NPDES MS4 Phase I Permit No. MN0061018

Annual Report for 2021 Activities

City of Minneapolis and the Minneapolis Park & Recreation Board – Co-Permittees

June 30, 2022

Minneapolis
City of Lakes

NPDES MS4 Phase I Permit
Annual Report for 2021 Activities

June 30, 2022

I hereby certify that this plan, specification, or report, was prepared by me or under my direct Supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Elizabeth Stout

Date 6/30/2022 Registration No. 46328

NPDES PERMIT NO. MN0061018
Issued February 16, 2018

NPDES MS4 Phase I Permit No. MN0061018
Annual Report for 2021 Activities

City of Minneapolis and the Minneapolis Park & Recreation Board
Co-Permittees

June 30, 2022

Table of Contents

SIGNATURE PAGE

Minneapolis
City of Lakes

NPDES MS4 Phase I Permit
Annual Report for 2021 Activities

June 30, 2022

I hereby certify that this plan, specification, or report, was prepared by me or under my direct Supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Elizabeth Stout

Date 6/30/2022 Registration No. 46328

NPDES PERMIT NO. MN0061018
Issued February 16, 2018

Prepared by Minneapolis Public Works – Surface Water and Sewers Division

Acronyms

BCWMC	Bassett Creek Watershed Management Commission
BMP	Best Management Practice
BOD_5	Biochemical Oxygen Demand of wastewater during decomposition over a 5-day period
CIP	Capital Improvement Program
CSO	Combined Sewer Overflow
DNR	Department of Natural Resources
EPA	Environmental Protection Agency
ESC	Erosion and Sediment Control
GIS	Geographic Information Services
I & I	Inflow and Infiltration
IPM	Integrated Pest Management
MCES	Metropolitan Council Environmental Services
MCM	Minimal Control Measure
MCWD	Minnehaha Creek Watershed District
MDA	Minnesota Department of Agriculture
MDR	Minneapolis Development Review
MIDS	Minimal Impact Design Standards
MNDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MPRB	Minneapolis Park & Recreation Board
MS4	Municipal Separate Storm Sewer System
MWMO	Mississippi Watershed Management Organization
NPDES	National Pollutant Discharge Elimination System
PW-SWS	Public Works – Surface Water and Sewers
PW-TMR	Public Works – Transportation Maintenance and Repair
SCWMC	Shingle Creek Watershed Management Commission
SMP	Stormwater Management Practice
SOP	Standard Operating Procedure
SSO	Sanitary Sewer Overflow
SWMP	Stormwater Management Program
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TSI	Trophic State Index
TSS	Total Suspended Solids
VRS	Vehicle Related Spills
WMO	Watershed Management Organization

ACKNOWLEDGEMENTS

Minneapolis Public Works - Surface Water & Sewers
Paul Chellsen
Lane Christianson
Angie Craft
Justin Flannery
Kevin Danen
Paul Hudalla
Katie Kowalczyk
Kelly MacIntyre
Shahram Missaghi
Kelly Moriarity
Sean Oberg
Isaac Prehall
Lillian Rouillard
Catherine Rowley
Elizabeth Stout

Minneapolis Public Works - Transportation Maintenance & Repair
Steve Collin

Minneapolis Health Department - Environmental Services
Jim Doten

Minneapolis Park & Recreation Board
Natalie Brown
Katelynn Chamberlin
Rachael Crabb
Gretchen Engstrom
Marcia Holmberg
Mike Perniel
MaryLynn Pulscher
Kait Ryan
James Shaffer
Mike Sorensen

Minneapolis Regulatory Services
Steve Kennedy

BACKGROUND

This report provides documentation and analysis of the Minneapolis Stormwater Management Program (SWMP) activities conducted during 2021. The City and Minneapolis Park & Recreation Board (MPRB) both lead the implementation of the SWMP activities and are jointly responsible for the completion of the required Permit submittals.

This Annual Report is prepared in compliance with the requirements of National Pollutant Discharge Elimination System (NPDES) Permit No. MN0061018, a Municipal Separate Storm Sewer System (MS4) Phase I permit issued to City of Minneapolis and the Minneapolis Park & Recreation Board as co-permittees. Permit No. MN0061018 was initially issued in December 2000 and reissued in January 2011. An updated NPDES permit was reissued again in February 2018. Activities completed under the new permit and approved Stormwater Management Program (SWMP) have been reported in the 2021 Annual Report and will be submitted to the MPCA (Minnesota Pollution Control Agency) by June 30, 2022.

The NPDES program was created in 1990 by the United States Environmental Protection Agency (EPA) to safeguard public waters through the regulation of the discharge of pollutants to surface waters including lakes, streams, wetlands, and rivers. The MPCA is the local authority responsible for administering this program. Under the NPDES program, specific permits are issued to regulate different types of municipal, industrial, and construction activities. This report is related specifically to municipal stormwater activities.

The SWMP is based on an adaptive management system, as outlined in Part III of the Permit, by which the Permittees continuously monitor, analyze, and adjust the SWMP to achieve pollutant reductions. Using the adaptive management approach, revisions to the SWMP are made and submitted to the MPCA as necessary. A 2013 EPA/MPCA audit helped to identify opportunities for improvement regarding comprehensive training, written procedures and documentation, and availability of staff resources that have influenced subsequent revisions to the SWMP. The Permit requires the implementation of approved Stormwater Management Activities, referred to as SMPs, also known as Best Management Practices (BMPs).

Minneapolis Public Works, Surface Water & Sewer Division provides program management and completes each Annual Report. An annual opportunity for public input into the SWMP and city priorities is required under the permit. The permit also requires the adoption of a formal resolution by the Minneapolis City Council each year, adopting the Annual Report. This resolution will be sent under separate cover.

In February 2018, the City’s most recent NPDES permit was reissued by the MPCA. In response to that permit update, the City’s Stormwater Management Program (SWMP) was updated to reflect any new permit requirements or changes. The updates SWMP was approved by the Minneapolis City Council in 2019 for submittal to the MPCA.

CATEGORY ONE: PUBLIC EDUCATION AND OUTREACH

PROGRAM OBJECTIVES

The objective of this stormwater management practice is to educate the public regarding point and non-point source stormwater pollution.

Targeted pollutants include:

- All pollutants

PROGRAM OVERVIEW

A successful stormwater management program involves participation and good management from everyone in the City, including municipal staff, residents, business owners, park visitors, facility managers, contractors, developers, and all others who live, work, and recreate In Minneapolis. Public education serves to provide information on the importance of water quality, the impacts of stormwater runoff, the sources of pollutants in stormwater runoff, and the activities that the public should adopt to fulfill their collective responsibilities towards improved water quality.

Many of the components of the program can be found at the City of Minneapolis Stormwater website or on the MPRB Water Resources website.

Program activities include hosting of educational events, distribution of educational materials, regular updates of web-based information, staff training, and other activities. Some of the program activities are carried out directly by the co-permittees, the City, and the Minneapolis Park & Recreation Board (MPRB). Other activities are coordinated with and carried out by watershed management organizations, Hennepin County, and other entities.

PREVIOUS YEAR ACTIVITIES

Minneapolis Park and Recreation Board Education Activities

In 2021, Minneapolis Park & Recreation Board (MPRB) staff provided water quality education programs throughout the City. Water quality education programs were unique in 2021 due to the continued impacts of the COVID-19 pandemic. Environmental Management Naturalist staff were still able to offer 173 program hours of in-person opportunities and interacted with nearly 2,000 people in neighborhood and regional parks. **Figure 1-1** shows two participants for weekly free programing at Loring Park. Additionally, educational sign prompts, offered in both Spanish and English were placed in 9 park locations, and 8 local hardware stores were furbished with displays to educate customers about the use of salt for winter snow and ice management. All program locations can be seen in **Figure 1-2**. Education staff utilized portable mini-golf, bean bag toss, an aerial photo floor graphic of the city and its watersheds, and other hands-on learning activities about stormwater and human impacts on our water quality in Minneapolis.

Figure 1-1. Two youth getting ready to safely canoe on Loring Pond with MPRB staff assisting

Minnehaha Park

A moveable water quality education exhibit was deployed at Minnehaha Park near the pavilion that houses the popular restaurant, Sea Salt Eatery. The spinning cubes provide information about watersheds, stormwater runoff, and actions people can take to positively impact water quality. This location was chosen because of the consistent captive audience of people standing in line waiting to order food. Intermittent staff observations throughout the season confirmed that many of the people waiting in line were reading from the exhibit.

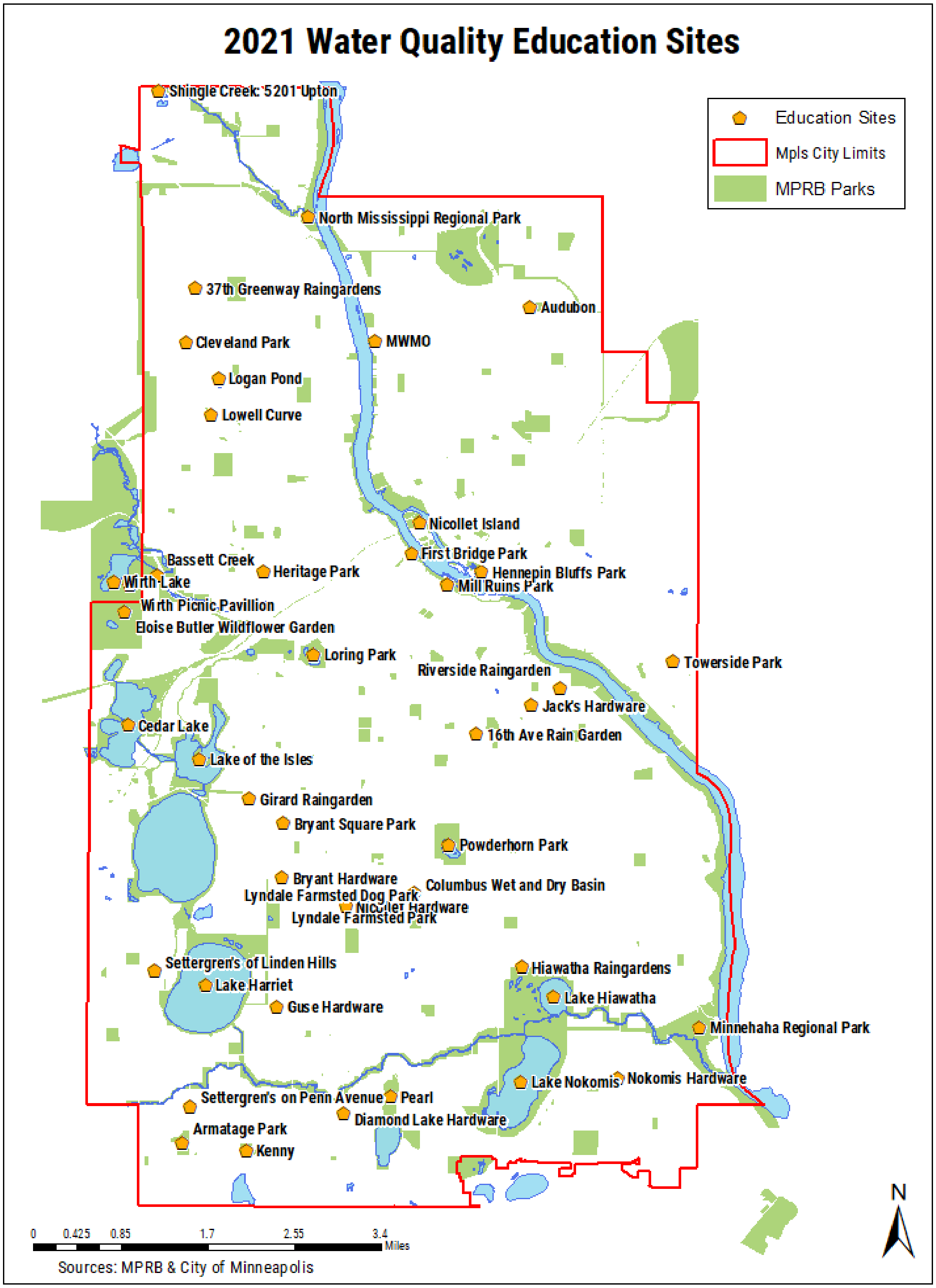


Figure 1-2. Map and list of water quality education sites in 2021

Water Quality Water Trail

The Water Trail, a designed series of buoys to follow like a trail on the water, for the Lagoon in Lake Nokomis was deployed in June. A set of 10 stand up paddleboard (SUP) yoga poses were designed to be above the waterline on the buoys holding water quality education messages. Shoreline signs were also posted for the summer season, letting park visitors know about the new resource, see **Figure 1-3** for one example. A series of SUP yoga classes were scheduled to include a Water Quality Educator to engage adult audiences, see **Figure 1-4** for two of such yoga participants.

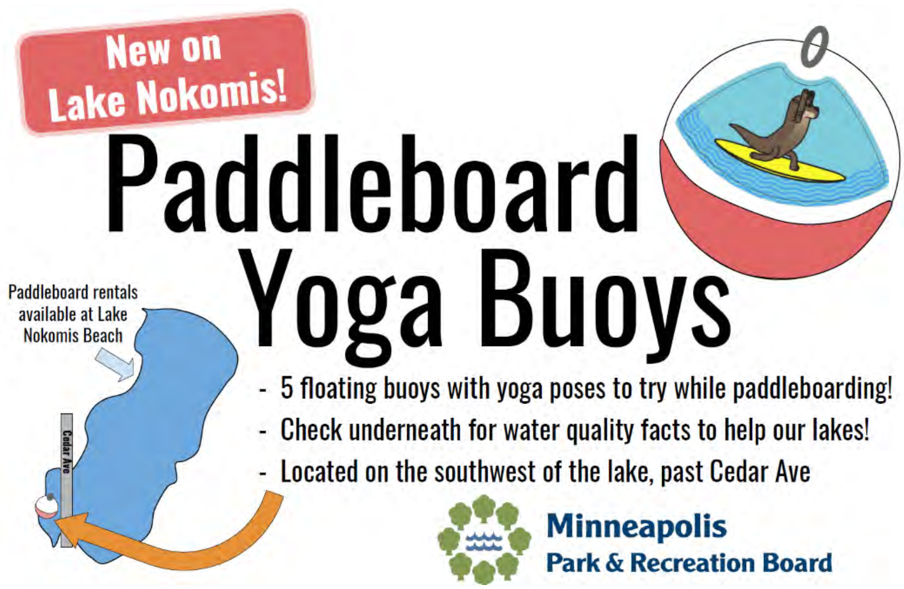


Figure 1-3. Shoreline sign posted around the Nokomis Lagoon to draw attention to this new resource

Figure 1-4. A small group testing out one stop on The Water Trail in the Lake Nokomis Lagoon

Spanish Language Publications

A series of weekly newsletter articles were published in La Matraca News, as seen in **Figure 1-5**. This newsletter featured topics on how storm drains work, raking fall leaves, picking up litter, reducing salt use in winter, picking up dog waste, and not feeding waterfowl. These articles appeared in Spanish and were accompanied with a photo and a list of park sites for readers to visit and learn more about water quality.

Figure 1-5. La Matraca online news featured using salt responsibly

Aquatic Invasive Species Education

The MPRB continued its extensive Aquatic Invasive Species (AIS) Inspection & Education Program at the public boat launches located at Bde Maka Ska, Lake Harriet, and Lake Nokomis. The boat launches are staffed seven days a week from May 1 to December 1, and all trailered boats entering and leaving the lakes are inspected for AIS. In addition to providing watercraft inspections, staff are an information source for the park visitors. Staff directly interacted with 15,571 park visitors in 2021. Adjacent to the AIS booths are sandwich boards, Figure 1-6, with action steps people can take to be a good water steward. The sandwich board messages can be changed out daily based on weather, time of year, etc. Annually, more than seven million people visit the Chain of Lakes, and more than one million visit Lake Nokomis.

Figure 1-6. Aquatic Invasive Species boat inspection and water quality education at boat launches.

Canines for Clean Water Campaign

According to US Census data, there were 188,017 households in Minneapolis in 2020. Using American Veterinary Medical Association ownership rates, an estimated 115,500 dogs live within Minneapolis city limits. The US Environmental Protection Agency has calculated the average dog produces 0.75 pounds of waste each day. That means Minneapolis dogs are generating an estimated 87,000 pounds of solid waste each day. Initiated in 2009, Canines for Clean Water is a water quality education program targeting dog owners to build awareness of the impacts of this waste when it is not properly disposed of and empowering people to take action and make a difference.

In 2021, MPRB's seven dog parks were sites that received a series of six educational sign prompts about the importance of picking up dog droppings to protect our water quality. **Figure 1-7** shows an example of one of these signs, all of which were offered in both Spanish and English.

Figure 1-7. An example of the signs posted in Minneapolis Dog Parks.

Do Not Feed the Ducks Campaign

Based on a successful pilot program in 2016 that focused on persuading park patrons to not feed the ducks, the MPRB moved forward with fabrication of permanent education pieces in 2017. In 2021, our yellow duck ambassadors continued their mission including an oversized buoy along the Lake Harriet shoreline, adjacent to the seasonal restaurant Bread & Pickle and 30 'please do not feed the ducks' rubber duck table-toppers installed in the following locations: picnic tables at Bread & Pickle at Lake Harriet, Sea Salt Eatery in Minnehaha Regional Park, the former Refectory site at Bde Maka Ska, Sand Castle at Lake Nokomis, and along the fishing rail at Powderhorn Lake, where ducks were provided in both English and Spanish. See **Figure 1-8** for the scale of our giant buoy rubber duck ambassador.

Figure 1-8. Photo of the Lake Harriet rubber duck buoy of the Don't Feed the Ducks Campaign

A redesign of sandwich board signs asking park visitors to not feed the wildlife were also deployed at Bde Maka Ska and Lake Harriet. These signs encourage visitors to "photo not feed" as a way to connect with ducks and geese living around our lakes. See **Figure 1-9** for examples of these newly designed signs.

Figure 1-9. Example of goose sign posted at Bde Maka Ska, and duck sign at Lake Harriet encouraging people to take pictures rather than offer food to the wildlife with the hashtag #PhotoDontFeed

Earth Day Watershed Clean-up

Since 2008, The MPRB Earth Day Clean-up event has inspired more than 20,000 residents to remove more than 160,000 pounds of garbage from Minneapolis parks. Due to the ongoing pandemic the 2021 Earth Day Celebration was again modified to a 'Do-It-Yourself' approach. Trash bags, gloves, and instructions were made available for pick up at participating park sites. Volunteers were encouraged to practice social distancing, follow current COVID-19 guidelines, and share pictures of their haul on social media using the hashtag #mplsDIYEarthDay. Pictured are a few of the generous volunteers in Loring Park **Figure 1-10.**

Figure 1-10. Photos from the 2021 Earth Day Watershed Clean-up

Mississippi River Green Team

The Mississippi River Green Team is a conservation-based teen crew engaged in daily hands-on environmental work throughout the summer. The crew is made up of 18 youth and two supervisors, who work mostly in the natural areas of the Minneapolis Park system. A typical season would see the crew at a different park space nearly every day, but because of COVID-19 restrictions, were limited to Theodore Wirth Park and North Mississippi Regional Park for all but two weeks of the season. Typical workdays included conducting invasive species removal, weed wrenching, planting, watering, and mulching.

A few special opportunities came up while working in Theodore Wirth Park. On rotation, three youth joined the naturalist staff each day at Eloise Butler Wildflower Garden to shadow their work and help with greeting at the front gate, identifying plants, and offering educational opportunities out of the Beach Cart at Wirth Beach. They also spend a day and a half working on a restoration project that was filmed by a crew under the direction of The Nature Conservancy (TNC), a global environmental organization focused on the conservation of land and water. TNC's Trees. Water. Soil. campaign explores natural solutions to climate change which not only reduce carbon emissions, but also provide a host of other benefits like cleaner water and air. The resulting video and article highlight the work the Green Team did at Theodore Wirth Park this summer and talks about the long-term goals of the Green Team program, which include diversifying the environmental workforce. **Figure 1-11** shows several youth planting native plants after they spend more than a week clearing buckthorn and other invasive species.

Figure 1-11. Mississippi River Green Team youth staff planting native ferns after clearing the area of buckthorn and other invasive species

As part of weekly career exposure days, the crews learned how to identify aquatic vegetation, captured macroinvertebrates from Bassett Creek, spray painted storm drains to raise awareness of the connection between streets and creek, watched a forestry crew remove ash trees damaged by the invasive species called Emerald Ash Borer, met the goatherder (and the goats) hired to clear invasive species from a hillside in Wirth park, participated in a bird survey with the Audubon Society, learned about the ecology of dragonflies while capturing them with the National Park Service, participated in the Sustainable Land Training with MetroBlooms, and learned about conservation of the Mississippi River from the Friends of the Mississippi River.

The Mississippi River Green Team is made possible through a partnership between the Minneapolis Park & Recreation Board and the Mississippi Watershed Management Organization.

The Green Team is also supported by City of Minneapolis Public Works through their contract with *Landbridge Ecological*, which manages vegetation at stormwater Best Management Practices (BMPs) throughout the city. Landbridge and the Green Team's work in 2021 focused on weed and invasive species management at 16th Ave Rain Garden, 37th Greenway Raingardens, Columbus Wet and Dry Basin, Girard Raingarden, Heritage Park, Hiawatha Raingardens, Logan Pond, Lowell Curve, Riverside Rain Garden at Svea Triangle, Shingle Creek, and Towerside Park

2021 Frog & Toad Survey of Select Stormwater Ponds

The presence and abundance of frogs and toads is a useful indicator of water and habitat quality, as well as short and long-term environmental changes. Long-term surveys by natural resource agencies have resulted in standardized methods of collecting data. The Minnesota Department of Natural Resources (DNR) implements statewide monitoring using the Minnesota Frog & Toad Calling Survey (MFTCS), which contributes to the nation-wide North American Amphibian Monitoring Program (NAAMP).

The question has been raised whether stormwater ponds, constructed to intercept and treat runoff, can also function as a refuge for amphibians. Furthermore, the public has complained about the absence of formerly abundant frogs and toads calling from Hiawatha Golf Course and the surrounding area. To evaluate these concerns, preliminary frog and toad listening surveys were conducted at Lake Hiawatha golf course in 2016 and 2017 and formalized in 2018 to the present. Additional stormwater ponds were added to the surveys in 2018 and again in 2019 to reflect different types and locations of stormwater ponds with standing water throughout Minneapolis. In 2020, the pond at 37th St E and Chicago Ave S was dropped from the study because only one toad was heard once in two years and there are a lot of lights, noise and even an active fountain, and there were safety concerns. Robert's Bird Sanctuary was added in 2020.

The purpose of these surveys is to:

1. Determine if any frog and toad species (anurans) are found in or near stormwater ponds.
2. Use the Minnesota Frog and Toad Calling Survey protocols adapted for Theodore Wirth Park to Identify species and abundance in stormwater ponds.
3. Generate ideas about why or why not species may use stormwater ponds.
4. Involve volunteers and concerned citizens in monitoring Hiawatha Golf Course ponds in a systematic way.

Overview of Findings

Seven species of anurans (frogs and toads)—of 14 total known in MN—were reported across all sites. Not more than three species were found at any single location (Table 2).

The highlight of the 2021 surveys was hearing a single spring peeper (*Pseudacris crucifera*) at the Columbia Golf Course ponds. This is highly significant as spring peepers have not been heard elsewhere in Minneapolis since these surveys began in 2015 (suspected but not confirmed in Wirth Park).

Green frogs (*Lithobates clamitans*), an aquatic frog, continue to be abundant—with a chorus of 3—in the stormwater pond at Upton Ave N and 52nd Ave N. Green frogs have not been heard elsewhere including in seven years of similar surveys at Theodore Wirth Park (2015-21).

American toads (*Anaxyrus americanus*) are still the most widespread and abundant species in stormwater ponds; and heard at least once in all but one stormwater pond, West Twin Pond. Toads are also the only species heard in full chorus (index of 3) at any of the stormwater ponds.

The full report can be found in Appendix A13.

Minneapolis Adopt-a-Drain Program

Since 2016, the Minneapolis Adopt-a-Drain program has empowered Minneapolis residents to take responsibility for storm drains and gutters in their neighborhoods by adopting and keeping them clean. In March 2019, the arrival of a metro-wide website (www.adopt-a-drain.org) was launched to serve all cities in the Twin Cities 7 county area.

Figure 1-12 Example of Adopt-a-Drain work in Minneapolis

2021 Adopt-a-Drain Program Results

Despite enduring the second year of the COVID-19 pandemic, the Minneapolis Adopt-a-Drain Program posted significant numbers in 2021:

- Minneapolis led all cities in the Twin Cities metro area with 2,732 total program participants
- 538 new program participants in 2021
- 2,732 total program participants
- 5,996 total storm drains adopted (1,145 were added in 2021)
- 1,102 participants in Minneapolis reported cleanings in 2020 (962 reported cleanings in 2019)
- Collected 56,048 pounds of debris in 2021 (54,712 pounds of debris was collected in 2020)
- 1,464 volunteer hours logged in 2021 (1,349 hours logged in 2020)

Adopt-a-Drain Mailings and Signs
In 2021, 485 welcome packets and signs were mailed to program participants (note: some participants opt out of receiving a yard sign, so the number of packets sent is lower than the total number of new signups this year. In addition, 52 Minneapolis residents signed up at the State Fair who did not receive a welcome packet in the mail). The yard signs provide a secondary touchpoint away from the storm drain, helping to raise awareness and to encourage people to keep storm drains near their homes clean.

Sample welcome packet pictured below included: waterbody-specific yard sign and stake, drain decals and adhesives, welcome card with safety tips and instructions, customized Minneapolis welcome letter, and drain decal application instructions.

