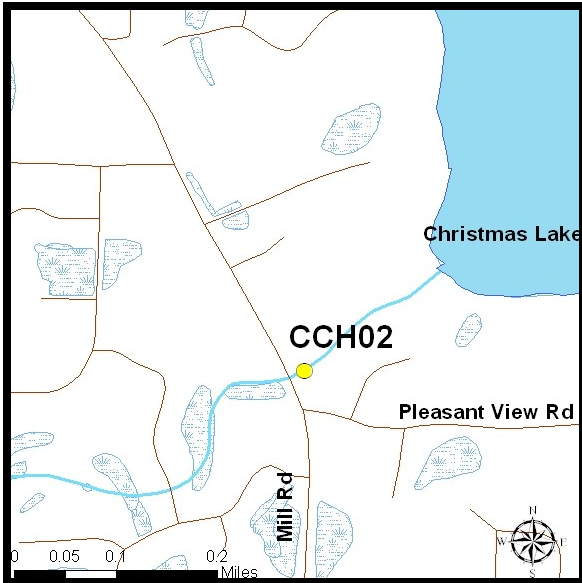
*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcwwd-lakes

†Listed as infested, but the zebra mussels in the containment area have been killed as of the end of 2014

Christmas Lake Subwatershed - Stream Monitoring Sites Information

Stream	MCWWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Christmas Lake Ck: Lk Inlet	CCH02	Yes	No	176.73	44.8877	-93.5492
Christmas Lake Ck: Lk Outlet	CCH01	Yes	No	565.51	44.9008	-93.5509



Christmas Lake Creek: Christmas Lake Inlet (CCH02)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	8
Total Suspended Solids (mg/L)	8
Total Phosphorus (µg/L)	284
<i>E. coli</i> (cfu/100 mL)*	N/A

*Geometric Mean

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

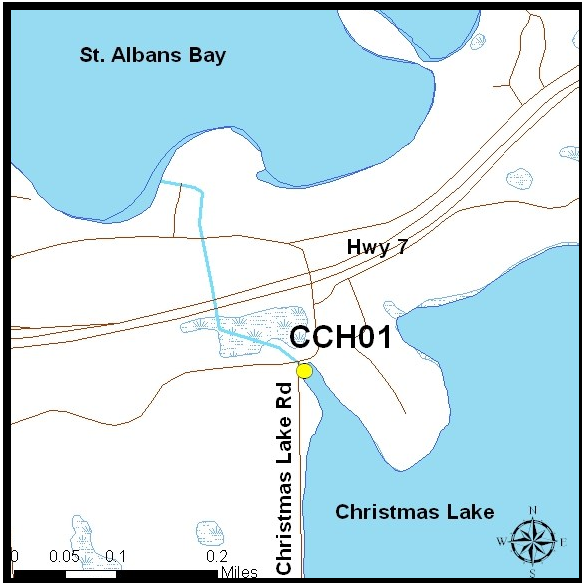
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	0.09	30	165	2.8	16	107	0.60	1	5		
2007	0.13	64	258	6.7	27	350	1.42	10	42		
2008	0.06	22	182	4.3	36	385	3.23	1	8	10	84
2009	0.02	9	280	0.8	24	85	2.66	1	21	3	104
2010	0.14	68	256	17	63	764	2.87	4	15	27	102
2011	0.15	68	229	17	55	635	2.13	3	9	12	40
2012	0.09	41	247	14	86	153	0.91	1	7	5	31
2013	0.22	93	220	46	109	647	1.52	2	4	11	27
2014	0.29	136	238	48	84	729	1.28	2	3	13	23

Note: Revised Means and Loads for 2008-2013

2014 Water Quality Data - CCH02

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	0.548	2.57	10.88	642	7.62	298	184	6.440	6	73
4/15/2014	0.152	3.19	12.26	753	7.73	142	19			
4/21/2014	0.454	14.86	13.50	844	8.05	161	5		11	
4/28/2014	9.548	6.36	11.00	511	7.67	270	89			
5/5/2014	0.170	13.75	20.59	720	8.77	153	<3	5.130	30	67
5/12/2014	1.260	14.21	9.69	620	7.77	131	40			
5/20/2014	1.168	12.54	11.01	668	7.81	127	62		4	
5/27/2014	0.399	18.82	9.07	769	7.73	138	40			
6/2/2014	0.684	20.92	5.95	648	7.59	232	156	2.270	4	57
6/9/2014	0.125	16.45	5.49	773	7.55	227	104			
6/16/2014	0.089	17.31	6.04	713	7.55	253	158		4	
6/23/2014	0.033	21.09	6.59	602	7.63	308	210			
6/30/2014	0.290	21.58	4.92	623	7.59	308	174	2.280	6	43
7/7/2014	0.054	18.98	6.38	680		328	87			
7/15/2014	0.192	17.66	6.29	676		316	116		6	
7/22/2014	0.011	20.47	4.69	819	7.62	213	94			
7/29/2014	0.026	16.69	6.12	787	7.61	316	87	1.570	9	104
8/5/2014	0.023	18.09	6.52	751	7.31	1010	74			
8/12/2014	0.003	16.89	5.75	767	7.58	183	57		6	
8/19/2014	0.072	18.80	5.58	646	7.54	256	71			
8/26/2014	0.004	16.15	5.56	705	7.50	271	92	1.610	6	83
9/2/2014	0.001	17.33	5.57	558	8.57	608	91			

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL);
Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report).



Christmas Lake Creek: Christmas Lake Outlet (CCH01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	19
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	33
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	0.70	42	84	6	12	97	0.20	4	8		
2007	0	1	68	0	9	4	0.49	2	7		
2008	0.08	5	32	0	0	0	0	1	3		
2009*											
2010*											
2011	0.46	26	29	0.10	0.10	260	0.29	5	6	21	23
2012*											
2013	0.36	18	25	0	0	*	*	0.22	0.30	*	*
2014	0.79	40	26	1	1	659	0.43	4.60	3	43	28

* Not enough data to calculate; Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CCH01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/28/2014	1.03	6.15	10.71	367	7.52	55	8			
5/5/2014	4.46	12.68	13.27	376	8.03	24	<3	0.508	1	36
5/12/2014	7.95	13.04	10.22	365	8.04	32	<3			
5/20/2014	4.83	12.13	12.08	371	8.18	29	4		2	
5/27/2014	2.37	19.56	7.69	375	7.86	42	3			
6/2/2014	5.22	24.53	8.10	365	8.28	21	<3	0.519	8	35
6/9/2014	0.74	20.48	8.47	361	8.27	30	<3			
6/16/2014	2.00	19.40	9.20	359	8.36	23	<3		2	
6/23/2014	10.53	23.68	11.29	343	8.63	18	<3			
6/30/2014	1.53	23.84	7.12	343	8.50	20	<3	0.680	2	33
7/7/2014	0.06	23.57	5.70	346		41	4			
7/15/2014	0.36	20.18	6.89	305		36	<3		9	
7/22/2014	0.11	25.91	3.66	355	7.33	52	4			

Christmas Lake Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Christmas Lake Ck: LK Inlet		None	None
Christmas Lake Ck: LK Outlet		None	None



MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Dutch Lake Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	3
Guidelines and Standards	5
Executive Summary	6
Subwatershed Facts and Map	7
Dutch Lake Subwatershed - Lake Monitoring Sites Information.....	8
Dutch Lake	9
Dutch Lake Subwatershed - Additional Lake Information.....	10
Dutch Lake Subwatershed - Stream Monitoring Sites Information	11
Dutch Lake Creek: Dutch Lake Inlet.....	12
Dutch Lake Creek: Dutch Lake Outlet.....	14
Dutch Lake Subwatershed - Additional Stream Information	16

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.

Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see the 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%

Executive Summary

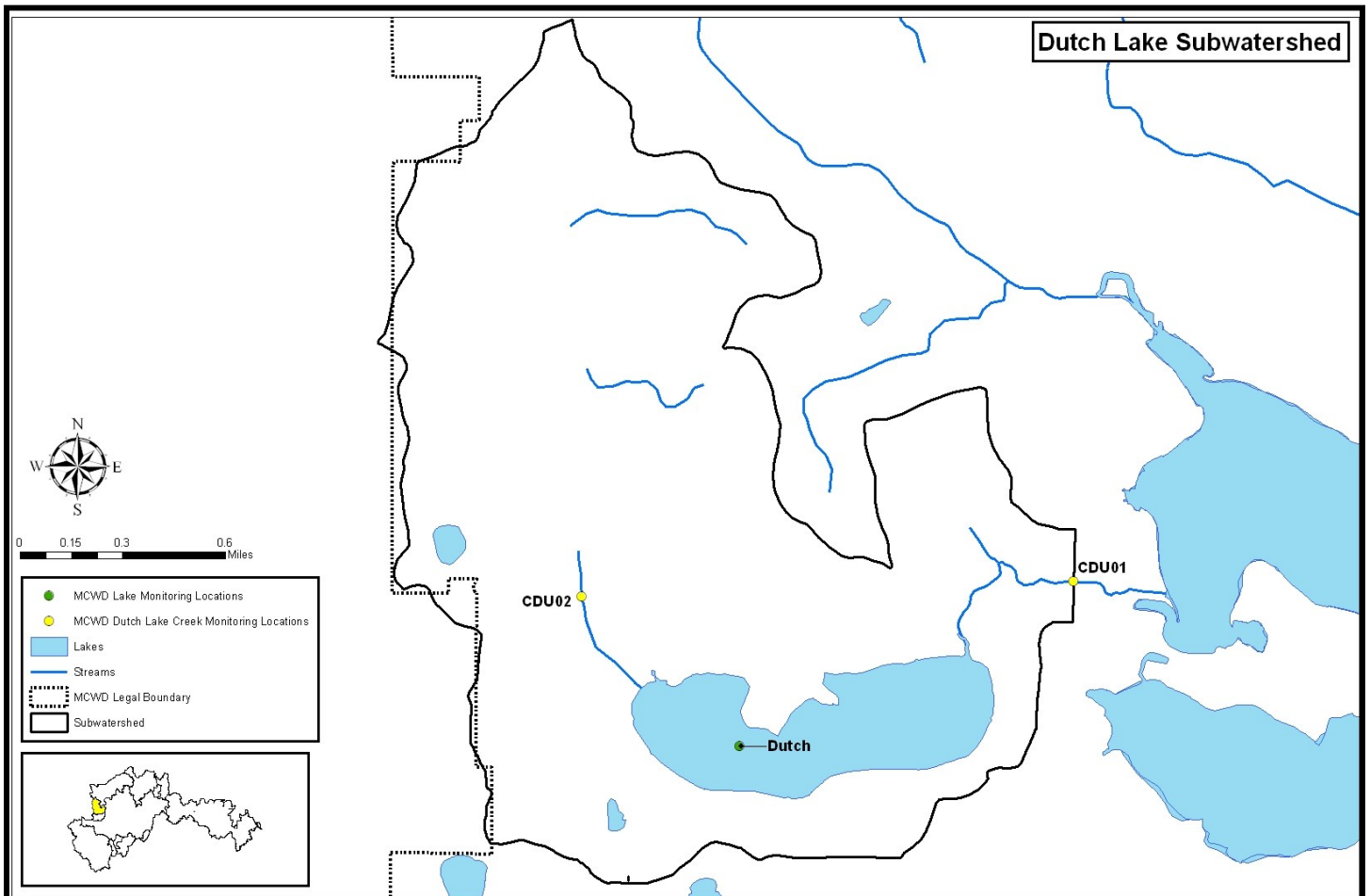
The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

The 2014 monitoring season is summarized for Dutch Lake Subwatershed in this report. There were two stream sites on Dutch Lake Creek and one lake monitored in 2014. Dutch Lake Creek inlet was below the North Central Hardwood Forest (NCHF) dissolved oxygen standard and exceeded the total phosphorus guideline in 2014. The table below displays the lakes monitored within the Dutch Lake Subwatershed that did not meet the NCHF eutrophication standards.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Dutch	X	X	X	

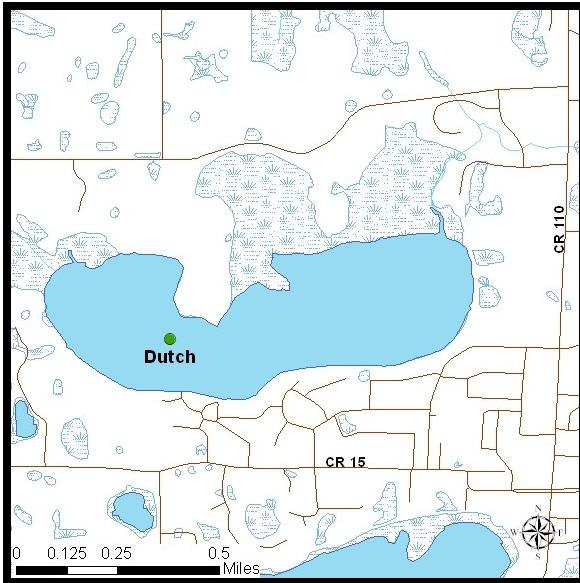
Subwatershed Facts and Map

Municipalities	Minnetrista and Mound
Area	About 1,888 acres
Population	Minnetrista = 6,788 people (2013) Mound = 9,270 people (2013)
Ecoregion	North Central Hardwood Forest
Groundwater	No MnDNR wells monitored
District Goals	<ul style="list-style-type: none"> Lakes and streams meet the MPCA water quality standards Reduce Dutch Lake Creek’s nutrient pollutant loads into Lake Minnetonka: Jennings Bay



Dutch Lake Subwatershed - Lake Monitoring Sites Information

Lake	MnDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft.)	Max Depth (ft.)	Water-shed Area (ac)	Water-shed to Lake Area Ratio	Latitude	Longitude
Dutch	27-0181-00	LDU01	Henne-pin	Yes	173.8	83	55.42	2560	16	46	1742	10:1	44.94314	-93.68542



Dutch Lake

(DNR ID: 27-0181-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	D	C	C-
2006	C	C	C	C
2007	C	C	C	C
2008	C	C	C	C
2009	C	C	C	C
2010	C	C	C	C
2011	C	C	C	C
2012	D	C	C	C-
2013	D	D	D	D
2014	D	C	D	D+

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.16	43.91	64	63
2006	0.93	26.33	49	61
2007	0.80	33.34	57	64
2008	1.20	41.44	57	62
2009	0.91	35.78	59	63
2010	1.11	40.72	51	62
2011	1.38	28.94	50	60
2012	0.71	34.71	60	65
2013	0.77	62.31	82	67
2014	0.97	44.25	114	67

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/13/2014	11.51	11.91	336	9.19	1.15	26	59	<3	1.22	1.14	0.081	32/34
6/10/2014	21.70	12.73	347	8.60	1.35	22	192	4	2.90	2.90	<0.03	31/32
7/15/2014	21.77	8.91	347	8.65	1.15	72	112	3	1.92	1.92	<0.03	28/33
8/12/2014	25.02	7.66	343	8.55	0.63	46	83	<3	1.72	1.68	0.036	31/33
9/15/2014	17.41	8.52	341	8.46	0.75	37	68	<3	1.55	1.55	<0.03	31/34
10/21/2014	11.69	6.76	369	7.70	3.00	10	238	163	2.47	2.47	<0.03	31/30

Note: Surface/Bottom Results

Dutch Lake Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Dutch	1977; 1998-2014	2008		2009	2011	Nutrient/ Eutrophication Biological Indicators	Aquatic Recreation

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Dutch		X		X			

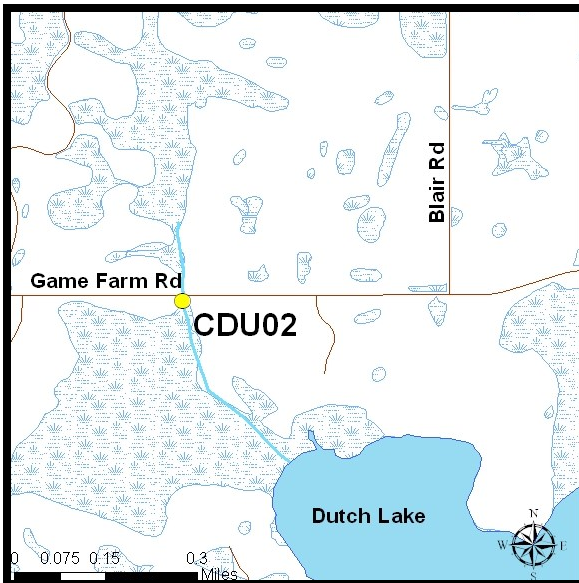
*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcawd-lakes

Dutch Lake Subwatershed - Stream Monitoring Sites Information

Stream	MCWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Dutch Lake Ck: Lk Inlet (Game Farm Rd)	CDU02	Yes	No	608.67	44.9493	-93.6886
Dutch Lake Ck: Lk Outlet (Hwy 110)	CDU01	Yes	No	987.56	44.9502	-93.6657





Dutch Lake Creek: Dutch Lake Inlet (CDU02)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	4
Total Suspended Solids (mg/L)	5
Total Phosphorus (µg/L)	346
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

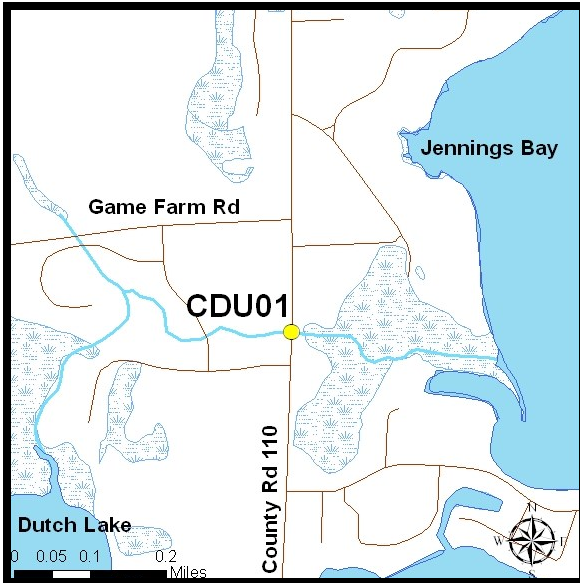
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	0.81	200	126	67	42	215	0.13	3.70	2		
2007	0.92	244	133	125	68	1267	0.69	3.27	2		
2008	0.18	91	251	49	134	308	0.85	1.63	4	7	20
2009	0.09	40	230	32	180	226	1.29	0.44	2	6	34
2010	0.42	184	222	119	143	1095	1.32	2.00	3	27	32
2011	0.85	349	207	166	99	1366	0.81	22.00	13	58	35
2012	0.47	231	250	146	158	343	0.37	21.00	23	91	10
2013	0.99	827	424	564	289	1502	0.77	5.00	3	23	12
2014	1.36	818	305	294	109	3779	1.41	18.00	7	80	30

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CDU02

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	4.490	1.99	4.70	345	7.95	164	106	1.86	2	28
4/15/2014	0.880	1.76	4.35	481	6.96	94	40			
4/22/2014	0.800	5.54	6.92	509	7.16	67	39		<1	
4/30/2014	18.110	3.14	6.03	348	7.89	127	92			
5/6/2014	4.940	8.20	5.34	432	7.30	54	32	1.00	1	37
5/13/2014	6.660	9.45	4.64	468	7.33	87	71			
5/21/2014	8.110	12.04	3.90	464	7.42	98	79		<1	
5/28/2014	2.940	19.76	3.16	522	7.24	185	156			
6/3/2014	9.496	21.39	1.26	412	7.07	404	217	1.58	22	29
6/9/2014	4.720	16.86	1.26	467	7.00	640	334			
6/16/2014	3.750	18.67	1.52	455	6.96	196	138		4	
6/23/2014	6.015	22.60	0.64	399	7.00	1160	623			
6/30/2014	1.810	20.56	1.49	455	7.45	1270	1040	1.34	8	22
7/7/2014	0.330	22.01	2.52	439		374	239			
7/16/2014	0.690	15.32	3.90	413		80	60		1	
7/22/2014	0.450	23.78	2.00	445	7.01	481	339			
8/5/2014	0.010	20.39	6.00	501	7.31	434	138			
9/3/2014	0.010	17.68	8.39	578		319	148			

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L);
E. coli (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report).



Dutch Lake Creek: Dutch Lake Outlet (CDU01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	6
Total Suspended Solids (mg/L)	10
Total Phosphorus (µg/L)	124
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	0.90	202	114	74	40	2327	1.31	26	15		
2006	1.37	225	84	96	36	316	0.12	7	3		
2007	0.98	272	141	102	53	4231	2.20	27	14		
2008	0.69	123	91	61	45	1451	1.07	12	9	60	44
2009	0.24	58	123	23	49	644	1.35	3	6	14	29
2010	1.08	227	106	105	49	3334	1.56	24	11	57	27
2011	1.63	296	92	104	32	1651	0.51	15	5	61	19
2012	0.49	138	142	62	64	1036	1.06	10	10	18	19
2013	1.51	377	127	159	54	4351	1.46	22	8	86	29
2014	2.74	533	99	198	37	8864	1.64	59	11	228	42

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CDU01

Date	Flow	TMP	DO	SP	pH	TP	SRP	TN	TSS	Cl
4/8/2014	0.925	5.79	9.81	378	7.58	149	56	1.660	4	36
4/15/2014	1.862	6.49	11.10	405	7.77	110	3			
4/22/2014	1.516	11.25	15.14	413	8.47	173	<3		20	
4/30/2014	22.469	4.95	11.22	373	7.95	124	<3			
5/6/2014	9.517	13.13	14.55	359	8.65	52	<3	1.430	8	35
5/13/2014	9.485	10.84	8.80	367	7.87	56	<3			
5/21/2014	8.473	13.69	7.06	382	7.68	50	11		4	
5/28/2014	7.883	20.03	4.79	376	7.46	91	56			
6/3/2014	29.480	21.60	4.00	361	7.28	92	47	1.220	17	32
6/9/2014	6.936	19.27	4.84	367	7.33	86	55			
6/16/2014	6.371	21.32	4.29	364	7.32	82	52		6	
6/23/2014	26.124	24.48	4.10	359	7.30	117	66			
6/30/2014	6.952	22.84	5.64	368	7.42	126	65	0.990	8	28
7/7/2014	2.423	25.44	5.25	377		134	72			
7/16/2014	1.775	19.35	5.31	372		113	32		40	
7/22/2014	1.298	26.66	3.08	346	7.60	131	38			
7/29/2014	0.833	24.11	3.58	347	7.35	124	76	1.930	4	30
8/5/2014	0.619	23.63	3.10	364	7.47	189	94			
8/12/2014	0.459	21.76	4.87	392	7.49	157	106		4	
8/19/2014	0.286	23.50	4.24	378	7.55	150	97			
8/27/2014	0.240	21.03	5.29	394	7.61	117	82	1.390	3	36
9/3/2014	0.985	19.53	6.58	368		111	63			
9/9/2014	0.149	19.41	5.43	424	7.64	117	93		3	
9/17/2014	0.148	14.44	7.34	432		82	47			
9/23/2014	0.062	16.32	6.88	450	7.44	100	72	1.370	2	41
9/30/2014	0.069	12.52	6.01	439	7.84	120	89			
10/7/2014	0.108	10.82	6.80	480	7.68	79	51		6	
10/14/2014	0.120	11.23	5.60	529	7.59	129	94			
10/21/2014	0.040	10.06	3.24	581	7.53	175	136	0.869	2	45
10/27/2014	0.036	9.64	2.05	642	7.47	226.5	131.5			
11/5/2014	0.024	6.26	5.55	794	8.08	281	137		26	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L);

E. coli (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report).

Dutch Lake Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Dutch Lake Ck: LK Inlet		None	None
Dutch Lake Ck: LK Outlet		None	None

MINNEHAHA CREEK



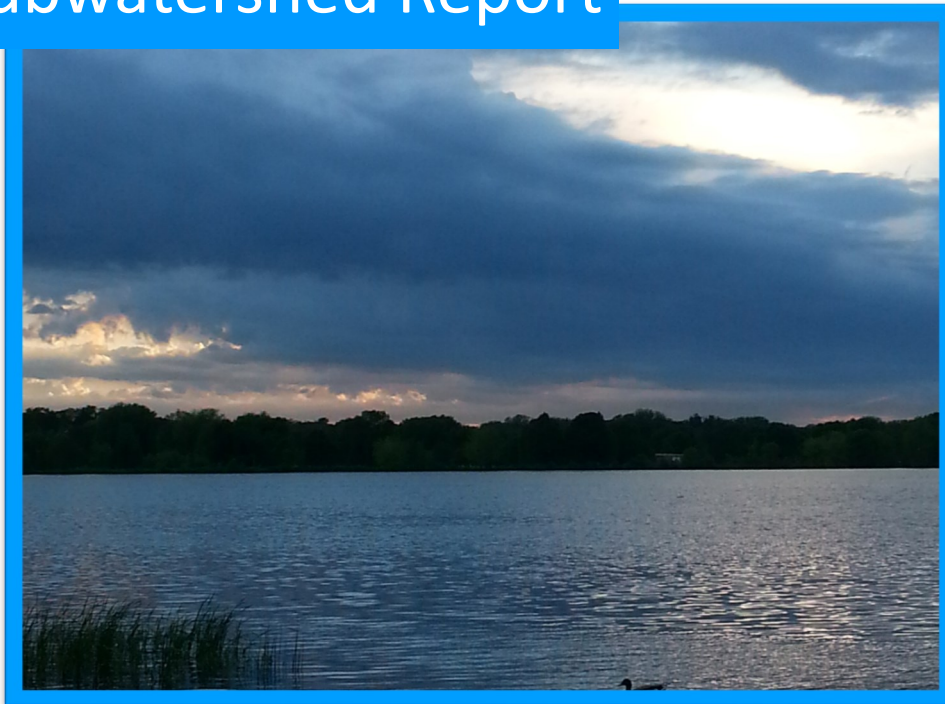
WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Gleason Lake Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	3
Guidelines and Standards	5
Executive Summary	6
Subwatershed Facts and Map	7
Gleason Lake Subwatershed - Lake Monitoring Sites Information	8
Gleason Lake	9
Unnamed West Lake	10
Gleason Lake Subwatershed - Additional Lake Information	11
Gleason Lake Subwatershed - Stream Monitoring Sites Information	12
Gleason Lake Creek: Gleason Lake Inlet	13
Gleason Lake Creek: Gleason Lake Outlet	15
Gleason Lake Subwatershed - Additional Stream Information	17

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.

Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see the 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone

Executive Summary

The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

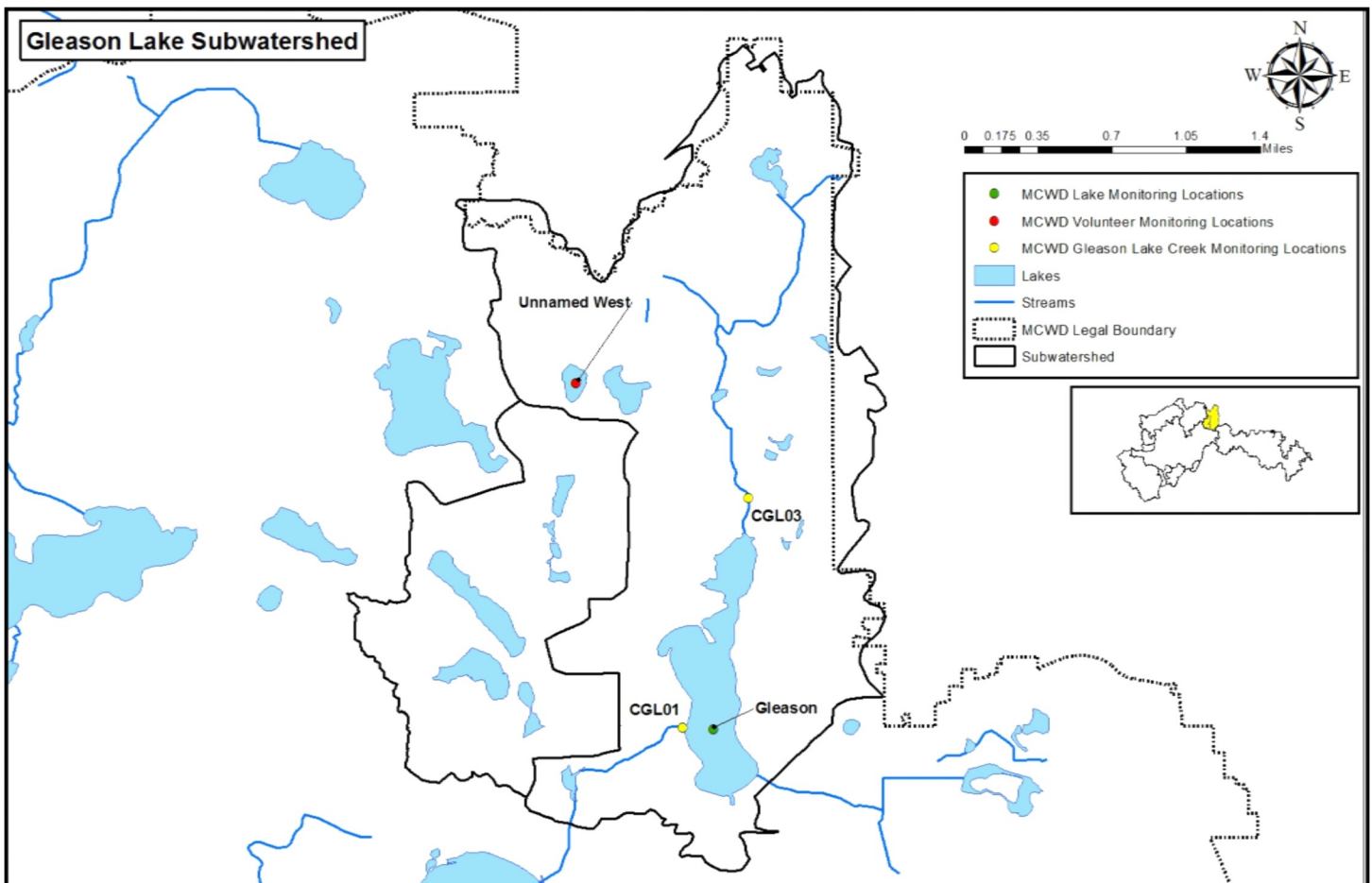
The 2014 monitoring season is summarized for Gleason Lake Subwatershed in this report. There were two stream sites on Gleason Lake Creek and two lakes monitored in 2014. Gleason Lake Creek inlet exceeded the North Central Hardwood Forest (NCHF) total phosphorus guidelines in 2014. The table below displays the lakes monitored within the Gleason Lake Subwatershed that did not meet the NCHF eutrophication standards. Unnamed (West) Lake had insufficient data to determine if the eutrophication standards were met.

Lake	(X) Indicates Not Meeting the			
	SECC	CHLA	TP	CI
Gleason		X	X	
Unnamed West	N/A	N/A	N/A	

N/A means insufficient data to assess if standards have been met

Subwatershed Facts and Map

Municipalities	Minnetonka, Orono, Plymouth, and Wayzata,
Area	About 3,765 acres
Population	Minnetonka = 51,368 people (2013) Orono = 7,796 people (2013) Plymouth = 73,987 people (2013) Wayzata = 4,217 people (2013)
Ecoregion	North Central Hardwood Forest
Groundwater	No MnDNR wells monitored
District Goals	<ul style="list-style-type: none"> • In Gleason Lake: reducing TP to 80 µg/L and chlorophyll-<i>a</i> to 20 µg/L • In Gleason Lake: increasing Secchi depth to greater than 1 m



Gleason Lake Subwatershed - Lake Monitoring Sites Information

Lake	MNDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft.)	Max Depth (ft.)	Watershed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Gleason	27-0095-00	LGL01	Hennepin	Limited	164.0	141	83	1201	7.7	17	2605	16:1	44.97830	-93.49262
Hadley*	27-0109-00	LHD01	Hennepin	No	22.0						537	24:1	44.98591	-93.51458
Unnamed East *	27-0108-00	LSN01	Hennepin	No	9.2				7.7	12	385	42:1	45.00190	-93.50652
Unnamed West	27-0468-00	LKR01	Hennepin	No	16.0				4.5	7	283	18:1	45.00096	-93.50132

*Not monitored in 2014



Gleason Lake

(DNR ID: 27-0095-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	C	D	C-
2006	C	C	D	C-
2007	D	C	D	D+
2008	C	D	D	D+
2009	C	C	D	C-
2010	C	C	C	C
2011	C	C	C	C
2012	C	B	C	C+
2013	C	B	C	C+
2014	C	D	D	D+

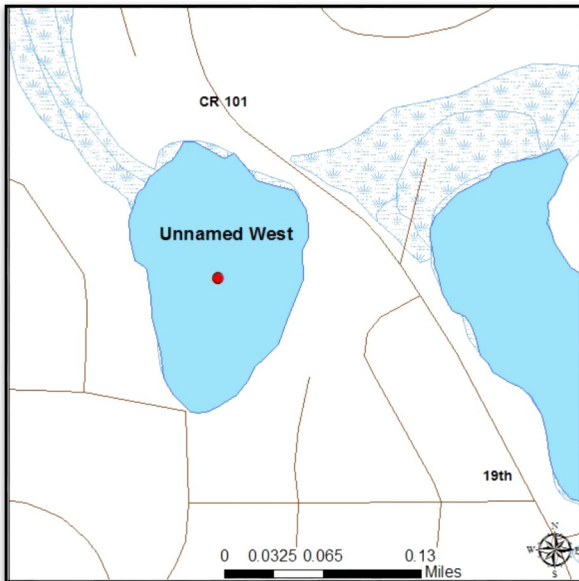
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.08	60.95	116	68
2006	0.91	53.03	133	69
2007	0.76	60.90	125	70
2008	1.11	69.44	96	67
2009	1.23	52.33	105	66
2010	1.24	36.89	65	62
2011	1.38	28.94	50	60
2012	1.93	14.13	41	55
2013	1.68	24.00	68	60
2014	1.08	85.75	98	68

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/14/2014	13.58	10.24	629	8.31	1.70	16	37	<3	0.898	0.898	<0.03	118/115
6/11/2014	22.14	8.70	604	8.02	2.35	20	59	8	1.190	1.190	<0.03	102/99
7/16/2014	21.63	11.55	509	8.98	0.80	194	110	3	1.870	1.870	<0.03	94/94
8/11/2014	24.22	7.92	559	7.74	0.68	51	137	15	2.060	2.060	<0.03	100/91
9/16/2014	17.05	12.34	555	8.74	0.50	78	84	<3	1.820	1.820	<0.03	91/91
10/20/2014	11.71	6.51	603	7.61	4.10	0	79	35	2.340	2.280	0.065	96/93

Note: Surface/Bottom Results



Unnamed (West) Lake (DNR ID: 27-0468-00) - Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	D	D	D	D
2009				
2010				
2011				
2012				
2013				
2014	N/A	N/A	N/A	N/A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	0.71	58.5	116	69
2009				
2010				
2011				
2012				
2013				
2014	N/A	N/A	N/A	N/A

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl
5/12/2014	14.7	0.65	59	108	1.38	1.35	0.032	74
6/29/2014	23.8	1.45	3	226	1.07	1.00	0.070	39
8/31/2014	21.5	0.45		235	2.06	2.06	<0.03	47
9/29/2014	22.8	0.55	57	133	1.75	1.75	<0.03	48

Note: Surface/Bottom Results

Gleason Lake Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Gleason	1982 - 2014	2008	July 2012	1996		Nutrient/ Eutrophication Biological Indicators	Aquatic Recreation
Hadley	1960 - 1978						
Unnamed East	1982 - 2014	In Progress				Nutrient/ Eutrophication Biological Indicators	Aquatic Recreation
Unnamed West		In Progress					

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Gleason	X	X	X				
Hadley							
Unnamed East							
Unnamed West							

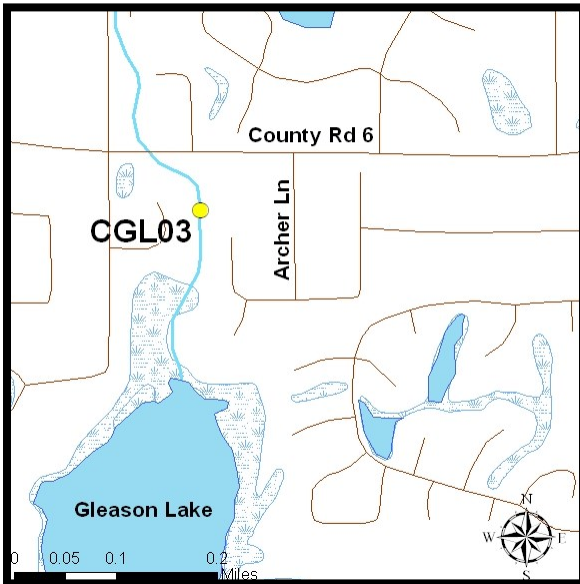
*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcawd-lakes

Gleason Lake Subwatershed - Stream Monitoring Sites Information

Stream	MCW/D Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Gleason Lk Ck: Lk Inlet	CG103	Yes	No	1642.10	44.9921	-93.4905
Gleason Lk Ck: Lk Outlet	CG101	Yes	No	962.97	44.9782	-93.4961





Gleason Lake Creek: Gleason Lake Inlet (CGL03)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	7
Total Suspended Solids (mg/L)	3
Total Phosphorus (µg/L)	172
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

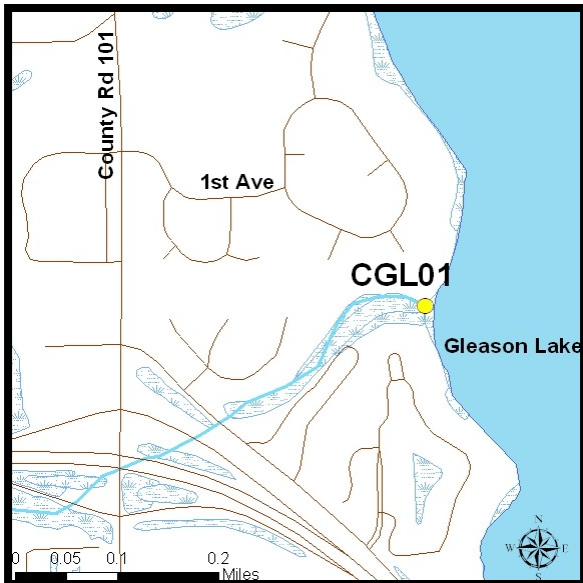
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	0.86	463	273	112	66	2810	1.65	41	24		
2006	0										
2007	1.20	657	279	88	37	2641	1.12	39	17		
2008	0.31	15	24	8	12	854	1.39	10	17	63	102
2009	0.28	63	115	17	31	370	0.68	3	6	89	163
2010	0.95	232	123	100	53	2095	1.12	7	4	351	187
2011	1.37	387	143	133	49	3537	1.31	43	16	347	128
2012	0.73	214	149	75	52	1004	0.70	14	10	112	78
2013	1.70	639	191	313	94	1801	0.54	29	9	242	73
2014	1.99	576	147	308	79	4978	1.27	15	4	505	129

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CGL03

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	5.374	5.18	10.79	1008	7.72	156	39	2.110	5	229
4/16/2014	1.976	4.85	12.42	1249		115	4			
4/23/2014	1.998	10.49	12.55	1260	8.18	101	3		5	
4/30/2014	24.862	5.59	11.15	649	7.84	147	79			
5/7/2014	4.306	14.12	13.59	908	8.15	84	6	1.110	7	193
5/14/2014	9.080	13.23	10.79	739	7.86	93	18			
5/21/2014	9.880	15.70	10.38	657	7.80	119	42		6	
5/29/2014	2.843	20.98	6.58	863	7.61	154	90			
6/4/2014	10.521	21.87	5.35	635	7.46	197	135	1.030	4	113
6/10/2014	2.746	20.16	6.34	766	7.55	192	127			
6/17/2014	9.232	21.47	6.70	620	7.57	146	91		3	
6/24/2014	10.700	23.63	7.52	617	7.57	178	128			
7/1/2014	5.588	21.69	6.40	689		207	138	2.100	2	126
7/8/2014	2.604	21.72	6.95	735		164	90			
7/16/2014	3.211	21.21	7.61	644		114	69		3	
7/23/2014	0.062	19.75	5.62	894	7.55	104	77			
7/30/2014	0.071	18.27	5.53	1120	7.65	90	53	0.917	1	184
8/6/2014	0.139	18.89	6.10	939	7.57	108	69			
8/13/2014	0.017	18.90	6.80	1052	7.67	77	57		1	
8/20/2014	0.023	19.78	5.24	1043	7.76	140	69			
8/26/2014	0.061	18.38	6.43	885	7.68	105	65	0.868	2	157
9/3/2014	0.899	20.67	7.80	645		146	75			
9/10/2014	0.478	15.59	7.17	623		132	68		6	
9/17/2014	0.027	15.07	7.32	1082		61	47			
9/24/2014	0.015	14.95	6.91	1076	7.43	72	36	0.591	<1	184
10/1/2014	0.179	12.70	5.69	434	7.00	327	211			
10/8/2014	0.012	10.24	6.22	1144	8.19	102	41		4	
10/15/2014	0.002	9.12	2.39	1151	7.70	121	56			
10/22/2014	0.011	10.99	1.40	1224	7.46	147	78	0.549	3	206
10/27/2014	0.008	11.75	0.43	1229	7.54	1270	27			

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Gleason Lake Creek: Gleason Lake Outlet (CGL01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	18
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	54
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	1.10	118	54	13	6	2083	0.96	7	3		
2006	1.41	125	45	36	13	911	0.33	7	3		
2007	1.43	209	74	28	10	2288	0.81	16	6		
2008	0.63	52	42	6	4	598	0.48	4	3		
2009	0.04	4	50	0	0	79	0.94	0.30	4	14	160
2010	0.71	71	51	7	5	1371	0.98	8	6	191	137
2011	1.45	79	28	6	2	1894	0.66	5	2	433	152
2012	0.30	21	37	0	1	143	0.25	1	2	19	32
2013	0.89	88	50	13	8	532	0.30	9	5	96	55
2014	1.53	141	47	17	6	2354	0.78	9	3	333	110

Note: Revised means and loads for 2008-2013

2014 Water Quality Data—CGL01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	0.009	4.08	6.56	254	7.58	47	6	0.766	2	53
4/16/2014	0.666	3.07	12.22	665	6.12	36	<3			
4/23/2014	0.911	9.92	12.97	668	8.25	33.5	<3		2	
4/30/2014	17.490	7.06	11.41	625	8.40	39	<3			
5/7/2014	6.127	12.31	16.75	627	8.85	59	<3	0.848	5	122
5/14/2014	6.113	14.58	9.76	628	8.49	31	<3			
5/21/2014	8.276	15.50	13.66	633	8.69	33	<3		3	
5/29/2014	2.597	23.46	9.15	630	8.52	27	<3			
6/4/2014	9.762	23.50	8.58	595	8.37	35	7	0.620	2	111
6/10/2014	3.041	22.69	8.29	591	8.33	37	7			
6/17/2014	6.030	21.29	6.89	596	7.97	48	3		3	
6/24/2014	10.812	23.16	9.51	550	8.36	55	16			
7/1/2014	4.292	23.56	6.52	537		93	33	0.995	3	90
7/8/2014	1.839	24.25	4.80	537		86	4			
7/16/2014	2.206	22.65	10.10	514		84	4		7	
7/23/2014	0.442	24.94	0.87	530	7.67	82.5	31			
7/30/2014	0.207	24.75	5.37	541	8.39	95	10	1.620	7	96

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Gleason Lake Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey*	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Gleason Lk Ck: Lk Inlet	2013	Chloride	Aquatic Life
Gleason Lk Ck: Lk Outlet		None	None

* The Macroinvertebrate Survey Report is available on the district website at <http://minnehahacreek.org/project/stream-assessment-2013>

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Lake Minnetonka Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	4
Guidelines and Standards	6
Executive Summary	7
Subwatershed Facts and Map	8
Lake Minnetonka Subwatershed - Lake Monitoring Sites Information	10
Black Lake	12
Carsons Bay.....	13
Cooks Bay.....	14
Crystal Bay	15
Forest Lake.....	16
Gideon Bay.....	17
Grays Bay	18
Halsted Bay	19
Jennings Bay	21
Lafayette Bay	23
Lower Lake South	24
Maxwell Bay.....	25
Peavey Lake	26
Priests Bay.....	27
Spring Park Bay	28
St. Albans Bay	29
Stubbs Bay	30

Table of Contents (cont.)

Wayzata Bay	31
West Arm	32
West Upper Lake	33
Lake William.....	34
Lake Minnetonka Subwatershed - Additional Lake Information.....	35
Lake Minnetonka Subwatershed - Stream Monitoring Sites Information	39
Classen Lake Creek: Upstream	40
Classen Lake Creek: Stubbs Bay Inlet	42
Classen Wetland Creek: Stubbs Bay Inlet.....	44
Forest Lake Creek: Forest Lake Inlet	46
Lake Minnetonka Subwatershed - Additional Stream Information	48

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrients for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.



Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see the 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NOx (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
E. coli (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%

Executive Summary

The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

The 2014 monitoring season is summarized for Lake Minnetonka Subwatershed in this report. There were three streams, 20 bays of Lake Minnetonka and one upper watershed lake monitored in 2014. Forest Lake Creek inlet, Classen Lake Creek: Stubbs Bay inlet, and Classen Lake Creek: upstream site exceeded the North Central Hardwood Forest (NCHF) guideline for total phosphorus (TP) in 2014. Classen Wetland Creek: Stubbs Bay inlet site was below the NCHF dissolved oxygen standard and above the NCHF TP guideline in 2014. The table below displays the lakes monitored within the Lake Minnetonka Subwatershed that did not meet the NCHF eutrophication standards.

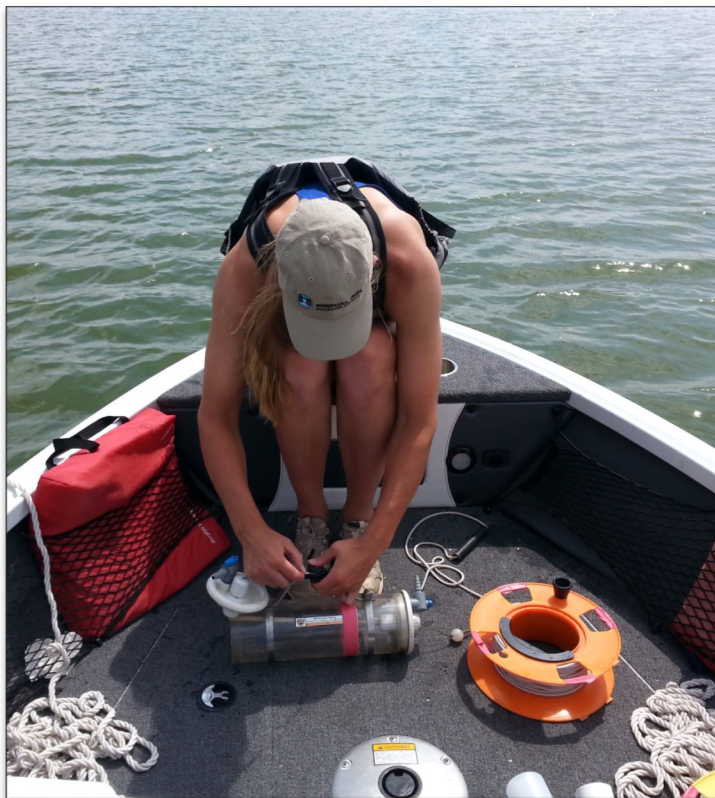
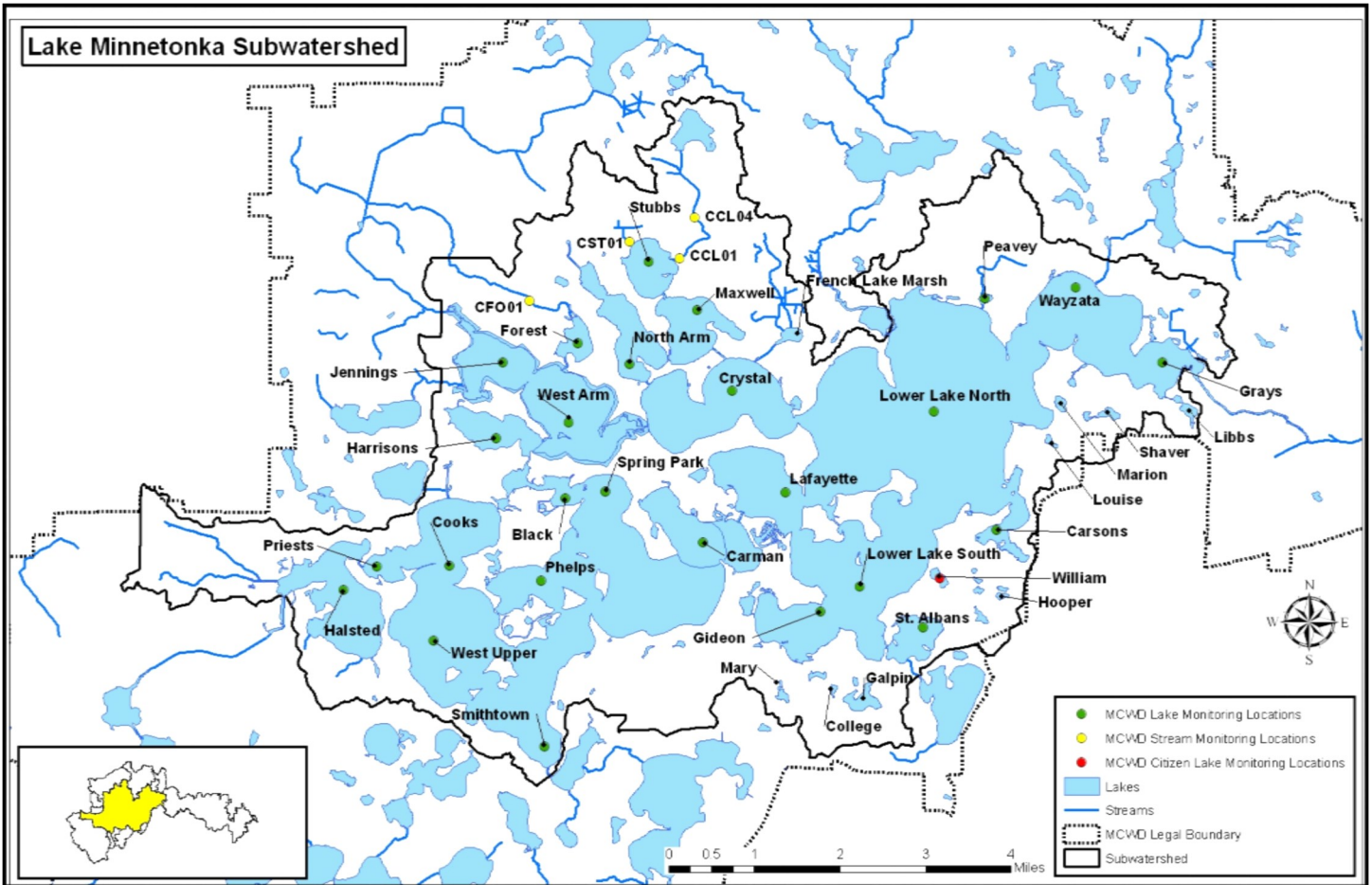
(X) Indicates Not Meeting the Standard in 2014																					
	Lake Minnetonka																				
Lake	Black	Carsons	Cooks	Crystal	Forest	Gideon	Grays	Halsted	Jennings	Lafayette	LL South	Maxwell	Peavey	Priests	Spring Park	St. Albans	Stubbs	Wayzata	West Arm	West Upper	Williams
SECC					X			X	X								X		X		
CHLA			X	X	X			X	X					X			X		X		
TP					X			X	X				X	X			X		X		
CI													X								

Note: For the water quality of Lake Minnetonka bays not monitored in 2014 - see Section 2.4 in 2014 Water Quality Report

Subwatershed Facts and Map

Municipalities	Chanhassen, Deephaven, Excelsior, Greenwood, Minnetonka, Minnetonka Beach, Minnetrista, Mound, Orono, Shorewood, Spring Park, Tonka Bay, Victoria, Wayzata, and Woodland
Area	About 23,330 acres
Population	<p>Chanhassen = 24,432 people (2012)</p> <p>Deephaven = 3,747 people (2013)</p> <p>Excelsior = 2,245 people (2013)</p> <p>Greenwood = 709 people (2013)</p> <p>Minnetonka = 51,368 people (2013)</p> <p>Minnetonka Beach = 555 people (2013)</p> <p>Minnetrista = 6,788 people (2013)</p> <p>Mound = 9,270 people (2013)</p> <p>Orono = 7,796 people (2013)</p> <p>Shorewood = 7,533 people (2013)</p> <p>Spring Park = 1,702 people (2013)</p> <p>Tonka Bay = 1,523 people (2013)</p> <p>Victoria = 8,030 people (2013)</p> <p>Wayzata = 4,217 people (2013)</p> <p>Woodland = 443 people (2013)</p>
Ecoregion	North Central Hardwood Forest
Groundwater	Orono and Mound MnDNR Wells Monitored
District Goals	<ul style="list-style-type: none"> • Reduce in-lake TP concentrations to levels identified in the Hydrologic, Hydraulic, and Pollutant Loading Study (HHPLS) • Reduce chlorophyll-<i>a</i> concentration to below 14 µg/L • Increase Secchi depth to above 1.4 m

Subwatershed Facts and Map



Lake Minnetonka Subwatershed - Lake Monitoring Sites Information

Lake	MNDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Watershed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Black	27-0133-06	LBL01	Hennepin	Yes	86.64			25	464.13	5:1	44.93050	-93.63540
Carman*	27-0133-05	LCM01	Hennepin	Yes	331.29			52	10126.01	31:1	44.92260	-93.60180
Carsons	27-0133-03	LCS01	Hennepin	Yes	116.84			24	719.52	6:1	44.92590	-93.53190
Classen*	27-0162-00	LCN01	Hennepin	No	92.00			3.3	321.55	4:1	44.99314	-93.60762
College*	27-0896-00	LCL01	Hennepin	No	4.34			9	505.33	115:1	44.89878	-93.57127
Cooks	27-0133-05	LCO01	Hennepin	Yes	466.16			43	3468.40	7:1	44.91800	-93.66310
Crystal	27-0133-10	LCR01	Hennepin	Yes	810.20			113	8553.66	11:1	44.94880	-93.59340
Forest	27-0139-00	LFO01	Hennepin	Yes	88.83			42	943.82	11:1	44.95637	-93.63403
French Lake Marsh*	27-0140-00	LFM01	Hennepin	No	36.00			6	891.87	25:1	44.95896	-93.58038
Galpin*	27-0144-00		Hennepin	No	46.00				505.33	11:1		
Gideon	27-0133-02	LGD01	Hennepin	Yes	359.45			66	977.72	3:1	44.91172	-93.57460
Grays	27-0133-01	LGB01	Hennepin	Yes	187.43			28	32420.90	173:1	44.95320	-93.49350
Halsted	27-0133-09	LHL01	Hennepin	Yes	578.67	7063	13.1	36	2364.50	4:1	44.91490	-93.68840
Harrisons*	27-0133-14	LHR01	Hennepin	Yes	272.08			46	458.74	2:1	44.94090	-93.65030
Hooper*	27-0876-00	LHP01	Hennepin	No	5.14			21	302.09	59:1	44.91455	-93.53187
Jennings	27-0133-15	LJE01	Hennepin	Yes	311.60	3345	11.3	26	868.70	3:1	44.95430	-93.65230
Lafayette	27-0133-02	LLF01	Hennepin	Yes	487.52			62	11246.17	23:1	44.93140	-93.58231
Libbs*	27-0085-00	LLB01	Hennepin	Yes	23.00			7	120.41	5:1	44.94728	-93.48852
Louise*	27-0870-00	LLS01	Hennepin	No	7.00			18	131.05	19:1	44.94103	-93.52066
Lower Lake North*	27-0133-03	LMU01	Hennepin	Yes	2002.72			90	30079.52	15:1	44.94635	-93.54041

* Not monitored in 2014; Note: Littoral area columns are not included due to insufficient data.