Figure 1-13 Examples of Adopt-a-Drain materials and welcome packet

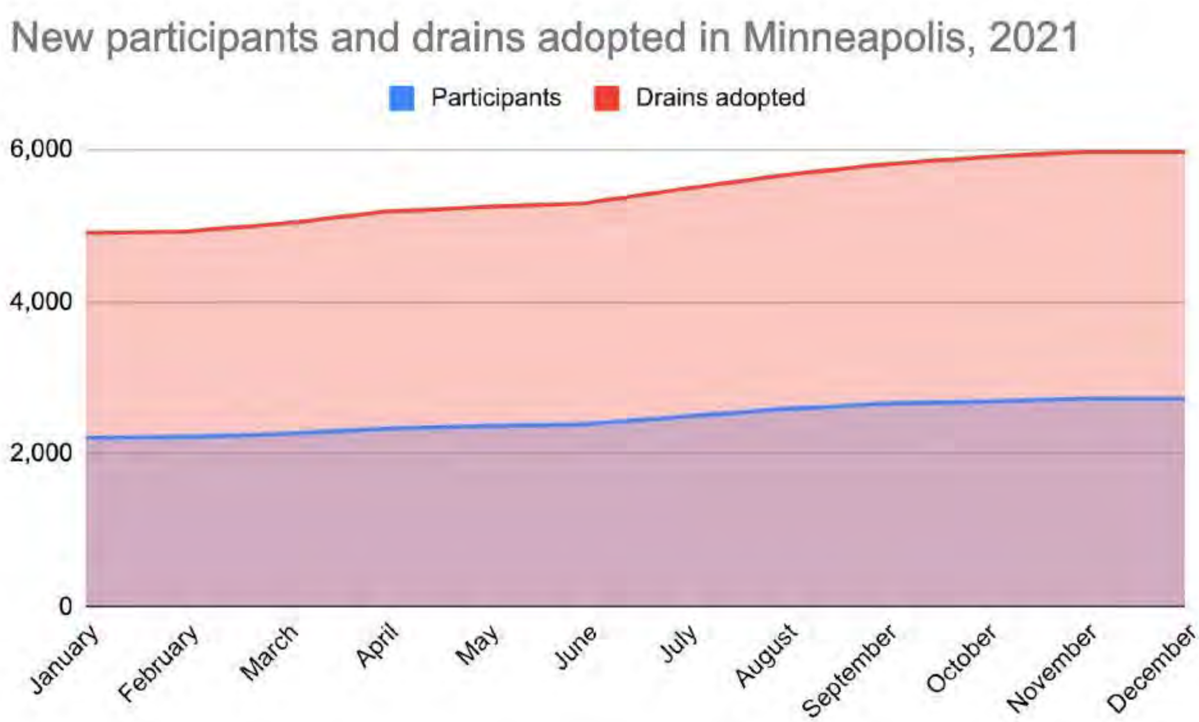
New Adopt-a-Drain Door / Storm Drain Stenciling Door Hangers

In 2021, a new double sided door hanger was created for use with multiple uses, including:

- Storm Drain Stenciling Program
- Adopt-a-Drain K-12 Outreach Program
- Earth Day cleanup events
- National Night Out
- Seeds to Harvest clean up events

Figure 1-14 Adopt-a-Drain program hanger

Figure 1-15 Storm drain stenciling program hanger


New participants and drains adopted in Minneapolis, 2021
Participants
Drains adopted
6,000
4,000
2,000
0
January
February
March
April
May
June
July
August
September
October
November
December

Geographic Breakdown: Watershed and Sub-watershed:

Watershed	Drains adopted	Debris collected (lbs)	Time spent (hours)
Mississippi	2,714	23,983.96	670.7
Minnehaha Creek	2,510	28,518.91	695.1
Shingle Creek	244	1,766.4	51.6
Bassett Creek	223	1,778.69	46.7
West Mississippi	1		

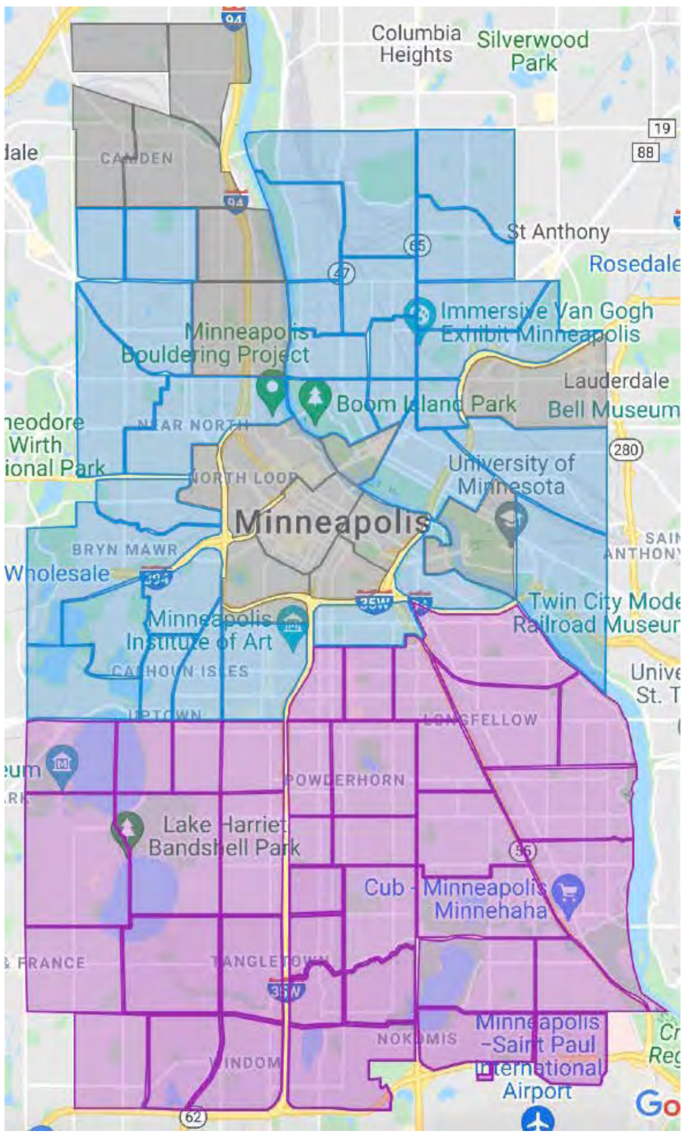
Subwatershed	Drains adopted	Debris collected (lbs)	Time spent (hours)
Mississippi River	3,021	26,874.0	770.4
Minnehaha Creek	947	13,984.5	271.2
Lake Hiawatha	312	2,111.9	69.7
Bde Maka Ska	191	2,312.9	61.8
Lake Nokomis	185	836.0	18.4
Lake Harriet	182	2,984.0	66.2
Lake of the Isles	145	1,018.6	20.1
Bassett Creek Main Stem	136	1,096.5	37.0
Shingle Creek	133	780.4	17.0
Diamond Lake	126	1,055.1	54.2
Crystal Lake	102	966.0	22.6
Grass Lake	74	578.5	11.2
Powderhorn Lake	73	260.0	18.3
Cedar Lake	31	595.2	11.6
Richfield Lake	9		
Silver Lake (MWMO)	8	272.0	4.8
Brownie Lake	7	209.8	5.4
Spring Lake	6		
Grimes Lake	2	112.6	4.4

Drains adopted: Cumulative total
Debris collected: 2021 data only

Door Hanging Efforts

Adopt-a-Drain educational door hanging efforts resumed in 2021, after no door hangers were distributed in 2020. Door hanging is a strong tool to encourage people to join the Adopt-a-Drain Program, as adoption rates in door hangered neighborhoods are consistently higher than non-door hangered neighborhoods.

From May through August, Hamline student workers, contractors with Clean Water Action, and neighborhood volunteers distributed 24,340 doorhangers to 31 neighborhoods in Minneapolis. Across these neighborhoods, 282 new participants signed up and 553 storm drains were adopted. On the map below, all neighborhoods in blue were completed in 2021. Neighborhoods in purple have been completed in past years. Neighborhoods in gray have not been completed yet.

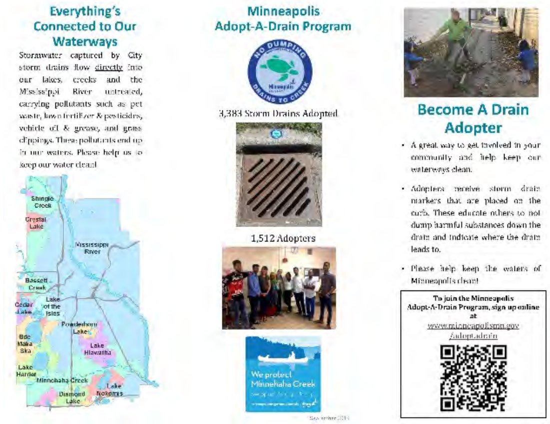


2021 NE Minneapolis Adopt-a-Drain Challenge

For the 2nd year in a year, Minneapolis Surface Water & Sewers Adopt-a-Drain staff worked with a Master Water Steward to organize a challenge involving all 13 Northeast Minneapolis neighborhoods to raise environmental awareness and increase storm drain adoption rates. It involved multi-level competitions where neighborhood organizations recognized monthly "winners", posted data throughout the 6-month challenge, and a celebration and recognition of neighborhood winners at the end of the season.

The City of Minneapolis provided outreach materials to many organizations, including:

- 47 MPRB Recreation Centers
- MPRB lake kiosks
- Hennepin County libraries
- Neighborhood organizations
- Various recipients in Minneapolis



These brochures include a QR code to allow program access from a smartphone or tablet.

Minneapolis Storm Drain Stenciling Program

Storm drain stenciling not only educates volunteers who paint environmentally friendly messages like "FLOWS TO RIVER/LAKE/CREEK – KEEP DRAIN CLEAN" on the storm drains, but also engages residents and people passing by. It is a great team-building exercise that helps people learn actions they can do to improve the quality of the lakes, creeks, and the Mississippi River in Minneapolis. The program provides stencils in English, as well as Spanish and Somali languages for certain neighborhoods.

Mississippi Green Team

Organizations who participated in storm drain stenciling in 2021 included schools, higher learning institutes, neighborhood organizations, block clubs, and individual residents and houses of worship.

These brochures include a QR code to allow program access from a smartphone or tablet.

<u>2021 STORM DRAIN STENCILING PROGRAM RESULTS:</u>

- 44 storm drain stenciling event
- 533 volunteers participating
- 737 storm drains stenciled
- 2,148 doorhangers distributed
- 136 bags of trash and debris collected
- 4,000 pounds of trash, leaves, and debris removed from storm drain system
- Over 3.7 pounds of phosphorus removed from lakes, creeks, and the Mississippi River

<u>Metro Blooms Training and Engagement Programs</u>

In 2021, the City of Minneapolis funded and provided project management and oversight for the non-profit Metro Blooms Resilient Yards Workshops and the Boulevard Bioswale Program.

Metro Blooms works with public and private partners to address long-term sustainability of constructed BMPs by regular maintenance, inspections, reporting for raingardens, bioswales, stormwater planters, wet and dry ponds, permeable pavers, and underground infiltration chambers.
Staff from Metro Blooms uses sustainable landscape management practices, prioritizing non-chemical methods and battery-operated landscaping equipment to maintain these practices. Metro Blooms provides maintenance and inspections for approximately 50 private BMPs in Minneapolis. This support helps the property owners maintain BMPs, to stay in compliance with Chapter 54 requirements and preserve their stormwater utility credit.

2021 Resilient Yard, Bee Lawns, and Pollinator Yards Workshops

An estimated 1,250 Minneapolis residents took part in a Resilient Yards, Bee Lawns, or Pollinator Yards workshops in 2021. Nearly 75% of attendees committing to a native planting in the next 2 years.

Workshop Ratings

- Resilient Yards - 53% will or are considering installing rain gardens
- Bee Lawns - 87% will or are considering installing bee lawns
- Planting for Pollinators - 98% will or are considering installing native plants

These workshops continue to adapt to meet new and upcoming issues and remain a successful part of education and engagement programs in the City of Minneapolis.

Minneapolis Neighborhood Rain Garden Program

Metro Blooms worked with the Conservation Corps of Minnesota to install 100 new rain gardens on residential properties in 2021. Partnering with 11 neighborhood organizations (Armatage, Audubon Park, Linden Hills, Holland, Logan Park, Lynnhurst, Prospect Park, Windom Park, Waite Park, North Loop, Marshall Terrace and Sheridan neighborhoods), the successful program yielded these results:

- 13,566 sq. ft. new pollinator habitat
- 1,600,628 gallons runoff captured per year
- 944.15 lbs. total suspended solids captured per year
- 5.9 lbs. total phosphorus removed

Conservation Corps crew working on one of the 100 raingardens installed

2021 Sustainable Landcare Training Program

Metro Blooms Staff and Partners developed an 18-hour curriculum to train youth in maintaining and planting sustainable gardens and plantings. The program was successful with over 100 youth and young adults engaged in the program.

- All participants were given a “green knowledge assessment” before and after going through the training
- 100% of attendees showed an increased familiarity with green infrastructure
- Scores increased, on average by ~25%, with more than 50% of respondents expressed an interest in exploring a green infrastructure career after going through the Blue Thumb Sustainable Landcare Training

Lawns to Legumes (L2L) Demonstration Neighborhoods

Minneapolis Public Works contract with Metro Blooms also provided matching funds for BWSR’s (Minnesota Board of Water and Soil Resources) LCCMR (Legislative-Citizen Commission on Minnesota Resources) funded Lawns to Legumes Program (winner of the 2021 Environmental Initiative Awards). In 2021, North Minneapolis were also awarded funds to install native plantings.

Five pollinator gardens installed in Northside in 2021, working with local youth that had participated in Metro Blooms’ sustainable Landcare training to plant them. In the Near North neighborhood, the Northside pollinator project utilized a targeted engagement approach, where Metro Blooms leveraged their relationships with local neighborhood groups and community leaders to connect with residents that are representative of the community.

Interpretive Signage Program

Stormwater BMPs by design blend into the community and are passively enjoyed as parks, gardens, and neighborhood ponds. Residents and businesses that benefit from these BMPs are often unaware of their own contributions to the problem, and, more importantly, their potential to be an active part of the solution. Locally designed artwork and online tools were used to create an engaging, visually compelling, and interactive story about the City’s network of BMPs.

The City of Minneapolis and HDR developed engaging, site-specific artwork for 26 BMPs, as well as a companion website to supplement and link the signs together. These tools allow viewers to engage with individual sites and how they function, as well as to explore ways which each site connects with and protects our creeks, lakes, and the Mississippi River.

Phase One includes 18 signs that were installed in 2021 on 11 stormwater ponds sites, and the interactive website will be live in the fall of 2022. Phase 2 will include 20 additional signs for 15 sites throughout the Minneapolis in 2022/2023.

Holland Basin Learning Lab

In 2021, the Holland Basin located next to Edison High School in Northeast Minneapolis was reconstructed by the City of Minneapolis to treat stormwater runoff from the neighborhood in addition to flood relief. The City partnered with Spark-Y to lead over 100 local youth and volunteers in planting 4,000+ rain garden plants. This presented a real-world learning lab for environmental topics of native habitat, water quality and stormwater management. Holland Basin provides a highly visible project with a multiple year outreach and plant observation and care opportunity.

Photo by Maria Maldonado

City of Minneapolis Salt Mini-Course Program

The City of Minneapolis Salt Mini-Course was launched in 2021 as an educational resource for residents, small businesses and organizations. This online program aims to increase awareness of the negative environmental impacts associated with winter de-icing salt, while providing best practices for snow and ice removal. Upon completion of the course, users take a "*Salt Stewardship Pledge*" to demonstrate their commitment to local clean water and receive a sticker to display their knowledge to their communities.

On May 4, 2021, the City of Minneapolis hosted a MPCA Smart Salting for Property Managers Certification Training. Attendees learned the impacts of salt on local freshwater, salt's contribution to infrastructure damage and how to balance public safety and environmental health. The training had 27 attendees from Minneapolis Public Works Surface Water and Sewers division, Health Department Environmental Services division, Transportation, Maintenance and Repair division, MPRB, MPCA and other Minnesota government, academic, and snow and ice management entities

Staff Training

Surface Water & Sewers Employee Training
In 2021, SWS employees attended the following training:

- 10 staff members certified for Erosion & Sediment Control training
- 105 attended HAZWOPER training
- 25 staff members certified for Wastewater Collection System license
- 16 staff members certified for NASSCO PACP/MACP
- 105 staff members attended Confined Space training

City Snow and Ice Management
City maintenance supervisors and equipment operators are trained in appropriate winter maintenance practices and procedures. Specific topics covered include guidelines for sand and salt application rates that are based on weather conditions, application techniques, and spreader calibration. All Public Works staff who perform snow and ice control typically attend a pre-winter season, annual review of procedures and best practices. However, COVID prevented that training in 2021. In 2022, the City is working with the MPCA Smart Salting Trainers to present to all winter staff in the Fall. Annual HAZWOPER refresher training covers the recognition and response to hazardous materials or situations. The Division Director is active with the APWA Winter Maintenance Subcommittee and was a contributor and a trainer for the APWA's Supervisor's Winter Maintenance Certificate course.

- 30 staff members attended eight-hour refresher for 40-hour hazardous materials training class
- 8 staff members attended training on the use of salt as presented by watershed organizations

On May 4th, the City of Minneapolis hosted a Minnesota Pollution Control Agency (MPCA) Smart Salting for Property Managers Certification Training. Attendees learned the impacts of salt on local freshwater, salt's contribution to infrastructure damage and how to balance public safety and environmental health. The training had 27 attendees from City of Minneapolis Public Works Surface Water and Sewers division, Health Department Environmental Services division, Transportation, Maintenance and Repair division, Minneapolis Parks and Recreation Board (MPRB), MPCA and other Minnesota government, academic, and snow and ice management entities.

MPRB Snow and Ice Management Training
The MPRB has 48 staff that hold the MPCA's Road Salt Applicators Training Certificate. Individuals who hold this certificate have attended a voluntary training, completed, and passed an associated test, and agreed to voluntarily apply best management practices to reduce chloride impacts. Attendees chose trainings that focused on the type of work they do at MPRB, either application to roads or to small sites (parking lots and sidewalks).

MPRB Integrated Pest Management Training

Golf course foremen, most horticulture staff as well as other MPRB staff, attend the annual Northern Green Expo each January, where they receive updated information on the newest turf and other related research as it applies to fertilizers, pesticides, bio-controls, and other topics. This annual industry event focuses on professional development and networking of outdoor professionals. Topics range from turf management to invasive species updates to landscape design.

All new hires for full-time positions of park keeper, mobile equipment operator (MEO), gardener, golf course park keeper, arborist, service area crew leaders, arborist crew leaders, park operations managers and forestry foreman are required to obtain their Minnesota Non-Commercial Pesticide Applicator license within 6 months of being hired. Every two years, as mandated by the Minnesota Department of Agriculture, staff attends re-certification training, that is offered and coordinated by the University of Minnesota. This effort is in conjunction with the Minnesota Department of Agriculture.

Other Education Partners

The City of Minneapolis has an official arrangement, through joint power agreements, with the BCWMC and SCWMC to provide financial contributions to the watersheds through an annual assessment. This assessment provides funding for the commissions' administrative operations and their public education programs.

Education-related activities of the BCWMC are guided by their 2015 Watershed Management Plan, specifically its education and outreach policies (Section 4.2.9), and education and outreach plan. The specific activities of the BCWMC public outreach and education program are set annually by the Commission after recommendations are forwarded by the BCWMC Education and Outreach Committee. The 2021 BCWMC water education activities report can be found in Appendix A1.

The SCWMC also conducts education and public outreach activities on behalf of its member cities. The 2021 SCWMC education activities report can be found in Appendix A2.

SCWMC and BCWMC, along with other west-metro watershed management organizations, are a part of a cooperative education organization known as the West Metro Water Alliance (WMWA) The WMWA annual report on educational activities can be found in Appendix A3.

CATEGORY TWO: PUBLIC PARTICIPATION AND INVOLVEMENT

PROGRAM OBJECTIVE

The objective of this stormwater management program is to maximize the effectiveness of the City's NPDES program by seeking input from the public.

Targeted pollutants include:

- All pollutants

PROGRAM OVERVIEW

The City of Minneapolis and the MPRB are the joint holders of the NPDES MS4 Permit, and this Annual Report is a coordinated effort by various City departments and the MPRB. The Permit requires an opportunity for public input in the development of the priorities and programs necessary for compliance.

The Permit requires the implementation of approved stormwater management activities, referred to as Best Management Practices (BMPs). The Stormwater Management Program (SWMP) is based on an adaptive management system by which the Permittees continuously monitor, analyze, and adjust the Program to achieve pollutant reductions. Using the adaptive management approach, revisions to the SWMP are submitted along with the Annual Report.

Each year, the City holds a public hearing at a meeting, prior to submission of the Annual Report. The hearing provides an opportunity for public testimony regarding the Program and Annual Report prior to report submittal to the Minnesota Pollution Control Agency. The hearing is officially noticed in the Finance and Commerce publication and publicized through public service announcements on the City cable television channel. This year's public hearing date was at the Public Works and Infrastructure (PWI) Committee meeting on June 9, 2022.

A copy of the presentation, a list of public notice recipients, public comment received, and the staff letter can be found in the City's Legislation Management System (LIMS).

All testimony presented at the public hearing, and all written comments received, are recorded, and given consideration. The comments are included with the Annual Report as Appendix C. A copy of the City Council resolution adopting the Stormwater Management Program and Annual Report Activities is included each year with the submission to the Minnesota Pollution Control Agency. The Stormwater Management Program and the Annual Reports are available for viewing or downloading.

PREVIOUS YEAR ACTIVITIES

The Public Hearing was noticed 30 days in advance and the public was offered the opportunity to speak and provide comments on the SWMP and Annual Report.

CATEGORY THREE: ILLICIT DISCHARGE DETECTION AND ELIMINATION

PROGRAM OBJECTIVE

The objective of this program is to minimize the discharge of pollutants to lakes, creeks, wetlands, and the Mississippi River by appropriately responding to spills and to detect, investigate and resolve illegal dumping, and disposal of unpermitted, non-stormwater flows in the City's stormwater drainage system including pavement, gutters, storm drains, catch basins, swales, permitted connections to the storm drain, and other conveyance infrastructure. Illicit discharges may be random, frequent, infrequent, accidental, or other, and may occur anywhere along the stormwater drainage pathways.

Targeted pollutants include:

- All pollutants

PROGRAM OVERVIEW

Dry Weather Flow Screening

Due to the COVID-19 pandemic, there was no dry weather flow screening in 2021, but it is planned to resume in the future.

Typical Hazardous Spill Response

The immediate goals of hazardous spill response are safety, containment of the spill, recovery of hazardous materials, and collection of data for use in assessment of site impacts. Motor vehicle collisions and electrical transformer overloads are examples of accidental releases, and results can include untreated waste and hazardous materials including heavy metals, toxics and solvents.

The life cycle of an event requires personnel from within the City and outside agencies to work as a team, utilizing resources to protect people, the environment, and property. Training and response procedures are coordinated by Regulatory Services, Public Works, and the Fire Department. The Regulatory Services Fire Inspection Specialist III is responsible for coordinating recovery efforts. Events are followed by post-action debriefings to determine the causes of the events, to identify measures to improve the City's response, and to determine the means to limit future occurrences. As the assessment of the event progresses, other departments and/or outside agencies or contractors may become involved. Full procedures are documented in the City of Minneapolis Emergency Action Plan.

For small spills of petroleum products or other vehicle fluids, personnel are dispatched with appropriate equipment to apply sand or floor-dry. Once the spill has been absorbed, it is removed and deposited in a leak-proof container. For large or extremely hazardous spills, a Hazardous Materials Response Team is mobilized and augmented with staff from additional departments, outside agencies and/or contractors if warranted as the event progresses. For spills that reach the Mississippi River or Minneapolis lakes, boats are available for spill response and personnel are trained in boom deployment.

Spills are reported to the MPCA Public Safety Duty Officer, 911 Emergency Communications and, for qualified spills, to the State Duty Officer as required by law.

The protocol used by the Street Maintenance section for handling spills is documented in Appendix A4: Standard Operating Procedure for Vehicle Related Spills.

Emergency Response Program

Minneapolis Regulatory Services utilizes a boat to respond to spills that could impact water resources. A properly equipped boat facilitates addressing these events on the Mississippi River as well as on City lakes. Regulatory Services and Public Works staff are trained in the river deployment of booms, have field experience in placement of both containment and absorbent types of booms, and years of experience on the water. These skills, coupled with an extensive level of knowledge of the Mississippi River, City lakes, landings, and outfalls, provide a high level of protection for our precious natural resources.

Boom Deployment Drill

Additionally, the boat is used for placement of monitoring and sampling equipment for tracking water quality, identifying points of illegal discharges, outfall assessment, and investigation of complaints that are inaccessible from shore. The City assists the Mississippi Watershed Management Organization (MWMO) in conducting a sampling program of the storm drainage system that drains to the Mississippi River to detect illegal discharges, and establish a baseline of chemical, physical, and biological parameters.

Unauthorized Discharges

City Environmental personnel carry out pollution prevention and control activities. Results are achieved through educational efforts, inspections, and coordinated outreach events. These activities include enforcement pursuant to applicable City codes, and coordination with other regulatory agencies at county, state and federal levels. Enforcement yields identification of the responsible party, documentation of clean-up activities, and endeavors to reduce the flow of pollutants from illegal dumping and disposal. Response is made to reports of unauthorized discharges and illicit connections.

Complaints are received from various sources, including Minneapolis residents, private contractors, City staff, the State Duty Officer and other government agencies. People with environmental concerns within Minneapolis are directed to contact 311 directly.

Minneapolis Public Works also provides site investigation and mapping assistance for MPCA permit enforcement and compliance programs for other types of discharges.

Facility Inspection Program - Stormwater Pollution Prevention Plans (SWPPP)

The City of Minneapolis has developed a strong facility inspection program for private, City owned, and other public facilities that store large quantities of both regulated and hazardous materials. Inspectors perform site visits of these facilities to review handling, storage, and transfer procedures as they relate to the site, spill response plans and equipment on site. Minneapolis Fire Inspection Services participates in most of the inspections, reviewing spill response strategies.

As per Fire Inspection Manager, six facilities were inspected in 2021. 302 facilities are self-reporting, which are reviewed, filed, and maintained by Fire Inspection Services. Based on latest information from Minnesota Homeland Security, 355 hazardous material facilities are inclusive to the City's Fire Commercial (FCOM) building permit. Hazmat registrations and inspections are based on FCOM cyclical rotations. 129 Emergency Response plans for TIER II Hazardous Materials Facilities were reviewed, including hazardous materials storage and spill response plans.

Lake Hiawatha Litter Reduction

In recent years there has been in increase in the visibility of litter within waterbodies in the City of Minneapolis, especially within Lake Hiawatha. Trash and litter impair the recreational function of a waterbody, is a visual impairment, and can contribute microplastics and chemicals to the environment that can be detrimental to aquatic life. The work done to date by the City of Minneapolis and the MPRB can be found in the 2021 Lake Hiawatha Liter Report that is attached as Appendix D.

The City and MPRB will continue to look for ways to understand the impacts of litter on the community and environment. Community engagement and education are cost-effective ways to manage this issue and the City will continue to sponsor programs to encourage community clean-up and responsible litter disposal.

PREVIOUS YEAR ACTIVITIES

Spill Response

City of Minneapolis Fire Inspection Services responded to 64 Emergency Response requests. In addition, the Minneapolis Fire Department also responds to a number of these requests. Response time varies between 5 to 20 minutes depending on Fire Department response and type of Emergency Response request. The City responded to two spill incidents on the Mississippi River and lakes where a containment boom was deployed. Minneapolis Fire Inspection Services, Minneapolis Public Works (Surface Water & Sewers Division) participated in these efforts.

SPILL RESPONSE TRAINING

Waterworks Drill/Training

Due to the COVID-19 pandemic, a Waterworks Drill/Training meeting took place with Minneapolis Public Works, Minneapolis Fire, and Minneapolis Fire Inspections Services. Existing Standard Operation Procedures to respond to a Spill Response/Boom deployment scenario at Minneapolis Waterworks were reviewed. A hands-on Spill Response/Boom deployment training took place on August 10, 2021, with Minneapolis Fire and Fire Inspection Services. Spill boom was deployed from boats and spill response strategies were reviewed and practiced.

CATEGORY FOUR: CONSTRUCTION RELATED EROSION & SEDIMENT CONTROL

PROGRAM OBJECTIVE

The objective of this stormwater management program is to minimize the discharge of pollutants through the regulation of construction projects. Regulation addresses erosion and sediment control for private development and redevelopment projects and for public projects completed by the City and the MPRB. Minneapolis Code of Ordinances Air Pollution and Environmental Protection, Chapter 52 Erosion and Sediment Control and Drainage contains erosion and sediment control requirements and other pollution control requirements related to construction site management.

Targeted pollutants include:

- Phosphorus
- Total Suspended Solids (TSS)

PROGRAM OVERVIEW

Ordinance

In 1996, the Minneapolis City Council amended Title 3 of the Minneapolis Code of Ordinances relating to Air Pollution and Environmental Protection by adding Chapter 52, entitled *Erosion and Sediment Control for Land* Disturbance Activities (now Erosion and Sediment Control and Drainage).

Requirements

The City's Erosion and Sediment Control ordinance addresses development sites, demolition projects, and other land disturbing activities. Sites disturbing more than five cubic yards, or 500 sq ft, are required to have an erosion control permit. Erosion and Sedimentation Control (ESC) Permits must be acquired prior to commencement of work and must be obtained before a building permit will be issued for the site.

For all disturbances greater than 5,000 sq ft, an approved erosion control plan is also required for demolition and construction projects before the ESC Permit can be issued.

Enforcement

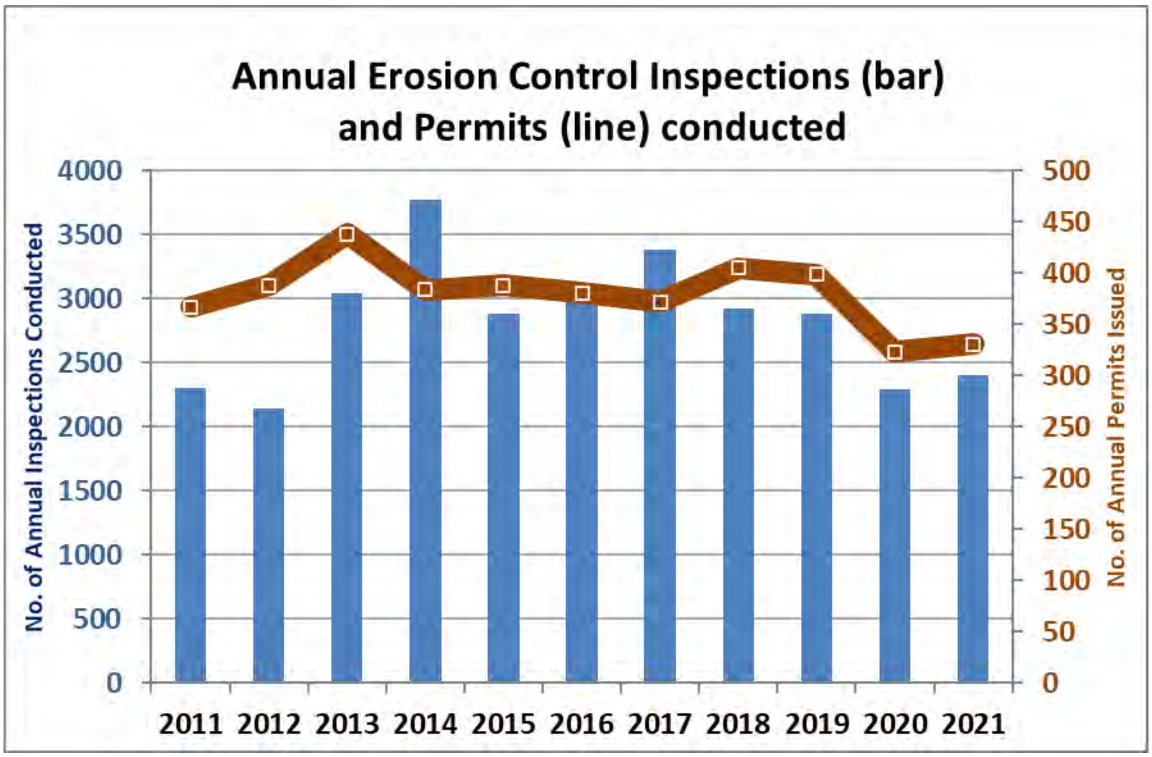
Ongoing site inspections are performed by City Environmental Services inspectors. Inspectors may issue citations and fines. Failure by the permittee to comply with the ordinance will constitute a violation pursuant to Section 52.300. If there is a demonstrated failure to comply, the City reserves the right to terminate an ESC permit at any time. The City then has the option of proceeding with the necessary restoration of the site. This restoration would be done at the expense of the owner/permittee.

PREVIOUS YEAR ACTIVITIES

Generally, since 2011 the number of sediment and erosion control permits issue has remained relatively consistent. While the number of permits issued by the City has been consistent, the number of inspections increased. Minneapolis normally employs four environmental inspectors that address sediment and erosion control enforcement and the City hires four additional seasonal technicians to help increase inspection frequency during the busy summer months.

However, in 2020 due to financial constraints from COVID-19 and civil unrest, Minneapolis employed three environmental inspectors and two additional seasonal technicians. Staffing levels were expected to return to normal in 2021, however, staffing levels remained unchanged in 2021. Additionally, emergency COVID-19 response duties reduced time available for inspections. After July 2021 the inspection staff was relieved of additional COVID-19 duties.

Year	Permits Issued	Inspections	Citations
2021	**331**	**2,402**	**4**



CATEGORY FIVE: POST-CONSTRUCTION STORMWATER MANAGEMENT

PROGRAM OBJECTIVE

The objective of this stormwater management program is to reduce the discharge of pollutants and stormwater runoff from public and private development and redevelopment projects, as compared to conditions prior to construction. Redevelopment of existing sites can lessen the impacts of urbanization of the waters of Minneapolis, since most present land uses were created prior to regulation under the Clean Water Act.

Regulation includes approval of stormwater management including ongoing operation and maintenance commitments. Minneapolis Code of Ordinances Title 3 Air Pollution and Environmental Protection, Chapter 54 - Stormwater Management, contains stormwater management requirements for developments and other land-disturbing construction activities.

Targeted pollutants include:

- Phosphorus
- TSS

PROGRAM OVERVIEW

Stormwater Management Ordinance

In 1999, the Minneapolis City Council amended Title 3 of the Minneapolis Code of Ordinances (relating to Air Pollution and Environmental Protection) by adding the Chapter 54 Ordinance Stormwater Management Ordinance, which required stormwater management plans utilizing permanent stormwater practices for all construction projects disturbing sites greater than 1 acre in size, at that time.

Pollinator friendly plants at Sanford Middle School infiltration basin

These plans are reviewed through the Minneapolis Development Review process and approved by the Surface Water & Sewers Division. Operation and Maintenance Plans for BMPs are also required as part of the approval process. Inspections of constructed BMPs are required and performed by the property owner or manager. These annual inspections are reviewed and approved by city staff, before being registered with Environmental Services, which includes a Pollution Control Annual Registration fee.

In 2018, City staff began updating Chapter 54 to be in compliance with the current NPDES MS4 permit and watershed management organization requirements. The ordinance was approved by Council on March 3, 2021 and went into effect on January 1, 2022.

The ordinance update integrated all the new NPDES and WMO requirements and best practices while maintaining the flexibility developers and project advocates appreciated about the previous ordinance. To facilitate a robust stakeholder engagement process, city staff implemented a stakeholder engagement and outreach plan (SE&O Plan) and was managed as a living document and updated as new engagement opportunities surfaced.

The new Chapter 54 includes many modifications such as:

- **Applicability**: This section highlights the change from regulating 1.0-acre or greater of land disturbing activities to **0.5-acre or greater**. Given the City Engineer authority to impose special conditions on any project within the City that may degrade the performance of the City's storm sewer system or create nuisance or unreasonable hazards to people or to public or private property.
- **Exemptions**: Mill and overlay, underground utility, and disconnected sidewalk and trail projects are exempt from the ordinance requirements.
- **Stormwater Management Plan (Plan) requirements**: This section included the following provisions:

    1) The Plan allows for the creation of a stormwater banking program for approved governmental entities and use of stormwater credits to meet the City's stormwater requirements, and

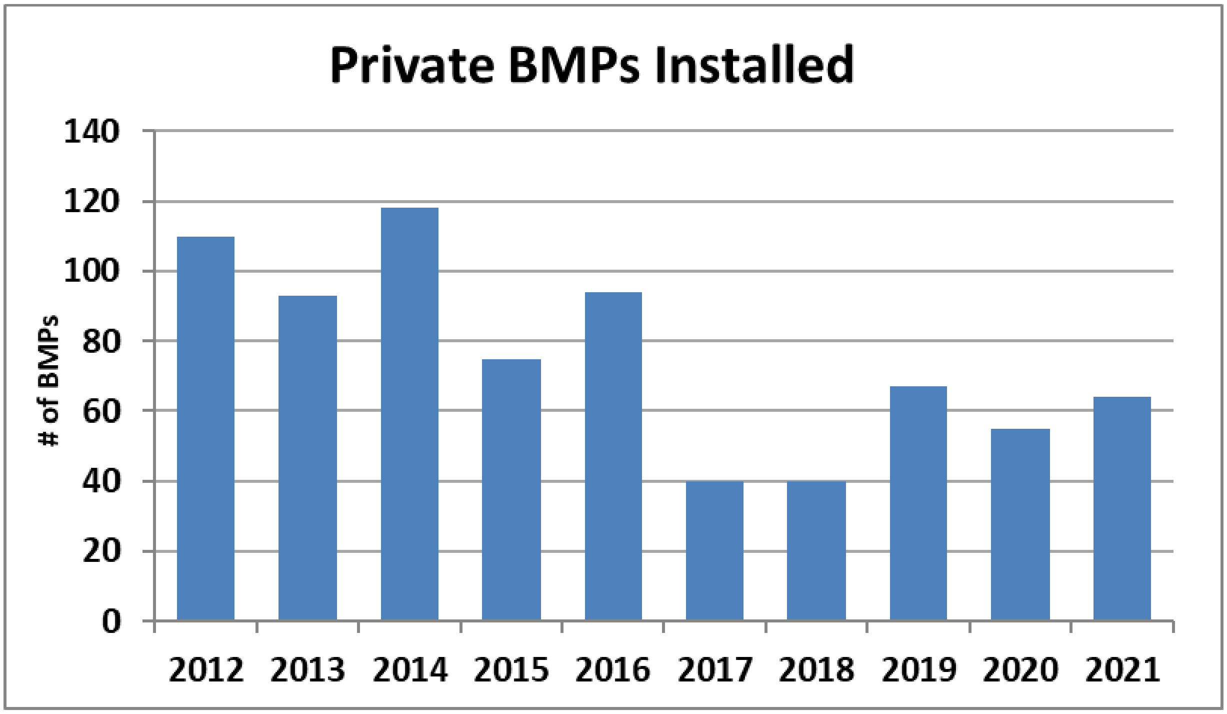
    2) The Plan requirement presents specific volume control requirements for new development, redevelopment, and linear projects without site restrictions.

- **Inspection, remedial actions, and compliance**: This new section provides four tiers for escalating violations of compliance with Chapter 54.
- **Prohibited discharge to storm sewer system**: This new section specifically highlights prohibited discharges to the City's storm sewer system and prohibitions on areas where infiltration can be implemented.

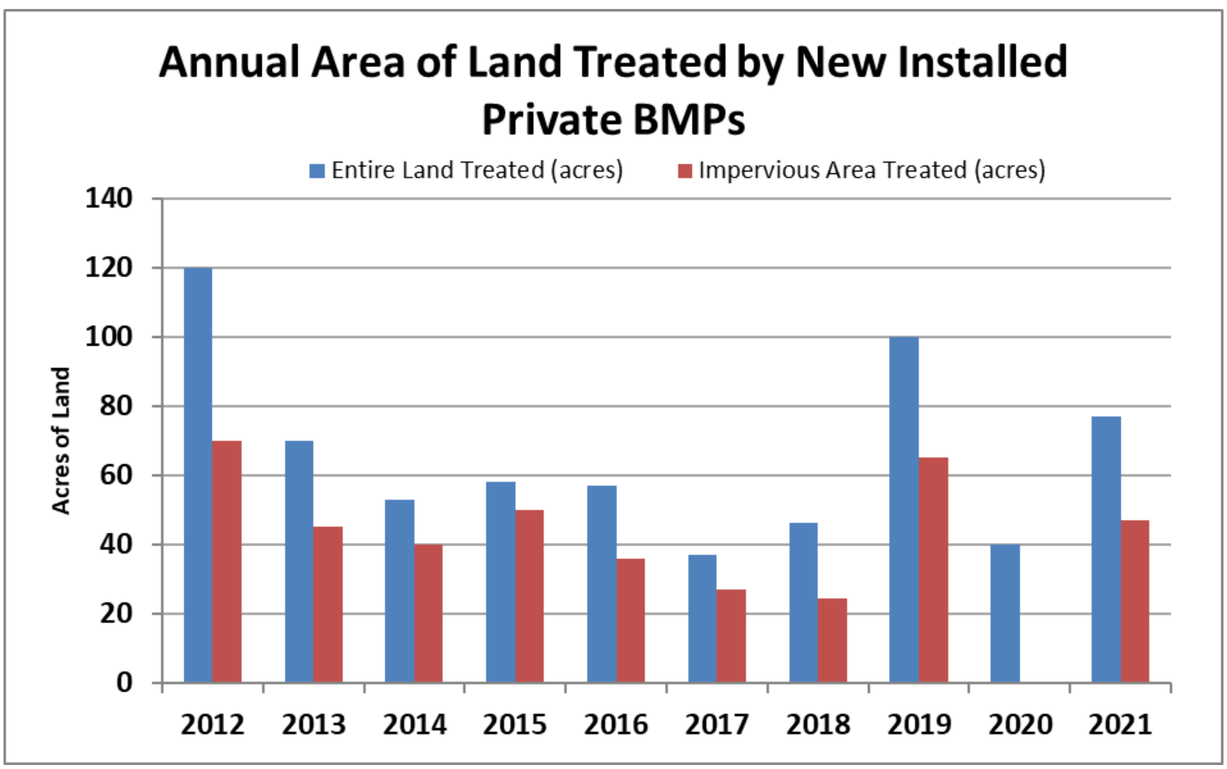
PREVIOUS YEAR ACTIVITIES

The City of Minneapolis has over 1,500 (private) BMPs registered to over 700 properties under Chapter 54 of the Minneapolis Code of Ordinances. The implementation of Chapter 54 has been very effective at seeing BMPs installed as properties develop in Minneapolis, with the numbers of the total BMPs installed with the City expected to grow in 2022.

During 2021, Minneapolis Public Works reviewed 194 projects, approving 143 of these projects, with 34 projects (24 Chapter 54 projects, 10 non-Chapter 54 projects) requiring 64 BMPs constructed. These BMPs will provide rate control and water quality for approximately 77 acres of land, including 47 acres of impervious area. See following 2 charts for more information.



(Private Development BMPs as required by Minneapolis Chapter 54 ordinance)

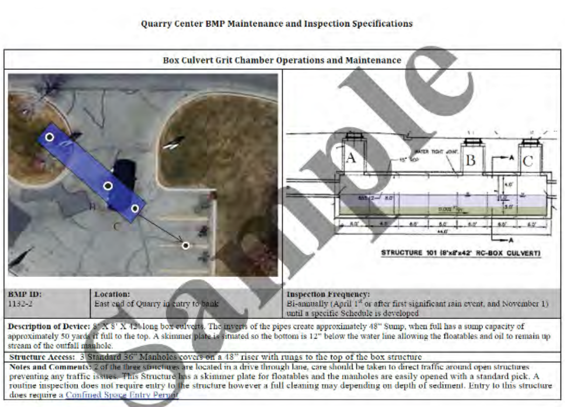


Operations, Maintenance and Reporting

Timely and frequent maintenance on a Chapter 54 rain garden provides spectacular results

All stormwater management devices are required to be inspected by the owner or responsible party as specified in the approved plan. Inspection reports determine and recommend the maintenance types, activities, and frequencies to restore the BMP's original design function. Inspection process must lead to a maintenance recommendation including taking no actions if BMP found in full compliance.

Site inspections and maintenance by the property owner are important to the long-term sustainability of any stormwater BMP. With limited staffing to inspect an ever-growing private BMP inventory, it is important to have a site and BMP specific *Operations and Maintenance Plan.* Minneapolis staff recognized this need and developed self-inspection forms. These were paired with onsite training for property owners to better maintain and inspect BMPs with limited regulatory oversight. As engineers develop better plans using the templates and property owners are trained to self-inspections, the hope to increase reporting numbers (currently less than 30% annually).



Quarry Center BMP Maintenance and Inspection Specifications

Box Culvert Grit Chamber Operations and Maintenance

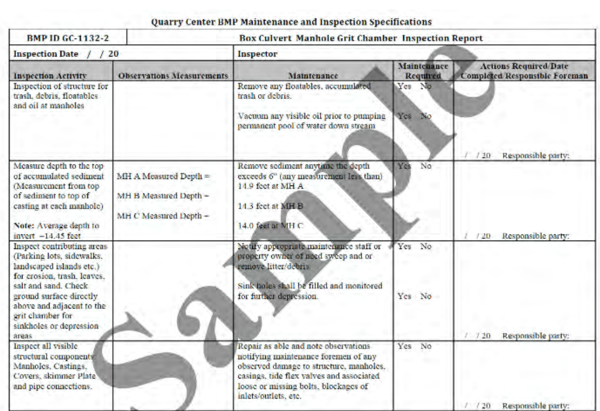
BMP ID:	Location:	Inspection Frequency:
1132-2	East end of Quarry in entry to bank	Bi-annually (April 1st or after first significant rain event, and November 1) until a specific Schedule is developed

Description of Device: 8' X 8' X 42' long box culverts. The inverts of the pipes create approximately 48" Sump, when full has a sump capacity of approximately 50 yards if full to the top. A skimmer plate is situated so the bottom is 12" below the water line allowing the floatables and oil to remain up stream of the outfall manhole.

Structure Access: 3 Standard 36" Manholes covers on a 48" riser with rungs to the top of the box structure

Notes and Comments: 2 of the three structures are located in a drive through lane, care should be taken to direct traffic around open structures preventing any traffic issues. This Structure has a skimmer plate for floatables and the manholes are easily opened with a standard pick. A routine inspection does not require entry to the structure however a full cleaning may depending on depth of sediment. Entry to this structure does require a Confined Space Entry Permit

Sample



Quarry Center BMP Maintenance and Inspection Specifications

BMP ID GC-1132-2	Box Culvert Manhole Grit Chamber Inspection Report			
Inspection Date / / 20		Inspector		
Inspection Activity	**Observations Measurements**	**Maintenance**	**Maintenance Required**	**Actions Required/Date Completed/Responsible Foreman**
Inspection of structure for trash, debris, floatables and oil at manholes		Remove any floatables, accumulated trash or debris. Vacuum any visible oil prior to pumping permanent pool of water down stream	Yes No Yes No	/ / 20 Responsible party:
Measure depth to the top of accumulated sediment (Measurement from top of sediment to top of casting at each manhole) **Note:** Average depth to invert –14.45 feet	MH A Measured Depth = MH B Measured Depth = MH C Measured Depth =	Remove sediment anytime the depth exceeds 6" (any measurement less than) 14.9 feet at MH A 14.3 feet at MH B 14.0 feet at MH C	Yes No	/ / 20 Responsible party:
Inspect contributing areas (Parking lots, sidewalks, landscaped islands etc.) for erosion, trash, leaves, salt and sand. Check ground surface directly above and adjacent to the grit chamber for sinkholes or depression areas		Notify appropriate maintenance staff or property owner of need sweep and or remove litter/debris Sink holes shall be filled and monitored for further depression.	Yes No Yes No	/ / 20 Responsible party:
Inspect all visible structural components: Manholes, Castings, Covers, skimmer Plate and pipe connections.		Repair as able and note observations notifying maintenance foremen of any observed damage to structure, manholes, casings, tide flex valves and associated loose or missing bolts, blockages of inlets/outlets, etc.	Yes No	/ / 20 Responsible party:

Sample

Current program support is critical as the number of existing private BMP's and additional BMPs in the future, the program's sustainability is challenged by when relying on small site BMP's. Maintenance, regulation, and performance of small site BMP's may not be sustainable or cost effective in the long run. Regional BMPs or pay in lieu programs that contribute to public BMP's should be examined to efficiently provide stormwater treatment in a fully developed urban environment.

CATEGORY SIX: POLLUTION PREVENTION AND GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS

PROGRAM OBJECTIVE

The City of Minneapolis operates its public works systems in a manner that maintains efficient and effective operability, ensures structural integrity, complies with regulatory requirements, and safeguards the ability to prevent impacts to health, safety, property infrastructure, and the environment. This is accomplished through the proper operation and maintenance of structural stormwater management practices, public streets, bridges, and alleys, parks and golf courses, municipal properties, municipal parking lots, and municipal equipment yards.

STORM DRAIN SYSTEM OPERATIONAL MANAGEMENT AND MAINTENANCE

PROGRAM OBJECTIVE

The objective of this NPDES stormwater management program is to minimize the discharge of pollutants through the proper operational management and maintenance of the City's storm drain system, streets, alleys, and municipal property. The City of Minneapolis contributes stormwater runoff to various receiving waters inside and outside of City boundaries, including Minnehaha Creek, Bassett Creek, Shingle Creek, several lakes, and the Mississippi River. Maps of the drainage areas that have been delineated according to topographic contours and the storm drain system are included in Appendix B. The 2010 population, size of drainage area, and land use percentages by body of receiving water are listed in Appendix A5.

Targeted pollutants include:

- TSS
- Nutrients
- Floatable Trash

PROGRAM OVERVIEW

The City's storm drain system is managed and maintained by the Operations section of the Public Works Department Surface Water & Sewers (PW-SWS) Division. Design engineering and regulatory issues are managed by the division's Capital and Regulatory sections, respectively.

The City utilizes Maximo™ for asset management to compile assets, track work orders, and assist in work scheduling and purchasing.

Brick Egg-type Sewer

The City's asset management program identifies the current state of assets and asset attributes (e.g., age, condition, etc.) and utilizing a standardized rating process for assets and asset attributes (e.g., National Association of Sewer Services Companies (NASSCO) Pipeline Assessment and Certification Program (PACP)).

PW-SWS Operations Section identifies risk areas, criticality of system, and life-cycle costs. This will improve future decision making as a result of data and analysis (e.g., succession planning, level of maintenance response, Capital Improvement Project prioritization), improve documentation and recordkeeping of assets (e.g., Maximo software), improve coordination and communication, lower long-term operation and maintenance costs, improve regulatory compliance, and be used as a communication tool for staff and regulators for effective information transfer and knowledge retention.

Staffing levels are key components for achieving the City's overall management goals. The current staffing level of the PW-SWS Operations section is approximately 102 full-time employees. This decrease is anticipated to result in a more reactive approach. In the PW-SWS Operations section, there are currently 61 permanent, full-time employees working directly within Sewer Maintenance (which includes both storm and sanitary personnel), and the remainder work within rehabilitation. General maintenance efforts include checking hours at pump stations, performing pump station maintenance, pipe inspections, pipe cleaning, system repairs, rehabilitation or reconstruction of existing infrastructure, inspection and operation of control structures, operation of pump stations, cleaning of water quality structures, and operational management of stormwater detention ponds.

The table below shows the base operational functions along with the corresponding staffing:

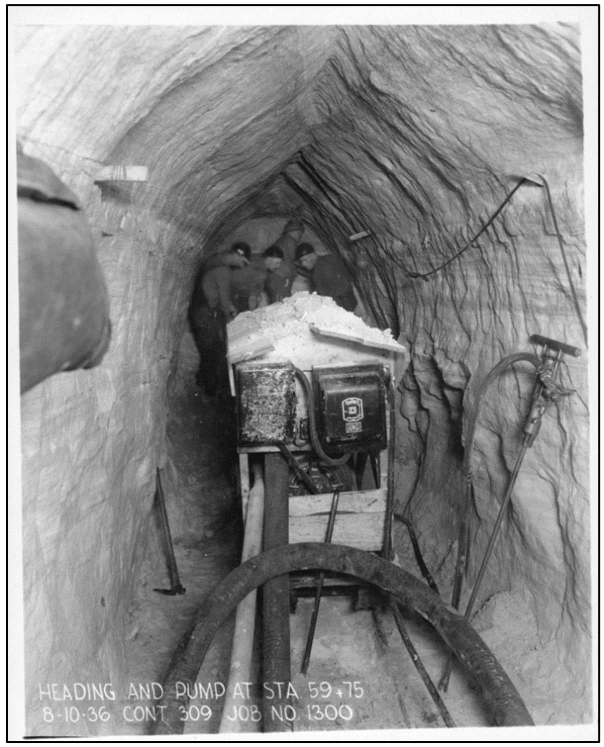
Crews	Staff/crew	Type	Tasks
4	2	Route Truck	Daily pipeline system inspections, complaint response, and resolution to minor system operational problems
5	2	Jet Truck	"As-requested" cleaning of storm system components, routine cleaning of sanitary system pipes, and "as-requested" cleaning of pump/lift stations. Hydro jet-wash technique.