Lake Minnetonka Subwatershed - Lake Monitoring Sites Information (Continued)

Lake	MNDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Watershed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Lower Lake South	27-0133-02	LG101	Hennepin	Yes	938.47			77	3612.35	4:1	44.91490	-93.56667
Marion*	27-0087-00	LMR01	Hennepin	No	14.00			45	339.61	24:1	44.94678	-93.51783
Mary*	27-0899-00	LMR02	Hennepin	No	11.00			6	95.48	9:1	44.89755	-93.58401
Maxwell	27-0133-11	LMA01	Hennepin	Yes	305.46	4242	14	44	2524.53	8:1	44.96240	-93.60330
North Arm*	27-0133-13	LMR01	Hennepin	Yes	325.56	4628	13	64	774.10	1:1	44.95313	-93.62008
Peavey	27-0138-00	LPE01	Hennepin	Yes	9.70			63	776	80:1	44.96460	-93.53590
Phelps*	27-0133-05	LPH01	Hennepin	Yes	433.92			30	1153.84	3:1	44.91660	-93.64200
Priests	27-0133-05	LPT01	Hennepin	Yes	97.90			46	2624	27:1	44.91861	-93.68074
Shaver**	27-0086-00	LSV01	Hennepin	No	19.00			7	229.11	12:1	44.94547	-93.50589
Smith-town*	27-0133-05	LSM01	Hennepin/ Carver	Yes	154.39			80	5951.27	39:1	44.88920	-93.64030
Spring Park	27-0133-05	LSP02	Hennepin	Yes	440.15			36	1617.97	4:1	44.93250	-93.62680
St. Albans	27-0133-04	LAL01	Hennepin	Yes	167.01			44	379.10	2:1	44.90861	-93.54891
Stubbs	27-0133-12	LSU03	Hennepin	Yes	198.81	3008	16	37	1944.64	10:1	44.96990	-93.61560
Wayzata	27-0133-02	LWA01	Hennepin	Yes	725.92			63	31547.32	43:1	44.96640	-93.51670
West Arm	27-0133-14	LWE01	Hennepin	Yes	499.96			44	3230.38	6:1	44.94350	-93.63420
West Upper	27-0133-05	LCI01	Hennepin	Yes	905.73			84	5951.27	7:1	44.90460	-93.66651
William	27-0142-00	LWL01	Hennepin	Yes	16.00			12	131.33	8:1	44.91803	-93.54715

* Not monitored in 2014

** Monitored by the City of Minnetonka, but data not represented in this report
Note: Littoral area columns are not included due to lack of data.



Black Lake

(DNR ID: 27-0137-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	C	B	C	C+
2007	C	B	C	C+
2008	B	A	B	B+
2009	C	B	C	C+
2010	B	B	B	B
2011	C	B	B	B-
2012	C	B	C	C+
2013	C	B	B	B-
2014	B	B	B	B

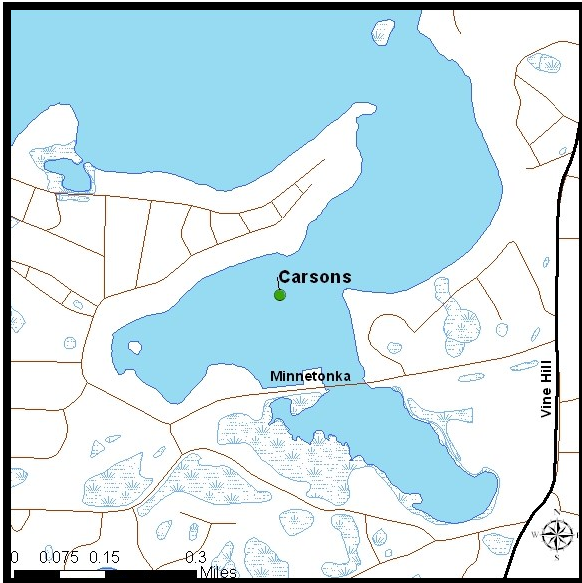
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	1.72	18.46	41	56
2007	1.45	17.40	39	57
2008	2.28	9.67	28	51
2009	1.89	15.61	32	54
2010	2.14	16.39	33	54
2011	1.71	13.38	27	53
2012	1.59	18.38	37	56
2013	2.14	9.75	28	51
2014	3.30	6.75	28	48

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/6/2014	10.44	14.77	413	8.59	1.53	23	42	<3	1.050	1.050	<0.03	49/50
6/3/2014	21.81	8.22	397	7.88	4.00	4	28	8	0.846	0.846	<0.03	42/44
7/8/2014	23.79	9.31	377	8.81	3.40	6	28	<3	0.815	0.815	<0.03	43/50
8/5/2014	25.91	8.64	378	8.59	3.60	4	20	<3	0.860	0.860	<0.03	41/43
9/9/2014	21.34	8.87	385	8.42	2.20	13	35	<3	0.825	0.825	<0.03	43/49
10/14/2014	11.86	11.16	386	9.31	2.55	13	33	<3	0.912	0.912	<0.03	43/42

Note: Surface/Bottom Results



Carsons Bay (DNR ID: 27-0133-03)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	B	A-
2006	B	A	C	B
2007	B	A	B	B+
2008	A	A	A	A
2009	A	A	A	A
2010	A	A	A	A
2011	B	A	A	A-
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.88	6.01	24	48
2006	2.50	5.40	37	50
2007	2.20	6.27	30	50
2008	3.16	4.83	19	45
2009	3.41	3.11	19	44
2010	2.89	5.78	18	46
2011	2.84	5.38	19	46
2012	4.68	2.63	18	41
2013	4.04	4.50	21	44
2014	5.18	2.50	15	40

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	9.71	12.22	415	8.10	6.15	1.5	12	<3	0.554	0.503	0.052	51/53
6/2/2014	20.47	9.80	418	8.12	5.00	3	20	<3	0.509	0.509	<0.03	50/51
7/7/2014	24.40	9.57	411	8.74	4.35	3	17	<3	1.400	1.400	<0.03	52/53
8/4/2014	26.31	10.32	407	8.83	5.85	2	12	<3	0.571	0.571	<0.03	47/46
9/8/2014	21.84	8.66	409	8.48	5.50	2	12	<3	0.674	0.674	<0.03	52/49
10/13/2014	12.16	11.05	413	8.33	6.00	3	10	<3	0.662	0.662	<0.03	52/52

Note: Surface/Bottom Results



Cooks Bay (DNR ID: 27-0133-05)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	B	B	C	B-
2006	C	A	B	B
2007	C	B	C	C+
2008	B	B	B	B
2009	B	B	B	B
2010	B	B	B	B
2011	C	B	B	B-
2012	C	B	B	B-
2013	B	B	A	B+
2014	B	B	C	B-

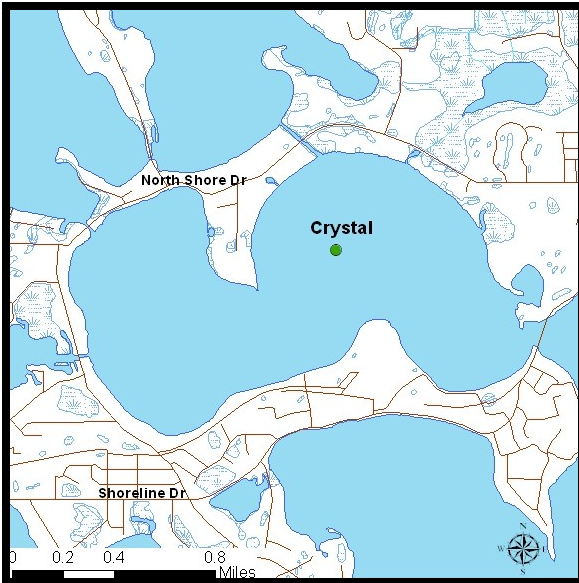
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.11	14.69	33	54
2006	2.02	10.68	30	52
2007	1.56	14.06	43	56
2008	2.33	13.67	24	51
2009	1.88	13.33	29	53
2010	2.28	12.17	24	51
2011	1.59	12.38	25	53
2012	1.44	19.25	30	56
2013	2.16	8.57	20	49
2014	2.49	17.75	34	54

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/6/2014	8.06	13.49	402	8.31	2.25	17.5	28	<3	0.879	0.787	0.092	43/44
6/3/2014	21.51	9.24	396	8.14	5.40	3	18	<3	1.00	0.942	0.061	41/42
7/8/2014	23.15	9.90	378	8.93	1.20	43	47	<3	1.08	1.08	<0.03	38/44
8/5/2014	25.12	7.88	380	8.74	1.65	12	35	<3	1.08	1.08	<0.03	35/41
9/9/2014	21.60	8.69	381	8.19	1.70	13	36	<3	0.836	0.836	<0.03	39/44
10/14/2014	12.39	9.50	24	8.03	3.25	16	42	11	0.979	0.979	<0.03	39/39

Note: Surface/Bottom Results



Crystal Bay

(DNR ID: 27-0133-10)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	B	B	B	B
2006	C	A	C	B-
2007	C	B	B	B-
2008	B	A	B	B+
2009	A	A	A	A
2010	A	A	A	A
2011	C	B	B	B-
2012	A	A	B	A-
2013	A	A	A	A
2014	A	C	C	B-

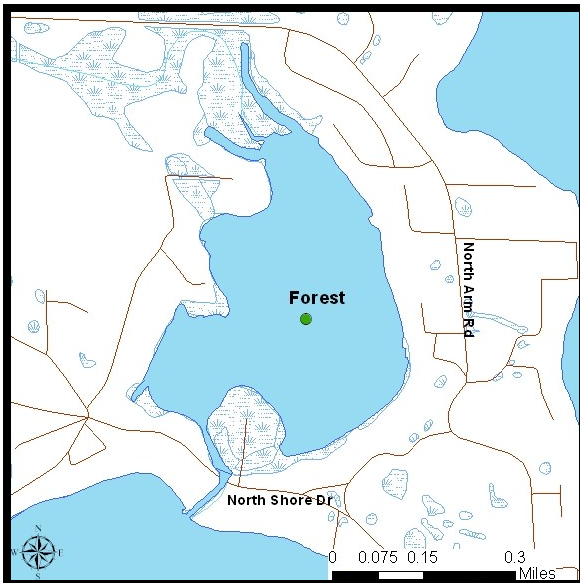
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.14	14.54	29	53
2006	1.63	11.94	31	54
2007	1.58	12.83	29	54
2008	2.76	7.25	26	49
2009	2.87	4.78	20	46
2010	2.50	9.11	21	49
2011	1.66	14.94	24	53
2012	2.83	6.63	21	47
2013	3.91	4.06	18	44
2014	3.66	19.00	34	52

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	9.38	14.86	432	8.48	1.88	24	43	<3	0.774	0.774	<0.03	52/50
6/4/2014	21.05	9.17	427	8.18	9.05	2	22	3	0.651	0.651	<0.03	48/50
7/9/2014	23.38	9.80	414	8.81	2.85	30	38	<3	1.440	1.440	<0.03	50/50
8/6/2014	25.23	8.63	408	8.68	1.15	26	39	<3	1.240	1.240	<0.03	46/46
9/9/2014	21.25	8.18	414	8.13	1.60	18	35	<3	1.090	1.090	<0.03	46/52
10/13/2014	12.16	8.74	421	7.86	3.20	7	39	14	0.960	0.960	<0.03	46/

Note: Surface/Bottom Results



Forest Lake

(DNR ID: 27-0139-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	C	D	C-
2006	D	D	C	D+
2007	D	C	D	D+
2008	D	D	C	D+
2009	D	D	D	D
2010	C	C	C	C
2011	D	C	C	C-
2012	C	D	C	C-
2013	D	C	D	D+
2014	D	D	D	D

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	0.90	45.02	72	65
2006	0.68	62.67	55	66
2007	0.56	69.34	60	68
2008	0.90	40.00	52	63
2009	0.69	46.06	58	66
2010	1.13	51.00	61	64
2011	0.99	55.13	50	63
2012	0.71	54.86	55	66
2013	1.06	44.94	61	63
2014	1.26	43.75	83	64

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	CI
5/7/2014	11.62	11.24	446	9.39	0.55	152	186	<3	2.350	2.350	<0.03	53/50
6/4/2014	23.48	6.70	413	7.87	2.80	4	144	90	1.200	1.140	0.055	44/52
7/9/2014	24.00	11.79	416	9.03	0.95	64	88.5	3	1.515	1.515	<0.03	42/54
8/5/2014	26.21	10.37	403	8.99	0.78	39	53	<3	1.520	1.520	<0.03	42/48
9/9/2014	21.02	9.25	409	8.77	0.53	68	47	<3	1.900	1.900	<0.03	46/52
10/15/2014	11.74	5.50	453	7.60	2.00	11	127	81	2.320	2.320	<0.03	47/52

Note: Surface/Bottom Results



Gideon Bay

(DNR ID: 27-0133-02)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010				
2011	B	A	A	A-
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010				
2011	2.66	5.69	20	47
2012	5.24	2.00	16	39
2013	5.04	4.06	15	42
2014	5.21	2.63	15	40

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	7.50	11.92	420	8.28	6.95	2	13	<3	0.667	0.607	0.06	54/53
6/2/2014	19.85	9.64	420	8.09	5.25	1	14	<3	0.489	0.489	<0.03	48/50
7/7/2014	22.94	9.24	408	8.61	4.05	4	16	<3	0.543	0.543	<0.03	52/52
8/4/2014	25.27	8.91	416	8.55	5.13	3.5	13.5	<3	0.624	0.624	<0.03	44/48
9/8/2014	21.51	7.80	414	8.16	6.40	2	16	<3	0.661	0.661	<0.03	49/51
10/13/2014	12.93	9.72	415	8.03	5.60	2	14	4	0.609	0.609	<0.03	50/50

Note: Surface/Bottom Results



Grays Bay

(DNR ID: 27-0133-01)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	A	A
2006	A	A	C	B+
2007	B	A	C	B
2008	A	A	A	A
2009	B	A	B	B+
2010	B	A	A	A-
2011	A	A	A	A
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

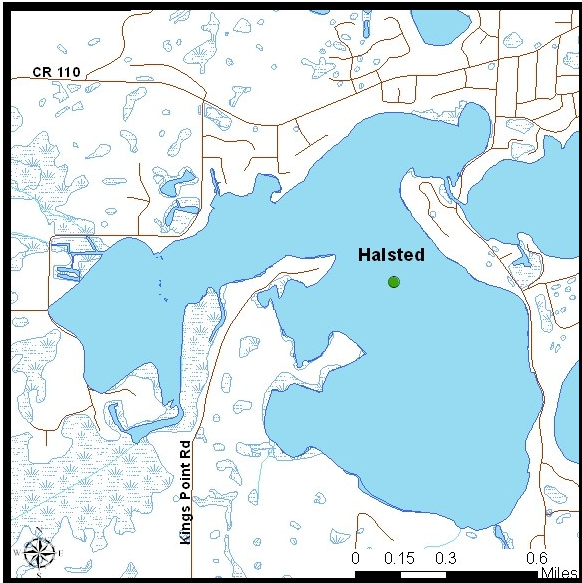
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	3.12	7.50	24	48
2006	3.09	3.74	35	48
2007	2.63	2.54	35	47
2008	3.54	4.39	16	44
2009	2.22	6.89	24	49
2010	2.52	4.78	18	46
2011	3.52	3.81	15	43
2012	3.94	4.63	19	44
2013	4.36	2.88	15	41
2014	5.57	2.00	14	38

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	8.89	11.95	430	8.38	7.30	2	11	<3	0.516	0.460	0.056	55/56
6/3/2014	20.24	9.56	432	8.21	4.60	4	13	<3	0.600	0.600	<0.03	51/54
7/7/2014	23.42	8.44	422	8.47	5.15	2	17	<3	0.596	0.596	<0.03	49/54
8/4/2014	25.82	8.71	422	8.53	5.75	1	12	<3	0.633	0.568	0.065	49/53
9/8/2014	21.38	8.37	423	8.26	6.78	1	14.5	<3	0.699	0.699	<0.03	50/48
10/13/2014	11.69	10.92	426	8.28	7.40	4	14	<3	0.698	0.698	<0.03	53/51

Note: Surface/Bottom Results; Volunteer Secchi data available upon request



Halsted Bay

(DNR ID: 27-0133-09)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	C	D	C-
2006	D	C	C	C-
2007	D	D	D	D
2008	C	D	D	D+
2009	D	D	D	D
2010	D	D	D	D
2011	D	D	D	D
2012	F	D	D	D-
2013	D	D	D	D
2014	D	D	D	D

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.16	47.90	138	67
2006	0.83	49.71	70	66
2007	0.54	77.44	93	71
2008	0.89	83.22	103	69
2009	0.59	76.56	104	71
2010	0.60	80.56	82	70
2011	0.81	55.63	79	67
2012	0.51	72.00	103	71
2013	0.90	62.88	108	68
2014	0.99	73.88	103	68

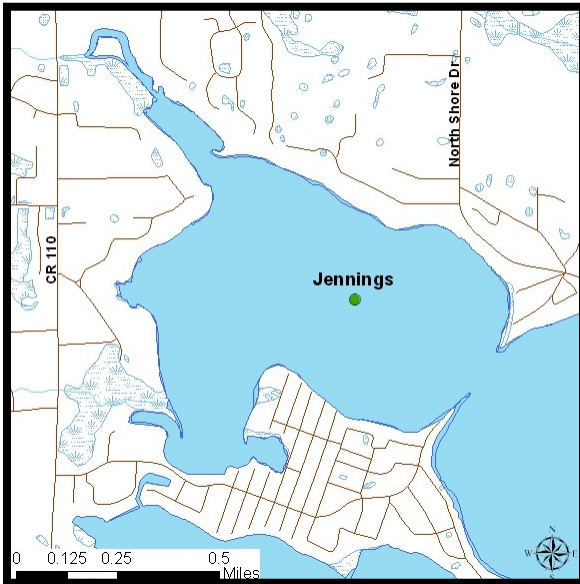
Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Halsted Bay (DNR ID: 27-0133-09)

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/6/2014	9.82	11.64	384	8.06	1.10	52	92/85	<3/15	1.88	1.56	0.316	35/35
5/21/2014	13.51	10.59	392	8.20	1.68	14	50/79	3/27	1.37	1.16	0.208	33
6/3/2014	21.84	8.78	395	7.97	2.70	9	50/396	16/355	1.11	0.96	0.146	32/34
6/17/2014	22.64	10.45	398	8.38	1.60	30	115/406	60/359	1.12	1.12	<0.03	32
7/8/2014	23.35	9.88	376	8.60	1.00	73	115/954	16/736	1.54	1.54	<0.03	29/33
7/23/2014					0.78	52	79/1000	<3/743	1.50	1.50	<0.03	28/29
8/5/2014	26.03	9.62	349	9.06	0.50	123	89/1940	<3/1210	1.97	1.97	<0.03	28/33
8/20/2014	25.16	9.78	352	8.74	0.48	99	95/2170	<3/1340	2.06	2.06	<0.03	29
9/9/2014	21.43	8.16	369	8.20	0.43	118	143.5/1830	<3	2.26	2.26	<0.03	29/32
9/25/2014	18.38	9.99	367	8.39	0.40	87	137/190	7/92	2.28	2.28	<0.03	30
10/14/2014	11.85	11.09	376	8.18	0.45	53	146/142	32/28	2.20	2.20	<0.03	30/29

Note: Surface/Bottom Results



Jennings Bay

(DNR ID: 27-0133-15)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	D	D	D	D
2006	D	D	D	D
2007	F	F	D	F
2008	D	D	D	D
2009	C	C	D	C-
2010	D	D	D	D
2011	D	D	D	D
2012	D	F	D	D-
2013	C	D	D	D+
2014	D	D	D	D

**Ten-Year Water Quality Means
(June-Sept)**

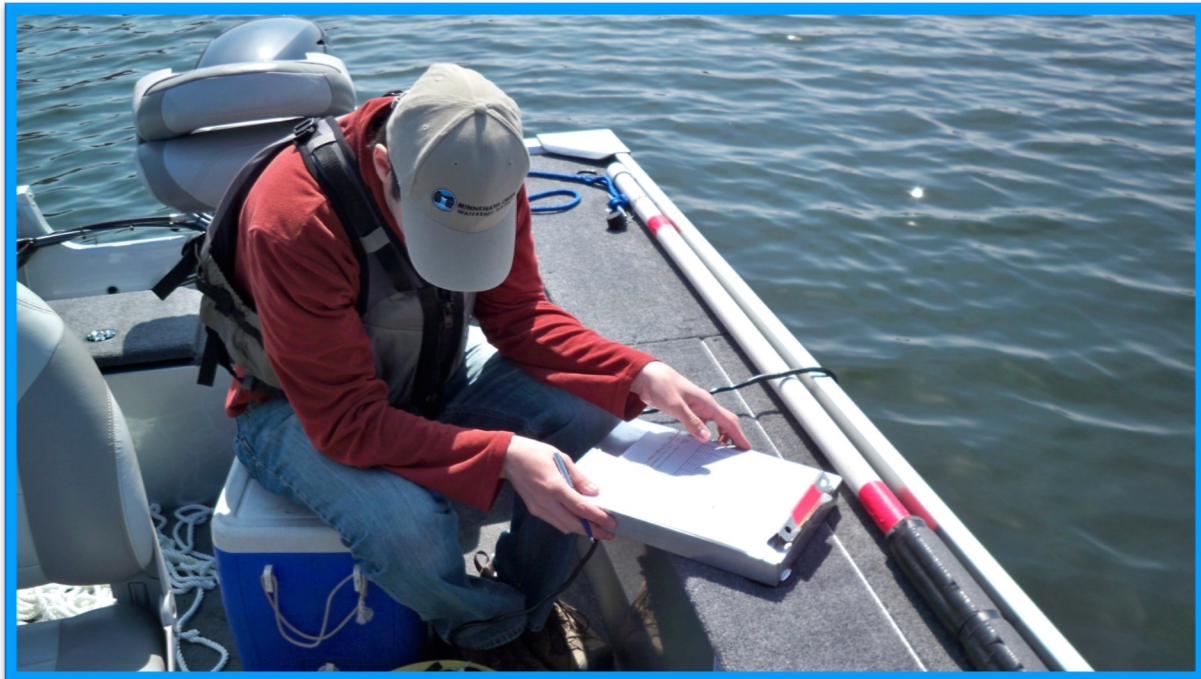
Year	SECC	CHLA	TP	TSI
2005	1.00	62.81	106	69
2006	0.69	75.33	79	69
2007	0.50	87.46	114	72
2008	0.94	68.75	102	68
2009	0.74	53.44	108	69
2010	0.75	65.22	80	68
2011	0.96	70.13	96	68
2012	0.57	131.94	126	73
2013	1.04	58.00	140	68
2014	0.87	77.43	124	70