3	2	Jet-Vac Truck	Routine cleaning of storm system infrastructure. Hydro jet-wash technique. Storm sewer cleaning by vacuum removal of sludge and debris build-up.
3	2	TV Truck	Televise and inspect storm drain and sanitary sewer system components. Log and assess condition of televised lines to determine and prioritize rehabilitation and/or repair needs to storm drain and sanitary sewer system components.
2	2	Repairs	Perform medium-sized repairs, requiring minimum excavation, to storm drain and sanitary sewer system pipeline components. May assist in the repair or reconstruction of larger repair/ reconstruction jobs.
2	2	Vac Truck	Vacuum-cleaning of water quality structures, manholes, and catch basins within the storm drain system. Assist in sanitary sewer cleaning by vacuum removal of sludge and debris build-up. Assist in repair/ construction activities using vacuum excavation process. Assist in erosion control compliance using vacuum cleanup of eroded soils and/or cleaning of erosion control structures.
0	2	Rod Truck	Remove roots and foreign objects from sanitary sewer system. Remove large debris from storm drain-pipes and free ice from frozen catch basin leads.
2	2	Pond & Pump	Operate, maintain, and repair sanitary lift station and stormwater pump stations. Operate and maintain stormwater detention basins.
1	1	Shop	Perform general maintenance and repair to specialty use vehicles and emergency response equipment. Fabricate, as needed, custom metal and wood objects for sewer and storm drain operations. Provide field deliveries of materials, tools, and equipment. Maintain material inventory and fleet management data.

PREVIOUS YEAR ACTIVITIES

2021 Storm Drain Infrastructure cleaning and repair information data

- Completed repairs on 171 catch basins
- Cleaned 3.3 miles of storm drain utilizing hydro-jet washing
- Televised and condition assessed 20.8 miles of storm drain-pipes
- Continued repairs of 1,000 feet of storm tunnel
- Continued work on the Central City tunnel, which is rehabilitating the condition of the structures and reducing erosion/transfer of the sandstone outside of the tunnel. This is decreasing transport of sand particles/solids to the Mississippi River
- Tracked 171 repairs for catch basins via Maximo asset management system



WATER RESOURCE FACILITIES OPERATIONAL MANAGEMENT AND MAINTENANCE

PROGRAM OBJECTIVE

The objective of this NPDES stormwater management program is to minimize the discharge of pollutants through the proper operational management and maintenance of water resource facilities (stormwater practices) within the City's storm drain system that affect system flow, rates, quantity, and water quality discharges.

Maintenance

Minneapolis Surface Water & Sewers maintains approximately 562 public BMP systems, including:

• Storm Drains (catch basins)	59
• Storm Manholes	63
• Grit Chambers	155
• Other Structural Management Practices	285

Targeted pollutants include:

- TSS
- Nutrients
- Floatable Trash

PROGRAM OVERVIEW

Water resource facilities that are part of the City's overall storm drainage system are operationally managed and maintained by Surface Water & Sewers Operations. These components are routinely inspected and maintained to ensure proper operation and reliability. Frequency of inspections and assigned maintenance efforts are based on both operational experience and incurred environmental events.

By agreement with the City of Minneapolis and the MPRB, the Minnehaha Creek Watershed District monitors the design capacity of several stormwater ponds in Minneapolis and performs dredging and restoration as needed including testing for proper disposal. The MPRB also maintains small scale Park Board stormwater devices including ponds, rain gardens, and pervious pavement.

Vegetated Swale at 25th Ave. SE

Water resource facilities for water quality improvement are separated into five separate categories:

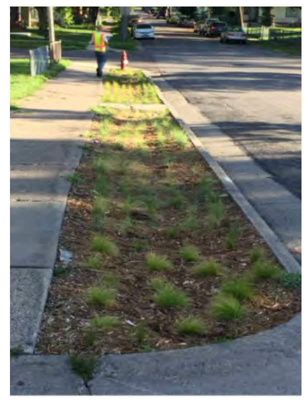
Pre-Treatment Practices

Pretreatment is an integral part of BMP application. In many applications (infiltration and stormwater ponds) the practice would not function properly if pre-treatment is ignored. Pre-treatment techniques are used to keep a BMP from being overloaded, primarily by sediment. Pre-treatment can also be used to dampen the effects of high or rapid inflow, dissipate energy, and provide additional storage. These benefits help overall BMP performance. Types of pre-treatment practices include:

- Settling devices (grit chambers)
- Sump manholes
- Storm Drains – sometimes enhanced with SAFL baffles, forebays, oil / water separators, and vegetated filter strips

Filtration Practices

Filtration BMPs treat urban stormwater runoff as it flows through a filtering medium, such as sand or an organic material. They are generally used on small drainage areas and are primarily designed for pollutant removal. They are effective at removing TSS, particulate phosphorus, metals, and most organics. They are less effective for soluble pollutants such as dissolved phosphorus, chloride, and nitrate. Most filtration BMPs will achieve some volume reduction, depending on the design and the use of vegetation to promote evapotranspiration. Filtration practices used in the City include rain gardens with underdrains and iron enhanced sand filters.


Vegetated Swale at Redeemer Church

Infiltration Practices

Infiltration BMPS treat urban stormwater runoff as it flows through a filtering medium and into underlying soil, where water percolates down into groundwater. This process removes pollutants from the runoff, either by being trapped within the practice, or broken down by chemical processes within the first few feet of soil (natural attenuation). The filtering media is typically coarse-textured and may contain organic material, as in the case of bio-infiltration BMPs. These practices are primarily designed for removal of stormwater runoff volume and pollutants in that runoff. They are effective at removing TSS, particulate phosphorus, metals, bacteria, nitrogen, and most organics. Soluble pollutants such as chloride and nitrate typically percolate through these BMPs and into underlying groundwater. These BMPs, when designed with no underdrain, include rain gardens, tree trenches (including Silva Cell systems), underground infiltration, and infiltration trenches including dry wells.


12x10 Infiltration Box Culvert Installation

Sedimentation Practices

Sedimentation is the process by which solids are removed from the water column by settling. Sedimentation BMPs include:

- Dry ponds
- Wet ponds
- Wet vaults
- Proprietary devices

Proprietary hydrodynamic devices are limited to treating small tributary areas while constructed ponds and constructed wetlands can be designed to treat the runoff from a much larger tributary area. These BMPs provide temporary storage of stormwater runoff and allow suspended solids to settle and be retained by the BMP. These BMPs are effective at removing TSS and any pollutants adsorbed to the solids but that are not effective in removing soluble pollutants or in providing any volume reduction.

Infiltration Box Culvert – inside view

Chemical Practices

Stormwater BMPs that employ chemical treatment are typically designed for treatment of a specific pollutant. Phosphorus is the most common pollutant of concern, but chemical treatment may also be employed for nitrogen, metals, and organic pollutants. The City has installed iron-enhanced sand filters and the MPRB has historically used alum as an in-lake treatment to enhance settling of suspended sediment and phosphorus by encouraging flocculation.

Structural Controls

The City also employs structural controls to manage stormwater runoff that are not directly related to water quality, including:

Storm Drain Outfall Inspections

These are the structural ends of system pipelines where conveyance of stormwater runoff is discharged into receiving water bodies. Outfalls are inspected on a 5-year schedule. Site inspections evaluate the general condition of structures, determine if any significant erosion has occurred and observe any contaminant discharges. If indications of illicit or contaminated discharges are present, they are reported to Minneapolis Environmental Services for reporting to the Minnesota State Duty Officer for further investigation and resolution. Any identified structural repair or maintenance work is prioritized and scheduled considering available personnel, budget funding, and coordination with other essential operations.

Grit Chamber Construction at Dean Pkwy

Outfall Inspection

6 days of Mississippi River outfall sampling were conducted, including visual inspections of outfalls, and developing spill response strategies by boat. Participating agencies included Minneapolis Fire, Minneapolis Public Works (Surface Water & Sewers Division), and Mississippi Watershed Management Organization.

The field screening program to detect and investigate contaminated flows in the storm drain system is part of daily operations for staff in Surface Water & Sewer Operations, Environmental Services, and Regulatory Services. Maintenance crews routinely inspect and clean storm drain structures in Minneapolis. In addition, inspections of flows that generate unusual odors, stains, and deposits are included in the annual tunnel inspection, outfall inspection, and grit chamber inspection and cleaning programs. Any suspect flows are reported to Environmental Services inspectors for further investigation. Environmental Services personnel also receive reports of alleged illicit discharges to the storm drain system from the public, other City departments, and various agencies. In 2021, City staff inspected 27 outfall structures. For more detailed information, see Appendix A7. In 2021, the City initiated an Outfall Working Group that meets second Wednesday of the month, and has:

- Compiled all past outfall inspections reports and data bases into one site,
- Adopted Survey123 software and provided training on it to use for conducting outfall inspection,
- Developed a uniform inspection form for various City staff to use for outfall inspections, and
- Has developed a protocol for reporting spills, suspected dry flows, and illicit discharges.

Pumps & Weirs

These are structural devices that mechanically affect the flow of stormwater runoff through the storm drain system. Pump stations are inspected regularly for routine operational checks and are annually for detailed condition assessment. Maintenance and/or repairs are performed with routine items being completed as needed and larger items being coordinated into a budgeted pump station operation program. Weirs and outlet structures are inspected and repaired as needed to facilitate their proper operational working order.

Storm Drains

These are structural devices located along the City's street system that provide entrance of stormwater runoff into the storm drainage system. Public Works crews routinely look for plugged or damaged structures. Reported damages and/ or plugs are given a priority for repair and / or cleaning. Cleaning storm drains, while ensuring proper runoff conveyance from City streets, also removes accumulated sediments, trash, and debris. Augmenting this effort is the street sweeping program that targets the pick-up of street sands, leaves, and debris prior to their reaching storm drains. Repair of damaged storm drains is also a priority, given their location in City streets and ultimate impact to the traveling public. Residents or business owners can also adopt storm drains near their home or businesses through the Adopt-a-Drain Program. This helps to keep leaves, sediment and garbage out of these adopted storm drains and our local waters.

PREVIOUS YEAR ACTIVITIES

- Monitored and maintained 25 pump stations

DISPOSAL OF REMOVED SUBSTANCES

PROGRAM OBJECTIVE

A key component of the MS4 stormwater management program is collection and disposal of materials removed from the storm drain system and structural controls in a manner that will prevent pollution and that will comply with applicable regulations.

Targeted pollutants include:

- Sediment
- Nutrients
- Floatable Trash
- Additional pollutants analyzed for stormwater pond sediment dredging are Copper, Arsenic, and Polycyclic Aromatic Hydrocarbons

PROGRAM OVERVIEW

Accumulated materials are removed from grit removal structures, storm drains, system piping, and deep drainage tunnels during the process of inspection and cleaning. Removed substances are screened for visual or olfactory indications of contamination. If contamination of the material is suspected, the City's Engineering Laboratory will select representative samples for an environmental analysis. Contaminated substances are disposed of in a landfill or another site that is approved by the MPCA. Non-contaminated targeted pollutants are disposed of the same way as street sweepings. During cleaning and disposal operations, erosion control measures are applied when needed to prevent removed material from re-entering the storm drain system.

The process for accumulated materials dredged from stormwater ponds is similar. The materials to be dredged from stormwater ponds are tested in advance and disposed of properly according to MPCA guidance.

PREVIOUS YEAR ACTIVITIES

In 2021, Minneapolis Public Works crews removed accumulated sediment and debris from grit chambers, and approximately 480 cubic yards from storm drains during hydro-jet washing operations.

FACILITY MANAGEMENT

PROGRAM OBJECTIVE

The stormwater management objective of these activities is to prevent or reduce the discharge of pollutants generated at City and MPRB owned facilities. Facilities include but are not limited to composting sites, equipment storage and maintenance, hazardous waste disposal, hazardous waste handling and transfer, landfills, solid waste handling and transfer, parks, pesticide storage public parking lots and ramps, public golf courses, public swimming pools, public works yards, recycling sites, salt storage yards, vehicle storage at maintenance yards, and materials storage yards.

Targeted pollutants include:

- TSS
- BOD_5
- COD
- Phosphorus
- Chlorides

PROGRAM OVERVIEW

Pollutant control is managed through proper storage of materials, routine maintenance, effective application of winter salt and deicers, and, where necessary, installation of structural stormwater management practices. Operations are performed to address public safety while balancing those needs with environmental and cost considerations.

PREVIOUS YEARS ACTIVITIES

In 2016, the City began developing Stormwater Pollution Prevention Plans (SWPPPs) for City and MPRB owned facilities to reduce the discharge of pollutants into the storm sewer system from municipal and Park Board operations An inventory of municipal operations facilities has been created which includes over 70 facilities; examples include Vehicle and Equipment Maintenance Facilities, Fleet Services, Parking Lots and Ramps, Fire Stations, Police Stations, Water Services Facilities, Stockyards, MPRB Service Centers, and MPRB Dog Parks. Site specific plans have been developed for each facility which include site maps, operations specific Best Management Practices, and inspection and reporting requirements.

These facility plans will be used to facilitate regular site inspections that will document and correct potential sources of pollution or illicit discharge to the storm sewer system from City or MPRB owned properties. Inspection frequency will be evaluated based on site specific needs such as continuing or ongoing issues, seasonal site usage, or change in property use. Implementation of the facility management plans will be prioritized based on the highest pollutant potential.

ROADWAYS

PROGRAM OBJECTIVE

The objective of this stormwater management program is to minimize the discharge of pollutants through the proper operation and maintenance of public streets and alleys.

Targeted pollutants include:

- TSS
- BOD_5
- COD
- Phosphorus
- Chlorides

PROGRAM OVERVIEW

Street Sweeping

Minneapolis Public Works employs several street sweeping approaches. Some are citywide, and some vary by area or land use. Curb-to-curb sweeping operations occur citywide twice a year in the spring and fall. At those times, all city streets are swept systematically (alleys are also included in the spring), and temporary parking bans are enforced to aid with sweeping operations and to ensure that curb-to-curb sweeping is accomplished. Operational routines and special methods are employed to address seasonal conditions, and to optimize cleaning. Flusher trucks apply pressurized water to the streets to push sediment and debris to the gutters. Street sweepers follow behind the flusher trucks and clean the gutters. During the fall, leaves are first bunched into piles, and then the leaves are picked up before flushing and sweeping occurs. During the summer, between the spring and fall sweep events, sweepers are assigned to maintenance districts for periodic area sweeping. Downtown and other high traffic commercial areas are swept at night on a weekly basis. In addition, summer sweeping in the Chain of Lakes drainage areas has occurred since 1995 as part of the Clean Water Partnership project. Two sweepers are dedicated to cleaning drainage areas around the Chain of Lakes, and one sweeper is devoted to the Minneapolis Parkway System.

The materials collected from street sweeping are received at two different locations, based on time of the year and nature of the material. The inorganic materials go to a construction demolition landfill site in Becker, Minnesota, to be used as daily cover. The Mulch Store, based in Chaska, MN, receives the City's organics in the fall of each year. The Mulch Store features four retail locations, but their main mulch operation originates in Chaska.

Special Service Districts

Special service districts are defined areas within the City where increased levels of service are provided and paid for by charges to the commercial or industrial property owners in the district. One of these special service districts, the Downtown Improvement District (DID) is a business-led non-profit organization with "a mission to make downtown Minneapolis a vibrant and attractive place for recruiting and retaining businesses, employees, residents, shoppers, students, and visitors. This is accomplished by providing services that make the 120-block district cleaner, greener, and safer." The organization is an important partner to the City, carrying out maintenance activities in the downtown public realm that minimize the discharge of pollutants through the proper maintenance of public right-of-way areas. The DID removes trash from sidewalks and operates sweepers for gutters and sidewalks throughout the 120-block district.

Snow and Ice Control

The Minneapolis Public Works Transportation, Maintenance, & Repair Division applies salt and sand to City roadways every winter for snow and ice control. Efficient application of de-icing materials is sought to appropriately balance three primary concerns: public safety, cost control, and environmental protection.

Reduced material amounts not only provide a cost savings but are also the best practice available for reducing harmful impacts on the environment. Sand harms lakes and streams by disturbing the ecosystems, and in depositing pollutants that bind to sand particles in lake bottoms and streambeds. An accumulation of sand calls for more frequent cleaning of catch basins and grit chambers. Salt (chloride) is harmful to aquatic life, groundwater, and to most plant and tree species. Salt causes corrosive damage to bridges, reinforcement rods in concrete streets, metal structures and pipes in the street, and vehicles.

Within Minneapolis, the following lakes and creeks do not meet standards for concentrations of chlorides set by the MPCA and are considered impaired:

- Bassett Creek
- Brownie Lake
- Diamond Lake
- Loring Lake
- Minnehaha Creek
- Powderhorn Lake
- Shingle Creek
- Spring Lake

Reducing usage of salt was the focus of the Shingle Creek Chloride TMDL Report, which was approved by the EPA in 2007. It placed limits on chlorides (salt) discharged to Shingle Creek. Consequently, the City developed improved snow and ice control practices, and they are being implemented not only in the Shingle Creek drainage area but also citywide. These practices are in line with the 2016 Twin Cities Metropolitan Area Chloride Management Plan completed by the MPCA.

Material spreaders are calibrated annually before the winter season. Maintenance yard housekeeping practices are designed to minimize salt/sand runoff. The materials that are used are tallied daily. Salt stockpiles are stored under cover to minimize potential groundwater contamination and runoff to surface waters.

PREVIOUS YEAR ACTIVITIES

The 2021-2022 winter season was a normal snow fall with several freeze-thaw cycles which required more granular material usage along with a heavy December snowfall that formed ice in the alleys and side streets especially with the cold December through February range. There were 31 notable events with 50.1 inches for the season, as compared to an average of 48 inches. The most snowfall was observed in December. There were three declared snow emergencies, compared to the annual average of four, and there were 166 days of temperatures at or below freezing by late of April. There were five notable freezing rain events in 2021-2022. The quantities of salt and sand used in snow and ice control are tracked by recording amounts that are delivered by suppliers, and by estimating the quantities that are on-hand daily. Street sweepings are scaled at the disposal site and reported to the City for record purposes only. Leaves picked up are weighed at the contractor's transfer facility in Minneapolis. The statistics for last year's program are as follows:

- 11,184 tons of salt applied to roadways
- 4,712 tons of sand applied to roadways
- 12,251 tons of materials reclaimed during spring and summer street sweeping operations
- 3,334 tons of leaves collected for composting during the fall Citywide sweeping

The City has been tracking the amount of salt applied within the City since 2001. Figure 6-1 shows the tons of salt applied annually. Figure 6-2 shows the amount of sand and salt applied in the City relative to the days below freezing. Figure 6-3 shows the amount of sand and salt applied in the City relative to the total amount of snowfall. These figures show that there has been an overall reduction in the amount of salt applied in the City. There has also been a reduction in the amount of salt applied relative to both the days below freezing and the inches of snowfall in the City.

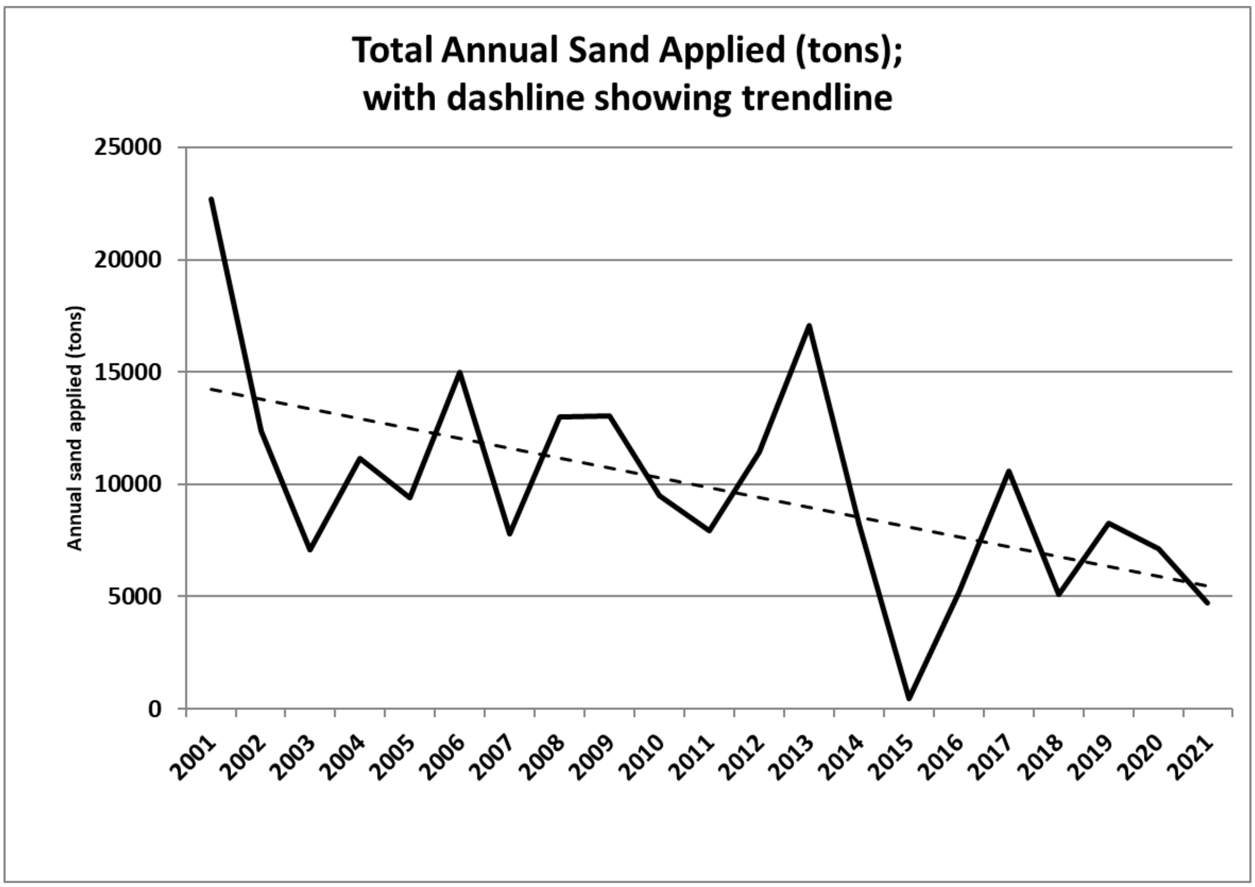


Figure 6-1

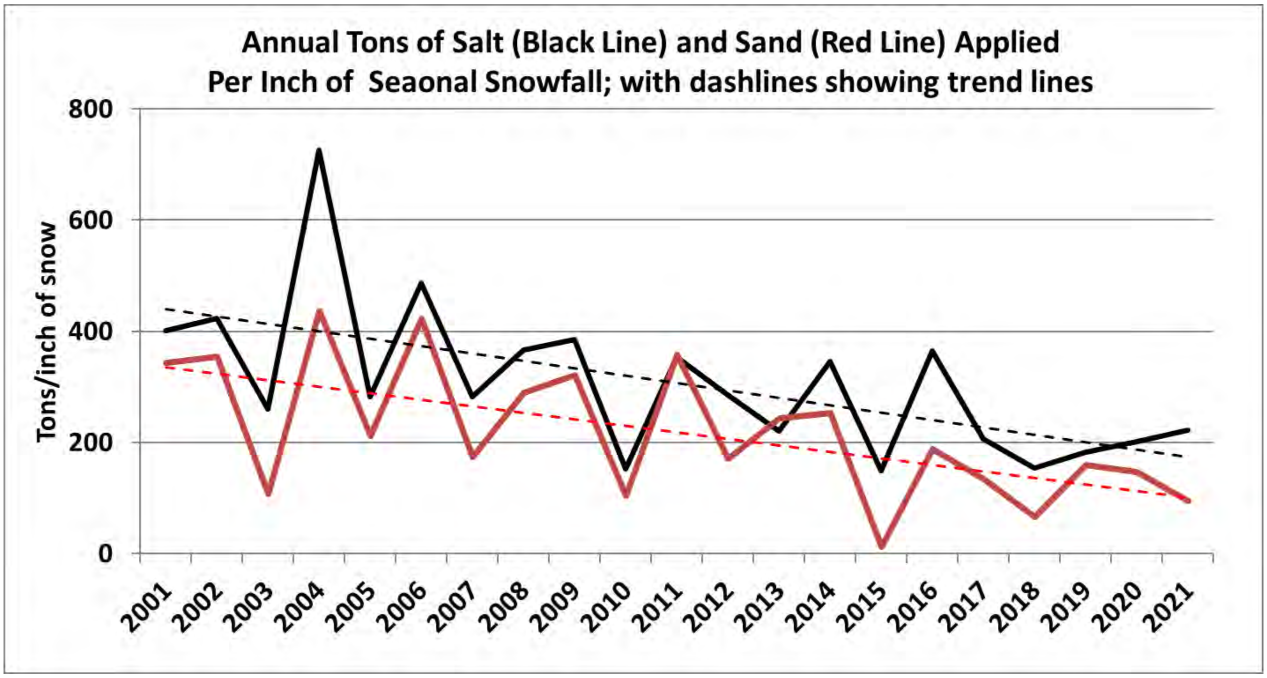


Figure 6-2

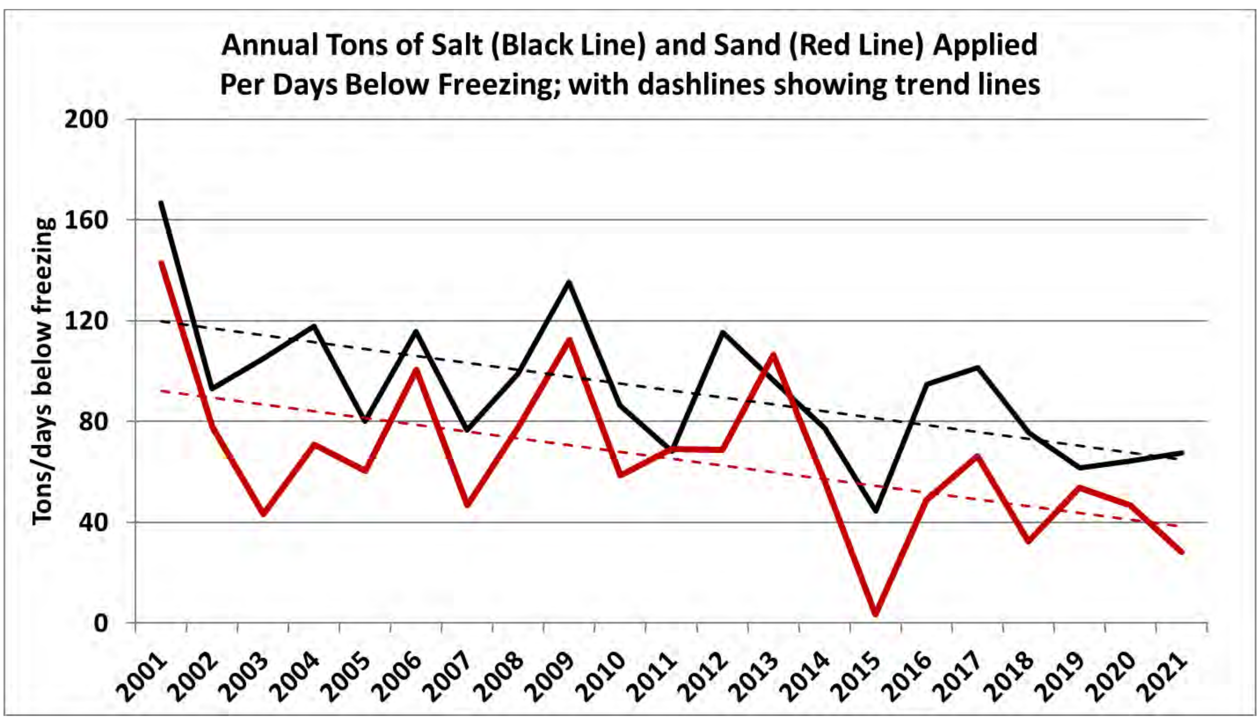


Figure 6-3

Performance Measures

- Amount of materials recovered as a percentage of materials applied: *98* %
- Amount of salt and sand applied relative to total snowfall: *317* tons/inch

VEGETATION MANAGEMENT: PESTICIDES AND FERTILIZER CONTROL

PROGRAM OBJECTIVE

The objective of this stormwater management program is to minimize the discharge of pollutants by utilizing appropriate vegetation management techniques and by controlling the application of pesticides and fertilizers.

The City of Minneapolis manages vegetation on 30 sites totaling approximately 77 acres. In addition to providing native vegetation with deep roots that can tolerate periods of both drought and inundation, this vegetation also allows for high infiltration capacity and erosion control protection. This high-quality native vegetation also provides invaluable habitat and food to pollinators and other insects, amphibians, and reptiles, as well as birds and small mammals.

Targeted pollutants include:

- Pesticides (insecticides, herbicides, fungicides, etc.)
- Nutrients (phosphorus, nitrogen, etc.)

PROGRAM OVERVIEW – MPRB PROPERTIES

Integrated Pest Management (IPM) Policy and Procedures

The Minneapolis Park and Recreation Board's Integrated Pest Management policy is included in the MPRB's General Operating Procedures. Specific areas where IPM is intensely used are the formal gardens athletic fields and golf courses. Horticulture, golf, and maintenance staff use an established IPM policy to set thresholds and determine the appropriate course of corrective action.

Pesticides Use on Park Lands

The MPRB manages 6,400 acres of park land and water in the City of Minneapolis (approximately 18% of the City's 35,244 total land acres).

The use of pesticide products on general park lands is not a routine maintenance practice. Landscape pesticide products may be used during park renovations, to repair athletic fields and golf courses, to control invasive species and noxious weeds, or to address plant health concerns within formal gardens. No cosmetic use of pesticide products is performed on general parkland. In 2016, MPRB banned the use of glyphosate in neighborhood parks. In 2018, the Board of Commissioners placed a moratorium on the use of glyphosate on all MPRB lands.

Invasive Species Control

Conservation Corp working at the Quaking Bog

MPRB Environmental Management (Natural Resources) staff use a variety of management techniques to control invasive plants in park natural areas. These techniques include mowing, weed whipping, hand pulling, and the use of biological controls. Invasive plant control within the Minneapolis Park System focuses on the species listed in the Minnesota Department of Agriculture's Noxious Weed List. The current State Prohibited Noxious Weed of greatest priority for eradication is Oriental Bittersweet, of which control efforts are underway.

Biological control agents have been used in the park system to control purple loosestrife, spotted knapweed, and leafy spurge. Biological control agents are insects or pathogens that are native to the invasive plant's country of origin. They are introduced after extensive research has been done by the scientific community. The MPRB partners with Minnesota Department of Agriculture (MDA) and Minnesota Department of Natural Resources (MnDNR), to control invasive plants with biological control agents.

Purple Loosestrife is a major invasive species problem in Minnesota wetlands. Working with the MnDNR the MPRB began a biocontrol program in the early 1990s. Leaf feeding beetles were reared and released into several sites throughout the City. Currently these populations are self-sustaining.

Partnering with MDA, spotted knapweed and leafy spurge biological controls were released into the prairie planting along the Cedar Lake bike trail in 2003. Insects that specifically feed on these plants are successfully controlling spotted knapweed and leafy spurge in the planted prairie.

SCUBA hand harvesting at Wirth Lake

Eurasian watermilfoil, an invasive aquatic plant, is harvested mechanically at Cedar Lake, Lake of the Isles, Bde Maka Ska, and Lake Harriet and harvested by hand via SCUBA at Lake Nokomis and Wirth Lake. Permits for managing Eurasian watermilfoil are obtained annually from the Minnesota Department of Natural Resources. The Environmental Stewardship Division coordinates the Eurasian watermilfoil control program.

The MPRB General Operating Procedures state no chemical application will be used to control aquatic weeds. When a noxious weed species is newly introduced, whether to our region or to a specific area, MPRB staff evaluate management solutions using an integrated pest management approach.

In fall 2021, MPRB began managing Phragmites australis spp. australis, an invasive species of wetland grass found around the Chain of Lakes. Invasive Phragmites can overtake shoreline areas and create unsuitable habitat for desirable plant and animal species. Invasive Phragmites was elevated from the “restricted” category to the “control” category of the Minnesota Department of Agriculture’s Noxious Weed List in 2021, meaning that MPRB was legally obligated to manage it for the first time in 2021. To manage three existing sites of invasive Phragmites in Minneapolis parks, MPRB utilized a strategy recommended by the University of Minnesota that involves alternating imazapyr herbicide treatments and mowing. Mowing alone would not have been an effective management strategy, according to the University of Minnesota. Follow-up mowing and herbicide treatments will occur in 2022 and 2023. The sites will be surveyed each year and will be revegetated with native species in 2024.

Fertilizer Use

In September 2001, the Minneapolis City Council amended Title 3 of the Minneapolis Code of Ordinances (relating to Air Pollution and Environmental Protection) by adding Chapter 55 regarding Lawn Fertilizer in January 1, 2002. The retail sale of fertilizer containing any amount of phosphorus or other compound containing phosphorus, such as phosphates, is prohibited in Minneapolis, as of January 1, 2002. The Minnesota Statute allows the use of phosphorus turf fertilizer if an approved and recent test indicates that the level of available phosphorus in the soil is insufficient or if the fertilizer is being applied to newly established turf, and only during the first growing season.

Under certain conditions specified in the Statute, fertilizer use is allowed on golf courses. Fertilization of turf on Minneapolis Park & Recreation Board Property is performed for golf courses, around athletic fields, and in areas of heavy traffic. MPRB staff are required to complete a report for every turf fertilizer application. These records are maintained for a period of 5 years, per state law.

Recordkeeping

MPRB staff who apply pesticides and fertilizers keep records of their applications, as required by the Minnesota Department of Agriculture. Since the 1980s, golf course foremen and park maintenance staff have documented the type, amount, and locations of the chemicals that are stored at park storage facilities. These chemical inventories provide detailed information to emergency responders in the event of a compromised storage facility. The plans identify how the fires are best extinguished and how to protect surface water in the surrounding area. The plans were put into place in the early 1980s, following a chemical company fire in north Minneapolis that resulted in the contamination of Shingle Creek.

Audubon Cooperative Sanctuary Program (ACSP) for Golf Courses

Audubon International provides comprehensive conservation and environmental education assistance to golf course superintendents and industry professionals through collaborative efforts with the United States Golf Association. The ACSP for golf courses seeks to provide open space benefits by addressing environmental concerns while maximizing golf course opportunities.

Participation in the program requires that golf course staff address environmental concerns related to the potential impacts of water consumption, and chemical use on local water sources, wildlife species, and native habitats. The program also aids in comprehensive environmental management, enhancement and protection of existing wildlife habitats, and recognition for those who are engaged in environmentally responsible projects.

Audubon International provides information to help golf courses with:

- Site Assessment and Environmental Planning
- Outreach and Education
- Water Quality and Conservation
- Resource Management
- Wildlife and Habitat Management

By completing projects in each of the above, the golf course receives national recognition as a Certified Audubon Cooperative Sanctuary. MPRB Golf Course foremen are expected to maintain the ACSP certification for courses. MPRB water resources staff conduct yearly water quality and wetland vegetation monitoring at the courses. All MPRB golf courses except for Columbia, Hiawatha and Fort Snelling have current Audubon Certification. The MPRB is currently in the process of obtaining certification for Columbia and Hiawatha Golf Courses.

Rain Garden at Riverside and 8th St. S

PREVIOUS YEAR ACTIVITIES

Currently around 200 MPRB employees hold pesticide applicator licenses, through the Minnesota Department of Agriculture (MDA). MPRB staff continues to reduce the use of pesticides through a variety of initiatives including improved design, plant selection, increased use of mechanical techniques and biological controls.

Turf fertilizer containing phosphorus is only purchased in accordance with the 2002 City and State regulation changes. Regulations require a soil or plant tissue test indicating a phosphorus deficiency or when new turf is being established during its first season.

PROGRAM OVERVIEW – CITY OF MINNEAPOLIS PROPERTIES

The City of Minneapolis maintains vegetation on its properties, including on stormwater management sites for a variety of reasons. These include public safety, preventing erosion, protecting, and improving water quality and ecological function, and creating wildlife habitat. Proper vegetation management will slow water movement, hold or convert pollutants, and enhance infiltration and evapotranspiration within stormwater management facilities like rain gardens and grass swales.

Integrated Pest Management (IPM)

The City uses integrated pest management when addressing pest management on the sites that the City maintains. IPM is a pest management strategy that focuses on long-term prevention or suppression of pest problems with minimum impact on human health, the environment and non-target organisms. In most cases, IPM is directed at controlling pests that have an economic impact on commercial crops. However, in the instance of mosquito control, IPM is used to control nuisance and potentially dangerous mosquito populations. The guiding principles, management techniques and desired outcomes are similar in all cases.

The City complies with the Minneapolis Code of Ordinances Title 11 - Health and Sanitation, Chapter 230 - Pesticide Control and Minnesota Department of Agriculture rules regarding pesticide application by posting plant protectant applications and maintaining the necessary records of all pest management activities completed by the City. The City's specific IPM goals, procedures, and guidelines can be found in Appendix A8.

CATEGORY SEVEN: STORMWATER RUNOFF MONITORING AND ANALYSIS

PROGRAM OBJECTIVES

The purposes of monitoring and analysis under the MS4 permit are to understand and improve stormwater management program effectiveness, characterize pollutant event mean concentrations, estimate effectiveness of devices and practices, and calibrate and verify stormwater models.

Targeted pollutants include:

- Phosphorus
- TSS
- Chloride
- Bacteria

PROGRAM OVERVIEW

In addition to stormwater monitoring, the Minneapolis Park & Recreation Board carries out an extensive lake monitoring program which is sometimes illustrative of the effects of stormwater on natural water bodies. All lakes in the monitoring program are sampled twice per month during summer, once each in spring and fall, and one time in winter. Escherichia coli (E. coli) monitoring per the MPCA's standard is also carried out at the MPRB's 12 official beaches located on six lakes. This monitoring is important for public health and provides indications of elevated bacteria issues (see Section 18, Public Beach Monitoring, of the MPRB's Water Resources Report referenced in the next paragraph). E. coli is a bacterium used to indicate the potential presence of waterborne pathogens that can be harmful to human health. Elevated bacteria levels generally occur in aquatic environments after rain events, when bacteria from various sources are washed into the lakes in stormwater runoff.

MPRB staff began a cyanotoxin monitoring pilot program in 2021. Cedar, Nokomis, and Powderhorn Lakes were selected for monitoring due to the historical frequency of blue-green algae blooms. Blue-green algae blooms, otherwise known as harmful algal blooms (HABs), are caused by a photosynthetic microorganism called cyanobacteria. Certain taxa of cyanobacteria have the capability to produce cyanotoxins that can be harmful to wildlife, pets, and humans if ingested. While the process of nutrient loading promotes cyanobacteria growth, warmer temperatures, more intense precipitation events, and longer stratification periods due to climate change will stimulate more intense and frequent future harmful algal bloom events.

PREVIOUS YEARS ACTIVITIES

Lake Monitoring

In 2021, MPRB scientists monitored 11 of the city's most heavily used lakes. The data collected were used to calculate a Trophic State Index (TSI) score for each of the lakes. Lower TSI scores indicate high water clarity, low levels of algae in the water column, and/or low phosphorus concentrations. Changes in lake water quality can be tracked by looking for trends in TSI scores over time. A negative slope indicates improving water quality, while a positive slope indicates declining water quality. These values are especially important for monitoring long-term trends (10+ years). Historical trends in TSI scores are used by lake managers to assess improvement or degradation in water quality. Trends are also used by the Minnesota Pollution Control Agency to assess non-degradation goals.

Deep water samples being collected on Lake Harriet in 2021

Most of the lakes in Minneapolis fall into either the mesotrophic or eutrophic category. Bde Maka Ska, Harriet, and Wirth are mesotrophic having moderately clear water and potential for hypolimnetic anoxia during the summer. Lake of the Isles, Cedar, and Hiawatha are eutrophic having an anoxic hypolimnion and potential for nuisance growth of aquatic plants. Nokomis, Loring and Powderhorn are also eutrophic with high algal productivity. Blue-green algae dominates the phytoplankton community on Lake Nokomis and Powderhorn Lake, resulting in periodic appearance of algal scum on these lakes. Brownie Lake was also classified as eutrophic in 2020 but was not sampled in 2021. Spring Lake is hypereutrophic with very high nutrient concentrations. Scores for Diamond and Grass Lake are not included since these lakes are too shallow to calculate the Secchi portion of the TSI index.

Long term trends in lake water quality can be seen by using the annual average TSI since the early 1990s, **Table 7-1**. Restoration activities have improved water quality indicators at Bde Maka Ska and Wirth Lake. When data from the last 10 years is looked at for Minneapolis lakes, shown in **Table 7-2**, Cedar and Spring Lakes have an increasing trend, signifying declining water quality indicators for those lakes. The decline in water quality indicators at Cedar Lake may be related to high water levels, or the end of the effective life of the previous alum treatment. The decline in water quality at Spring Lake is due to higher chlorophyll-*a* and total phosphorus concentrations.

Table 7-1. Water quality trends in Minneapolis lakes from 1991-2021.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
Bde Maka Ska	Brownie Lake	No lakes with declining trend
Wirth Lake	Cedar Lake	
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Lake Nokomis	
	Loring Pond	
	Powderhorn Lake	
	Spring Lake	

Table 7-2. Water quality trends in Minneapolis lakes from 2011-2021.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
No Lakes with improving trend	Bde Maka Ska	Cedar Lake
	Brownie Lake	Spring Lake
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Lake Nokomis	
	Loring Pond	
	Powderhorn Lake	
	Wirth Lake	

Pond Screening and Monitoring

BACKGROUND

Introduction

In 2020, the City of Minneapolis, working with Stantec Engineering, conducted a city-wide screening study of 22 dry and retention stormwater ponds. The purpose of the study was to determine if any of the ponds had internal phosphorus loading and should be prioritized for future monitoring or retrofit projects that would increase pollutant removal.

Accompanying this study, in 2020, the Minneapolis Park and Recreation Board (MPRB) carried out a pond screening study of 16 retention ponds, that largely overlapped and augmented the Stantec study. The 2020 study included wet pond water chemistry monitoring, bathymetric surveys, and oxygen/temperature water column profiles. Ponds could then be prioritized for future monitoring and projects if they had evidence of high phosphorus return from the sediment or sediment resuspension. These conditions ultimately reflect the pond's effectiveness as a treatment device. Note, the 25th Ave SE Pond in 2020 was mistakenly called 25th Ave NE in MPRB 2020 reports.

In 2021, four ponds were prioritized for additional monitoring based on the 2020 pond screening data, as shown in **Table 24-1**. Water chemistry and microcystin samples were collected in 2021, along with Hydrolab/YSI sonde profiles and Secchi transparency from May through October. Pond water level was monitored at 15 min intervals from June through October. The pond level data can inform when the pond discharged water from the outlet to the downstream storm sewer system.

The 2021 pond study attempted to:

1. Determine the potential for internal phosphorus release from the pond sediments within each stormwater pond.
2. Determine chloride (Cl) levels of the ponds to assess the potential for aquatic habitat.
3. Using chlorophyll-*a* (Chl-*a*) and the cyanotoxin microcystin to determine the potential for Harmful Algal Blooms (HABs) in the ponds.

Pond Monitored	Construction Year	Watershed Area	Predominant Land Use	Last Dredged	Reason for Monitoring
Park and 44th W	2002	109 acres	Park Residential/Single Family	Never	Potential for HABs, Potential for Internal Phosphorus Release
25th Ave SE	2011	4 acres	Park Commercial Industrial	Never	High Cl levels, Potential for Internal Phosphorus Release
Heritage Park #5	2004	116 acres	Residential Single Family/Multifamily Institutional	2014	High phosphorus levels, Potential for HABs, Potential for Internal Phosphorus Release
Camden	2007	235 acres	Cemetery Park Residential	Never	Potential for HABs, Potential for Internal Phosphorus Release

Table 24-1. Ponds that were monitored by MPRB in 2021

Internal Release of Phosphorus Monitoring

The first goal of the 2020 - 2021 Pond Screening and Monitoring program was to determine the potential for internal phosphorus release from the pond sediments within each stormwater pond. Stormwater ponds receive both external loads and internal loads of phosphorus throughout the year. Internal load is caused by the release of phosphorus from the pond sediments throughout the year. Iron-bound phosphorus in pond sediments can be released into the water column when the pond bottom water was less than 2 mg/L oxygen content. Unmixed stormwater ponds can become anoxic during the summer months as bacteria and microorganisms consume oxygen. Dissolved oxygen usually remains high at the pond surface due to mixing with oxygen-rich air, but thermal stratification prevents this oxygen from circulating to the pond bottom. This thermal stratification can also prevent sediment released phosphorus from reaching the pond surface. Thus, the amount of phosphorus at the pond surface can reflect the extent of mixing that occurs within the pond or sediment resuspension throughout the year. Resuspension of sediments can also cause internal release of phosphorus. Sediment resuspension can occur due to sediment disturbance from fish, wind mixing, or inlet hydraulic velocity.

Given that stormwater ponds are designed to trap and settle out phosphorus, a significant internal release of phosphorus from the sediment, followed by mixing, means that the pond is not working effectively. However, if the phosphorus released remains near the pond bottom and does not migrate to the pond surface, it is less likely to impact the downstream water body. Thus, monitoring the internal release of phosphorus gives insight into which ponds are working effectively and which ponds need retrofitting.

Chloride (Cl) Monitoring: Effect on Aquatic Habitat

The second goal of the 2020 – 2021 Pond Screening and Monitoring program was to determine chloride (Cl) levels to assess the potential for pond aquatic habitat.

Chloride content above the Minnesota Pollution Control Agency (MPCA) 5-day chronic threshold of 230 mg/L is an impairment to aquatic life and is an indication that a pond is poor aquatic habitat. The 230 mg/L Cl chronic threshold is a standard applied to MN Class 2B waters used for fishing and swimming. Stormwater ponds do not currently have standards for Cl content; however, it is often a desire that stormwater ponds provide a habitat benefit. High Cl is detrimental to aquatic life and may be a limitation on habitat suitability of ponds.

Chl-a, microcystin and Harmful Algal Blooms (HABs) Monitoring

The third goal for 2021 was to use chlorophyll-a (Chl-a) and the cyanotoxin microcystin to determine the potential for Harmful Algal Blooms (HABs) in the ponds. Chl-a and the cyanotoxin microcystin were measured in surface samples collected at the four stormwater ponds. Chl-a concentrations over 30 µg/L are considered an indicator of moderate or greater likelihood for potential HABs (Heiskary and Lindon, 2009). The MPCA recreational health risk advisory toxin concentration level for microcystin is 6 ug/L and was used as a reference for the stormwater ponds. Stormwater ponds are not constructed or intended for recreational body contact. Sampling was intended to determine if the cyanotoxin microcystin levels were elevated above the MPCA recommendations.

Blue-green algae, also referred to as cyanobacteria, are photosynthetic microorganisms that occur naturally in lakes, streams, and other waterbodies. When cyanobacteria reproduce rapidly under certain conditions, they can form blooms, or high concentrations of cyanobacteria that can create streaks of accumulation along the shore, or open water discoloration. Blooms can look like green paint in the waterbody. Certain taxa of cyanobacteria have the capability to produce toxins called cyanotoxins, and these toxins can reach harmful levels during blooms. Wildlife, pets, and humans can be harmed if they ingest or otherwise come into close contact with cyanotoxins (US EPA, 2017). HABs in neighborhood ponds could be a potential health hazard for people or animals visiting the pond. It is not well understood when or why cyanobacteria make cyanotoxins.

While the studies ponds are intended to store runoff volume, the City of Minneapolis is also interested in the potential for ponds to function as aquatic habitat and greenspace. HABs could have a detrimental effect on the recreational space of citizens. Thus, ponds could also be prioritized for additional monitoring or retrofit if they had a high potential of HABs that could affect the pond's secondary benefits as habitat and greenspace.

Detailed monitoring methods and results are listed in **Appendix A-12**

Stormwater Quarterly Grab Monitoring

As part of the federal Clean Water Act, the Minneapolis Park and Recreation Board (MPRB) and the City of Minneapolis are co-signatories on the Environmental Protection Agency (EPA) issued National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit. The permit requires quarterly grab samples for NPDES chemistry, pH, E. coli, and a pilot project to monitor Fat, Oils, and Grease (FOG). The purpose of this monitoring is to characterize the seasonality of runoff for parameters that cannot be collected with flow-weighted composite auto-monitoring (e.g., pH, E. coli, FOG). Criteria for snowmelt sample collection was a winter snowpack melt event. Criteria for spring, summer, and fall grab sample collection was precipitation event greater than 0.10" separated by at least 8 hours from other rain events.

The NPDES permit requires quarterly grab stormwater event monitoring to be attempted, but it is not always possible to carry out. Rain events must occur when staff are working, and the laboratory is open to receive samples. Ideally, annual quarterly grab monitoring includes two snowmelt grab samples, and a one each spring, summer and fall grab sample. Quarterly grab monitoring includes pH, E. coli, NPDES water chemistry, and a Fat Oil and Grease (FOG) sample. The grab water chemistry samples are analyzed for the chemistry parameters outlined in the NPDES permit.

Grab sampling characterizes a point in time of a snowmelt or rain event. The first snowmelt event in a year usually has higher pollutant concentration than subsequent snowmelt events. The chemical concentrations can change over time throughout the hydrograph as the rising limb usually mobilizes fine particles and FOG material previously deposited on hard surfaces first. Chemical concentrations can vary not only throughout the individual hydrograph but also from storm to storm, largely driven by the time since the last precipitation. It can be helpful to think of stormwater runoff pollution in a watershed as behaving like dust. It accumulates over time and then washes off in a melt or rain event. The longer the time between snowmelt or rain the more pollutants accumulate.

As part of the NPDES permit, a study of quarterly FOG grab sampling was conducted along with regular grab sample monitoring with the intent to sample six sites. The latest NPDES permit prescribed that if a

FOG sample was measured greater than 15 mg/L at a site, then that site would continue to be monitored throughout the permit cycle. FOG in stormwater can come from a variety of sources such as: vehicles, industry, food waste, gas stations, etc. Elevated levels of hydrocarbons can be harmful to aquatic plants and animals. It is important to minimize FOG in stormwater through best practices in industry, public education about vehicle maintenance, and the prevention of improper waste disposal.

In 2018, quarterly grabs were collected at representative land use sites. Following snowmelt, grab samples could not be collected from the Pershing land use site since auto-monitoring equipment was housed in an equipment box on top of the manhole. 61st and Lyndale had extensive road construction and stormwater pipe replacement beginning mid-summer 2018 that restricted access. In 2019, the grab sites were changed to the Powderhorn Lake Inlets: SE, S, and W and the 24th Ave. SE & Elm St. SE infiltration basin Inlets: N and S. The intention was to continue sampling at the 61st and Lyndale site, but the site was again inaccessible due to the stormwater pipe replacement and road reconstruction.

In 2020, the quarterly grab sites were, 24th Ave. SE & Elm St. SE Inlets: N and S and Powderhorn Inlets: SE, S, and W, and 61st & Lyndale. In 2020, after several unsuccessful attempts were made, the Powderhorn Inlet N site was deemed physically inaccessible to collect grab samples and dropped from any grab sampling. 2020 was also a difficult year for field work with the COVID-19 pandemic restrictions, and the significant social unrest in Minneapolis.

In 2021 grab sampling was completed at six sites: three locations at Powderhorn Lake Inlets (SE, S, and W), two sites at 24th Ave SE & Elm St SE infiltration basin Inlets (N and S), and a location at 61st and Lyndale were all successfully monitored.

Detailed monitoring methods and results are listed in **Appendix A-12**.

Powderhorn Lake Inlet Monitoring

The City of Minneapolis Public Works (MPW) and the Minneapolis Park and Recreation Board (MPRB) developed a major restoration plan for Powderhorn Lake in 1999. In 2001, five continuous deflective separation (CDS) grit chambers were installed to remove solids from stormwater inflow see **Figure 26-3**. A drawing of a CDS unit is shown in **Figure 26-1**. The Powderhorn Lake watersheds are shown in **Figure 26-2**.