Jennings Bay (DNR ID: 27-0133-15)

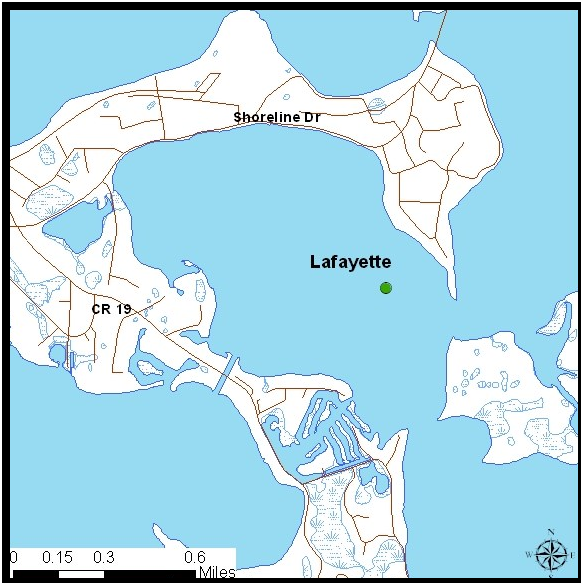
2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/7/2014	10.57	11.29	438	8.70	0.98	40	74/68	4/3	1.460	1.40	0.062	50/50
5/21/2014	13.74	10.79	433	8.53	2.00	10	59/98	4/53	1.590	1.590	<0.03	47
6/4/2014	22.27	10.73	424	8.37	2.70	14	81/306	24/231	0.939	0.939	<0.03	44/48
6/17/2014	22.80	12.12	426	8.65	1.35	37	162/351	75/274	1.240	1.240	<0.03	42
7/9/2014	24.11	13.02	407	8.99	1.00	133	164/1590	34/716	1.970	1.970	<0.03	40/44
7/23/2014					0.55	115	111/2160	<3/720	2.020	2.020	<0.03	39/42
8/5/2014	25.98	9.67	393	9.02	0.55	53	79/1030	<3/584	1.960	1.960	<0.03	39/40
8/20/2014	25.10	10.64	391	8.83	0.60	87	104/1740	<3/317	1.960	1.960	<0.03	43
9/9/2014	21.25	7.87	412	8.07	0.48	103	160/181	26/24	2.240	2.240	<0.03	41/41
9/25/2014	18.35	9.15	407	8.40			129/158	20/59	2.210	2.210	<0.03	44
10/15/2014	12.22	10.63	414	8.26	0.50	44	136/128	28/31	2.210	2.210	<0.03	42/43

Note: Surface/Bottom Results; Volunteer Secchi data available upon request



Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Lafayette Bay

(DNR ID: 27-0133-02)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	C	B+
2006	B	A	B	B+
2007	C	A	C	B-
2008	A	A	A	A
2009	A	A	A	A
2010	A	A	A	A
2011	B	A	A	A-
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

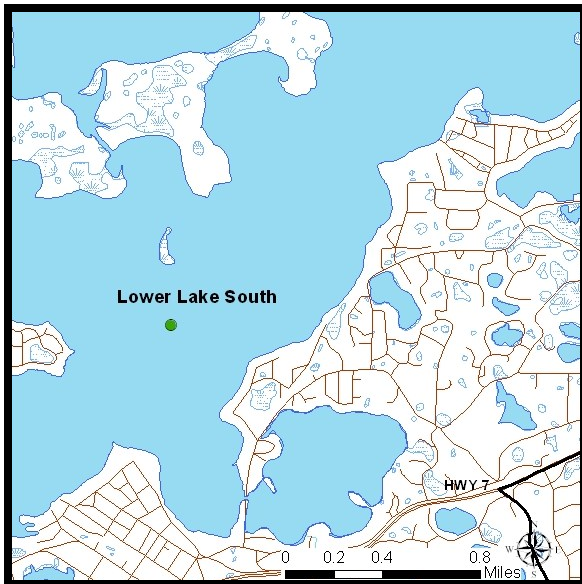
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.90	9.61	30	50
2006	2.40	6.54	27	49
2007	2.16	8.38	32	52
2008	3.50	5.22	18	45
2009	3.30	3.89	18	44
2010	2.94	5.67	18	46
2011	2.44	6.75	21	48
2012	4.39	3.25	18	42
2013	4.65	3.44	15	41
2014	4.94	3.00	17	41

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	8.73	12.21	420	8.03	7.15	1	11	<3	0.560	0.495	0.065	52/52
6/3/2014	18.41	9.85	416	8.19	5.10	1	11	<3	0.790	0.790	<0.03	48/51
7/7/2014	23.46	9.35	399	8.66	3.55	4	17	<3	0.846	0.846	<0.03	47/53
8/6/2014	25.22	8.61	412	8.62	5.20	4	18	<3	0.693	0.693	<0.03	46/47
9/9/2014	21.73	8.65	410	8.31	5.90	3	23	<3	0.614	0.614	<0.03	49/48
10/14/2014	12.56	9.43	414	8.05	4.65	4	16	3	0.606	0.606	<0.03	49/50

Note: Surface/Bottom Results



Lower Lake South

(DNR ID: 27-0133-02)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	B	A-
2006	B	A	B	B+
2007	B	A	B	B+
2008	A	A	A	A
2009	A	A	A	A
2010	A	A	A	A
2011	B	A	A	A-
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	3.17	6.95	25	48
2006	2.64	5.54	30	49
2007	2.23	6.60	28	50
2008	3.56	5.17	16	44
2009	3.56	4.00	18	44
2010	3.31	4.72	16	44
2011	2.96	5.00	18	45
2012	5.59	2.13	13	38
2013	5.20	3.75	15	41
2014	5.14	2.75	15	40

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	7.41	11.86	419	8.33	6.55	1	12	<3	0.547	0.486	0.061	50/52
6/2/2014	20.09	9.64	418	8.09	5.50	1	13	<3	0.465	0.465	<0.03	49/50
7/7/2014	23.01	9.09	413	8.62	4.20	5	18	<3	0.599	0.599	<0.03	51/56
8/4/2014	25.31	9.04	417	8.58	4.95	2	12	<3	0.636	0.636	<0.03	45/47
9/8/2014	21.56	7.95	415	8.20	5.90	3	16	<3	0.677	0.677	<0.03	49/51
10/13/2014	12.96	9.73	415	8.10		4	17	4	0.669	0.669	<0.03	51/51

Note: Surface/Bottom Results



Maxwell Bay

(DNR ID: 27-0133-11)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	B	C	C+
2006	C	B	C	C+
2007	C	C	C	C
2008	B	B	B	B
2009	C	B	C	C+
2010	C	B	B	B-
2011	C	B	B	B-
2012	C	B	C	C+
2013	C	B	C	C+
2014	B	A	B	B+

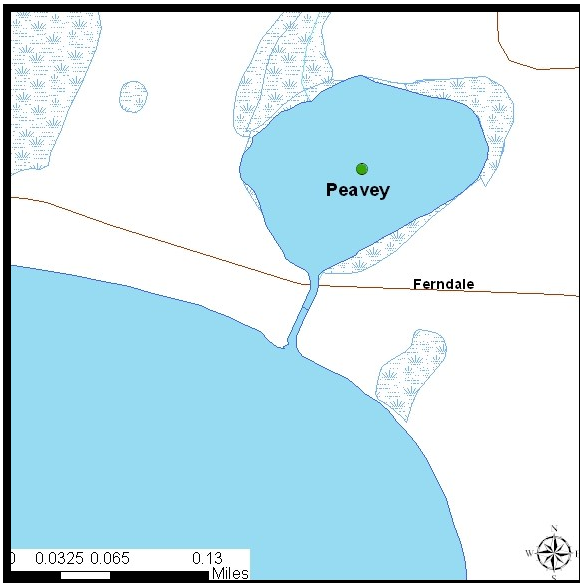
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.63	20.51	36	56
2006	1.32	18.42	36	57
2007	1.28	20.66	34	57
2008	2.19	12.50	31	53
2009	1.75	12.06	43	55
2010	1.54	15.89	26	54
2011	1.81	10.06	25	52
2012	1.61	20.44	30	55
2013	1.65	14.69	38	55
2014	2.71	9.00	26	50

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/7/2014	10.07	12.88	443	8.35	1.73	12	29	<3	1.040	0.892	0.153	53/52
6/4/2014	22.32	9.27	442	8.20	4.70	4	28	5	0.837	0.790	0.047	48/50
7/9/2014	23.31	8.82	427	8.79	1.25	21	31	<3	1.090	1.090	<0.03	51/54
8/4/2014	26.55	8.48	432	8.49	2.70	4	23	<3	0.867	0.867	<0.03	46/46
9/8/2014	21.78	8.51	429	8.30	2.20	7	21	<3	0.835	0.835	<0.03	49/52
10/15/2014	11.95	8.81	430	7.80	4.13	4.5	30.5	12	1.030	0.994	0.036	50/46

Note: Surface/Bottom Results



Peavey Lake

(DNR ID: 27-0138-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	B	C	D	C
2006	C	C	D	C-
2007	C	C	D	C-
2008	C	B	C	C+
2009	C	C	C	C
2010	C	C	C	C
2011	C	B	D	C
2012	C	D	C	C-
2013	C	B	D	C
2014	C	C	D	C-

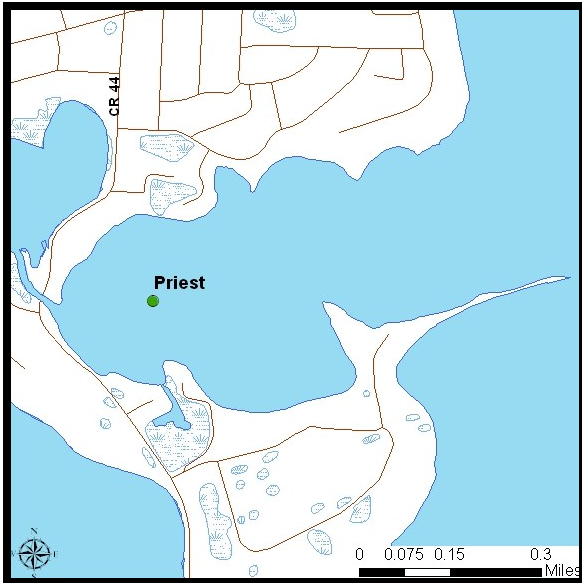
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.03	27.62	77	60
2006	2.00	44.87	94	63
2007	1.84	32.00	111	63
2008	2.30	16.33	42	55
2009	1.96	39.33	65	60
2010	1.98	32.78	67	60
2011	2.37	9.88	88	56
2012	1.48	27.13	139	64
2013	1.78	9.75	129	60
2014	1.90	8.00	125	58

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	10.97	15.07	813	7.76	1.00	68	110	3	2.820	1.180	1.640	100/240
6/2/2014	22.08	5.56	761	7.51	1.85	4	130	72	1.240	1.100	0.141	86/246
7/7/2014	24.42	6.74	737	7.82	1.70	12	174	73	1.370	1.370	<0.03	87/243
8/4/2014	25.98	5.50	711	7.69	2.00	9	101	42	0.993	0.993	<0.03	73/220
9/8/2014	21.09	5.59	751	7.70	2.05	7	93	56	0.948	0.948	<0.03	86/241
10/13/2014	11.97	7.74	723	7.65	4.05	5	99	81	1.030	1.030	<0.03	94/246

Note: Surface/Bottom Results



Priests Bay (DNR ID: 27-0133-05)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	C	B	C	C+
2007	C	B	C	C+
2008	C	B	C	C+
2009	C	B	C	C+
2010	C	B	C	C+
2011	C	C	C	C
2012	D	C	C	C-
2013	C	C	C	C
2014	C	C	C	C

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	1.47	16.53	36	56
2007	1.34	20.78	43	58
2008	1.46	20.78	34	57
2009	1.51	20.50	35	57
2010	1.52	22.67	34	57
2011	1.21	26.06	35	58
2012	0.98	41.38	63	64
2013	1.31	23.25	30	57
2014	1.71	27.25	48	58

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/6/2014	10.76	11.93	392	8.64	1.23	32	59	<3	1.35	1.18	0.173	41/41
6/3/2014	21.19	9.41	401	8.13	3.65	5	35	6	1.01	0.91	0.099	38/41
7/8/2014	23.22	8.97	380	8.71	1.23	34	53	3	1.24	1.24	<0.03	35/41
8/5/2014	25.86	8.65	374	8.89	0.88	45	58	<3	1.53	1.53	<0.03	32/39
9/9/2014	21.39	8.79	376	8.39	1.10	25	45	<3	1.08	1.08	<0.03	36/38
10/14/2014	12.41	9.78	385	8.03	1.80	20	62	20	1.34	1.34	<0.03	39/38

Note: Surface/Bottom Results



Spring Park Bay

(DNR ID: 27-0133-05)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	B	A	A	A-
2006	B	A	C	B
2007	C	A	B	B
2008	B	A	A	A-
2009	B	A	A	A-
2010	A	A	A	A
2011	B	A	A	A-
2012	B	A	A	A-
2013	A	A	A	A
2014	A	A	A	A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.63	8.40	22	49
2006	2.33	7.84	34	51
2007	1.91	9.28	29	52
2008	2.60	8.56	21	49
2009	2.75	6.50	21	48
2010	2.97	7.44	19	47
2011	2.21	8.38	21	49
2012	2.64	8.75	23	49
2013	4.03	3.25	16	52
2014	4.99	2.63	19	41

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/6/2014	9.82	11.73	404	8.02	5.25	1	14	<3	0.708	0.659	0.049	46/46
6/3/2014	19.80	9.33	397	8.14	5.50	2.5	14.5	<3	0.622	0.622	<0.03	43/44
7/8/2014	22.74	8.85	384	8.63	4.55	3	18	<3	0.741	0.741	<0.03	44/44
8/5/2014	24.74	9.45	387	8.76	5.55	2	16	<3	0.678	0.678	<0.03	39/39
9/9/2014	21.59	8.44	377	8.33	4.48	3	27	<3	0.501	0.501	<0.03	44/44
10/14/2014	12.54	10.48	378	8.24	4.80	4	18	<3	0.666	0.666	<0.03	42/43

Note: Surface/Bottom Results; Volunteer Secchi data available upon request



St. Albans Bay (DNR ID: 27-0133-04)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	A	A
2006	A	A	B	A-
2007	B	A	B	B+
2008	A	A	A	A
2009	A	A	A	A
2010	A	A	A	A
2011	B	A	A	A-
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

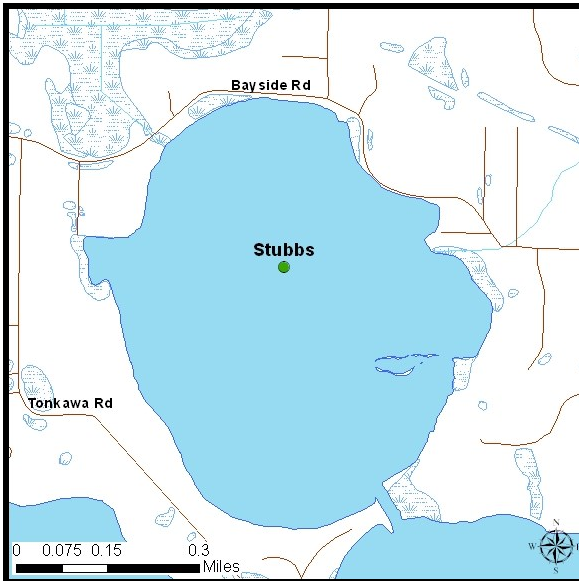
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	3.13	6.96	21	47
2006	2.74	5.11	24	47
2007	2.46	5.00	33	49
2008	3.28	4.67	16	44
2009	3.33	3.33	16	43
2010	3.29	4.56	15	44
2011	2.58	5.50	20	47
2012	3.44	3.88	19	44
2013	4.31	2.94	16	41
2014	5.77	1.25	14	37

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/6/2014	10.46	11.55	425	8.06	4.45	2	13	<3	2.060	2.020	0.039	52/55
6/2/2014	21.83	9.28	417	8.26	5.00	1	12	<3	0.498	0.498	<0.03	51/53
7/7/2014	24.57	9.05	389	8.78	5.63	1	21	<3	0.773	0.773	<0.03	50
8/6/2014	25.56	8.82	386	8.77	6.30	1	11	<3	0.573	0.573	<0.03	47/52
9/8/2014	21.93	8.82	384	8.64	6.15	2	13	<3	0.548	0.548	<0.03	51/55
10/13/2014	12.18	9.90	400	8.19	7.65	3	11	<3	0.611	0.611	<0.03	52/52

Note: Surface/Bottom Results



Stubbs Bay

(DNR ID: 27-0133-12)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	D	C	C-
2006	D	D	C	D+
2007	D	C	C	C-
2008	C	C	C	C
2009	C	C	C	C
2010	C	C	C	C
2011	C	C	C	C
2012	D	D	C	D+
2013	D	D	D	D
2014	D	C	D	D+

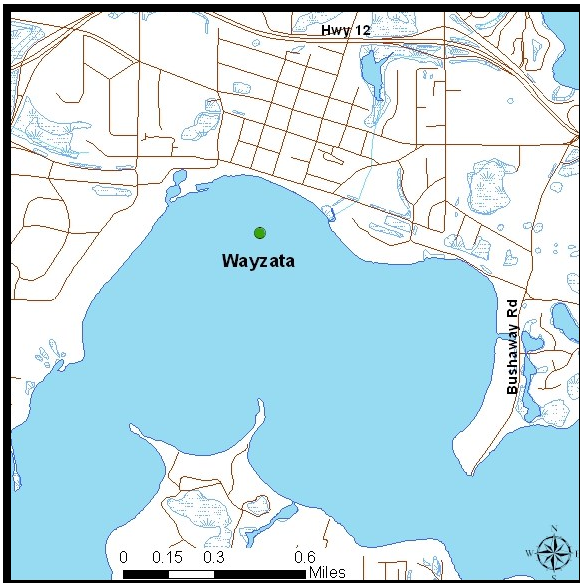
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	0.88	51.66	74	66
2006	0.74	71.00	57	66
2007	0.78	45.23	50	64
2008	1.03	42.63	48	62
2009	1.03	27.33	41	60
2010	1.03	29.56	43	61
2011	1.01	38.44	39	61
2012	0.54	63.44	51	67
2013	0.96	56.38	80	66
2014	1.15	47.13	79	65

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/7/2014	10.57	15.01	461	8.95	1.23	28	76	<3	1.640	1.40	0.243	56/55
6/4/2014	22.01	9.13	450	8.17	2.95	14	114	71	1.090	1.050	0.040	45/54
7/9/2014	23.41	9.13	414	8.90	0.83	40	84	3	1.530	1.530	<0.03	46/56
8/4/2014	26.76	12.18	406	8.99	0.39	61.5	59.5	<3	1.720	1.720	<0.03	43/53
9/8/2014	21.57	9.54	400	8.79	0.45	73	60	<3	1.860	1.860	<0.03	48/56
10/15/2014	11.93	8.31	443	7.72	0.90	31	143	74	2.380	2.380	<0.03	51/50

Note: Surface/Bottom Results



Wayzata Bay

(DNR ID: 27-0133-02)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	B	A-
2006	B	A	B	B+
2007	B	A	C	B
2008	A	A	A	A
2009	A	A	A	A
2010	A	A	A	A
2011	A	A	A	A
2012	A	A	A	A
2013	A	A	A	A
2014	A	A	A	A

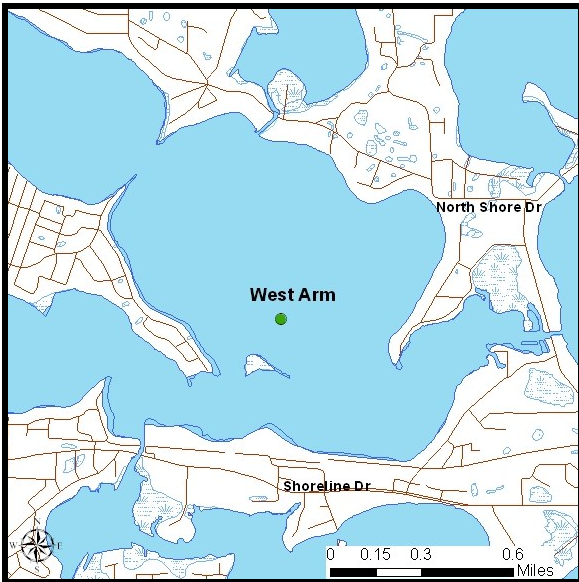
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	3.13	9.82	26	49
2006	2.75	4.58	27	47
2007	2.46	5.07	42	51
2008	3.74	4.00	16	43
2009	3.87	3.28	15	42
2010	3.49	4.72	15	44
2011	3.32	4.88	16	44
2012	5.73	1.75	14	38
2013	4.77	3.50	17	42
2014	4.95	3.25	16	41

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	7.12	11.77	437	8.38		2	12	<3	0.584	0.493	0.09	57/58
6/2/2014	21.11	9.50	428	8.14	4.20	3	14	<3	0.577	0.577	<0.03	52/53
7/7/2014	23.08	9.24	419	8.61	4.35	4	20	<3	0.705	0.705	<0.03	48/51
7/29/2014					4.90							
8/6/2014	24.95	9.03	423	8.66	5.30	3	15	<3	0.720	0.720	<0.03	49/52
9/8/2014	21.89	8.29	422	8.25	5.98	3	15	<3	0.633	0.633	<0.03	50/53
10/13/2014	13.13	9.78	422	8.15	5.65	6	18	4	0.673	0.673	<0.03	53/52

Note: Surface/Bottom Results



West Arm (DNR ID: 27-0133-14)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	C	C	C
2006	D	D	C	D+
2007	D	D	D	D
2008	D	D	C	D+
2009	C	C	D	C-
2010	C	C	C	C
2011	C	D	C	C-
2012	D	D	D	D
2013	C	C	D	C-
2014	D	D	D	D

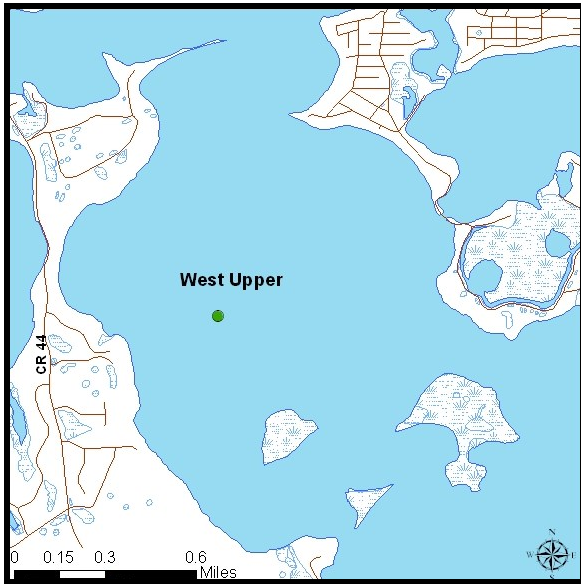
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.13	43.57	68	64
2006	0.80	65.58	59	66
2007	0.71	62.99	76	68
2008	1.00	57.31	63	65
2009	0.95	43.78	70	65
2010	0.91	44.28	48	63
2011	1.12	67.00	64	65
2012	0.63	78.94	80	69
2013	1.36	51.13	76	64
2014	1.15	65.25	89	66

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/7/2014	9.95	14.83	432	8.89	1.15	40	85	<3	1.64	1.58	0.06	50/49
6/4/2014					2.80	9	50	4	1.06	1.06	<0.03	46/47
7/9/2014	23.81	9.19	408	8.91	0.65	93	117	<3	1.86	1.86	<0.03	44/48
8/6/2014	25.48	10.29	388	9.02	0.65	60	80	<3	1.72	1.72	<0.03	39/44
9/9/2014	21.33	7.51	407	8.20	0.48	99	109	<3	2.02	2.02	<0.03	42/46
10/15/2014	12.00	10.08	413	8.13	0.55	45	108	19	2.03	2.03	<0.03	43/43

Note: Surface/Bottom Results



West Upper Lake

(DNR ID: 27-0133-05)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	B	A-
2006	B	A	C	B
2007	C	B	C	C+
2008	B	A	B	B+
2009	B	A	B	B+
2010	A	A	A	A
2011	C	A	B	B
2012	C	B	B	B-
2013	B	B	A	B+
2014	A	A	B	A-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.52	10.75	27	51
2006	2.17	7.69	45	53
2007	1.76	11.96	29	53
2008	2.64	9.33	33	51
2009	2.40	9.33	22	50
2010	2.53	9.61	20	49
2011	1.81	9.25	22	51
2012	1.83	13.13	26	53
2013	2.66	7.13	19	47
2014	3.86	5.50	25	46

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/6/2014	8.99	13.70	403	8.35	2.40	11	22	<3	0.921	0.845	0.076	45/44
6/4/2014	21.71	8.12	392	8.26	7.10	3	31	<3	0.844	0.798	0.046	39/44
7/8/2014	22.90	9.13	383	8.77	2.05	10	24	<3	0.757	0.757	<0.03	41/45
8/5/2014	25.50	9.13	382	8.73	3.40	4	23	<3	0.941	0.941	<0.03	37/39
9/9/2014	21.36	7.75	380	8.21	2.90	5	22	<3	0.716	0.716	<0.03	40/44
10/14/2014	12.42	10.00	218	7.98	3.70	6	25	6	0.840	0.840	<0.03	40/43

Note: Surface/Bottom Results



Lake William

(DNR ID: 27-0133-05)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010	B	A	C	C+
2011	N/A	A	B	N/A
2012	N/A	A	C	N/A
2013	N/A	A	C	N/A
2014	D	A	C	C+

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010	1.04	8.67	36	56
2011	N/A	5.75	30	50
2012	N/A	8.50	56	57
2013	N/A	5.25	43	53
2014	1.21	7.75	36	55

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl	TSS
5/28/2014	24.4	1.05	8	37	0.644	0.644	<0.03	37	4
6/26/2014	22.9	1.25	3	44	0.798	0.798	<0.03	32	2
7/27/2014	24.6	1.15	14	30	0.752	0.752	<0.03	37	2
8/26/2014	23.0	1.25	10	45.5	0.974	0.974	<0.03	40	2
9/29/2014	19.6	1.20	4	25	0.742	0.742	<0.03	39	1