Despite this and other restoration work, the lake was listed as impaired and placed on the Environmental Protection Agency (EPA) 303d list based on eutrophication and biological indicators in 2001. Powderhorn Lake later trended towards better water quality and met state standards for several years, it was subsequently removed from the 303d list in 2012. After relapsing to poor water quality, Powderhorn was relisted on the EPA 303d list as impaired for nutrients in 2018.

The purpose of monitoring the stormwater inlets into Powderhorn Lake was to:

1. Comply with the NPDES Permit provision to monitor stormwater runoff.
2. Measure the pollutant load of the main tributaries to Powderhorn Lake. This information can be used to assist in any future external load reduction plans.
3. Trouble shoot the CDS unit functionality, since 2020 work discovered that the CDS units were malfunctioning.

In 2021, four of the largest Powderhorn Lake watershed inlets, with CDS units, were all auto-monitored downstream of the CDS units as part of the NPDES stormwater monitoring permit.

Detailed monitoring methods and results are listed in **Appendix A-12**.

Green Infrastructure Monitoring

The purpose of the Hoyer and Windom Green Stormwater Infrastructure (GSI) monitoring is to better understand the Hoyer and Windom basins' ability to minimize the impacts of stormwater runoff. Due to an ordinance change, the City of Minneapolis is building numerous small-footprint infiltration/filtration basins throughout the City. Many of these GSI Best Management Practices (BMPs) treat less than 1 acre of impervious surface. The City of Minneapolis chose two GSI sites to be monitored in 2021, Hoyer and Windom.

The Hoyer GSI site is in Northeast Minneapolis at the southeast corner of 36 ½ Avenue NE and Fillmore Street NE and is shown below. It drains approximately 0.072 acres of a residential watershed (0.0407 acres impervious). The GSI has an uncapped underdrain which flows to the storm sewer system. The Hoyer GSI site was built for flood control.

The Hoyer GSI basin in Fall of 2021 in Northeast Minneapolis

The Windom GSI site, shown below**,** is in Southwest Minneapolis on West 62nd Street and Dupont Avenue South. It drains approximately 3.67 acres of a residential watershed (0.506 acres impervious). The Windom site has a capped underdrain and is built for stormwater infiltration.

The Windom GSI basin in Fall of 2021 in southwest Minneapolis

The Hoyer Windom GSI monitoring project is a partnership between the City of Minneapolis, Saint Anthony Falls Hydrology Laboratory (SAFL) at the University of Minnesota, and the Minneapolis Park and Recreation Board (MPRB). The funding, survey, and GIS data used in the project were supplied by the City of Minneapolis. Monitoring of rainfall, flow, infiltration tests, and flood functionality tests were the responsibility of both the City and SAFL. Confined space entry, soil sampling/testing, and monthly observational field inspection data were the responsibility of the MPRB.

Detailed monitoring methods and results are listed in **Appendix A-12**

CATEGORY EIGHT: PROGRESS TOWARD WASTE LOAD ALLOCATION FOR APPROVED TMDLS

PROGRAM OBJECTIVES

Total maximum daily loads (TMDLs) are one of the many tools Congress authorized in the Clean Water Act to "restore and maintain the chemical, physical, and biological integrity of the nation's water." The goal of the City's TMDL program is to work closely with the MPCA and other water resource agencies during the study and implementation phases of each TMDL Study which is being conducted for a waterbody that receives stormwater runoff from the Minneapolis MS4 system. Additionally, this program aims to develop and maintain a tracking system to assess and report on the progress towards compliance with TMDL established maximum pollutant discharges.

Targeted pollutants include:

- Phosphorus
- TSS
- Chlorides
- Bacteria

PROGRAM OVERVIEW

The City of Minneapolis is subject to the following TMDLs:

TMDL project name	Waste Load Allocation type	Percent reduction	Pollutant of concern
Shingle Creek and Bass Creek Biota and Dissolved Oxygen TMDL	Categorical		Nitrogenous biochemical oxygen demand
Minnehaha Creek Watershed District Lakes TMDL – Lake Nokomis	Individual	38%	Phosphorus
Wirth Lake: Excess Nutrients TMDL	Categorical		Phosphorus
Silver Lake TMDL	Categorical	17%	Phosphorus
Crystal Lake Nutrient TMDL	Categorical		Phosphorus
Twin and Ryan Lakes Nutrient TMDL - Ryan Lake	Categorical		Phosphorus
Shingle Creek Chloride TMDL	Categorical	67%	Chloride
Minnehaha Creek/Lake Hiawatha TMDL	Individual	31%	Phosphorus
Minnehaha Creek Lake Hiawatha TMDL	Categorical	N/A	E. coli
TCMA Chloride TMDL Study	Categorical	N/A	Chloride
Upper Mississippi River: Bacteria	Categorical		E. coli
South Metro Mississippi River TMDL (Metro)	Categorical	0%	TSS

SHINGLE CREEK AND BASS CREEK TMDL: BIOTA AND DISSOLVED OXYGEN

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed

MINNEHAHA CREEK WATERSHED DISTRICT LAKES – LAKE NOKOMIS TMDL: PHOSPHORUS

- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

WIRTH LAKE TMDL: NUTRIENTS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

SILVER LAKE TMDL: PHOSPHORUS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB

- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

CRYSTAL LAKE TMDL: NUTRIENTS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model Completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

TWIN AND RYAN LAKES TMDL: NUTRIENTS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

SHINGLE CREEK TMDL: CHLORIDE

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works equipment upgrades, advancements in de-icing technologies, and staff training
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- Stormwater Utility Credit program participation requires a chloride management plan

MINNEHAHA CREEK LAKE - HIAWATHA TMDL: NUTRIENTS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

MINNEHAHA CREEK - LAKE HIAWATHA TMDL: BACTERIA

- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- Public Works Storm Sewer Maintenance and Repair Program
- Leadership, membership, and participation in Minnesota pathogen Task force
- Development of Stormwater Pathogen Investigation and Prevention Toolbox to identify, prevent, and remediate pathogens in stormwater runoff

TWIN CITIES METRO AREA (TCMA) TMDL: CHLORIDE

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works equipment upgrades, advancements in de-icing technologies, and staff training
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- Stormwater Utility Credit program participation requires a chloride management plan

UPPER MISSISSIPPI RIVER TMDL: BACTERIA

- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- Implementations of the 2019 Minnehaha Creek Bacterial Source Identification Study
- Leadership, membership, and participation in the MN Pathogen Task Force
- Developing a toolbox for identification, prevention, and remediation of pathogens in stormwater runoff
- Public Works Storm Sewer Maintenance and Repair Program
- MPRB nuisance goose management program

SOUTH METRO MISSISSIPPI RIVER TMDL (METRO): TSS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- Public Works Storm Sewer Maintenance and Repair Program

CATEGORY NINE: COORDINATION AND COOPERATION WITH OTHER ENTITIES

PROGRAM OBJECTIVE

The objective of this Stormwater Management Program is to maximize stormwater management efforts through coordination and partnerships with other governmental entities.

PROGRAM OVERVIEW

Coordination and partnerships of the City and the MPRB with other governmental entities include the four watershed organizations in Minneapolis: BCWMC, MWMO, MCWD and SCWMC. Coordination activities and partnerships with other governmental entities also include MnDOT, Hennepin County, MPCA, Minnesota Board of Water and Soil Resources (BWSR), MnDNR, neighboring cities, the Metropolitan Council, the University of Minnesota and various other entities.

The coordination and partnership activities can include the joint review of projects, joint studies, joint water quality projects, stormwater monitoring, water quality education, and investigation or enforcement activities.

Coordination with the Bassett Creek Water Management Commission (BCWMC)

In 2015, the BCWMC adopted its Third Generation Watershed Management Plan, with Minneapolis and the other eight-member cities as active partners. Minneapolis provides yearly financial contributions to the BCWMC annual operations budget. The City and the MPRB are also stakeholders with other BCWMC joint power cities in development of several Total Maximum Daily Load (TMDL) studies and implementation plans.

Coordination with the Minnehaha Creek Watershed District (MCWD)

The MCWD receives revenue through direct taxation against properties within its jurisdiction. MCWD’s fourth Generation Watershed Management Plan was adopted on January 11, 2018 and sets priorities for the organization for the period from 2018-2027. The City of Minneapolis and the MPRB are stakeholders in development of TMDL studies and implementation plans, in collaboration with the MCWD and other stakeholders.

Coordination with the Mississippi Watershed Management Organization (MWMO)

In 2021, the MWMO adopted its Fourth Generation Watershed Management Plan (2021-2031). The City and MPRB participated in its review. The MWMO delegates stormwater management requirements for new developments and redevelopments to its member cities and does not provide separate project review and approval. The MWMO receives revenue through direct taxation against properties within its jurisdiction. The City and the MPRB partner with the MWMO on many studies and projects. Additionally, MWMO conducted 35 educational events with a total of 853 participants.

Coordination with the Shingle Creek Watershed Management Commission (SCWMC)

In April 2013, the SCWMC adopted its Third Generation Watershed Management Plan, with Minneapolis and the other member cities as active partners. Minneapolis provides yearly financial contributions to the SCWMC annual operations budget. The City of Minneapolis and the MPRB are stakeholders with other SCWMC joint power cities in development of TMDL studies and implementation plans.

Coordination with Hennepin County

In 2016, Hennepin County adopted the Natural Resources Strategic Plan (2015-2020). This plan is intended to guide the county and its partners, including the City, in responding to natural resource issues and developing internal and external policies, programs, and partnerships that improve, protect, and preserve natural resources. City staff and residents provided feedback on this plan through a series of meetings and survey.

Coordination with the Minnesota Pollution Control Agency (MPCA)

Minneapolis Fire Inspection Services coordinates with the MPCA on Spill Response incidents and investigations and enforcement for incidents of illegal dumping or illicit discharges to the storm drain system.

Minneapolis Public Works coordinates with the MPCA on the various work groups, including the Minnesota Stormwater Manual and surface water/groundwater interactions.

Coordination with the US Coast Guard and WAKOTA CARE

Minneapolis Fire Inspection Services coordinates with these agencies on spill response issues, training, and spill response drills. A Spill Response training on the Mississippi River took place with WAKOTA CARE members, Minneapolis Fire, and Minneapolis Fire Inspections. Classroom training covering spill response and boom deployment strategies were covered. On the water boom deployment from boats and on shore boom deployment took place. U.S. Coast Guard spill training was put on hold due to COVID issues.

Coordination with the Minneapolis Park & Recreation Board (MPRB)

In 2020, Minneapolis Park & Recreation board adopted an Ecological Systems Plan. This plan included input from Minneapolis Public Works to ensure that the two entities mutual water quality and environmental management goals can be achieved. This plan now serves as the MPRB's principal policy document regarding environmental performance and provides a framework for how environmental considerations can be addressed in ongoing planning, operations and management efforts at the MPRB. In 2021, MPRB adopted a new comprehensive plan, Parks for All (2021-2036). The plan's environmental sustainability focus area outlines how MPRB will work independently and with Minneapolis and other partners on preservation of parklands, natural areas, waters and the urban forest as well as management, design, operations and programming of parks through practices that mitigate and adapt to climate change.

PREVIOUS YEAR ACTIVITIES AND ONGOING COORDINATION EFFORTS

MPRB and the City of Minneapolis coordinate stormwater management efforts and coordinate with the watershed management organizations, the watershed district, and other governmental agencies on several water quality projects. Minneapolis Public Works maintains communications with all watershed management organizations and the watershed district within the City boundaries.

Interactions take several forms to facilitate communication and provide support:

- Attend selected local board and special issues meetings
- Attend selected education and public outreach committee meetings
- Take part in Technical Advisory Committee meetings
- Inform organizations of upcoming City capital projects to identify projects that may benefit from partnerships
- Provide developers who submit projects for site plan review with information and contacts to meet watershed requirements
- Share information and data regarding storm drainage system infrastructure, watershed characteristics, flooding problems, modeling data, etc.
- The MPRB and the City coordinate and partner with watershed management organizations and state agencies on capital projects and water quality programs. For example:
- A feasibility study began in 2019 for a proposed project that will improve water quality and habitat and increase flood storage in Bassett Creek by dredging accumulated sediment that has collected in the “lagoons” created within the creek in Theodore Wirth Park between Golden Valley Road and Trunk Highway 55. The City of Minneapolis and the MPRB are cooperating with BCWMC on the study. The feasibility study was completed in the spring of 2020 and the project design was completed in late 2021. Clean Water Funding was also awarded from the MN Board of Soil and Water Resources in 2020. Project design achieved 50% plans, An EAW was completed, and a Hennepin County Opportunity Grant was awarded in 2021. Implementation of this project is expected to occur in the winter of 2022/23.
- MPRB and City of Minneapolis along with BCWMC are working towards implementation of a stormwater project in Bryn Mawr Meadows. The project will be designed and constructed in conjunction with the MPRB's master planning process for this area. The project includes diverting runoff from a 45.1-acre residential area west of the park and low flows from MnDOT’s Penn Pond discharge into new stormwater ponds within the park for a total phosphorus reduction of 30 pounds per year. Additional funding for this project has been contributed by Hennepin County and BWSR. Design of the project began in 2021 and has continued in 2022. Construction is expected in 2022/2023.
- MPRB and City of Minneapolis along with MWMO are collaborating on common water quality, flood control and habitat improvement goals in MWMO’s 1NE project area. The overall goal of the project is to reduce flooding and reduce pollution to the Mississippi River. Projects have been completed on the MPRB’s Colombia Golf Course, MPRB Parkland, and integrated with City of Minneapolis street projects. Detailed study of shallow groundwater on the southern half of the golf course was ongoing in 2021 with final construction and project closeout expected in 2022.
- **A phase of the overall project, the Northern Colombia Golf Course and Park BMP project began construction was completed in 2021 with funding from MWMO, BWSR, City of Minneapolis, and Hennepin County.**
- Collaboration between MPRB, MCWD, and Minneapolis continued via the master planning process for the Minnehaha Regional Trail corridor along Minnehaha Creek. If plans are fully implemented, 1.7 miles would be added to the length of the creek, runoff from 1,400 acres of land would be treated, 22 acre-feet of flood storage would be created, and over 400 pounds of phosphorus would be removed from the creek annually. The plan was adopted by the MPRB

Board in 2020 laying out priorities for the Minnehaha Creek Corridor within Minneapolis and how the three entities can collaborate to meet common goals of managing stormwater, flooding, streambank stability, and ecology in a heavily used recreation corridor. Community engagement and design for the first project focus area occurred in 2021 and continues into 2022. Project prioritization is taking place among all of the partner organizations with a needs identification and community focused project list being developed.

- The City's Environmental Services section coordinates with the MPCA regarding investigations and enforcement for incidents of illegal dumping or illicit discharges to the storm drain system.
- Public Works and MPRB staff coordinate with the MPCA, the watershed management organizations and other stakeholders for Total Maximum Daily Load (TMDL) studies and implementation plans.
- Public Works engages with MPRB, MnDOT, Hennepin County, Metropolitan Council, and watershed management organizations on those entities' capital projects and infrastructure maintenance within the City regarding compliance with NPDES issues.
- Finally, other sections of this NPDES Annual Report provide additional information about other projects or issues on which the permittees have cooperated with other governmental entities.

INTEGRATED INFRASTRUCTURE MANAGEMENT

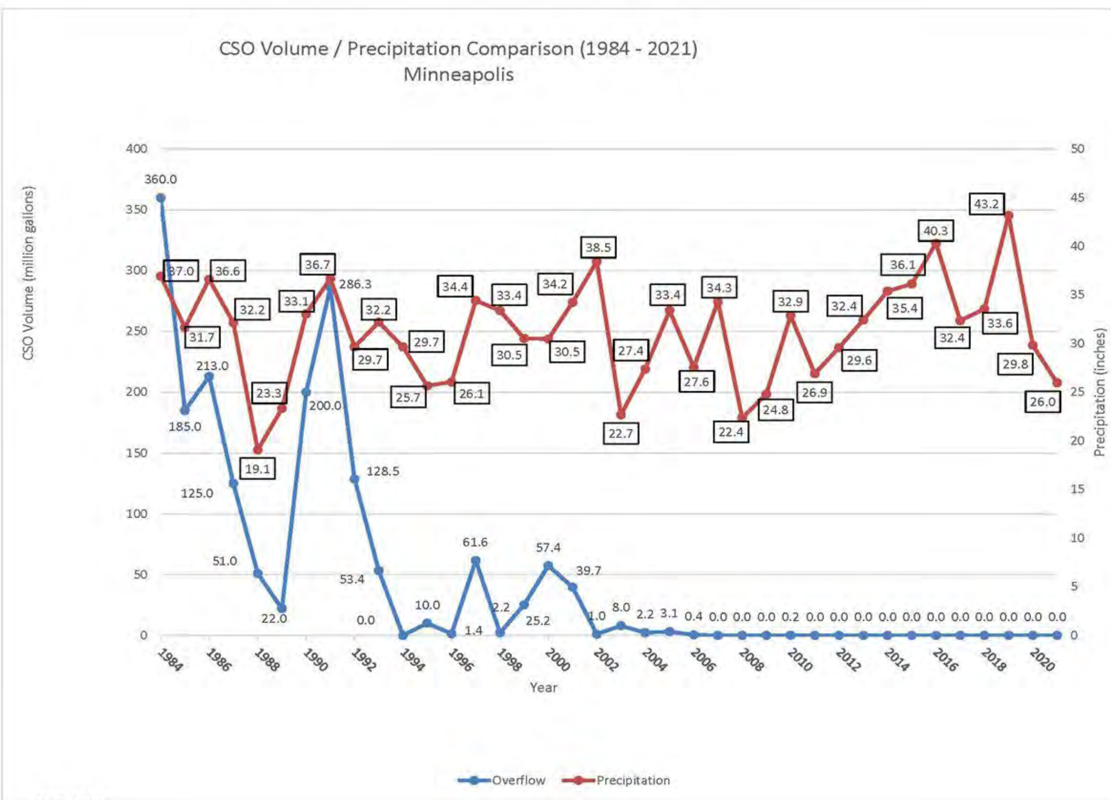
PROGRAM OBJECTIVE

The objective of this program is to prevent the unintentional discharge of untreated sewage from the Minneapolis sanitary sewer system at the regulators located on Metropolitan Council Environmental Services (MCES) Interceptors.

BACKGROUND

Transition to Integrated Infrastructure Management

In 2019**,** Minneapolis transitioned from a Combined Sewer Overflow (CSO) permit to an Integrated MS4 permit. This transition is possible because of the success of the efforts of the City of Minneapolis and MCES to reduce the risk of CSO events through storm drain separation, improvements to hydraulic performance and programs to reduce Inflow & Infiltration (I & I). The chart below shows a dramatic decrease in overflow volume from 1984-2021.



Storm drain separation can add significant flow to the stormwater system where capacity might be limited. Minneapolis is working to address stormwater capacity through the Flood Mitigation and Storm

Tunnel Programs mentioned in this report. The addition of stormwater from separation projects has contributed to capacity problems in these systems. The integrated permit allows the City to prioritize work and investment in projects to improve water quality and meet the requirements of the Clean Water Act.

Cooperation with Metropolitan Council Environmental Services (MCES)

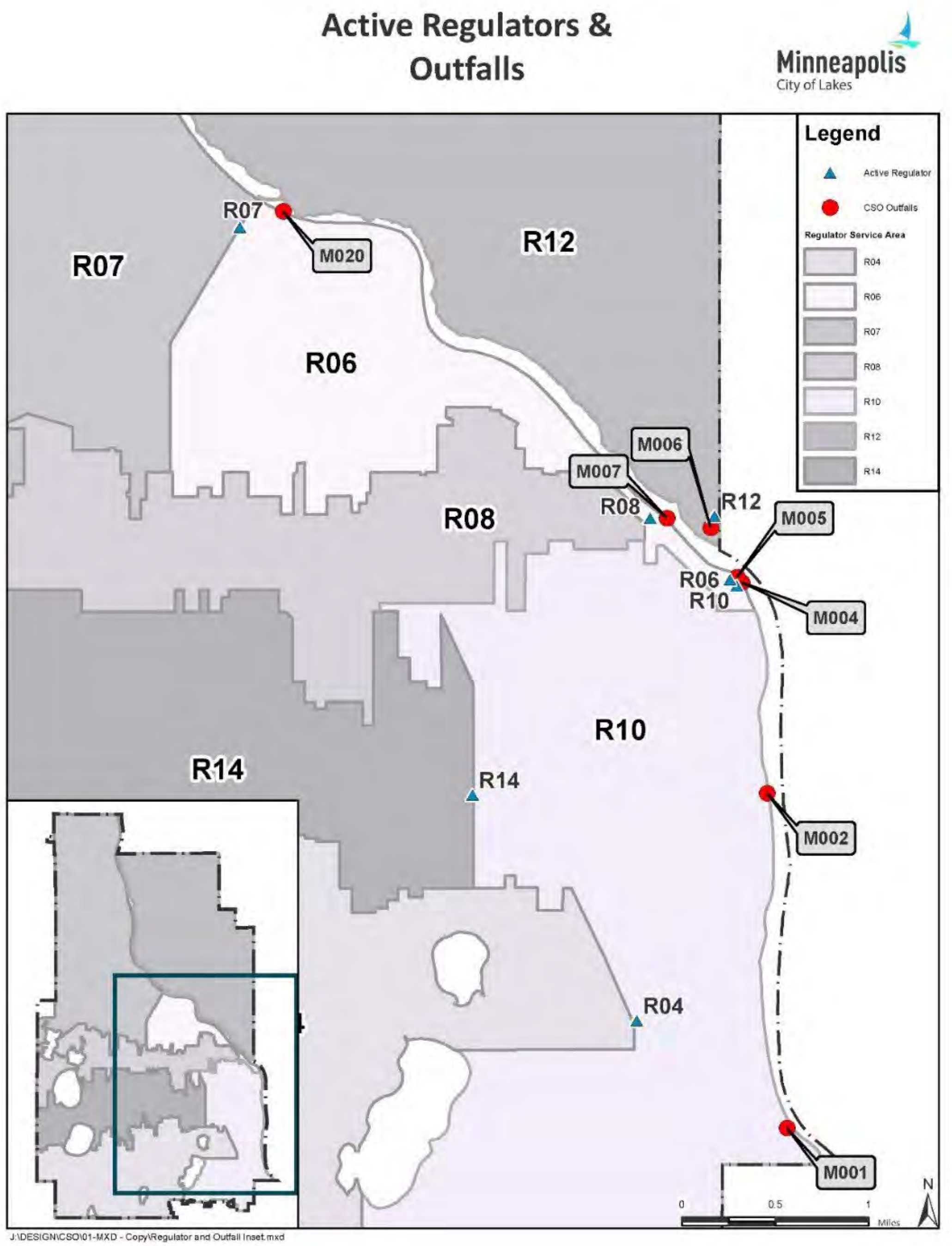
The sanitary sewer system from Minneapolis discharges to the Metropolitan Wastewater Plant, which is owned by the Metropolitan Council. Release events from the sanitary or combined sewer system can occur during periods of hydraulic overload caused by extraordinary rainfall or snowmelt events. Release events of this type occur at regulator structures owned by the Metropolitan Council. Each regulator has an associated stormwater outfall to the Mississippi River. Most of these stormwater outfalls are part of a larger storm water network owned and maintained by the City of Minneapolis. Outfalls that bypass directly from the interceptor system are owned by Metropolitan Council.

MCES and the City of Minneapolis entered into a cooperative agreement to coordinate ongoing responsibilities for release events with the termination of the joint CSO permit. The cooperative agreement was executed on March 27, 2018. It provides an inventory of regulators and outfalls and clarifies the commitments of each party to invest in, operate and maintain, and reduce Inflow & Infiltration (I & I) in each system. The following tables and map include the locations of active regulators and outfalls.

REGULATOR (Historic CSO Permit)	NAME AND LOCATION	X COORDINATE	Y COORDINATE
R04	Minnehaha Pkwy and 39th Ave S	543110.618	145799.774
R14	East 38th St and 26th Ave S	538476.110	152176.124
R10	Southwest Meters Diversion	545947.525	158095.063
R06	Northwest Meters Diversion	545745.715	158269.413
R12	East Meters Diversion	545309.317	160067.832
R08	East 26th St and Seabury Ave	543494.387	160010.412
R07	Portland Ave S and Washington Ave	531898.897	168232.605

MINNEAPOLIS NPDES OUTFALL	OUTFALL (Historic CSO Permit)	NAME AND LOCATION	X COORDINATE	Y COORDINATE
10-720	M001 (R04)	Minnehaha Tunnel	547368.436	142760.471
10-680	M002 (R14)	East 38th St	546801.334	152225.749
*	M004 (R10)	Southwest Interceptor	546085.529	158191.394
*	M005 (R06)	Northwest Interceptor	545955.556	158342.521
*	M006 (R12)	Eastside Interceptor	545208.244	159734.115
10-610	M007 (R08)	East 26th St	543969.672	160010.388
10-410	M020 (R07)	Chicago Ave S	533124.589	168689.291

**Owned by Metropolitan Council*


Active Regulators & Outfalls
Minneapolis
City of Lakes
Legend
Active Regulator
CSO Outfalls
Regulator Service Area
R04
R06
R07
R08
R10
R12
R14
R07
R12
R06
R08
R10
R14
M020
M006
M007
M005
M004
M002
M001
R07
R08
R12
R06
R10
R14
R04
0
0.5
1
Miles
N
J:\DESIGN\CSO\01-MXD - Copy\Regulator and Outfall Inset.mxd

PROGRAM OVERVIEW

Studies, Investigations and Monitoring Activities

Studies, investigations, and monitoring activities provide information about inflow and infiltration in the sanitary sewer system. These efforts are accomplished through the I & I Program and Operation & Maintenance of the sanitary sewer system. Studies include flow monitoring, smoke testing of cross connection, manhole and sewer assessments. Since 2007, 807 miles of sewer smoke testing (97.8% of the sewer system) have been completed.

Capital Improvement Projects

Inflow from the public sewer system is addressed through projects included in the City of Minneapolis Capital Improvement Program, which includes:

- Combined Sewer Overflow Program – projects to reduce inflow by separating storm drains from the sanitary sewer system
- Inflow & Infiltration Removal Program – rehabilitation and repair projects to reduce I & I
- Sanitary Tunnel & Sewer Rehab Program – projects to repair and rehabilitate sanitary sewers, lift stations, tunnels and access structures.

Since 2002, 199 storm drain separations projects have been identified for the Combined Sewer Overflow Program. Of the identified projects, 154 were completed, separating 624.8 acres of drainage from the sanitary sewer system. The Combined Sewer Overflow Program is a continuation of the 1980s program that separated 4,600 acres of drainage from the sewer system.

Inflow from the private sewer system is addressed through the Rainleader Disconnection Program. Since 2003, 7,331 of 7,560 rainleader violations have been resolved.

PREVIOUS YEAR ACTIVITIES AND ONGOING COORDINATION EFFORTS

Release Events from the Sanitary or Combined Sewer System

MCES continues to monitor overflow duration and volume at each of the regulators. In 2020, there were zero reported releases to the Mississippi River from the monitored regulators.

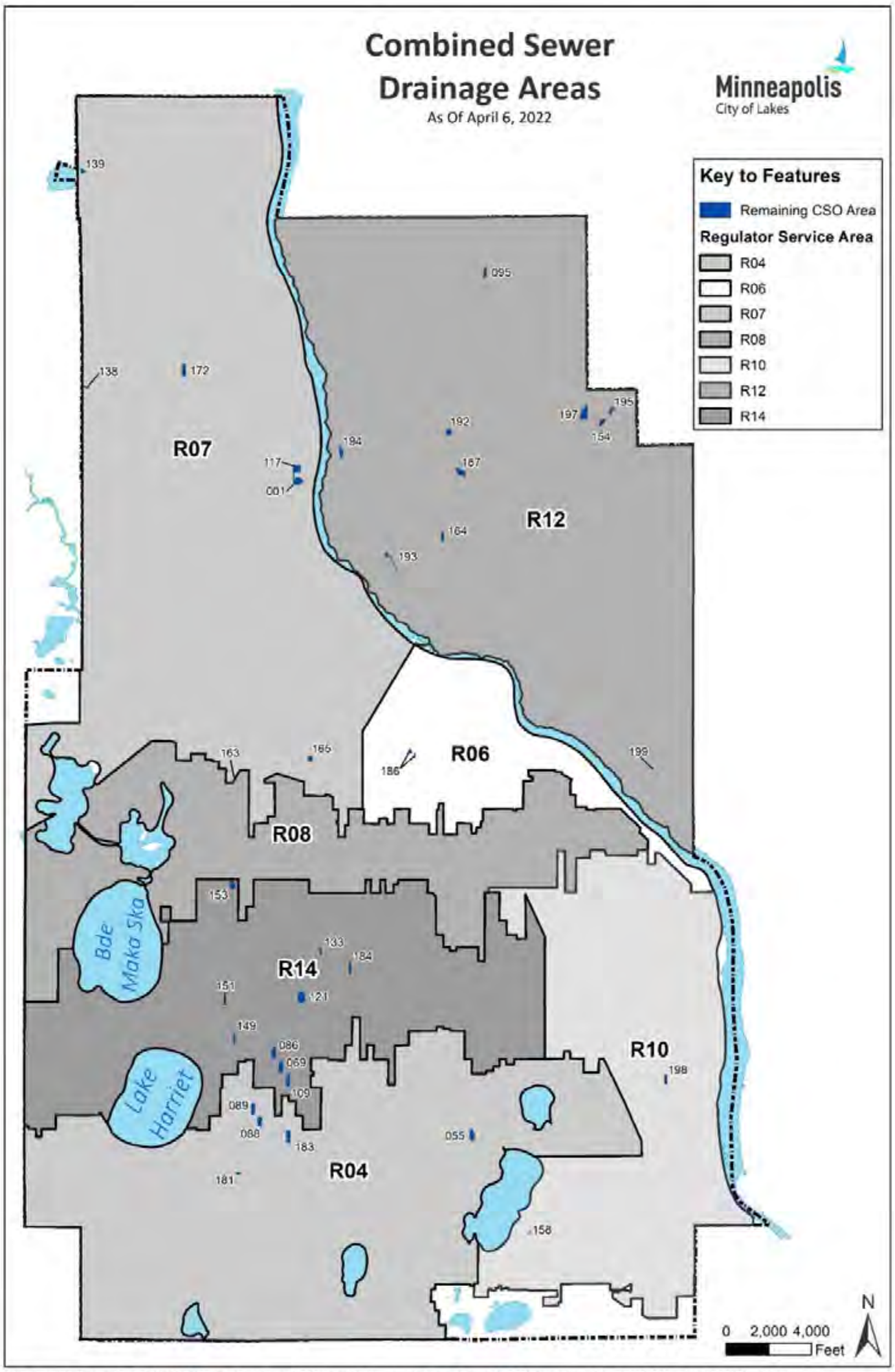
Studies, Investigations and Monitoring Activities

In 2021, Minneapolis continued to invest in studies, investigations, and monitoring activities aimed at identifying sources of inflow and infiltration. These efforts included the following:

- Flow Monitoring: 51 sanitary sewers and 5 rain gages were monitored in 2021. Sewer metering data was reviewed for rainfall dependent inflow and infiltration.
- Smoke Testing: 53.1 miles of sanitary sewer were smoke tested in 2021.
- Suspected Cross Connection Investigations: 3 investigations were completed in 2021. These include suspected connections identified from record drawings, GIS work and routine maintenance of the sewer system.
- Sewer Condition assessments: Televising and NASSCO condition assessments were completed on 25.5 miles of sanitary sewer.

Identified Inflow to the Sanitary Sewer System

An inventory of the drainage areas and sewersheds of the remaining 34 combined sewer areas is provided in the following map and table.



CSO AREA ID	SEWER SHED	AREA [acres]	LOCATION
1	R07	2.77	22nd Ave N & 2nd St N
55	R04	2.45	Alley west of Cedar Ave & south of 47th St E
69	R14	2.29	Alley west of Pillsbury Ave & north of 43rd St W
86	R14	2.49	Alley east of Grand Ave & north of 42nd St W
88	R04	2.14	Alley west of Harriet Ave & south of 46th St W
89	R04	2.23	Alley west of Garfield Ave & north of 46th St W
95	R12	1.50	Alley north of 33rd Av NE & east of Tyler St NE
109	R14	2.17	Alley east of Pillsbury Ave & south of 43rd St W
117	R07	3.30	2nd St N & 23rd Ave N
121	R14	3.43	Alley north of W 38th St & east of Blaisdell Ave S
133	R14	0.76	Stevens Ave S & 35th St E
138	R07	0.47	Xerxes Ave N & Lowry Ave N
139	R07	0.76	Washburn Ave N & Osseo Rd
149	R14	1.25	Bryant Ave S & 40th St W
151	R14	0.30	38th St W & Dupont Ave S
153	R14	2.00	Alley south of 29th St W, east of Colfax Ave S
154	R12	1.51	Coolidge St NE & 19th Ave NE
158	R10	0.21	24th Ave S & 54½ St E
163	R08	0.23	Hennepin Ave & Franklin Ave W
164	R12	1.35	Alley south of Spring St NE east of Madison St NE
165	R07	1.23	South of I-94 & 1st Ave S
172	R07	2.32	33rd Ave N & Irving Ave N
181	R04	0.51	50th St W & Aldrich Ave S
183	R04	2.66	Alley south of 47th St W, west of Wentworth Ave S
184	R14	1.47	4th Ave S & 36th St E
186	R06	1.13	17th St E & 11th Ave S
187	R12	2.69	14th Ave NE & Van Buren St NE
191	R10	0.40	51st St E and 40th Ave S
192	R12	1.67	Monroe St NE & 19th Ave NE
193	R12	1.41	Main St NE & 4th Ave NE
194	R12	1.72	Marshall St NE & 16th Ave NE
195	R12	1.11	Coolidge St NE & 22nd Ave NE
197	R12	4.11	Stinson BLVD & 22nd Ave NE

198	R10	1.6	4300 block of 42nd Av S
199	R12	0.18	Arthur Ave SE & Franklin Ave SE

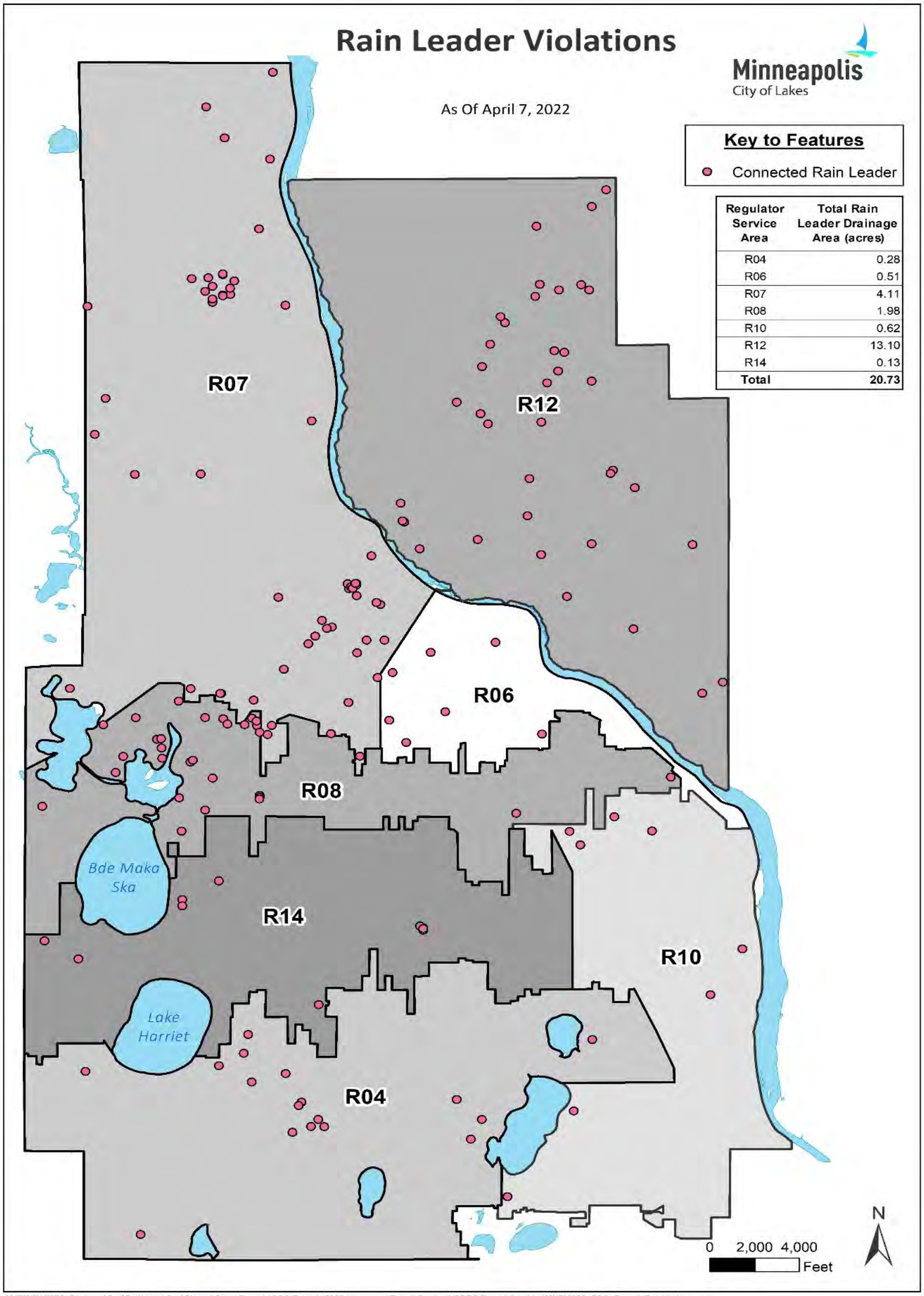
Combined Sewer Overflow / I & I Reduction Projects

1 storm drain separation projects was completed in 2021, eliminating 0.40 acres of direct drainage.

PROJECT NAME	PROJECT LOCATION	DRAINAGE AREA [acres]
CSO 191	E 51st St & 40th Ave S	0.40
	Total:	**0.40**

Rainleader Disconnection Program

Inflow from private property through roof drains, area drains, sump pumps, and open standpipes are tracked by parcel. The following map and table summarize parcels with open rainleader violations by sewershed. In 2021, 21 rainleaders were disconnected.



M:\PWSWS\ES_Directory\Grp2PatWrase\Grp2Shared\SewerReports\CSO Reports\2022 Intergrated Permit Section NPDES Report\Graphics\MXD\2022_CSO_Report_Rainleaders.mxd

Combined Sewer Drainage Area Percentage

The drainage areas for the storm drain connections to sanitary sewer system and total sewershed areas are compared in the table below. The comparison shows these areas are a small fraction of the tributary areas to each regulator and associated outfall.

OUTFALL NUMBER	REGULATOR NUMBER	TOTAL SEWER SHED AREA [acres]	COMBINED SEWER DRAINAGE AREA [acres]	PERCENT COMBINED SEWER AREA [%]
1	R04	5,881.04	10.27	.17
2	R14	3,973.96	16.29	0.41
4	R10	4,239.58	2.43	0.06
5	R06	1,459.49	1.64	0.11
6	R12	8,322.38	30.35	0.36
7	R08	3,019.47	2.21	0.07
20	R07	8,571.93	14.96	0.17
	Total	**35,467.85**	**78.15**	**1.35**

Sanitary Tunnel & Sewer Rehabilitation Program

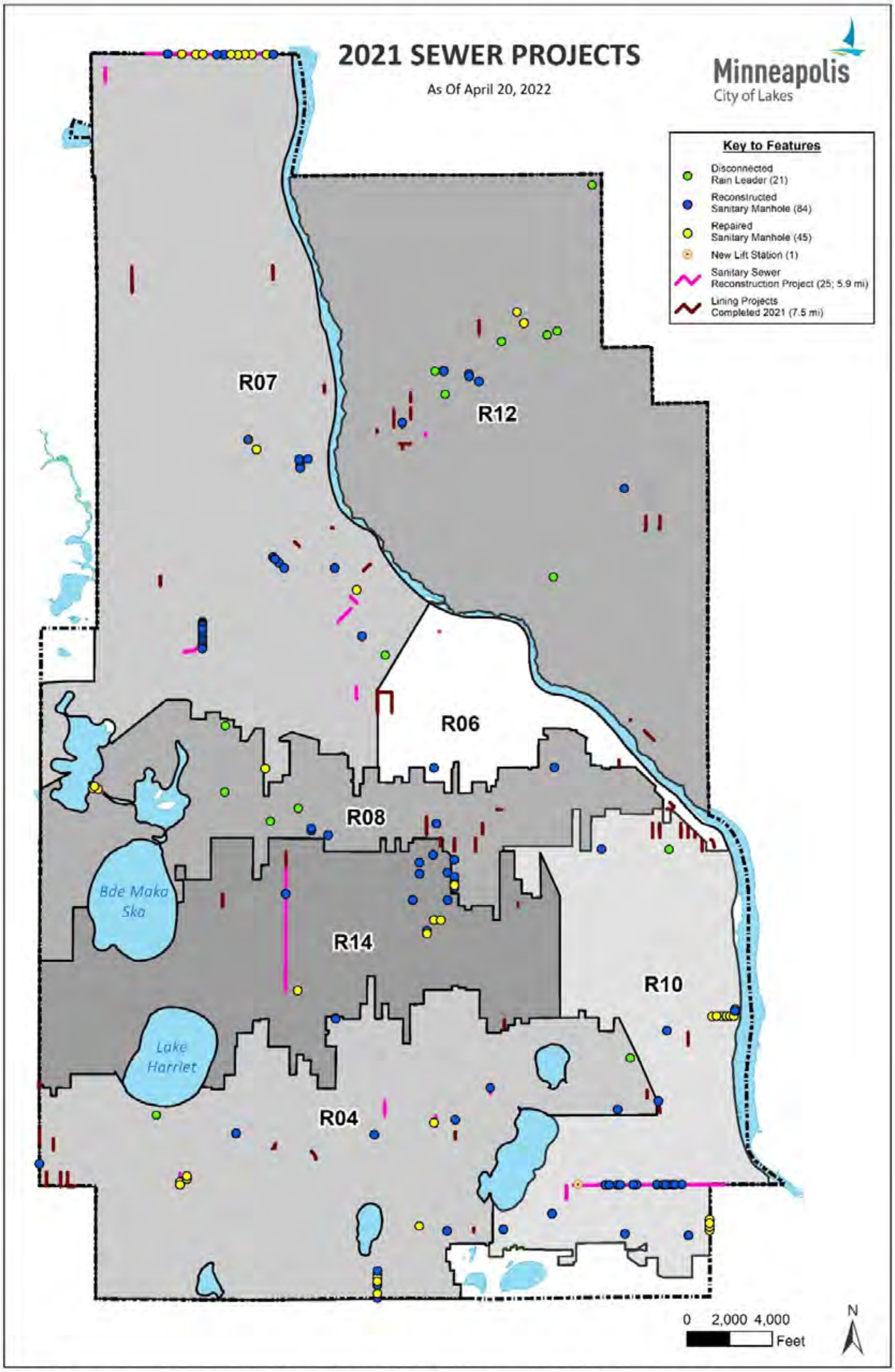
Sewer condition assessment data is used to develop this program. Repairs are prioritized based on structural and maintenance scores, paired with the likelihood and consequence of failure of each sewer. This condition assessment also determines if a sewer should be lined or reconstructed. Reconstruction is needed when sewers have collapsed or are deformed.

- Sewer Lining: Cured-In-Place-Pipe lining (CIPP) is a process to rehabilitate existing sewer pipes, due to age, cracks or leaks. Sewers are lined by inserting a fiberglass sock that is inverted and cured to an outer pipe with steam. In 2021, 7.5 miles of sanitary sewer were lined.
- Sewer Reconstruction: Full replacement of a sewer through an open excavation or tunneling for mainline is utilized when that sewer can no longer be rehabilitated. In 2021, 25 sewer construction projects were completed, replacing 5.6 miles of sewer and 131 manholes.
- Manhole Repairs: Includes a range of repairs from mortar work to partial or full reconstruction of manholes. In 2021, 129 repairs to sanitary manholes were completed.

Summary of Annual Expenditures for Program Activities

Sanitary Rehab Projects – Repair and Replacement	$16,790,527
CIPP Lining Projects	$3,077,168
Sewer Separation Projects *	$0
Rainleader Disconnect Work	$111,000
Flow Metering	$589,055
Smoke Testing	$339,023
Other I & I Studies	$100,659
Total	**$21,007,432**

**Sewer separation project included in repairs total*


2021 SEWER PROJECTS
As Of April 20, 2022
Minneapolis
City of Lakes
Key to Features
Disconnected Rain Leader (21)
Reconstructed Sanitary Manhole (84)
Repaired Sanitary Manhole (45)
New Lift Station (1)
Sanitary Sewer Reconstruction Project (25; 5.9 mi)
Lining Projects Completed 2021 (7.5 mi)
R07
R12
R06
R08
R14
R10
R04
Bde Maka Ska
Lake Harriet
0 2,000 4,000
Feet
N

Collaboration with External Partners

MCES and the City of Minneapolis share a commitment to minimize the risk of overflows. A 5-year joint study of the regional wastewater system within Minneapolis was initiated in 2018. The purpose of the study, which is being led by MCES, is to develop a work plan to address hydraulic capacity and provide for continued system reliability and reduced risk of system overflow. The goals of the study include:

- Identify areas within Minneapolis with high rates of I & I
- Identify areas of the MCES system with highest risk of sanitary sewer overflow
- Identify areas where hydraulic capacity is limited in the MCES system
- Identify projects that could lower risks of sewer overflow and increase needed capacity, including consideration of regulator closures
- Reduce I & I contributions to wastewater flows to recover interceptor capacity
- Maximize conveyance and storage capacity in the existing interceptor system
- Identify areas of the City where insufficient storm sewer capacity affects MCES system capacity and reliability
- Develop feasible alternatives to reduce risk of sewer overflows, including evaluation of cost-effectiveness, for capital projects that address the hydraulic capacity, risk of sewer overflow, and sources of I & I identified in the study

Minneapolis also participates in the Metropolitan Councils I & I Surcharge Program. The Surcharge Program is aimed at reducing peak flows from I & I that would require the MCES to construct additional capacity.

APPENDIX A

APPENDIX A1	2020 BCWMC WATER EDUCATION ACTIVITIES REPORT
APPENDIX A2	2020 SCWMC EDUCATION & PUBLIC OUTREACH PROGRAM GOALS
APPENDIX A3	WEST METRO WATERSHED ALLIANCE ANNUAL EDUCATION REPORT
APPENDIX A4	VEHICLE RELATED SPILLS SOP
APPENDIX A5	STORM DRAINAGE AREAS BY RECEIVING WATER BODY
APPENDIX A6	STORMWATER RETROFIT PLAN PROJECTS REPORT
APPENDIX A8	INTEGRATED PEST MANAGEMENT POLICY
APPENDIX A9	2019 UTILITY RATE RESOLUTION
APPENDIX A10	STORMWATER UTILITY FEE FAQ
APPENDIX A11	2021 GRIT CHAMBER REPORT
APPENDIX A12	MPRB 2021 STORMWATER MONITORING RESULTS & DATA ANALYSIS
APPENDIX A13	2021 FROG & TOAD REPORT

APPENDIX B

APPENDIX B1	FEMA FLOOD ZONES
APPENDIX B2	WATERSHED MANAGEMENT BOUNDARIES
APPENDIX B3	PIPESHED DRAINAGE BOUNDARIES
APPENDIX B4	DRAINAGE AREAS TO RECEIVING WATER BODIES
APPENDIX B5	PHOSPHORUS LOAD REDUCTION REQUIREMENTS
APPENDIX B6	DRAINAGE AREAS BY WATERBODY TYPE
APPENDIX B7	STORM MODELING STATUS
APPENDIX B8	FLOOD MITIGATION STUDY AREAS

APPENDIX C

2022 NPDES REPORT RESPONSE TO COMMENTS

APPENDIX D

LAKE HIAWATHA LITTER REPORT

Appendix A

Minneapolis
City of Lakes

Bassett Creek Watershed Management

March 23, 2022

Liz Stout
City of Minneapolis, City of Lakes Bldg
309 Second Ave. South
Minneapolis MN 55401

RE: 2021 Water Education Activities – Letter of Understanding

Dear Liz,

This letter is to serve as an official arrangement between the Bassett Creek Watershed Management Commission (BCWMC) and the City of Minneapolis. The City of Minneapolis provides financial contributions to the BCWMC through an annual assessment based on area within the watershed and tax valuation of property in the watershed. In 2021 this assessment was $37,983. Further, watershed commissioners representing Minneapolis participate in, guide, and help implement the programs of the BWCMC, including its public education program. In 2021, approximately 6% of BCWMC budget was spent on education activities.

Education-related activities of the BCWMC are guided by its 2015 Watershed Management Plan, specifically its education and outreach policies (Section 4.2.9), and its overall Education and Outreach Plan found in Appendix B. http://www.bassettcreekwmo.org/document/wmp-plans. The specific activities of the BCWMC public outreach and education program are set annually by the Commission after recommendations are forwarded by the BCWMC Education and Outreach Committee.

As in 2020, education and outreach activities in 2021 were impacted by the COVID-19 pandemic which significantly reduced the number and size of in-person educational events. The BCWMC supported virtual and online education, continued with some traditional activities such as writing educational columns and social media posts, and continued producing a series of educational videos for You Tube. The BCWMC contracted with Dawn Pape, (DBA Lawn Chair Gardener) through November 2021 as an educational consultant who created much of the Commission's educational content. Activities and partnerships in 2021 included:

Bassett Creek Coloring Book – In late 2020 a local artist, Erika Fine, created a Bassett Creek coloring book with water-related scenes throughout the watershed and interesting facts and points of interest. Copies of the coloring book are available for events. In 2021, the cities of Plymouth and Robbinsdale requested multiple copies for local events. The coloring book is also available online.

Kayaking Bassett Creek in the News – In May 2021, Golden Valley Mayor Shep Harris and I provided an on-camera interview that aired on WCCO's "Finding Minnesota" segment during the local nightly news. The segment included some information about the creek and how residents can help improve and protect water quality. It also spurred interest in paddling the creek. BCWMC worked with Golden Valley staff and local paddlers to begin producing an interactive paddling map that will be available later in 2022.

BCWMC Bicycling Tour – In September 2021, the BCWMC held a biking tour of past, present, and future CIP projects in Minneapolis and Golden Valley. Approximately 15 commissioners, alternate commissioners, Commission staff, city staff, and MPRB staff attended the event to learn about these projects and to enjoy some in-person conversation at Utepils Brewery following the tour.

SEA School Walk for Water Event – In October 2021, Alternate Commissioners McDonald Black and Holter volunteered at this event where dozens of school families gathered to learn about Bassett Creek and walk to the creek as part of a school fundraiser. The alternate commissioners also tabled at the event, providing education materials and information to families.

BCWMC Website - The BCWMC maintained its new user-friendly website in 2021 and maintained the information including latest news, contact list, meeting calendar, meeting materials, watershed plan, data, and projects. In 2021, there were approximately 8,300 unique users and 11,600 sessions, up about 15% from 2020.

West Metro Water Alliance (WMWA) Membership – The BCWMC continued its participation in WMWA along with several watershed management and other water-related organizations in the west Metro area. Through WMWA, these organizations collaborated on educational campaigns including the Watershed PREP program aimed at educating 4th grade students about water resources and the impacts of stormwater. Watershed PREP has three individual lessons meeting State education standards. **Lesson 1***, What is a Watershed and Why do We Care?* provides an overview of the watershed concept and is specific to each school's watershed. It describes threats to the watershed. **Lesson 2,** *Water Cycle - More than 2-dimensional,* describes the movement and status of water as it travels through the water cycle. **Lesson 3,** *Stormwater Walk,* investigates movement of surface water on school grounds.

Due to the COVID-19 pandemic in 2021, schools were forced to provide instruction through online platforms during much of the year, significantly hampering WMWA's ability to deliver the Watershed PREP curriculum. In addition, the primary educator contracted by WMWA resigned in late 2020. A new educator was hired in November 2021 and has multiple classroom visits scheduled for spring 2022.

A video of the Watershed PREP class was produced and distributed to schools for their use in the fall 2020. Since then, it's been viewed 225 times, although there is no analytic information on viewership. https://youtu.be/bq4zKMfc-pQ.

In 2021 WMWA began development of three new educational flyers to address MS4 permit education needs on the topics of Pet Waste, Water Softener Chlorides, and Deicer Chlorides. These flyers will be completed in 2022 and provided to member cities for distribution and addition to website/social media.