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Lake Minnetonka Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Black		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
Carrman		2008		2012	2012	None	None
Carsons		2008	August 2013	2012	2012	Mercury in Fish Tissue	Aquatic Consumption
College							
Cooks		2008		2012	2012	None	None
Crystal		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
Forest		2008		1992		Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
French Lake Marsh							
Galpin	1998 - 2014	Yes (DNR)					
Gideon		2008		2012	2012	None	None
Grays		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
Halsted		2008		2012	2012	Mercury in Fish Tissue, Nutrient/Eutrophication Biological Indicators	Aquatic Consumption and Recreation
Harrisons		2008		2012	2012	None	None
Hooper	1993						
Jennings		2008		2012	2012	Mercury in Fish Tissue, Nutrient/Eutrophication Biological Indicators	Aquatic Consumption and Recreation
Lafayette		2008		2012	2012	None	None
Libbs	1989					None	None
Louise		Yes (DNR)					

*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcawd-lakes

Lake Minnetonka Subwatershed - Additional Lake Information (Continued)

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Lower Lake North		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
Lower Lake South		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
Marion	1983						
Mary	1997 - 1998						
Maxwell		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
North Arm		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
Peavey		2008		1992		Chloride	
Phelps		2008	August 2013	2012	2012	None	None
Priests		2008		2012	2012	None	None
Shaver	1977 - 2014						
Smithtown		2008		2012	2012	None	None
Spring Park		2008		2012	2012	None	None
St. Albans		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
Stubs		2008		2012	2012	Mercury in Fish Tissue, Nutrient/Eutrophication Biological Indicators	Aquatic Consumption and Recreation
Wayzata		2008		2012	2012	None	None
West Arm		2008		2012	2012	Mercury in Fish Tissue, Nutrient/Eutrophication Biological Indicators	Aquatic Consumption and Recreation
West Upper		2008		2012	2012	Mercury in Fish Tissue	Aquatic Consumption
William				2012	2012		

*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcawd-lakes

Lake Minnetonka Subwatershed - Additional Lake Information (Continued)

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Black	X	X	X	X	X		X
Carman	X	X	X	X	X		X
Carsons	X	X	X	X	X		X
Classen							
College							
Cooks	X	X	X	X	X		X
Crystal	X	X	X	X	X		X
Forest	X	X	X	X	X		X
French Lake Marsh							
Galpin				X			
Gideon	X	X	X	X	X		X
Grays	X	X	X	X	X		X
Halsted	X	X	X	X	X		X
Harrisons	X	X	X	X	X		X
Hooper							
Jennings	X	X	X	X	X		X
Lafayette	X	X	X	X	X		X
Libbs				X			X
Louise							
Lower Lake North	X	X	X	X	X		X
Lower Lake South	X	X	X	X	X		X

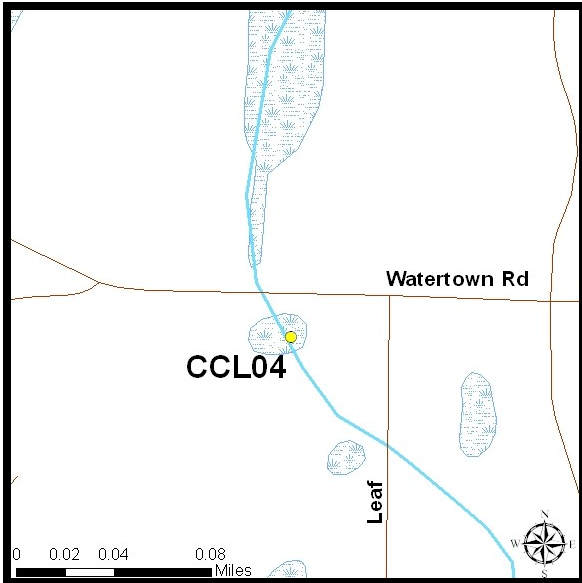
Lake Minnetonka Subwatershed - Additional Lake Information (Continued)

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curtyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Marion							
Mary							
Maxwell	X	X	X	X	X		X
North Arm	X	X	X	X	X		X
Peavey	X	X	X	X	X		X
Phelps	X	X	X	X	X		X
Priests	X	X	X	X	X		X
Shaver							
Smithtown	X	X	X	X	X		X
Spring Park	X	X	X	X	X		X
St. Albans	X	X	X	X	X		X
Stubbs	X	X	X	X	X		X
Wayzata	X	X	X	X	X		X
West Arm	X	X	X	X	X		X
West Upper	X	X	X	X	X		X
William							

Lake Minnetonka Subwatershed - Stream Monitoring Sites Information

Stream	MCWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Classen Lake Creek: Upstream	CCL04	Yes	No	773.77	44.9783	-93.6053
Classen Lake Creek: Stubbs Bay Inlet	CCL01	Yes	No	219.57	44.9716	-93.6081
Classen Wetland Creek: Stubbs Bay Inlet	CST01	Yes	No	506.55	44.9739	-93.6207
Forest Lake Creek: Forest Lk Inlet	CF001	Yes	No	294.96	44.96337	-93.6363

Classen Lake Creek: Upstream (CCL04)



NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	14
Dissolved Oxygen (mg/L)	6
Total Suspended Solids (mg/L)	5
Total Phosphorus (µg/L)	187
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

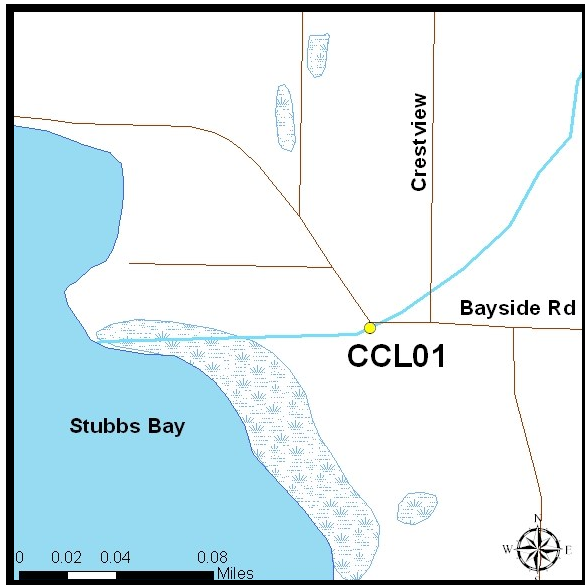
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	0.63	223	179	71	57	400	0.32	23	18		
2007	0.43	137	163	50	59	2347	2.79	7	8		
2008	0.20	46	117	24	60	634	1.59	1	3	17	42
2009	0.18	44	127	27	79	587	1.69	1	2	37	106
2010	0.36	118	165	70	98	921	1.28	2	2	42	59
2011	0.82	216	134	123	77	2111	1.31	10	6	107	66
2012	0.27	99	187	63	119	410	0.77	2	4	18	34
2013	0.87	490	0	309	0	2862	1.68	5	3	65	38
2014	1.02	278	138	172	86	3131	1.56	7	3	124	62

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CCL04

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	4.021	1.84	9.1	567	7.48	154	104.5	3.095	3	72
4/16/2014	1.590	0.62	10.04	616	7.11	79				
4/23/2014	1.515	5.65	9.37	641	7.28	50	19		<1	
4/30/2014	14.810	4.23	10.14	482	7.51	79	20			
5/7/2014	2.884	10.31	9.32	574	7.41	42	24	0.891	1	69
5/14/2014	4.031	8.78	9.23	594	7.44	45	27			
5/21/2014	4.802	14.14	9.66	598	7.61	68	45		2	
5/29/2014	2.396	16.82	5.71	629	7.42	162	126			
6/4/2014	7.278	18.41	4.61	517	7.33	241	186	1.09	4	51
6/10/2014	1.707	16.58	5.98	541	7.35	155	104			
6/17/2014	3.184	19.13	5.81	545	7.39	170	126		6	
6/24/2014	2.499	20.28	6.07	501	7.34	229	185			
7/1/2014	2.071	19.10	5.54	536	7.23	564	347	1.95	11	52
7/7/2014	0.643	22.87	5.49	526		268	176			
7/16/2014	0.813	17.89	6.6	551		150	105		2.5	
7/22/2014	1.356	24.10	4.21	551	7.31	212	139			
7/30/2014	0.030	19.21	4.93	645	7.27	226	124	1.96	11	61
8/6/2014	0.051	17.34	4.11	737	7.02	213	125			
9/2/2014	0.011	19.33	5.18	773		269	126			
9/17/2014	0.073	15.19	6.4	745		111	90			
9/24/2014	0.019	14.21	2.97	852	6.8	193	15	0.928	10	92
10/1/2014	0.015	12.61	0.94	1008	7.11	429	16			
10/8/2014	0.059	7.74	5.53	820	7.36	152	57		2	
10/14/2014	0.056	11.55	2.32	1023	7.17	219	107			

Blue Highlight = Flow calculated from rating curve.



Classen Lake Creek: Stubbs Bay Inlet (CCL01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	13
Total Phosphorus (µg/L)	180
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

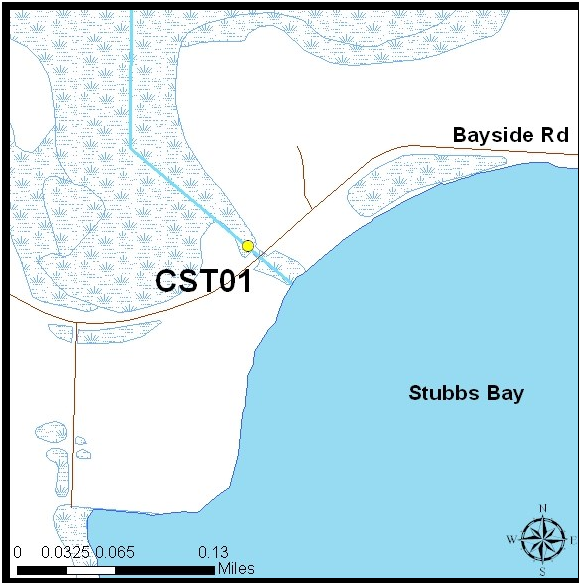
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	1.37	875	320	272	100	4588	1.70	234	87		
2006	0.48	145	152	80	84	758	0.80	9	10		
2007	0.67	361	275	180	137	1849	1.41	10	8		
2008	0.17	38	113	26	77	566	1.68	4	10	20	59
2009	0.10	39	191	26	128	276	1.35	0.47	2	22	106
2010	0.31	107	174	74	120	833	1.36	3	5	47	77
2011	0.65	231	182	93	73	1589	1.25	86	68	76	59
2012	0.20	91	236	55	143	244	0.63	11	30	16	42
2013	0.63	364	295	229	186	2285	1.85	18	15	45	37
2014	0.80	260	164	175	110	2241	1.42	23	14	94	59

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CCL01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	2.460	3.15	11.74	622	7.89	217	169	3.04	10	72
4/16/2014	0.743	2.97	11.67	654	7.77	122	60.5			
4/23/2014	0.764	8.76	11.72	632	7.97	76	33		2	
4/30/2014	9.554	3.79	11.46	490	7.66	115	60			
5/7/2014	2.810	11.62	11.23	605	7.86	68	<3	0.897	19	56
5/14/2014	3.160	10.49	10.85	621	7.91	75	56			
5/21/2014	3.980	13.87	11.44	604	8.09	90	<3		3	
5/29/2014	1.960	17.77	8.47	635	8	188	147			
6/4/2014	6.150	18.61	7.27	533	7.73	286	216.5	1.09	19	52
6/10/2014	1.620	17.01	8.27	567	7.97	206	176			
6/17/2014	3.700	18.21	8.35	572	7.93	183	150		25	
6/24/2014	2.630	20.23	9.05	528	7.81	279	231			
7/1/2014	1.180	19.91	8.49	554	7.95	301	231	1.66	5	49
7/7/2014	0.430	22.17	7.89	572		227	162			
7/16/2014	1.890	18.86	9.93	597		185	152		4	
7/22/2014	0.092	24.03	7.19	586	8.17	154	136			
7/30/2014	0.050	20.05	8.64	618	8.25	187	164	1.32	6	57
8/6/2014	0.050	18.52	7.86	610	7.92	172	154			
8/13/2014	0.010	17.82	7.4	641	7.59	194	164		2	
9/17/2014	0.100	13.98	8.44	655		182	135			
10/8/2014	0.060	8.38	10.01	771	8.34	240	143		52	
10/14/2014	0.041	11.81	8.94	826	8.05	214	189			

Blue Highlight = Flow calculated from rating curve.



Classen Wetland Creek: Stubbs Bay Inlet (CST01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	10
Dissolved Oxygen (mg/L)	4
Total Suspended Solids (mg/L)	7
Total Phosphorus (µg/L)	621
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

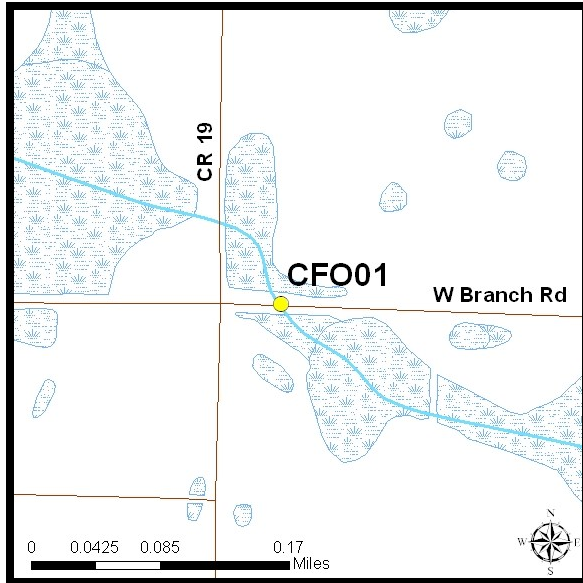
Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	Cl (1000 lbs)	Cl (mg/L)
2005	0.41	537	671	260	325	2142	2.67	41.6	52		
2006	0.22	77	175	48	109	256	0.58	1.4	3		
2007	0.20	470	1207	92	236	597	1.53	36.7	94		
2008	0.08	25	152	20	118	405	2.44	0.2	1	6	37
2009	0.04	18	229	11	141	80	1.04	0.3	3	3	43
2010	0.18	86	249	57	165	391	1.13	1.0	3	17	48
2011	0.34	179	264	101	149	595	0.88	3.7	5	42	62
2012	0.18	96	267	77	215	186	0.52	0.1	0.4	7	18
2013	0.31	197	318	167	271	771	1.25	1.1	2	13	21
2014	0.42	182	222	138	168	1078	1.32	3.0	3	21	25

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CST01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	1.930	4.28	4.97	578	7.30	355	322	2.86	1	56
4/16/2014	1.030	1.57	6.20	763	6.65	171	130			
4/23/2014	0.530	6.83	4.72	765	7.14	201	186		<1	
4/30/2014	8.570	5.21	8.66	424	7.40					
5/14/2014	1.480	9.14	3.99	605	7.36	258	234			
5/21/2014	2.110	15.69	4.04	582	7.45	395	329		8	
5/29/2014	1.430	18.06	0.56	655	7.28	1180	803			
6/4/2014	0.957	19.05	0.19	581	7.22	1790	1030	1.69	17	31



Forest Lake Creek: Forest Lake Inlet (CFO01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	13
Dissolved Oxygen (mg/L)	5
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	226
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	0.42	334	400	155	185	1165	1.39	18	21		
2006	0.43	112	131	75	88	16	0.02	1	1		
2007	0.23	80	175	53	117	477	1.05	2	4		
2008	0.12	34	142	27	112	165	0.69	1	3	13	56
2009	0.10	37	181	29	141	287	1.42	6	31	26	130
2010	0.17	98	291	69	205	373	1.11	1	3	32	94
2011	0.74	202	138	151	103	2419	1.65	14	9	319	218
2012	0.19	90	240	68	181	171	0.45	2	5	31	84
2013	0.39	301	390	205	266	946	1.23	2	3	29	38
2014	0.62	216	177	189	155	916	0.75	3	2	51	42

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CFO01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	4.120	5.04	8.03	584	7.49	229	194	1.520	11	74
4/16/2014	0.670	1.34	8.73	827	7.35	117	75			
4/22/2014	0.450	10.41	8.02	845	7.40	86	74		<1	
4/30/2014	10.420	3.59	8.61	509	7.39	143	133			
5/6/2014	1.140	10.08	7.11	682	7.48	94	89	0.749	<1	77
5/13/2014	3.650	10.04	6.72	641	7.46	118	111			
5/21/2014	3.960	12.25	4.47	623	7.51	138	119		1	
5/28/2014	3.960	19.66	4.02	635	7.39	210	185			
6/4/2014	1.470	17.74	2.82	587	7.32	303	276.5	1.034	1.5	51
6/10/2014	0.500	15.86	3.52	709	7.36	222	188			
6/17/2014	2.170	18.72	2.93	634	7.29	234.5	215.5		1	
6/24/2014	0.992	19.51	2.68	643	7.32	357	294			
6/30/2014	0.790	20.56	2.56	761	7.62	688	314	1.560	14	60

Lake Minnetonka Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey*	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Classen Lake Creek: Upstream	2013	None	None
Classen Lake Creek: Stubbs Bay Inlet		None	None
Classen Wetland Creek: Stubbs Bay Inlet		None	None
Forest Lake Creek: Forest LK Inlet		None	None

* The Macroinvertebrate Survey Report is available on the district website at <http://minnehahacreek.org/project/stream-assessment-2013>

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Lake Virginia Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	3
Guidelines and Standards	5
Executive Summary	6
Subwatershed Facts and Map	7
Lake Virginia Subwatershed - Lake Monitoring Sites Information	8
Lake Minnewashta	9
Lake Virginia	10
St. Joe Lake	11
Tamarack Lake	12
Lake Virginia Subwatershed - Additional Lake Information	13
Lake Virginia Subwatershed - Stream Monitoring Sites Information	14
Lake Minnewashta Creek: Lake Minnewashta Outlet	15
Lake Virginia Subwatershed - Additional Stream Information	17

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ion (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.



Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); Shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%

Executive Summary

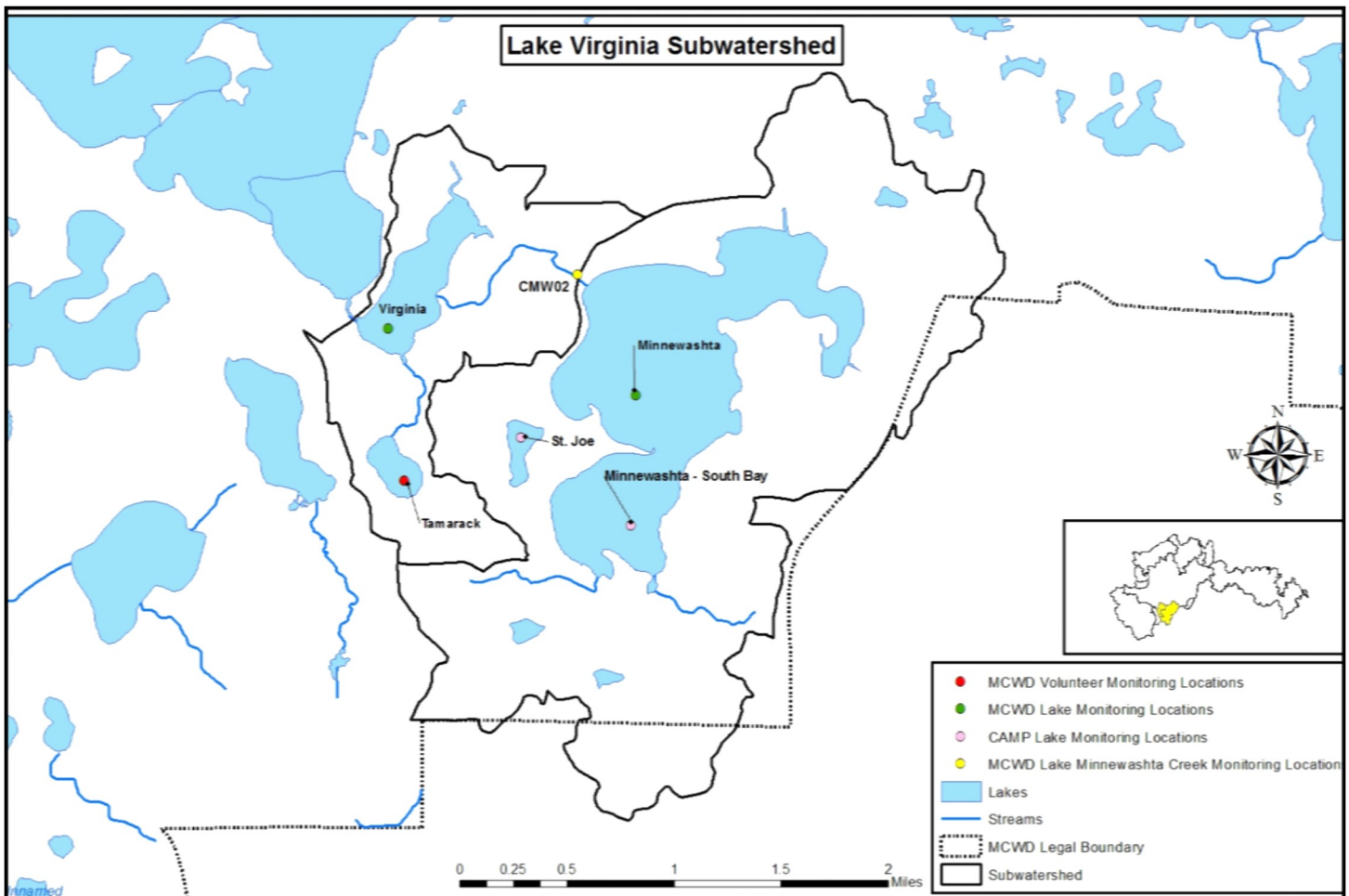
The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

The 2014 monitoring season is summarized for Lake Virginia Subwatershed in this report. There was one stream site on Lake Minnewashta Creek and four lakes monitored in 2014. Lake Minnewashta Creek outlet 2014 means met the North Central Hardwood Forest (NCHF) guidelines and standard. The table below displays the lakes monitored within the Lake Virginia Subwatershed that did not meet the NCHF eutrophication standards.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Minnewashta		X		
Minnewashta: South Bay				
St. Joe				
Tamarack		X		
Virginia			X	

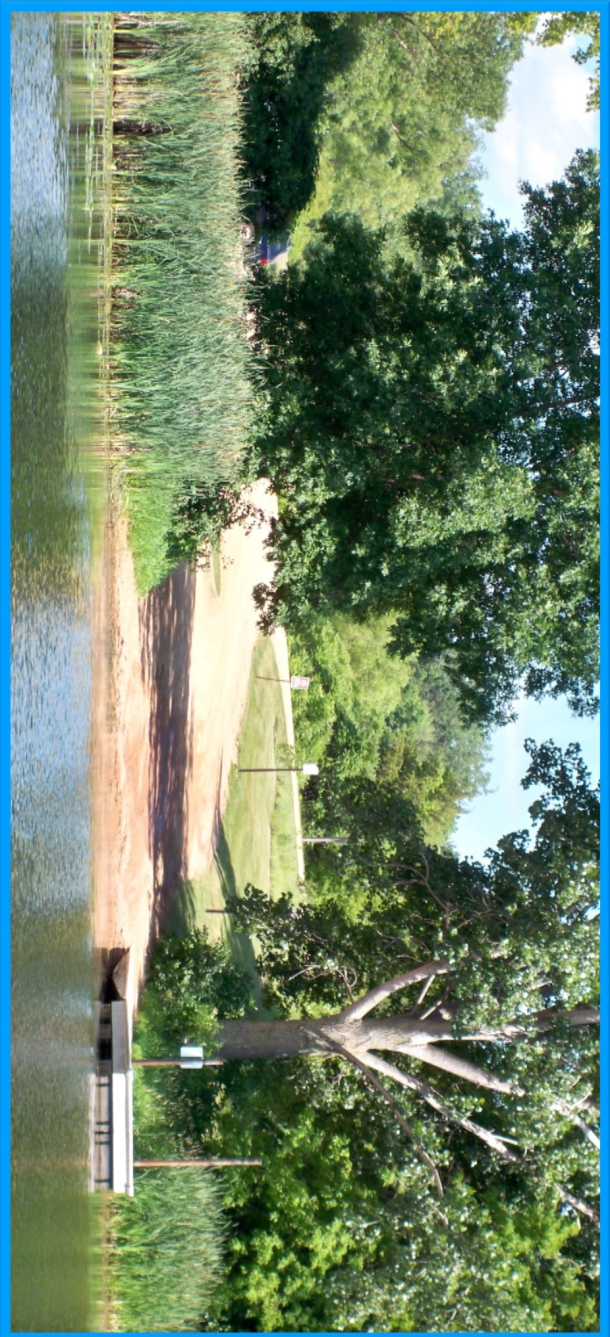
Subwatershed Facts and Map

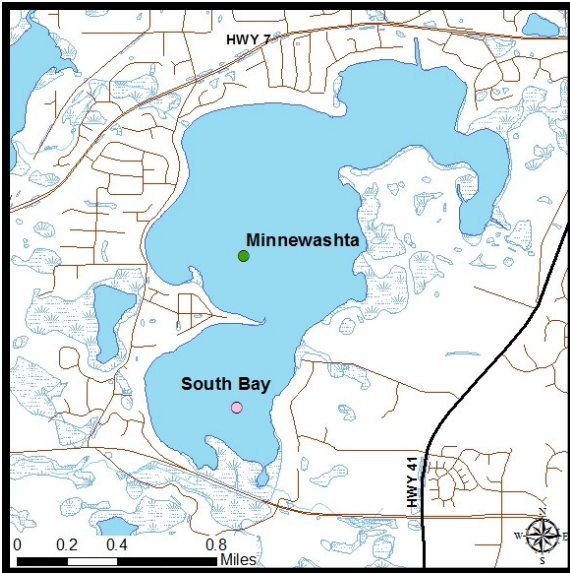
Municipalities	Chanhassen, Shorewood, and Victoria
Area	About 3,990 acres
Population	Chanhassen = 24,432 people (2013) Shorewood = 7,533 people (2013) Victoria = 8,030 people (2013)
Ecoregion	North Central Hardwood Forest
Groundwater	No MnDNR wells monitored
District Goals	<ul style="list-style-type: none"> • Reduce TP concentrations to 20 µg/L in Lake Minnewashta • Reduce TP concentrations to 40 µg/L in Lake Virginia • Maintain Secchi depth of at least 1.4 m and chlorophyll-<i>a</i> concentrations of less than 14 µg/L



Lake Virginia Subwatershed - Lake Monitoring Sites Information

Lake	MNDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Watershed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Minnewashata	10-0009-00	LMW01	Carver	Yes	686	371	54	12614	17	70	3081.00	4:1	44.87830	-93.61010
Virginia	10-0015-00	LVI01	Carver	Yes	113	30	26	1210	11	34	3995.42	35:1	44.88330	-93.63570
St. Joe	10-0011-00		Carver	Yes	19	6.5	34			52	214.51	11:1	44.87580	-93.62310
Tamarack	10-0010-00	TAM01	Carver	No	29	9.9	35			82	215.14	7:1	44.87274	-93.63460





Lake Minnewashta (DNR ID: 10-0009-00) & Lake Minnewashta - South Bay - Monitored by CAMP -

**Lake Minnewashta
Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	A	A	B	A-
2006	B	A	B	B+
2007	C	A	A	B+
2008	B	A	A	A-
2009	B	A	B	B+
2010	C	A	A	B+
2011	C	A	A	B+
2012	B	A	B	B+
2013	C	A	B	B
2014	C	B	B	B-

**Lake Minnewashta - South Bay
Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009				
2010	B	B	A	B+
2011	A	A	A	A
2012	C	A	C	B-
2013	B	C	A	B
2014	B	A	A	A-

**Combined
Lake Grade**

Year	Lake Grade
2005	A-
2006	B+
2007	B+
2008	A-
2009	B+
2010	B+
2011	A-
2012	B
2013	B
2014	B+

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	3.90	1.54	18	40
2006	1.91	11.38	29	53
2007	1.90	7.80	21	50
2008	2.91	6.72	19	47
2009	2.15	7.44	21	49
2010	1.80	9.00	19	50
2011	1.99	8.94	20	50
2012	2.00	9.63	23	51
2013	1.81	10.38	23	54
2014	2.05	16.63	27	53

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009				
2010	1.88	19.20	19.00	52
2011	4.29	8.11	21.63	46
2012	1.89	9.67	49.11	55
2013	2.54	24.24	17.50	51
2014	2.5	8.2	15	47

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Lake Minnewashta
(DNR ID: 10-0009-00)
And
Lake Minnewashta - South Bay
- Monitored by CAMP -

Lake Minnewashta**2014 Water Quality Data**

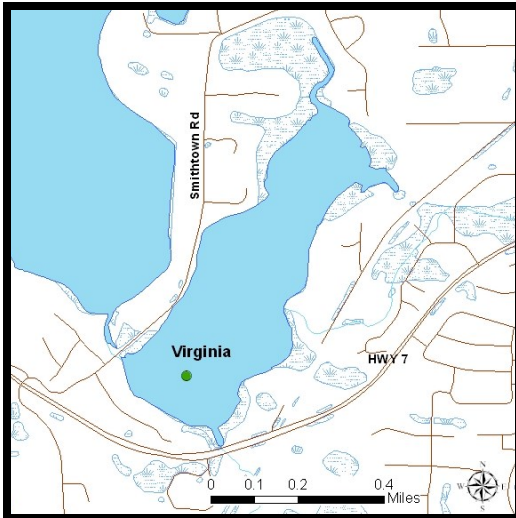
Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/12/2014	12.21	11.67	429	8.28	1.75	6	28	<3	0.913	0.788	0.125	45/47
6/9/2014	21.06	9.91	415	8.33	2.55	16.5	22	<3	0.671	0.671	<0.03	44/46
7/14/2014	23.03	8.92	385	8.66	2.55	21	34	<3	1.070	1.070	<0.03	40/46
8/11/2014	24.56	7.93	400	8.46	1.10	16	28	<3	1.070	1.070	<0.03	42/45
9/16/2014	17.02	10.05	403	8.04	2.00	13	24	<3	0.831	0.831	<0.03	43/46
10/21/2014	12.08	9.85	418	7.99	2.80	12	46	5	1.100	1.100	<0.03	44/44

Note: Surface/Bottom Results

Lake Minnewashta - South Bay
2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TKN
6/2/2014	25.9	3.7	1.0	12	0.86
6/16/2014	22.5	4.0			
7/16/2014	26.7	3.2	6.1	30	0.78
8/1/2014	27.1	1.0	14.0	13	1.00
8/9/2014	19.5	2.3	8.8	14	0.90
8/14/2014	25.6	1.2	9.7	12	0.84
8/22/2014	18.3	2.0	9.6	9	0.74
10/24/2014	11.5	3.2	17.0	50	1.00

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Lake Virginia (DNR ID: 10-0015-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	D	B	C	C
2006	C	C	C	C
2007	C	C	C	C
2008	C	C	D	C-
2009	C	C	C	C
2010	C	C	C	C
2011	C	C	C	C
2012	D	C	C	C-
2013	D	C	C	C-
2014	C	B	C	C+

**Ten-Year Water Quality Means
(June-Sept)**

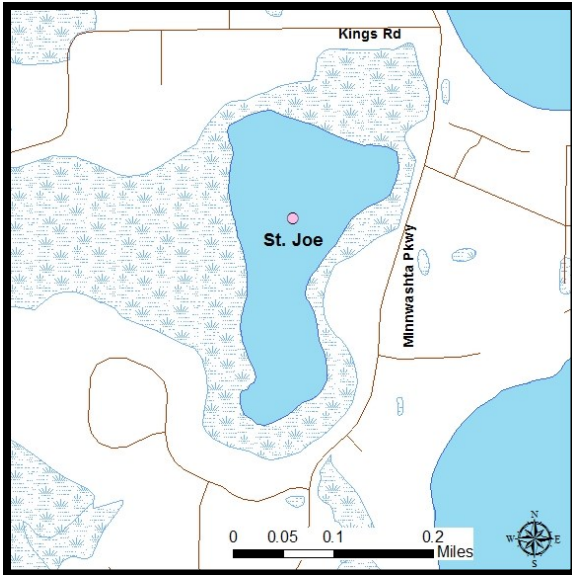
Year	SECC	CHLA	TP	TSI
2005	0.96	22.84	44	60
2006	1.33	37.00	54	61
2007	1.36	37.48	60	67
2008	1.88	30.11	75	60
2009	1.64	33.22	48	59
2010	1.14	37.33	51	62
2011	1.37	43.22	47	61
2012	0.84	54.25	64	66
2013	1.19	51.25	61	69
2014	1.86	12.88	44	56

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/14/2014	13.79	11.28	465	8.59	0.98	28	130	<3	1.460	1.460	<0.03	52/56
5/27/2014	20.86	9.39	458	8.27	1.13	15	44/244	<3/142	0.854	0.854	<0.03	50/56
6/11/2014	22.41	11.51	446	8.30	1.70	12	58/338	<3/270	1.060	1.060	<0.03	47/51
6/23/2014	25.28	10.58	418	8.47	1.88	20	89/462	3/365	0.814	0.814	<0.03	43/53
7/16/2014	22.66	8.73	397	8.42	1.65	12	41/612	<3/390	0.958	0.958	<0.03	42/54
7/29/2014	23.93	8.08	406	8.09	2.15	7	31/803	3/463	0.876	0.876	<0.03	42/54
8/13/2014	24.22	7.93	417	8.16	2.10	7	33/1110	<3/638	0.948	0.916	0.032	44/57
8/26/2014	24.20	7.33	412	8.03	1.90	12	30/1220	<3/661	0.900	0.900	<0.03	46/54
9/11/2014	18.50	7.54	418	8.03	1.60	18	36/962	<3/397	0.803	0.803	<0.03	46/51
9/30/2014	17.88	8.47	420	8.35	1.88	15	33/1620	<3/870	0.956	0.956	<0.03	47/56
10/22/2014	11.44	9.78	441	8.06	1.80	24	50/217	<3/77	1.110	1.110	<0.03	46/47

Note: Surface/Bottom Results

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



St. Joe Lake

(DNR ID: 10-0011-00)
- Monitored by CAMP -

**Ten-Year Lake Grade Record
(May-Sept Means)**

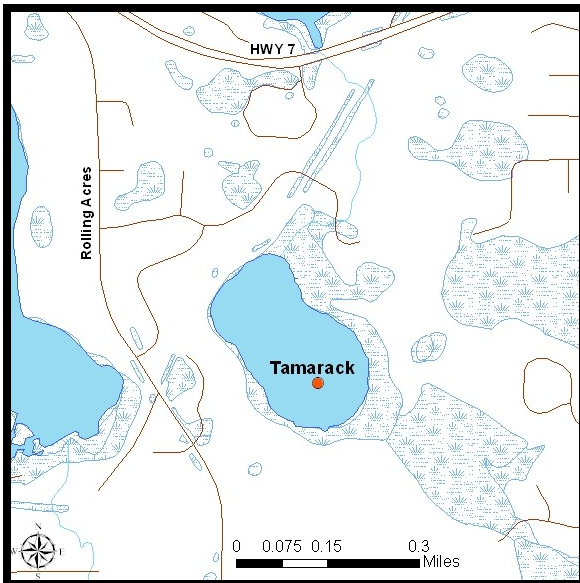
Year	SECC	CHLA	TP	Lake Grade
2005	A	A	A	A
2006	B	A	C	B
2007	A	A	A	A
2008	B	A	A	A-
2009	A	A	C	B+
2010	B	A	A	A-
2011	B	A	A	A-
2012	B	A	A	A-
2013	N/A	N/A	N/A	N/A
2014	B	A	A	A-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	2.77	7.93	18	47
2006	2.66	7.94	39	51
2007	3.42	6.13	22	46
2008	2.73	8.07	20	48
2009	N/A	N/A	N/A	N/A
2010	2.30	8.38	20	49
2011	2.56	5.29	20	47
2012	2.73	3.50	17	44
2013	N/A	N/A	N/A	N/A
2014	2.57	6.18	21	48

Date	TMP	SECC	CHLA	TP	TKN
6/16/2014	19.5	3.0	6.5	43	0.68
7/20/2014	23.8	2.2	7.4	22	0.68
8/1/2014	27.1	1.7	4.7	16	0.92
8/17/2014	17.1	2.3	8.5	18	0.72
8/31/2014		2.8	6.3	14	0.78
9/14/2014		3.4	3.7	14	0.68
10/25/2014	12.3	2.0	32	25	0.82

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO3, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Tamarack Lake

(DNR ID: 10-0010-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	C	C	C
2006	C	C	D	C-
2007	B	B	B	B
2008	B	A	B	B+
2009	B	A	B	B+
2010	N/A	N/A	N/A	N/A
2011	B	A	C	B
2012	B	A	B	B+
2013	B	B	C	B-
2014	B	B	C	B-

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	1.92	26.03	34	56
2006	1.97	22.58	80	60
2007	2.42	13.96	30	52
2008	2.81	9.26	25	49
2009	2.19	12.21	29	52
2010	2.92	11.17	31	51
2011	2.43	9.75	46	53
2012	2.95	6.25	24	48
2013	2.10	17.00	39	55
2014	2.69	18.25	35	53

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl
5/26/2014	21.6	2.55	2	27	1.010	1.010	<0.03	38
6/29/2014	24.9	2.05	16	40	1.220	1.220	<0.03	28
7/27/2014	24.9	1.55	41	51	1.240	1.240	<0.03	28
8/24/2014	25.5	2.65	15	31	0.951	0.951	<0.03	30
9/28/2014	20.4	4.50	1	16	0.819	0.819	<0.03	31

Lake Virginia Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Minnewashta	1957 - 2014	2010		2011		Mercury in Fish Tissue	Aquatic Consumption
Virginia	1958 - 2014	2010		2009	2011	Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
St. Joe	1962 - 2014	Yes (DNR)		1994		None	None
Tamarack	1998 - 2014	Yes (DNR)		1994		Nutrient/Eutrophication Biological Indicators	Aquatic Recreation

Lake	Invasive Species							
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels	
Minnewashta		X	X	X				
Virginia		X	X	X			X	
St. Joe			X					
Tamarack								

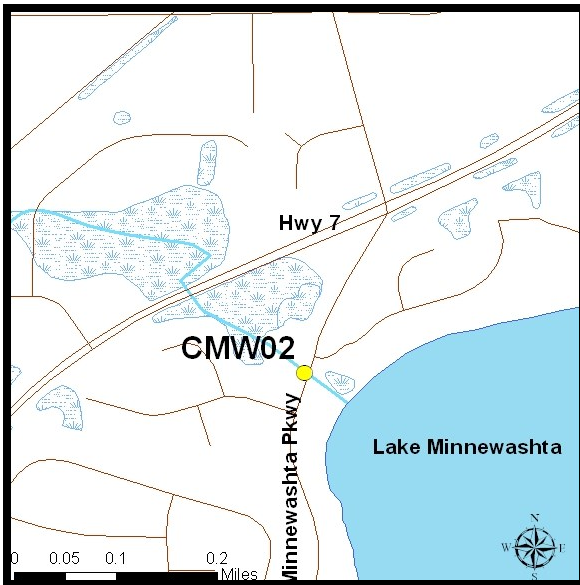
*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcwg-lakes

Lake Virginia Subwatershed - Stream Monitoring Sites Information

Stream	MCWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Lake Minnewashta Ck: Lk Outlet	CMW02	Yes	No	2985.30	44.8866	-93.6176





Lake Minnewashta Creek: Lake Minnewashta Outlet (CMW02)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	19
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	37
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	2.10	163	39	12	3.00	488	0.12	4	1		
2007	1.07	145	69	12	5.66	1038	0.50	7	3		
2008	0.92	59	33	3	1.58	1221	0.68	5	3	27	15
2009	0.73	51	36	3	1.76	50	0.04	5	3	2	1
2010	1.58	84	27	59	19	2541	0.82	13	4	136	44
2011	1.84	87	24	4	1	3220	0.89	12	3	117	32
2012	0.51	31	32	1	1	404	0.41	2	2	23	23
2013	1.34	63	24	0	0	2246	0.85	12	4	112	42
2014	3.46	229	34	1	0	4145	0.61	20	3	213	31

Note: Revised means and loads for 2008-2013

2014 Water Quality Data - CMW02

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/15/2014	0.152	3.19	12.26	753	7.73	39	3			
4/21/2014	1.383	7.53	13.46	482	8.14	33	<3		4	
4/28/2014	6.407	6.28	11.27	361	7.93	107	4			
5/5/2014	15.802	12.31	14.03	441	8.21	29	<3	0.888	4	48
5/13/2014	15.017	11.91	12.13	433	8.35	25	<3			
5/20/2014	13.445	12.75	12.63	439	8.49	20	<3		2	
5/27/2014	11.786	20.90	9.46	430	8.31	27	<3			
6/2/2014	1.950	21.91	8.12	554	8.00	23	<3	0.786	3	46
6/9/2014	14.605	20.96	9.14	431	8.52	100	<3			
6/16/2014	12.204	19.81	9.10	415	8.57	22	<3		2	
6/23/2014	30.859	23.99	9.92	431	8.48	23	<3			
6/30/2014	19.139	23.82	8.23	392	8.68	24	<3	0.768	3	41
7/7/2014	10.401	23.53	10.64	391		24	<3			
7/15/2014	8.908	21.72	8.04	391		26	<3		5	
7/22/2014	5.168	25.12	7.35	383	8.68	26	<3			
7/29/2014	3.388	23.39	7.48	394	8.67	28	3	1.050	6	40
8/5/2014	2.670	25.04	8.15	392	8.64	23	<3			
8/12/2014	0.531	22.73	5.91	377	8.28	24	<3		2	
8/19/2014	0.382	23.32	4.81	403	8.09	29	<3			
8/26/2014	0.047	19.64	1.00	440	7.38	122	40.5	1.635	7.5	45
9/2/2014	2.148	22.56	6.67	387	8.86	23	<3			
9/9/2014	0.847	20.35	8.48	249	8.35	47	<3		8	
9/16/2014	0.723	15.72	8.44	409		22	<3			
9/23/2014	0.470	16.70	9.01	396	8.09	28	<3	0.990	4	44

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Lake Virginia Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Lake Minnewashita Ck: Lk Outlet		None	None

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Langdon Lake Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	3
Guidelines and Standards	5
Executive Summary	6
Subwatershed Facts and Map	7
Langdon Lake Subwatershed - Lake Monitoring Sites Information	8
Langdon Lake	9
Langdon Lake Subwatershed - Additional Lake Information	10
Langdon Lake Subwatershed - Stream Monitoring Sites Information	11
Langdon Lake Creek: Langdon Lake Inlet	12
Langdon Lake Creek: Langdon Lake Outlet	14
Langdon Lake Subwatershed - Additional Stream Information	16

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

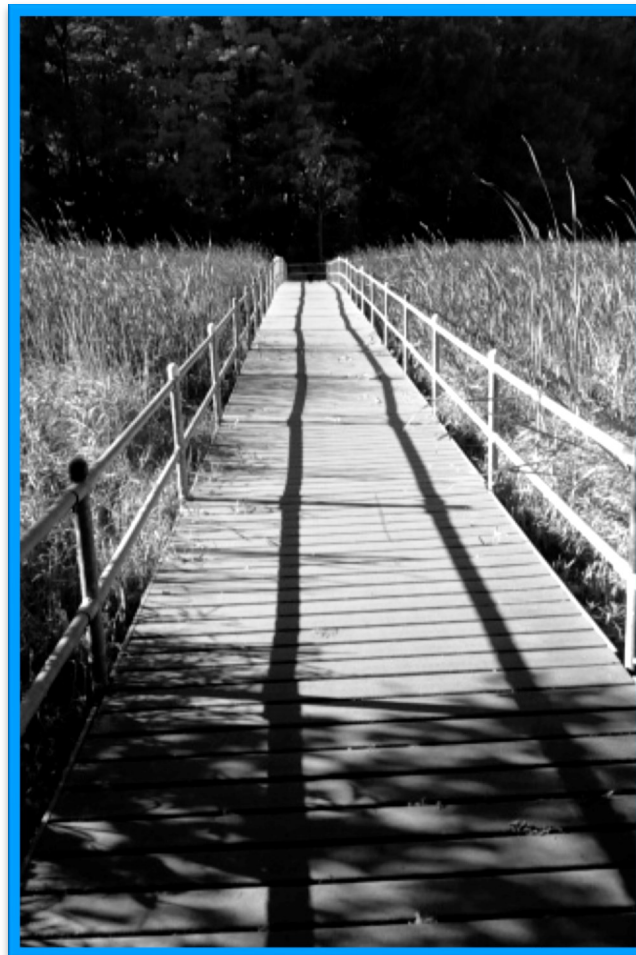
Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient from plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.



Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
<i>E. coli</i> (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%.

Executive Summary

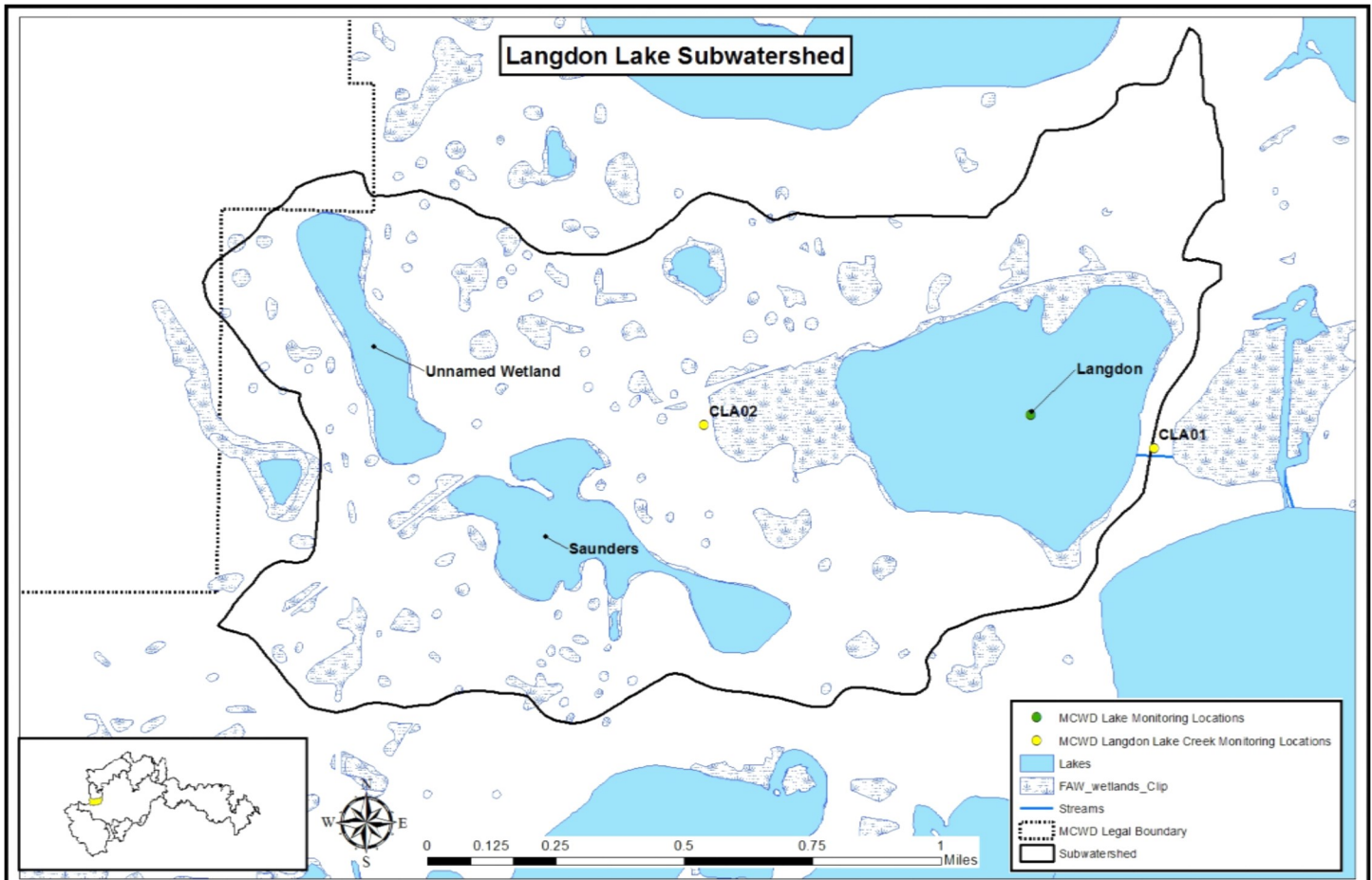
The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

The 2014 monitoring season is summarized for Langdon Lake Subwatershed in this report. There were two stream sites in Langdon Lake Creek and one lake monitored in 2014. Langdon Lake Creek outlet exceeded the North Central Hardwood Forest (NCHF) guideline for total phosphorus in 2014. The table below displays the lakes monitored within the Langdon Lake Subwatershed that did not meet the NCHF eutrophication standards.

Lake	(X) Indicates Not Meeting the Standard in 2014			
	SECC	CHLA	TP	CI
Langdon	X	X	X	

Subwatershed Facts and Map

Municipalities	Minnetrista and Mound
Area	About 1,055 acres
Population	Minnetrista = 6,788 people (2013) Mound = 9,270 people (2013)
Ecoregion	North Central Hardwood Forest
Groundwater	No MnDNR wells monitored
District Goals	<ul style="list-style-type: none"> • Reduce TP concentrations to 55 -70 $\mu\text{g/L}$ • Increase Secchi depth to greater than 1.4 m • Reduce chlorophyll-<i>a</i> concentrations to 14 $\mu\text{g/L}$ in Langdon Lake



Langdon Lake Subwatershed - Lake Monitoring Sites Information

Lake	MNDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Watershed Area (ac)	Watershed to Lake Area Ratio	Latitude	Longitude
Langdon	27-0182-00	LLA01	Hennepin	Limited	140.0	82.7	57.83	1195	8.3	39	1055.4	8:1	44.93260	-93.67265
Saunders*	27-0185-00	LSD01	Hennepin	Limited	26.0						508.01	20:1	44.92942	-93.69212
Lake Flanagan (unnamed wetland)*	27-0183-00	LBL02	Hennepin	No	31.0					28	119.54	4:1	44.00330	-93.73330

* Not monitored in 2014; Note: Lake Flanagan was known as Black Lake (unnamed wetland) in past monitoring reports.





Langdon Lake

(DNR ID: 27-0182-00)

Ten-Year Lake Grade Record
(May-Sept Means)

Year	SECC	CHLA	TP	Lake Grade
2005	D	D	D	D
2006	F	D	F	F
2007	N/A	N/A	N/A	N/A
2008	F	F	F	F
2009	D	C	D	D+
2010	D	C	C	C-
2011	D	C	D	D+
2012	F	F	D	F
2013	D	F	D	D-
2014	C	C	D	C-

Ten-Year Water Quality Means
(June-Sept)

Year	SECC	CHLA	TP	TSI
2005	0.65	61.36	122	70
2006	0.41	48.44	193	74
2007	N/A	N/A	N/A	N/A
2008	0.54	81.29	167	74
2009	0.85	37.11	77	65
2010	0.88	24.44	49	61
2011	0.84	39.89	68	65
2012	0.36	107.13	116	75
2013	0.50	92.38	122	73
2014	1.39	39.00	83	63

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/14/2014	13.64	12.14	418	8.96	0.88	67	127	<3	2.44	2.31	0.127	53/56
6/10/2014	22.63	10.06	390	8.44	2.05	12	41	<3	1.63	1.63	<0.03	48/53
7/15/2014	21.76	7.32	407	8.12	1.00	36	88	9	1.42	1.42	<0.03	45/52
8/11/2014	24.82	8.41	404	8.19	1.95	26	72	<3	1.40	1.40	<0.03	46/55
9/16/2014	17.06	9.78	383	8.83	0.55	82	131	<3	1.99	1.99	<0.03	48/48
10/22/2014	11.18	11.58	391	8.63	0.50	69	137	<3	2.05	2.05	<0.03	46/49

Note: Surface/Bottom Results

Langdon Lake Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Langdon	1977 - 2014	2010		1993		Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Saunders	1984 - 2014						
Lake Flanagan (unnamed wetland)							

Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlyleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Langdon		X	X				
Saunders				X			
Unnamed wetland (Black)							

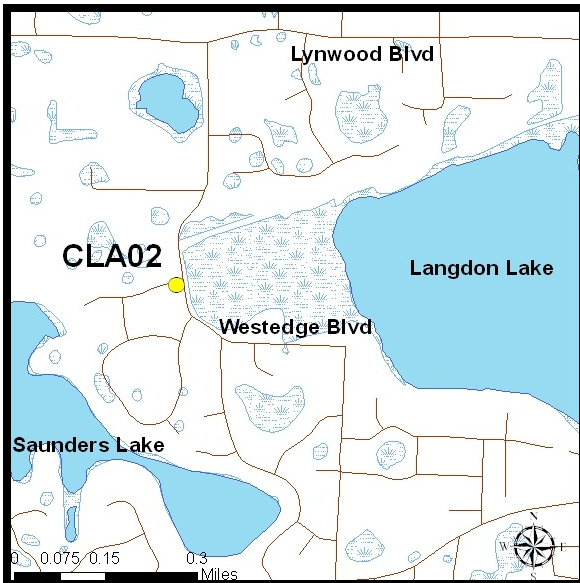
*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcawd-lakes

Langdon Lake Subwatershed - Stream Monitoring Sites Information

Stream	MCWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Langdon Lk Ck: Lk Inlet	CLA02	Yes	No	508.10	44.9323	-93.6887
Langdon Lk Ck: Lk Outlet	CLA01	Yes	No	547.35	44.9318	-93.6693





Langdon Lake Creek: Langdon Lake Inlet (CLA02)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	17
Dissolved Oxygen (mg/L)	8
Total Suspended Solids (mg/L)	8
Total Phosphorus (µg/L)	77
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	0.19	24	65	5	13	27	0.07	0.07	0.18		
2007	0.20	20	50	2	5	529	1.34	1.69	4.27		
2008	0.01	2	178	1	43	1	0.11	0.04	3.16		
2009	0.02	4	117	2	67	11	0.33	0.05	1.56	0.24	8
2010	0.18	28	79	13	36	123	0.34	0.55	1.53	1.44	4
2011	0.90	96	54	1	1	1701	0.96	22	12	41	23
2012	0.03	5	86	2	41						
2013	0.36	44	62	21	30	12	0.02	0.39	1	0.48	1
2014	0.52	64	63	23	22	1250	1.22	15	15	33	32

Note: Revised data for 2008-2013

2014 Water Quality Data - CLA02

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	0.030	3.94	9.59	506	7.53	74	44	0.657	1	34
4/15/2014	0.149	8.08	9.87	360	7.66	53	19			
4/22/2014	0.145	15.05	8.77	365	7.65	50	14		6	
4/30/2014	5.050	6.51	10.93	290	7.58	40	7			
5/6/2014	1.471	14.77	11.52	333	7.94	38	7	0.657	3	30
5/13/2014	1.097	13.30	9.29	327	7.77	41	10			
5/20/2014	3.686	17.93	9.93	321	7.88	39	9		3	
5/28/2014	1.501	22.17	6.97	334	7.65	67	35			
6/3/2014	3.850	23.10	6.09	298	7.58	59	21	0.798	4	25
6/9/2014	0.800	20.88	6.44	313	7.57	66	30			
6/16/2014	0.860	20.57	6.19	312	7.32	81	28		8	
6/23/2014	0.420	24.43	8.02	275	7.69	69	22			
6/30/2014	3.510	24.19	6.96	287	7.58	126	38	1.180	35	22
7/7/2014	0.830	25.66	8.39	239		58	29			
7/16/2014	0.500	20.26	8.66	224		54	20		12	
7/22/2014	0.150	26.77	6.74	209	8.76	57	29			
7/29/2014	0.130	23.58	7.58	214	8.43	47	28	0.783	6	22
8/5/2014	0.165	24.18	7.28	230	8.03	53	25			
8/12/2014	0.156	22.55	8.40	239	7.87	55	23		4	
8/19/2014	0.108	24.29	7.30	253	7.78	75	31			
8/27/2014	0.002	19.55	7.80	352	8.37	112	61	0.839	6	30
9/3/2014	0.004	19.14	7.23	386		133	58			
9/9/2014	0.001	19.72	7.69	312	7.47	92	53		6	
9/16/2014	0.001	15.03	10.75	289		56	30			
9/23/2014	0.042	17.67	8.92	252	7.52	66	30	0.746	18	27
9/30/2014	0.012	12.64	8.40	316	8.02	97	66			
10/7/2014	2.640	11.56	10.08	312	7.65	81	47		7	
10/14/2014	0.001	11.26	8.20	471	7.85	139	37			
10/21/2014	0.004	10.02	8.41	373	7.42	143	76	0.567	6	35
10/27/2014	0.034	9.81	9.14	372	7.61	153	96			
11/5/2014	0.010	5.67	11.70	390	7.65	113	69		5	

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Langdon Lake Creek: Langdon Lake Outlet (CLA01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	20
Dissolved Oxygen (mg/L)	9
Total Suspended Solids (mg/L)	12
Total Phosphorus (µg/L)	180
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	0.53	134	130	3.00	3	1903	1.82	15	15		
2006	0.24	64	138	2.42	5	77	0.17	4	8		
2007	0.40	74	94	4.25	5	1532	1.95	5	6		
2008	0.22	63	146	0.33	1	811	1.89	4	10	7	17
2009	0.02	5	156	0.27	8	59	1.75	1	18	1	42
2010	0.48	51	53	0	0.24	987	1.04	4	5	34	36
2011	0.52	75	73	0.30	0.29	1168	1.14	70	68	40	39
2012	0.09	17	99	0.21	1			1	6		
2013	0.63	200	162	2	1	2440	1.98	24	19	101	82
2014	1.22	175	73	11	5	4955	2.06	16	7	143	59

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, CI, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

2014 Water Quality Data - CLA01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/8/2014	0.386	1.38	9.95	109	8.47	48	8	1.130	2	14
4/30/2014	2.932	6.38	11.83	443	8.85	140	3			
5/6/2014	3.661	10.14	19.35	427	9.20	214	4	3.640	21	57
5/13/2014	3.754	12.68	11.80	422	9.06	109	<3			
5/20/2014	3.000	15.94	14.66	419	9.29	107	<3		6	
5/28/2014	7.883	20.03	4.79	376	7.46	46	5			
6/3/2014	12.564	23.44	7.86	385	8.60	56	17	1.350	5	50
6/9/2014	8.003	22.02	10.70	388	8.81	38	<3			
6/16/2014	3.184	22.66	12.22	393	8.76	44	<3		1	
6/23/2014	12.114	26.53	11.91	385	8.68	42	<3			
6/30/2014	2.430	24.34	6.60	395	8.01	76	13	0.869	3	43
7/7/2014	1.100	26.14	10.89	403		66	4			
7/16/2014	0.820	20.72	7.55	408		60	3		4	
7/22/2014	0.400	27.05	9.49	394	8.72	64	<3			
7/29/2014	0.250	25.87	10.86	375	8.79	62	<3	1.360	8	45
8/5/2014	0.143	26.39	7.12	399	8.53	70	<3			
8/12/2014	0.015	21.91	4.09	400	7.69	159	<3		34	
8/19/2014	0.019	25.11	7.22	389	8.44	146	<3			
8/27/2014	0.060	23.39	8.01	369	8.92	103	<3	1.710	16	48
9/3/2014	0.120	21.67	7.21	364		104	<3			
9/9/2014	0.040	20.98	7.08	376	8.62	80	<3		10	
9/16/2014	0.010	15.42	3.14	389		1950	<3			
9/23/2014	0.020	17.34	3.24	381	7.36	359	<3	3.990	32	49

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Langdon Lake Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Langdon Lk Ck: Lk Inlet		None	None
Langdon Lk Ck: Lk Outlet		None	None

MINNEHAHA CREEK



WATERSHED DISTRICT

QUALITY OF WATER

QUALITY OF LIFE

Long Lake Creek Subwatershed Report

2014



**Minnehaha Creek Watershed District
Research and Monitoring Department**

15320 Minnetonka Blvd

Minnetonka, MN 55345

www.minnehahacreek.org

952-641-4535

Table of Contents

Glossary	3
Guidelines and Standards	5
Executive Summary	6
Subwatershed Facts and Map	7
Long Lake Creek Subwatershed - Lake Monitoring Sites Information	8
Dickeys Lake.....	9
Holy Name Lake	10
Long Lake	11
Lydiard Lake	12
Mooney Lake	13
Tanager Lake (Lake Minnetonka)	14
Wolsfeld Lake.....	15
Long Lake Creek Subwatershed - Additional Lake Information	16
Long Lake Creek Subwatershed - Stream Monitoring Sites Information	17
Long Lake Creek: Long Lake Inlet - CR 6	18
Long Lake Creek: Long Lake Outlet.....	20
Long Lake Creek: Tanager Inlet - Browns Rd	22
Long Lake Creek Subwatershed - Additional Stream Information	24

Glossary

Chlorophyll-a (CHLA) is an estimation of the algae abundance in a lake.

Chloride (Cl) is toxic to plants and aquatic organisms and rarely flushes out of a waterbody. Road salt applications during winter continue to be the biggest contributing factor to elevated chloride levels.

Dissolved Oxygen (DO) levels below 5 mg/L put stress on aquatic life.

Ecoregion: The geomorphic and chemical properties of lakes and streams vary across the state. These differences are the reasons for dividing the state into seven different ecoregions. Each ecoregion contains a geographically distinct collection of plants, animals, natural communities and environmental conditions.

Escherichia coli (E. coli) is a member of the fecal coliform group of bacteria. Ingestion of water with high levels of *E. coli* may cause illness.

Eutrophication is excessive nutrients accumulating in a waterbody that support dense growth of algae and plants. The result often depletes oxygen that is needed to support aquatic life.

Flow is the measurement of water discharged through a natural stream channel or culvert. Flow is measured in cubic feet per second (cfs).

Nitrate (NO₃) is the fraction of nitrogen that is available for the biota. Usually only trace amounts of nitrate are found, due to biotic consumption.

pH is a measure of the concentration of hydrogen ions (H⁺) in water.

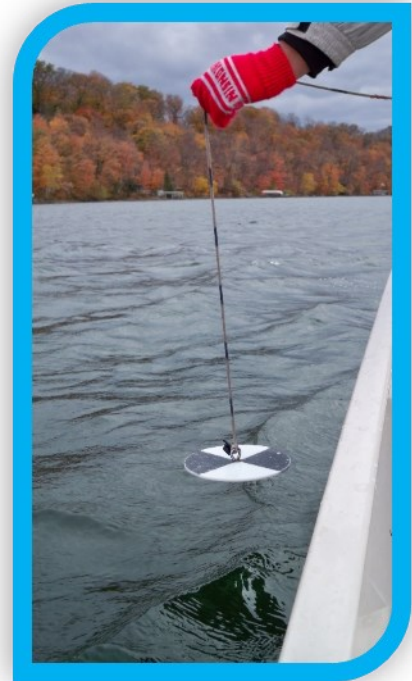
Secchi Depth (SECC) is a measure of water clarity; clearer lakes will have a higher Secchi depth.

Soluble Reactive Phosphorus (SRP) is a measurement that indicates the amount of phosphorous immediately available for plants and algae.

Specific Conductance (Sp Cond) is a measure of the water's ability to act as a conductor. High conductivity is an indicator of poor water quality and implies high concentrations of chlorides or other dissolved solids.

Subwatershed: Part of a larger watershed, a subwatershed is the land that drains to a specific waterbody.

Temperature effects the amount of oxygen dissolved in the surface waters. Temperature varies depending on the weather experienced during the year.



Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia, representing the fraction of nitrogen that is not available for use by plants and algae.

Total Nitrogen (TN): The sum of total Kjeldahl-nitrogen and nitrate-nitrite. Essential nutrient for plants and animals, though excessive levels can lead to algal blooms.

Total Phosphorus (TP) is usually the limiting food source for algae and plants. When there are excessive levels of phosphorus, there is an increased chance of algal blooms and/or excessive plant growth.

Total Suspended Solids (TSS) is a measurement of all the solids in the water, anything from soil particles to algae. These suspended solids, which can come in through runoff or erosion, can carry excessive nutrients, such as phosphorus.

Trophic State Index (TSI) is a numerical index to determine the productivity of a lake. A lower TSI score indicates fewer nutrients and less productivity.

Watershed: A watershed is the area of land that drains to a common lake, wetland, stream or river.



Guidelines and Standards

Guidelines and standards are declared by the Minnesota Pollution Control Agency (MPCA) for Minnesota's seven ecoregions. The guidelines allow for comparison of waterbodies within an ecoregion even though a standard may not have been set. Minnehaha Creek Watershed District is within the North Central Hardwood Forest Ecoregion. For more information on guidelines and standards, please see the 2014 Technical Report.

North Central Hardwood Forest Ecoregion	Guidelines (25 th – 75 th percentile)	
	Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	5 - 22	
NO _x (mg/L)	< 0.01	0.04 - 0.26
Secchi Depth (m)	1.5 - 3.2	
Temperature (°C)		2 - 21
Total Kjeldahl Nitrogen (TKN) (mg/L)	< 0.60 - 1.2	
Total Phosphorus (µg/L)	23 - 50	60 - 150
Total Suspended Solids (TSS) (mg/L)	2 - 6	4.8 - 16
pH	8.6 - 8.8	7.9 - 8.3

North Central Hardwood Forest Ecoregion	Standards		
	Shallow Lakes	Deep Lakes	Streams
Chlorophyll- <i>a</i> (µg/L)	< 20	< 14	
Chloride (mg/L)	230/860	230/860	230/860
Dissolved Oxygen (mg/L)			> 5
E. coli (cfu/100 mL)			126/1,260
Secchi Depth (m)	> 1.0	> 1.4	
Total Phosphorus (µg/L)	< 60	< 40	

Note: (Chronic/Acute); shallow lakes have a maximum depth less than 15 feet or have a littoral zone greater than 80%.

Executive Summary

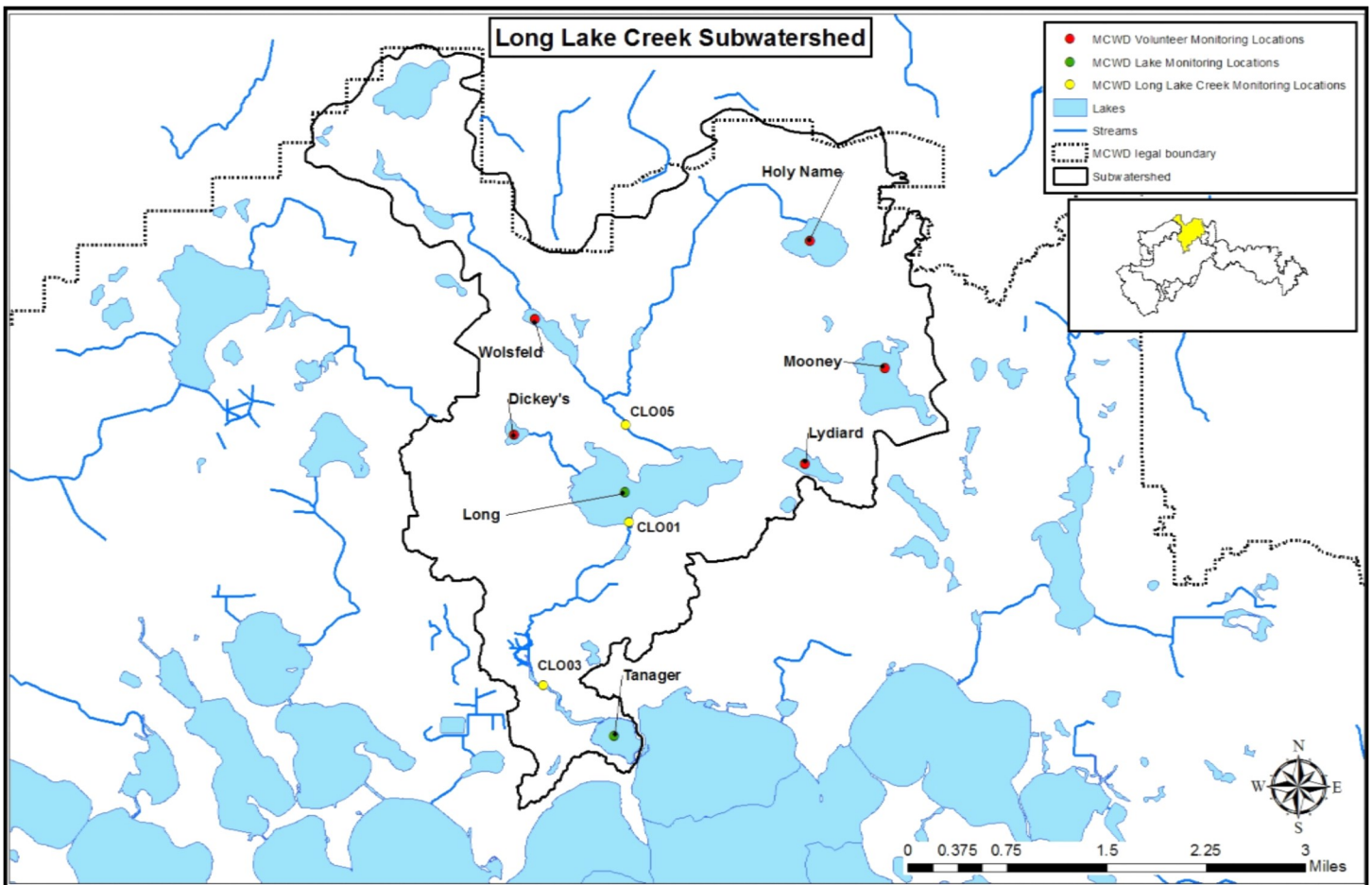
The Minnehaha Creek Watershed District (MCWD) monitors lakes and streams within its watershed boundaries on a seasonal basis for water quality indicators linked to recreational, aesthetic, and biological conditions. There are eleven major subwatersheds within the Minnehaha Creek Watershed boundary.

The 2014 monitoring season is summarized for Long Lake Subwatershed in this report. There were three sites on Long Lake Creek and seven lakes monitored in 2014. Long Lake Creek inlet to Long Lake was below the North Central Hardwood Forest (NCHF) dissolved oxygen standard and above the total phosphorus guideline in 2014. The table below displays the lakes monitored within the Long Lake Subwatershed that not meet the NCHF eutrophication standards.

Lake	(X) Indicates Not Meeting the Standard in 2014						
	Dickeys	Holy Name	Lake Minkta: Tanager	Lydiard	Long	Mooney	Wolsfeld
SECC			X		X	X	X
CHLA			X		X	X	N/A
TP	X		X		X		X
CI							

Subwatershed Facts and Map

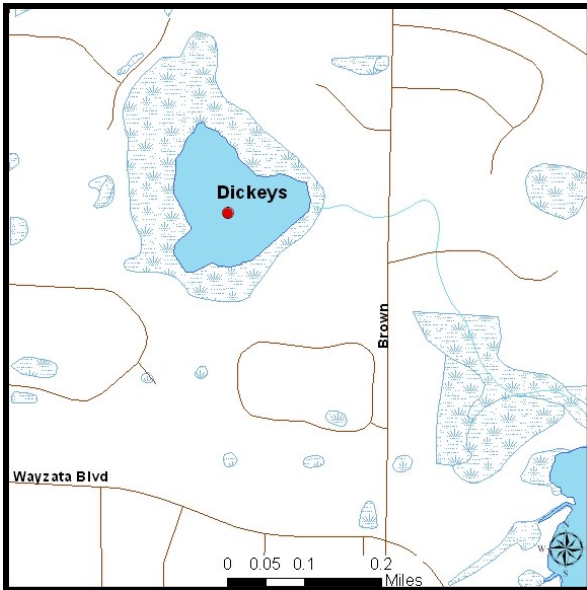
Municipalities	Long Lake, Medina, and Orono,
Area	About 8,215 acres
Population	Long Lake = 1,768 people (2010) Medina = 4,892 people (2010) Orono = 7,796 people (2013)
Ecoregion	North Central Hardwood Forest
Groundwater	No MnDNR wells monitored
District Goals	<ul style="list-style-type: none"> • Reduce TP concentrations to 50 µg/L in Long Lake • Reduce TP concentrations to 70 µg/L in Tanager Lake • Increase Secchi depth to greater than 1.4 m and decrease chlorophyll-<i>a</i> to 14 µg/L in both lakes



Long Lake Creek Subwatershed - Lake Monitoring Sites Information

Lake	MnDNR ID	MCWD Site ID	County	Public Access	Area (ac)	Littoral Area (ac)	% Littoral Area	Volume (ac-ft)	Mean Depth (ft)	Max Depth (ft)	Water-shed Area (ac)	Water-shed to Lake Area Ratio	Latitude	Longitude
Dickey's	27-0161-00	LDY01	Hennepin	No	12.0	7	59			26	158.86	13:1	44.99440	-93.57725
Holy Name	27-0158-00	LHN01	Hennepin	Yes	68.0	65		376	6	7	463.66	7:1	45.01582	-93.53286
Long	27-0160-00	LL001	Hennepin	Yes	298.0	131	44	3680	14	33	6850.97	23:1	44.98705	-93.56107
Lydiard	27-0159-00	LDR01	Hennepin	No	33.0	23.5	72			52	846.65	26:1	44.99126	-93.53321
Mooney	27-0134-00	LM002	Hennepin	No	117.0	116.9	100			10	598.71	5:1	45.00192	-93.52111
School*	27-0151-00	LSH01	Hennepin	No	11.0					21	561.98	51:1	44.12360	-93.85720
Tanager	27-0141-00	LTG01	Hennepin	Yes	54.0	38	75	250	5	23	8127.61	151:1	44.96126	-93.56134
Wolfsfeld	27-0157-00	LW001	Hennepin	No	34.0	25		380	11	26	1592.28	47:1	45.00707	-93.57513

* Not monitored in 2014



Dickey's Lake

(DNR ID: 27-0161-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009	B	A	C	B
2010	B	A	C	B
2011	B	A	C	B
2012	B	A	C	B
2013	C	C	C	C
2014	C	B	D	C

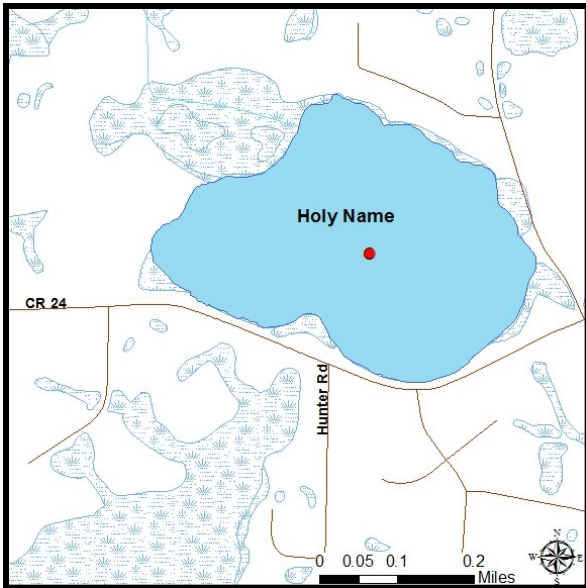
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009	2.85	6.50	56	52
2010	2.64	5.38	41	50
2011	2.73	9.00	32	51
2012	2.83	5.00	33	49
2013	2.13	14.25	48	55
2014	2.45	13.88	93	58

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl
5/20/2014	14.10	1.05	11	63	1.150	1.150	<0.03	66
6/30/2014	23.50	2.65	1	159	1.030	1.030	<0.03	48
7/24/2014	24.50	2.35	36.5	106.5	1.395	1.395	0.02	53
8/19/2014	24.50	2.35	13	49	0.989	0.989	<0.03	55
9/18/2014	16.50	2.85	5	59	1.040	1.040	<0.03	64

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Holy Name Lake

(DNR ID: 27-0158-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	D	D	D	D
2009				
2010				
2011				
2012				
2013				
2014	N/A	A	B	N/A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	1.08	74.50	91	67
2009				
2010				
2011				
2012				
2013				
2014	N/A	5.00	24	48

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl
5/15/2014	11.70	2.00	11.0	28.0	0.785	0.785	<0.03	44
6/17/2014	19.90		2.0	23.0	0.549	0.549	<0.03	43
7/15/2014	19.60		3.0	27.0	0.897	0.897	<0.03	36
8/14/2014	22.40		5.0	22.0	1.020	1.020	<0.03	43
9/18/2014	15.80		10.0	25.0	1.130	1.130	<0.03	42

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Long Lake (DNR ID: 27-0160-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005	C	C	C	C
2006	C	C	C	C
2007	D	C	C	C-
2008	C	C	C	C
2009	C	C	D	C-
2010	C	C	C	C
2011	D	C	C	C-
2012	D	C	D	D+
2013	C	C	C	C
2014	D	D	D	D

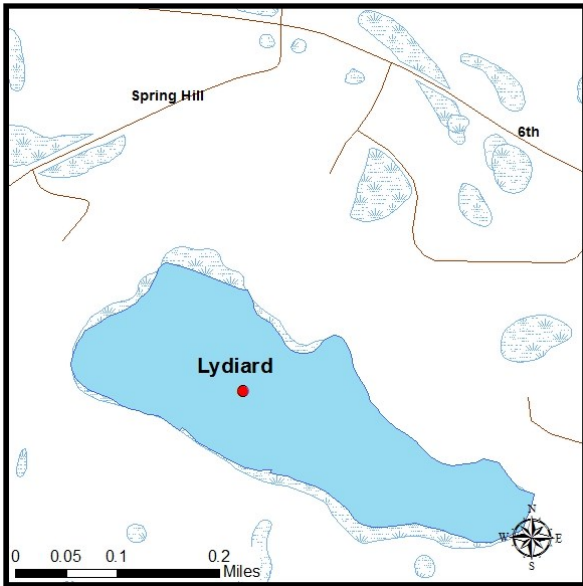
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005	0.84	43.73	63	65
2006	0.91	35.54	50	63
2007	0.77	42.11	74	66
2008	1.31	40.11	54	62
2009	0.94	37.39	76	65
2010	1.07	35.11	51	62
2011	1.29	37.38	59	62
2012	1.14	31.00	65	62
2013	1.38	37.50	64	62
2014	1.11	54.50	88	66

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/13/2014	11.51	12.53	431	9.01	0.93	54	74	<3	1.285	1.285	<0.03	54/56
6/10/2014	21.31	13.91	408	8.67	1.50	50	64	4	1.060	1.060	<0.03	46/55
7/15/2014	22.26	8.33	382	8.68	1.00	47	67	<3	1.320	1.320	<0.03	41/54
8/12/2014	24.73	7.66	390	8.49	1.05	23	55	<3	1.360	1.360	<0.03	42/57
9/15/2014	17.79	9.49	402	8.21	0.90	98	164	28	2.020	2.020	<0.03	45/53
10/21/2014	11.80	9.99	420	8.13	0.93	99	214	75	2.430	2.430	<0.03	46/44

Note: Surface/Bottom Results



Lydiard Lake

(DNR ID: 27-0159-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006				
2007				
2008				
2009	A	A	A	A
2010	B	A	A	A-
2011	B	A	B	B+
2012	B	A	A	A-
2013	B	A	A	A-
2014	B	A	B	B+

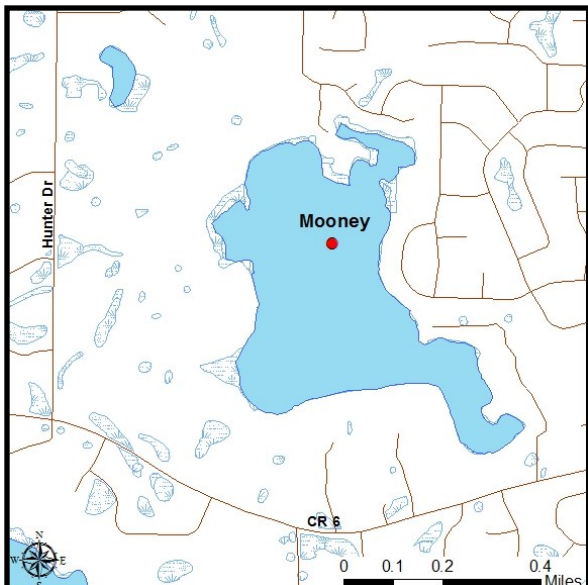
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006				
2007				
2008				
2009	3.70	1.50	16	40
2010	3.05	3.38	17	44
2011	2.65	3.50	26	47
2012	2.75	3.75	20	45
2013	2.73	10.00	14	47
2014	2.73	1.00	23	42

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl
5/15/2014	10.80	2.80	4	27	0.600	0.600	<0.03	39
6/12/2014	20.90	2.75	1	21	3.750	3.750	<0.03	39
7/17/2014	20.30	2.75	1	23	0.818	0.818	<0.03	38
8/21/2014	23.10	2.70	1	21	0.723	0.723	<0.03	42
9/4/2014	21.20	2.70	1	25	0.768	0.768	<0.03	42

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.



Mooney Lake

(DNR ID: 27-0134-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	C	C	C	C
2009				
2010				
2011	N/A	C	C	N/A
2012	N/A	N/A	N/A	N/A
2013	D	C	C	C-
2014	D	C	C	C-

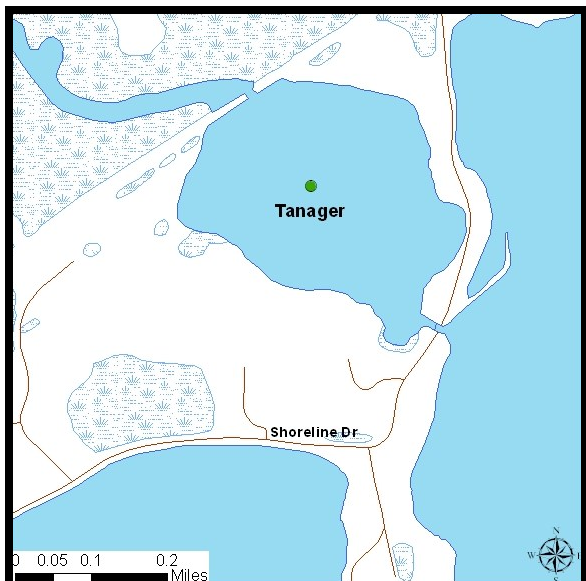
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	1.15	42.00	58	63
2009				
2010				
2011	N/A	33.00	64	65
2012	N/A	N/A	N/A	N/A
2013	0.88	25.50	58	62
2014	0.95	22.50	56	61

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl	TSS
5/7/2014	11.60	0.80	138	48/40	<3/<3				41/39	11
6/10/2014	22.80	1.25	17	51/91	<3/<3	1.06	1.06	<0.03	38/38	9
7/13/2014	23.90	0.85	28	59/69	<3/<3	1.06	1.06	<0.03	33/35	13
8/11/2014	24.80	1.05	8	46/59	<3/<3	1.16	1.16	<0.03	37	7
9/17/2014	20.20	0.65	37	68/80	<3/<3	1.66	1.66	<0.03	38/38	16
10/9/2014	11.40	0.25	41	108/113	<3/<3	1.90	1.90	<0.03	39/38	27

Note: Surface/Bottom Results; Volunteer DO data available upon request



Tanager Lake (Lake Minnetonka) (DNR ID: 27-0141-00)

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	D	D	D	D
2007	D	F	D	D-
2008	D	D	D	D
2009	D	D	D	D
2010	C	D	D	D+
2011	D	D	D	D
2012	D	F	D	D-
2013	D	D	D	D
2014	D	C	D	D+

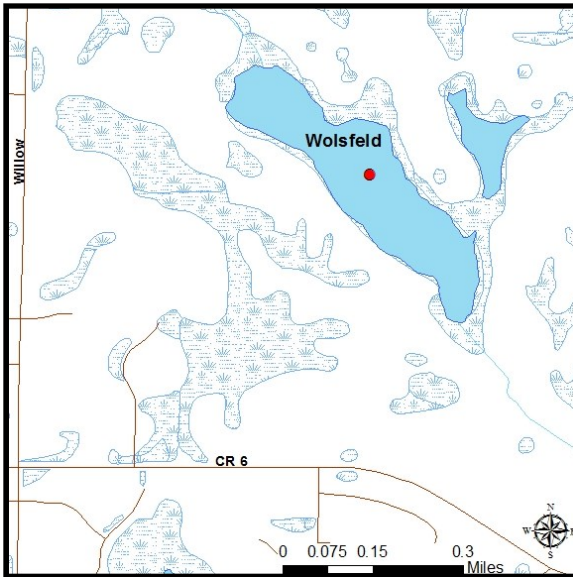
**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	0.68	71.90	98	69
2007	0.99	91.35	108	69
2008	0.97	73.00	85	67
2009	0.76	77.33	85	69
2010	1.06	73.39	81	67
2011	0.83	59.50	95	68
2012	0.71	93.13	117	70
2013	1.08	69.57	102	67
2014	1.26	26.75	96	63

2014 Water Quality Data

Date	TMP	DO	SP COND	pH	SECC	CHLA	TP	SRP	TN	TKN	NO ₃	Cl
5/5/2014	10.86	14.88	458	8.72	0.98	64	80	<3	1.33	1.33	<0.03	58/55
6/2/2014	22.76	7.82	452	7.53	2.00	16	108	44	1.15	1.15	<0.03	49/53
7/7/2014	24.24	9.48	426	8.06	1.25	27	109	42	0.92	0.92	<0.03	42/50
8/4/2014	26.36	13.36	422	8.92	0.95	28	90	<3	1.45	1.45	<0.03	41/52
9/8/2014	20.96	8.50	433	7.99	0.83	36	75	<3	1.36	1.36	<0.03	45/48
10/13/2014	11.85	10.94	431	8.13	1.63	40	79	18	1.39	1.39	<0.03	49/48

Note: Surface/Bottom Results



Wolsfeld Lake

(DNR ID: 27-0157-00)

- Monitored by MCWD Volunteer -

**Ten-Year Lake Grade Record
(May-Sept Means)**

Year	SECC	CHLA	TP	Lake Grade
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	D	D	D	D
2009				
2010				
2011				
2012				
2013				
2014	F	N/A	D	N/A

**Ten-Year Water Quality Means
(June-Sept)**

Year	SECC	CHLA	TP	TSI
2005				
2006	N/A	N/A	N/A	N/A
2007	N/A	N/A	N/A	N/A
2008	0.98	65.00	102	68
2009				
2010				
2011				
2012				
2013				
2014	0.65	N/A	134	71

2014 Water Quality Data

Date	TMP	SECC	CHLA	TP	TN	TKN	NO ₃	Cl
5/13/2014	12.70	0.75	69	93	1.450	1.450	<0.03	40
6/16/2014	21.50	1.30		163	0.927	0.927	<0.03	31
7/13/2014	24.80	0.55	54	123	2.890	2.890	<0.03	26
8/20/2014	26.30	0.35	88	103	3.170	3.170	<0.03	31
9/17/2014	19.90	0.38	97	146	2.730	2.730	<0.03	32

Note: Flow (cfs); TMP (°C); DO, TN, TKN, NO₃, Cl, and TSS (mg/L); SP COND (µS/cm); SECC (m); CHLA, TP, and SRP (µg/L); *E. coli* (CFU/100 mL); Red indicates not meeting the DO Std; Bold Font = duplicate; Red Font = flagged duplicate results (see technical report); N/A = insufficient data.

Long Lake Creek Subwatershed - Additional Lake Information

Lake	Lake Levels Recorded* (DNR)	Bathymetric Map**	Vegetation Survey	Fish Survey (DNR)	Fish Stocking (DNR)	Impairment: Pollutant (MPCA)	Impairment: Affected Designated Uses (MPCA)
Dickeys	1991 - 1998	Yes (DNR)		1979	2005	None	None
Holy Name	1998 - 2014	Yes (DNR)				Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Long	1937 - 2014	2013		2008	2011	Mercury in Fish Tissue, Nutrient/Eutrophication Biological Indicators	Aquatic Consumption and Recreation
Lydiard	1991 - 2014	Yes (DNR)		2007	2012	None	None
Mooney	1958 - 2014		September 2011	1992	2012	Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
School	2006	Yes (DNR)					
Tanager	1984	Yes (DNR)		1992		Nutrient/Eutrophication Biological Indicators	Aquatic Recreation
Wolfsfeld	2006 - 2012	Yes (DNR)				Nutrient/Eutrophication Biological Indicators	Aquatic Recreation

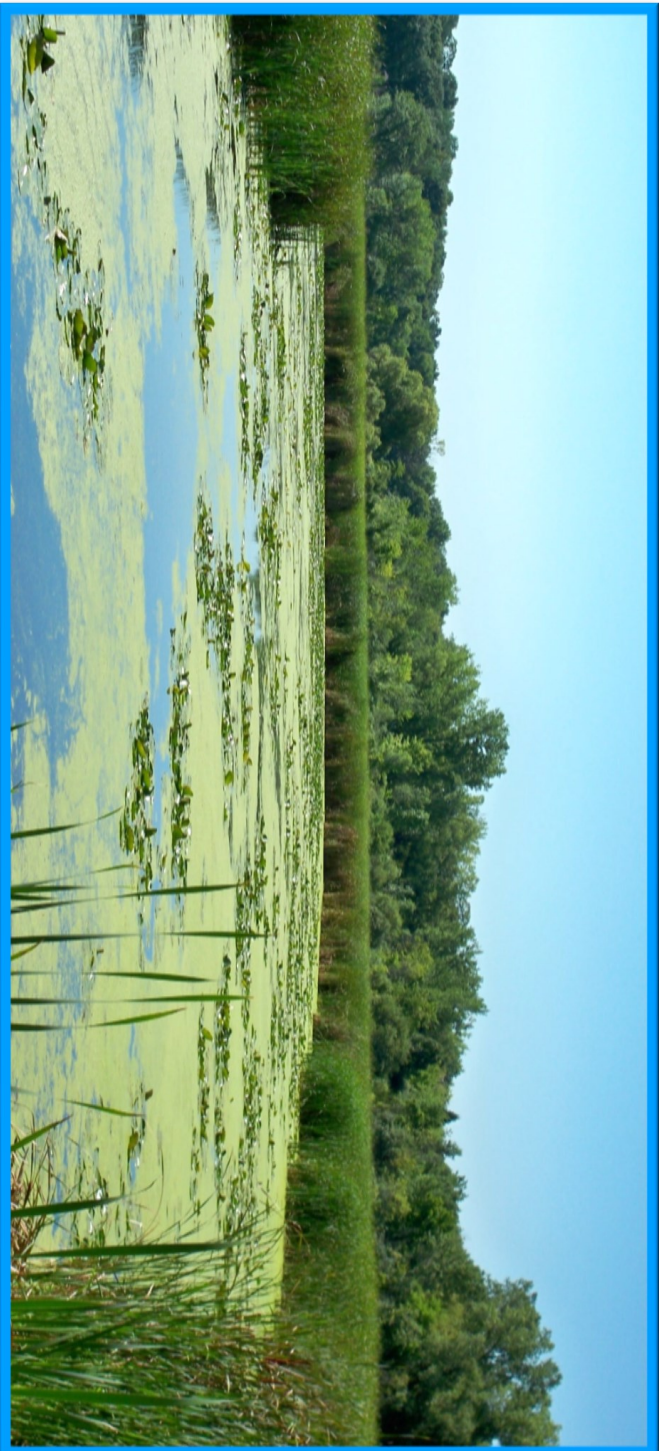
Lake	Invasive Species						
	Chinese Mystery Snail	Common Carp	Curlleaf Pondweed	Eurasian Water Milfoil	Flowering Rush	Purple Loosestrife	Zebra Mussels
Dickeys							
Holy Name			X				
Long		X	X	X			
Lydiard							
Mooney			X				
School							
Tanager	X	X	X	X	X		X
Wolfsfeld							

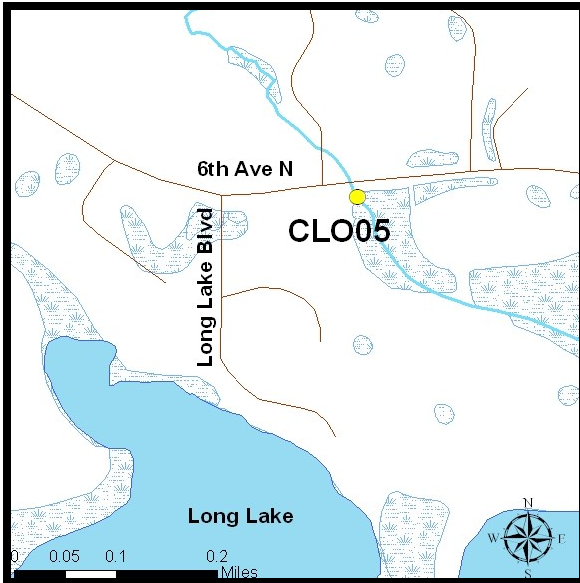
*Lake Levels data is available at www.dnr.state.mn.us/lakefind/index.html

**Bathymetric maps are available on our website at www.minnehahacreek.org/project/bathymetric-mapping-mcwwd-lakes

Long Lake Creek Subwatershed - Stream Monitoring Sites Information

Stream	MCWD Site ID	Weekly Flow Gauging	Automated Stage	Watershed Area (ac)	Latitude	Longitude
Long Lk Ck: Long Lk Inlet	CLO05	Yes	No	1632.79	44.9958	-93.5612
Long Lk Ck: Long Lk Outlet	CLO01	Yes	Yes	3563.15	44.9850	-93.5606
Long Lk Ck: Tanager Lake Inlet	CLO03	Yes	No	892.88	44.9670	-93.5734





Long Lake Creek: Long Lake Inlet (CR 6) (CLO05)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	16
Dissolved Oxygen (mg/L)	4
Total Suspended Solids (mg/L)	11
Total Phosphorus (µg/L)	213
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Note: Red indicates exceedance

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005											
2006	3.40	903	135	283	42	715	0.11	36	5		
2007	1.52	547	182	215	72	1713	0.57	27	9		
2008	0.77	221	147	93	62	3429	2.27	7	4	42	28
2009	0.28	120	214	44	78	1756	3.13	2	4	49	88
2010	1.27	444	178	172	69	5498	2.20	16	6	130	52
2011	1.82	627	175	239	67	2310	0.64	18	5	129	36
2012	1.45	539	188	210	73	1049	0.37	37	13	33	12
2013	3.92	2051	266	1368	177	8733	1.13	47	6	189	24
2014	2.68	897	170	478	91	11401	2.16	41	8	225	43

Note: Revised means and loads for 2008-2013

2014 Water Quality Data– CLO05

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	12.20	4.84	12.2	417	9.73	240	128	3.240	6	46
4/16/2014	2.61	2.93	2.61	473	11.65	254	10			
4/23/2014	5.04	8.43	5.04	448	14.23	210	10		17	
4/30/2014		5.33			12.28	187	51			
5/14/2014	15.10	12.93	15.1	389	11.13	74	17			
5/21/2014	13.95	15.43		394	11.4	86	35		4	
5/29/2014	9.30	21.34	9.3	421	6.86					
6/4/2014	17.07	21.74		354	5.56	218	162	1.070	6	30
6/10/2014	9.46	19.90	9.46	371	6.25	209	153			
6/17/2014	8.08	21.22		371	7.69	182	111		8	
6/24/2014	20.88	23.62	20.88	351	7.18	278	190			
7/1/2014	5.37	21.62	5.37	365	6.71	368	243	1.570	19	28
7/8/2014	2.37	21.95	2.37	368	7.43	237	97			
7/16/2014	2.12	20.70	2.12	407	7.94	138	84		6	
7/23/2014	1.60	20.74	1.6	391	6.48	165	115			
7/30/2014	0.16	22.33	0.16	415	6.37	184	120	1.710	11	32
8/6/2014	0.51	20.10	0.509	410	7.39	210	122			
8/13/2014	0.01	19.71	0.01	359	8.33	228	6		15	
8/20/2014	0.21	20.17		416	6.25	182	70			
8/27/2014	0.04	20.25	0.04	423	7.89	220	83	1.880	12	34
9/3/2014	0.45	19.86	0.45	404	8.28	252	67			
9/10/2014	0.57	15.83	0.57	401	7.2	304	100		29	
9/17/2014	0.04	15.89	0.04	438	9.9	174	21			
9/24/2014	0.03	15.41	0.03	479	8.38	237.5	80.5	1.925	15	42
10/8/2014	0.04	8.72	0.04	478	9.47	233	103		13	
10/15/2014	0.05	8.29	0.05	551	7.73	259	92			
10/22/2014	0.06	9.63	0.059	543	7.15	277	120	1.250	8	52
10/27/2014	0.01	11.08	0.011	574	6.95	158	43			
11/5/2014	0.05	5.80	0.054	563	12.6	186	65		2	

Blue Highlight = Flow calculated from rating curve.



Long Lake Creek: Long Lake Outlet (CLO01)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	19
Dissolved Oxygen (mg/L)	11
Total Suspended Solids (mg/L)	7
Total Phosphorus (µg/L)	87
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

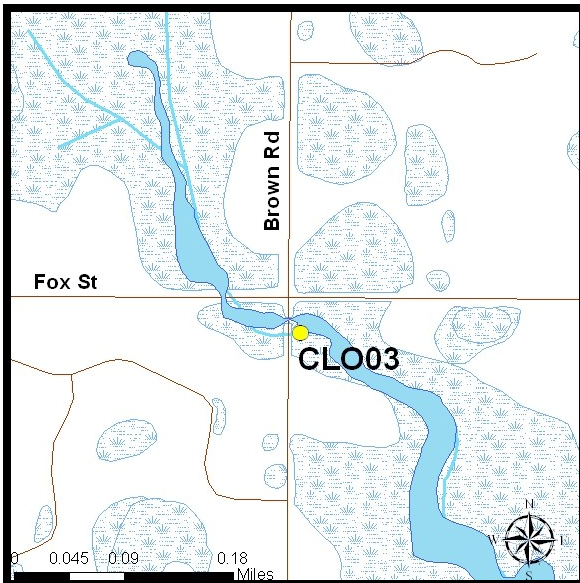
Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	3.72	910	124	46	6	12934	1.77	165	23		
2006	5.63	574	52	34	3	1413	0.13	19	2		
2007	3.15	573	92	110	18	11687	1.88	79	13		
2008	2.23	268	61	14	3	7853	1.79	28	6	130	30
2009	0.66	119	92	39	31	1922	1.49	6	4	70	54
2010	2.45	296	61	18	4	8409	1.74	25	5	359	74
2011	4.12	546	67	210	26	6213	0.77	50	6	359	44
2012	2.04	422	105	18	5	3268	0.81	22	5	165	41
2013	5.29	800	77	67	6	15458	1.48	73	7	459	44
2014	7.33	1247	86	167	12	22419	1.55	69	5	914	63

Note: Revised means and loads for 2008-2013

2014 Water Quality Data– CLO01

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	20.326	3.90	8.84	512	7.70	108	9	2.230	4	60
4/16/2014	12.238	4.72	11.63	446	8.43	99	<3			
4/23/2014	7.924	7.80	17.89	470	8.61	157	<3		16	
4/30/2014	61.180	6.79	14.23	451	8.99	127	<3			
5/7/2014	31.476	10.95	20.76	431	9.29	96	44	1.830	7	71
5/14/2014	29.144	11.97	13.95	430	9.11	61	<3			
5/21/2014	30.375	14.45	13.27	437	9.13				7	
5/29/2014	17.772	21.97	7.81	445	8.47	42	13			
6/4/2014	53.703	21.52	7.89	424	8.36	67	26	0.876	2	48
6/10/2014	26.995	22.01	14.93	408	9.07	94	<3			
6/17/2014	21.342	21.20	8.85	419	8.57	58	8		2	
6/24/2014	47.164	26.25	13.03	391	8.91	98	20			
7/1/2014	15.896	22.59	8.41	398	8.56	112	14	1.300	6	40
7/8/2014	7.567	23.51	11.81	389		77	<3			
7/16/2014	6.719	24.66	11.02	383		58	<3		7	
7/22/2014	2.918	27.50	11.50	374	9.16	67	<3			
7/30/2014	0.479	22.33	6.37	415	8.10	50	<3	1.170	6	41
8/6/2014	0.997	25.73	8.51	377	8.89	50	<3			
8/13/2014	0.680	24.47	8.08	379	8.53	47.5	<3		5	
8/20/2014	0.041	24.35	5.14	368	8.33	111	<3			
8/27/2014	0.586	26.98	8.46	387	8.77	43	<3	1.210	4	43
9/2/2014	1.305	25.36	8.46	375		43	<3			
9/10/2014	1.344	19.64	8.24	387	8.22	54	<3		7	
9/17/2014	0.645	19.30	10.39	396		123	11.5			
9/24/2014	0.018	17.97	7.39	392	8.33	106	12	1.720	9	46
10/8/2014	0.541	11.95	8.17	419	7.94	220	111		10	

Blue Highlight = Flow calculated from rating curve.



Long Lake Creek: Tanager Lake Inlet (Browns Rd) (CLO03)

NCHF Ecoregion Guidelines and Standards	Means
Temperature (°C)	15
Dissolved Oxygen (mg/L)	5
Total Suspended Solids (mg/L)	4
Total Phosphorus (µg/L)	120
<i>E. coli</i> (cfu/100 mL)*	N/A
*Geometric Mean	

Ten-Year Annual Time-Weighted Flow, Flow-Weighted Mean, and Loads

Year	Flow (cfs)	TP (lbs)	TP (µg/L)	SRP (lbs)	SRP (µg/L)	TN (lbs)	TN (mg/L)	TSS (1000 lbs)	TSS (mg/L)	CI (1000 lbs)	CI (mg/L)
2005	1.27	612	244	228	91	4289	1.71	34	14		
2006	3.78	660	89	131	18	631	0.08	22	3		
2007	2.96	601	103	205	35	4798	0.82	46	8		
2008	3.09	496	81	111	18	10284	1.689	51	8	162	27
2009	1.30	258	101	80	31	3316	1.299	17	6	141	55
2010	3.10	586	96	197	32	7857	1.288	30	5	360	59
2011	5.44	1036	97	398	37	2819	0.26325	65	6	171	16
2012	2.92	704	122	186	32	4023	0.700	92	16	177	31
2013	7.16	2079	147	997	71	15437	1.095	71	5	586	42
2014	12.84	2630	104	1262	50	17707	0.70	75	3	730	29

Note: Revised means and loads for 2008-2013

2014 Water Quality Data– CLO03

Date	Flow	TMP	DO	SP COND	pH	TP	SRP	TN	TSS	Cl
4/9/2014	20.326	3.90	8.84	512	7.70	109	38	2.28	4	64
4/16/2014	19.346	3.52	10.67	464	7.72	76	<3			
4/23/2014	10.969	7.27	13.25	508	8.10	122	<3		12	
4/30/2014	81.760	5.86	10.47	460	7.94	110	<3			
5/7/2014	45.096	11.06	8.39	463	8.01	87	<3	1.36	12	56
5/14/2014	43.149	10.58	4.85	470	7.65	40	7			
5/21/2014	38.424	14.74	4.53	474	7.58	58	30		1	
5/29/2014	24.136	20.21	2.40	475	7.36	115	78			
6/4/2014	73.547	21.00	1.64	441	7.25	109	77	0.89	1	45
6/10/2014	33.581	19.88	2.06	439	7.28	136	88			
6/17/2014	26.868	20.32	1.94	450	7.25	157	114		1	
6/24/2014		23.82	1.65	414	7.36	162	109			
7/1/2014		22.02	2.02	426	7.29	214	121	1.24	2	41
7/8/2014	13.339	21.84	0.37	432		220	118			
7/16/2014	33.026	19.67	1.60	420		93	58		1	
10/8/2014	0.169	8.35	2.42	531	7.99	105	32		5	

Long Lake Creek Subwatershed - Additional Stream Information

Stream	Macroinvertebrate Survey*	Impairments (MPCA)	Impairment: Affected Designated Uses (MPCA)
Long Lk Ck: Long Lk Inlet	2013	None	None
Long Lk Ck: Long Lk Outlet		None	None
Long Lk Ck: Tanager Lake Inlet		None	None

* The Macroinvertebrate Survey Report is available on the district website at <http://minnehahacreek.org/project/stream-assessment-2013>