Metro WaterShed Partners Membership —The BCWMC participated as a member of the Metro WaterShed Partners as a general supporter of the program and a financial supporter of the Metro Clean Water Minnesota Media Campaign. Metro Watershed Partners maintains a listserve and a website as forums for information sharing, holds monthly meetings for members to collaborate, and coordinates the Adopt-a-Drain program. In 2021, the Clean Water Minnesota Media Campaign provided its members with regular, seasonally appropriate stories about metro area residents taking action at home and in their lives to keep water clean. These professionally produced stories and photos are used by partners across a variety of media platforms. The BCWMC occasionally used these stories in social media and its website homepage. Find more information at www.cleanwatermn.org.

Chloride Education – The BCWMC continued its focus on education surrounding chloride and over salting in 2021 including working with other partners in the Metro area who are concerned about over salting.

The BCWMC started coordinating the Hennepin County Chloride Initiative (see below for HCCI purpose and membership) early in the year (taking over for RPBCWD who previously coordinated). In that role, the Commission spearheaded a project which developed an RFP and hired a marketing firm to develop a program that will engage, educate, and support citizen boards of condo and townhome associations and faith-based organizations in reducing the amount of winter deicing salt used on their properties. Implementation of the program should result in a shift in client demand toward a reduction in deicing salts, and the use of best practices by contracted winter maintenance crews for targeted properties. That project is currently underway and will be completed later this year.

HCCI: *The Hennepin County Chloride Initiative (HCCI) is a collaborative of all eleven watershed organizations in Hennepin County, the County, the Minnesota Pollution Control Agency, and many cities from across the county. HCCI's goal is to reduce the amount of chloride entering our waterways from the overuse of winter deicing materials. While each of the HCCI members work in their own jurisdictions on this issue, the HCCI project uses Clean Water Funds through a state grant to collectively address this issue by pooling ideas and resources and promoting common messages and strategies, with an emphasis on private property owners and managers, from large retail centers to small properties or residences.*

Additionally, the Sun Sailor local newspaper ran our article on pet safe deicers in February. https://www.hometownsource.com/stillwater_gazette/opinion/columnists/column-which-deicer-is-safest-for-pets/article_f7f4d5f6-77a5-11eb-bb42-f3aaeacf62a5.html And, in March, we developed and posted the educational video "Time to Sweep the Salt" https://www.youtube.com/watch?v=o45uHzw8oSI. On YouTube the video has over 100 views which doesn't include views through Facebook.

The BCWMC was an official sponsor of the Annual Salt Symposium and actively recruited participants and helped to market the event to commissioners, member cities, partners, and the general public.

Finally, BCWMC continued to provide smart salting education materials at events through partners. We mailed over 120 smart salting flyers to residents requesting them.

Partnership with Metro Blooms for Harrison Neighborhood Project – Since 2016, the BCWMC has partnered with and supported the Metro Blooms on outreach, engagement, and project installation in Near North neighborhoods in Minneapolis. The projects aim to engage residents and commercial businesses, train youth, and install water quality practices in Minneapolis' Near North neighborhoods. The BCWMC collaborates on grant-funded projects and offers its own financial support. These programs have resulted in engagement with and bioswale installations on dozens of residential properties; participation by neighborhood residents at multiple community block parties; engagement with more than 14 commercial/institutional property owners with 6 completed projects, and 20 landcare stewards trained. In 2021, the BCWMC continued a partnership with Metro Blooms on a Lawns to Legumes "Northside Pollinator Project." In 2021, 17 native plantings covering 1,275 square feet in Northside Minneapolis were installed through this project.

Volunteer Monitoring Programs – The BCWMC entered an agreement with the Metropolitan Council to participate in the Citizen Assisted Monitoring Program (CAMP). In 2021, volunteers collected data from 10 locations on 8 lakes in the watershed.

Educational Guest Columns in Local Papers – The BCWMC education consultant, on the Commission's behalf, submitted multiple articles related to water resources to the Sun Post local newspaper. Many articles were published in the online newspaper and some appeared in print in the Post and/or the Sun Sailor.

February: Which deicer is safest for our pets
April: Bee Kind – Pollinator Friendly Yards
May: What Is Your Eco-Yard IQ?
June: No One Can Do Everything. But Everyone Can Do Something to Reduce Climate Impacts

July: Golden Valley residents unite to make a difference: rain garden offers pollution and drainage solutions
September: Children's Water Festival
November: Honoring Native American Indian Heritage in our Watershed

Educational Videos – BCWMC YouTube Channel - In 2021, BCWMC continued creating and posting videos to its YouTube channel and began the "Making Connections" series with five videos produced in 2021. On You Tube, these videos have been viewed 114 times (not including views from social media). See them all at: https://www.youtube.com/channel/UCKrsWkEW8Dl5FZbl93Fb_hg

May: Eco Yard
June: Flooding, Water Quality, Climate Change
July: Golden Valley Neighbors Build Large Rain Garden
August: Don't Dump Your Bait
October: Leave the Leaves

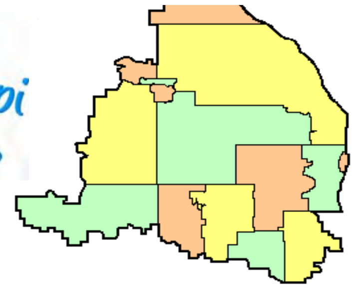
Social Media – The BCWMC continued with weekly posts on its Facebook page. The BCWMC made 82 Facebook and Instagram posts reaching 16,651 people and had 1,562 engagements.

Due to the City of Minneapolis's financial contributions and close involvement and participation with the BCWMC's activities, the BCWMC's education activities can and should be considered part of the city's implementation of Minimal Control Measures (MCM) 1 and 2 in the MS4 stormwater permit. Please let me know if you have any questions or require further information.

Sincerely,
Laura Jester
Laura Jester, Administrator

Shingle Creek Watershed Management Commission

West Mississippi Watershed Management Commission



3235 Fernbrook Lane N • Plymouth, MN 55447
Tel: 763.553.1144 • Fax: 763.553.9326
Email: judie@jass.biz • Website: www.shinglecreek.org

National Pollutant Discharge Elimination System (NPDES) Phase II
Education and Public Outreach Program
2021 Annual Report

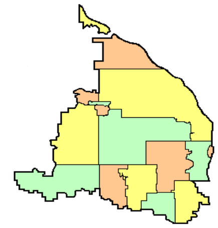
The Shingle Creek and West Mississippi Watershed Management Commissions conducted education and public outreach activities in 2021 in fulfillment of their Third Generation Watershed Management Plan Watershed Education and Public Outreach Program goals. However, due to the COVID-19 pandemic, many of these activities were modified to meet in-person guidelines, conducted virtually, or curtailed altogether.

EDUCATION AND PUBLIC OUTREACH PROGRAM GOALS

1. All members of the community become knowledgeable about the water resources in the watersheds and take positive action to protect and improve them.
2. All members of the community have a general understanding of watersheds and water resources and the organizations that manage them.
3. All members of the community have a general understanding of the Impaired Waters in the watersheds and take positive actions to implement TMDL requirements.

The Commissions identified the following general education and outreach strategies in the Third Generation Watershed Management Plan. More detailed educational goals by stakeholder groups may be found in Appendix E of that Plan.

- Maintain an active Education and Outreach Committee (EPOC) with representatives from all member cities to advise the Commissions and to assist in program development and implementation
- Participate in the West Metro Water Alliance (WMWA) to promote interagency cooperation and collaboration, pool resources to undertake activities in a cost-effective manner, and promote consistency of messages
- Use the Commissions', member cities', and educational partners' websites and newsletters, and local newspapers and cable TV to share useful information to stakeholders on ways to improve water quality
- Prominently display the Commissions' logos on information and outreach items, project and interpretive signs, and other locations to increase visibility
- Provide opportunities for the public to learn about and participate in water quality activities
- Provide cost-share funding to assist in the installation of small BMPs and demonstration projects
- Educate elected and appointed officials and other decision-makers
- Enhance education opportunities for youth
- Each year review and modify or develop and prioritize education and outreach activities and strategies for the coming two years



PROGRAM: WATERSHED PREP (PROTECTION, RESTORATION, EDUCATION, AND PREVENTION)

Audience: Fourth grade students, educators, families, the general public

Program Goals:

a. Engage elementary students in hands-on learning about the water cycle and how the built environment influences stormwater runoff and downstream water quality.
b. Provide general watershed and water quality education to citizens, lake associations, other civic organizations, youth groups, etc.

Educational Goals:

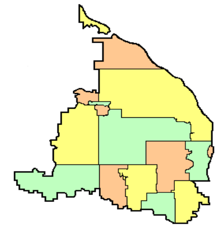
a. Have a general understanding of watersheds, water resources and the organizations that manage them.
b. Understand the connection between actions and water quality and water quantity.

Specific Activities to Reach Goals:
Watershed PREP is a program of the West Metro Water Alliance (WMWA), a consortium of four WMOs including the Shingle Creek and West Mississippi WMOs, and stands for **P**rotection, **R**estoration, **E**ducation, and **P**revention. 2021 was the eighth year of the program. Individuals with science education backgrounds serve as contract educators to be shared between the member WMOs. The focus of the program is two-fold - to present water resource-based classes to fourth grade students and to provide education and outreach to citizens, lake associations, civic organizations, youth groups, etc.

Table 1. Watershed PREP Program participation.

Year	# Classrooms	# Students	# and Type of Schools
Lesson 1			
2013	63	1,679	13 in six districts; one charter school; one parochial school
2014	116	3,469	30 in seven districts; one magnet school; one parochial school
2015	122	3,183	36 in nine districts; two charter schools; five parochial schools
2016	107	2,850	29 in seven districts, one charter school, 5 parochial schools
2017	121	3,249	12 in seven districts, one charter school, one parochial school
2018	143	3,593	32 in seven districts, one charter school, 2 parochial schools
2019	103	2,681	27 in six districts, two magnet schools; one parochial school
2020*	20	572	6 in four districts, two magnet schools
2021	4	80	4 in one district
Lesson 2			
2013	14	390	Three in three districts; one charter school; one parochial school
2014	22	645	Five in three districts
2015	27	859	Six in five districts
2016	20	524	Five in three districts, one parochial school
2017	38	1,072	Seven in three districts, one parochial school
2018	69	1,755	16 in five districts, one parochial school
2019	58	1,516	16 in five districts, one magnet school
2020*	7	172	2 in two districts
2021			This lesson was not taught in 2021

*In 2021, Watershed PREP classes were limited by the constraints of the COVID-19 pandemic that closed schools. In some cases, Watershed PREP classes were conducted virtually.



Fourth Grade Program. Three individual classes meeting State of Minnesota education standards have been developed. **Lesson 1*, What is a Watershed and Why do we care?,*** provides an overview of the watershed concept and is specific to each school's watershed. It describes threats to the watershed. **Lesson 2, *The Incredible Journey,*** describes the movement and status of water as it travels through the water cycle. **Lesson 3, *Stormwater Walk,*** investigates movement of surface water on school grounds.

Table 2. 2021 schools and students participating in Lesson 1: What is a Watershed?

Date	School	School District	City	Watershed	Classes	Students
10/26	Rice Lake	Osseo	Maple Grove	Elm	4	80

Table 3. 2021 schools and students participating in Lesson 2: The Incredible Journey

Date	School	School District		Watershed	Classes	Students
					0	**0**

One of the WMWA educators, has converted classroom Lesson #1 into a virtual, on-line learning experience. The lesson is posted to the WMWA website and to YouTube where it is available to educators, students, and the general public. She also sent out a link to the video to the teachers that she and the other educators have worked with in the classroom. The video can be viewed at westmetrowateralliance.org/. The video has had 222 views as of December 31, 2021.

The ultimate goal is to make this program available to all fourth graders in the four WMWA watersheds (Shingle Creek, West Mississippi, Bassett Creek, and Elm Creek), and to other schools as contracted. The program is offered to public, private, parochial, magnet and charter schools.

Community Education and Outreach. The PREP educators provide outreach at community and school events. Because of the nature of these events, it is usually difficult to keep a tally of the number of contacts made and citizens engaged. Scheduled events were cancelled in 2021.

Evaluation:
The educators evaluate the success of the Fourth Grade Program by surveying students and teachers about the quality of the program, the learning that was observed, and the performance of the educators. Much of the feedback occurs during and right after the presentations in spontaneous comments.

PROGRAM: DISTRIBUTE EDUCATIONAL MATERIALS

Audience: Multiple
Program Goals:

a. Inform various stakeholders about the watershed organizations and their programs.
b. Provide useful information to a variety of stakeholders on priority topics.
c. Engage stakeholders and encourage positive, water-friendly behaviors.

Educational Goals:

a. Property owners maintain properties and best management practices (BMPs) to protect water resources.
b. Property owners adopt practices that protect water resources.
c. Stakeholders support and engage in protection and restoration efforts.

NPDES Phase II
Education and Public Outreach
2021 Annual Report

Specific Activities to Reach Goals:

Maintain Your Property the Watershed Friendly Way

This handbook is targeted to small businesses, multi-family housing properties, and common ownership communities such as homeowners' associations. It contains tips for specifying and hiring turf and snow maintenance contractors and includes checklists for BMP inspections. Electronic copies have been provided to Shingle Creek and West Mississippi cities for their use and to be displayed on their websites. The handbook also appears on the WMWA website. Print copies are available for distribution.

10 Things You Can Do

In 2019 the Commissions partnered with WMWA to revise and refresh the popular brochure *10 Things You Can Do to protect Minnesota's lakes, rivers, and streams.* New emphasis was placed on salting sparingly and on conserving water.

Roots Displays

In 2020 WMWA partnered with other groups to design and commission fabrication of a new, lighter-weight version of a popular interactive display highlighting native plants, comparing their long roots to the shorter-rooted turf grasses. The new displays have been completed and delivered to the various groups that joined in on WMWA's order.

Press Releases and Newspaper Articles

Northwest Community Television currently provides services as CCX Media. CCX Media provides a Connected Community Experience for the northwest Hennepin County suburbs, offering daily televised news, and coverage of city council meetings, local events, and high school sports. CCX News aired televised coverage of the following stories:

- Grants awarded for upcoming stream stabilization projects in Shingle and Bass Creeks (CCX)
- Alum treatment on Crystal Lake (CCX)
- Carp removals on Crystal Lake (CCX) (Sun Post)
- Invasive carp removal is a thing and the video is really cool | kare11.com
- A Partnership Grant helped fund improvements to the Crescent Cove play space (Sun Post)

Fliers

WMWA worked with the cities in the four watersheds to create or update informational fliers on three topics that are the focus of education and outreach in the 2021 General Stormwater Permit: pet waste and chloride management, and proper use and maintenance of water softeners.

Web Site

The Commissions maintained a joint web site, shinglecreek.org, which includes information about the watersheds, the Commissions, and the water resources in the watersheds. In 2021, the website had 2,509unique visitors for a total of 5,916 page views. The most common landing page was the home page, followed by the Commission and TAC meeting materials pages and the project review pages.

While the website is used mainly to access meeting and application materials, it is a good forum for sharing specific project information and gets decent traffic on other more general interest pages.

<u>Social Media</u>
The Commission established a Facebook page in 2016. In 2021 the Facebook page had 253 followers.

Evaluation:
Evaluation measures are as noted above: number of brochures and handbooks distributed; number of website hits; social media engagement. The new website uses Google Analytics to better track page views and unique visitors.

Program: Public Outreach

Audience: Residents, youth

Program Goals:

a. Provide opportunities for people of all ages to participate in hands-on activities to protect and improve waters.
b. Provide opportunities for people to learn about ways they can protect and improve waters.

Educational Goals:

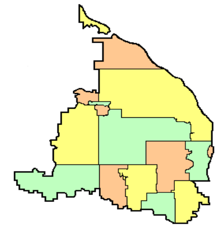
a. Maintain their properties and best management practices (BMPs) to protect water resources.
b. Adopt practices that protect water resources.
c. Support and engage in protection and restoration efforts.
d. Participate in volunteer activities.

Specific Activities to Reach Goals:
The *Pledge to Plant Campaign* was developed by Metro Blooms/Blue Thumb to encourage residents to replace impervious surface and turf grass with native plantings to benefit clean water by reducing stormwater runoff. The project includes the additional benefit of creating habitat for pollinators. In past years, the project was promoted in the Blue Thumb space at the State Fair where the public voted to name the campaign, *Pledge to Plant for Clean Water and Pollinators.*

Phase two of the project included a roll out of the Pledge campaign on the Metro Blooms and WMWA websites where citizens entered the square footage of their new plantings, creation of a *Pledge to Plant* banner to be displayed at events, and a social media campaign that began in 2016. In 2021, COVID-19 limited in-person engagement, cancelling most area events.

At year-end 2018, over 630 people had submitted the Pledge online covering over 417 acres. The total includes a handful of larger prairie restoration projects; the median pledge covers 250 square feet. Most of the Pledges came from the metro area, but Pledges have been received from more than 20 states. The *Pledge to Plant* campaign was also promoted during the Watershed PREP classes. Pledges were not tallied in 2019-2021.

<u>Rain Garden Workshops</u>
The Commissions partnered with WMWA to sponsor workshops through Metro Blooms. Metro Blooms is a non-profit organization whose mission is to promote and celebrate gardening, to beautify our communities and help heal and protect our environment.



Since the pandemic precluded holding in-person workshops, a new Blue Thumb training program was implemented to teach participants skills in inspecting and caring for raingardens and other green infrastructure, all within a framework of eco-friendly landscaping practices. People who take part in the three-session program receive a Sustainable Landcare Certificate. Participants in the program first receive Stormwater Basics, learning about watersheds and how water travels in our urban environment. They also learn how raingardens are built, how they work, and how to inspect them to ensure that they function properly. An important part of the program is identifying weeds, a major culprit of dysfunctional raingardens, and then choosing a way to manage them (without chemicals, if possible).

Hennepin County Chloride Initiative (HCCI)

The eleven WMOs in Hennepin County elected to set aside 10 percent ($101,800) of the BWSR Watershed-Based Funding from the 2018 Pilot Program specifically for joint, countywide chloride reduction initiatives. The HCCI is comprised of one representative designated by each WMO. Ben Scharenbroich from the City of Plymouth represents Shingle Creek and Andrew Hogg from the City of Brooklyn Center represents West Mississippi.

The HCCI has been primarily engaged in better understanding barriers to chloride reduction BMPs and assessing training needs. The group has been partnering with the Minnesota Pollution Control Agency (MPCA) on one of the identified training needs – outreach and training opportunities for property managers. A training workshop has been developed and an accompanying handbook has been made available on the MPCA's website at: https://www.pca.state.mn.us/water/salt-applicators. The handbook is intended to accompany the workshop, not replace it. The MPCA will be translating manuals and training materials into Spanish and may make other languages available if there is demand.

The HCCI also funded a demonstration project, the Parkers Lake Chloride Reduction Project, a partnership with Bassett Creek and the City of Plymouth. That project is evaluating a commercial/industrial area to identify chloride reduction BMPs to see what it would take to make a measurable reduction in chloride in runoff.

Finally, late in 2021 the HCCI engaged a marketing consultant to develop a campaign targeted toward homeowner's associations and faith-based communities. This work would develop marketing materials and strategies to persuade these groups to adopt smart salting tactics. The intent is to start with targeted groups and then build up to larger entities in a grassroots-type marketing campaign.

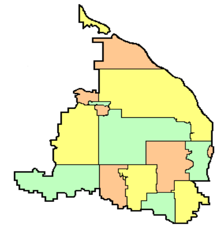
Shingle Creek Cleanup

The 21st Annual Great Shingle Creek Cleanup was scheduled to be held the week of April 18-24. Each city sponsors its own cleanup. While most cities cancelled the event in 2021, others held abbreviated versions to limit in-person contact.

Volunteer Monitoring

The Commissions provide opportunities for high school students and adults to gain hands-on experience monitoring lakes, streams, and wetlands.

Lakes. Volunteer lake monitoring is performed through the Met Council's Citizen Assisted Lake Monitoring Program (CAMP). The Met Council provides the monitoring equipment and the laboratory work and data analysis while the Shingle Creek Commission staff recruit and train volunteers to perform sampling, collect the volunteers' water quality samples, and get them to the Met Council. Schmidt, Magda, Meadow, Eagle, and Pike lakes were monitored by volunteers in 2021.



Streams. Routine stream macroinvertebrate monitoring in both watersheds is conducted by volunteers through Hennepin County's RiverWatch program. This program was initiated in 1995 to provide hands-on environmental education for high school and college students, promote river stewardship, and obtain water quality information on the streams in Hennepin County. Hennepin County coordinates student and adult volunteers who use the RiverWatch protocols to collect physical, chemical, and biological data to help determine the health of streams in the watershed. One site on Shingle Creek was monitored as part of RiverWatch in 2021 but others were cancelled due to COVID-19.

Wetlands. Two sites in the Shingle Creek watershed and two sites in the West Mississippi watershed were monitored through the Hennepin County Environmental Services' Wetland Health Evaluation Program (WHEP). WHEP uses trained adult volunteers to monitor and assess wetland plant and animal communities in order to score monitored wetlands on an Index of Biological Integrity for macro-invertebrates and vegetation. No sites were monitored in 2021 due to COVID-19.

Evaluation:
Evaluation of these programs is based on participation.

Program: Collaborative Efforts

Audience: Multiple

Program Goals:
a. Promote interagency cooperation and collaboration, pool resources to undertake activities in a cost-effective manner, and promote consistency of messages.
b. Share information and ideas with other partners.

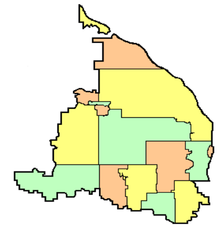
Educational Goals:
a. All people have a general understanding of watersheds, water resources and the organizations that manage them.
b. All people understand the connection between actions and water quality and water quantity.

Specific Activities to Reach Goals:

<u>WMWA</u>
The Commissions partner with the Bassett Creek WMO and the Elm Creek WMO and other interested parties as the West Metro Water Alliance (WMWA). Other participating parties have included other WMOs, Hennepin County Environment and Energy, and cities outside the four-watershed area. Each member watershed organization contributes funds to WMWA, which sponsors programs such as Watershed PREP, standardized brochures and booklets, and the *Planting for Clean Water Program.* WMWA publishes an annual report on its activities.

The very popular *10 things you can do to protect Minnesota's lakes, rivers, and streams* brochure was revised and updated in 2019 and was printed at no cost to WMWA members by the Hennepin County Department of Environment and Energy. It can also be downloaded from the WMWA website.

<u>Other Partnerships</u>
The Commissions are also members of:



- WaterShed Partners, a coalition of agencies, educational institutions, WMOs, Watershed Districts, and Soil and Water Conservation Districts that coordinate water resources education and public outreach planning in the Metro area;
- Blue Thumb, a consortium of agencies and vendors partnering to increase outreach and awareness; and
- NEMO (Nonpoint Education for Municipal Officials), a program that provides educational and skill-building programming to elected and appointed officials and community leaders to increase their knowledge of the connection of land use and management decisions to water quality and natural resources. NEMO was inactive in 2021.

Evaluation:
No specific evaluation of this programing has been completed.

Program: Continuing Education

Audience: Commissioners, Technical Advisory Committee (TAC)

Program Goals:
a. Effectively and efficiently manage the water resources in the watershed.
b. Increase awareness and knowledge of broader water resources issues and trends.

Educational Goals:
a. Commissioners and TAC understand watershed management, water quality and quantity conditions and issues in the watershed, regulatory requirements and the current standards and practices.
b. Commissioners and TAC aware of broader water management issues and trends in Minnesota and elsewhere.

Specific Activities to Reach Goals:

<u>Staff Presentations</u>
All of the Staff presentations were project-related, none were for “Commissioner education.”

<u>Guest Speakers</u>
Stephen Mastey, Landscape Architects, gave an update on the Crescent Cove Partnership Cost Share project. He and associates from his firm and the Crescent Cove Association returned later in the year to present a pictorial update on the project which is located in Brooklyn Center. The project created a play area at the Crescent Cove Children’s Hospice Facility that is mostly within the 100-year floodplain and converted the adjacent existing non-native landscape to a diverse native plant community that creates an ecologically appropriate wetland buffer.

Representatives from Metro Blooms and Boisclair Corporation provided a pictorial update of Phase I of the Brooks Gardens Partnership Cost Share project. Brooks Gardens is an affordable housing community in Brooklyn. The project consisted of installing a series of rain gardens to capture and infiltrate or treat runoff from impervious surface on site, including roofs, pavement, and a new play area.

Evaluation:

No specific evaluation of this programming has been completed.

WMWA

WEST METRO WATER ALLIANCE

2021 ANNUAL REPORT

Background

In 2006 the Shingle Creek and West Mississippi Watershed Management Commission's Education and Public Outreach Committee (EPOC) invited the Education Committee of the Bassett Creek Watershed Management Commission to partner in developing joint education and outreach activities. Since that time this voluntary partnership has grown to include the Elm Creek Watershed Management Commission, the Three Rivers Park District, Hennepin County Department of Environment and Energy, and the Freshwater Society. The WMOs are designated as "members," the latter three organizations as "partners."

This alliance, the West Metro Water Alliance (WMWA), grew from a recognition that the individual organizations have many common education and public outreach goals and messages that could be more efficiently and effectively addressed and delivered collaboratively and on a wider scale.

Meetings

WMWA meets monthly, as needed, on the second Tuesday, virtually via Zoom. Member representatives include Laura Jester, Bassett Creek WMC Administrator; Doug Baines, Commissioner, Elm Creek WMC; Nico Cantarero, Stantec, Dayton, Elm Creek WMC; Marta Roser, Robbinsdale, Shingle Creek WMC. and Ben Scharenbroich and Amy Riegel, Plymouth, Shingle Creek, Bassett Creek and Elm Creek WMCs. Other attendees include Sharon Meister, Watershed PREP Educator; Diane Spector, Stantec/Wenck Associates, serves as technical support for WMWA, and Amy Juntunen, JASS, serves as administrative support. In 2021 eleven meetings were held. All WMWA member Commissioners and city staff are welcome to attend meetings.

The WMWA Program

Goals of the WMWA program are to:

- Inform the public about the watershed organizations and their programs.
- Provide useful information to the public on priority topics.
- Engage the public and encourage positive, water-friendly behaviors.
- Help member cities meet MS4 permit requirements regarding education.

Three informational pieces have been developed by WMWA to support these goals. The *10 Things You Can Do* Brochure targets the general public. The brochure is distributed at all venues where the Commissions or member cities have a presence and also in the Watershed PREP classrooms. It is also available on the websites of the WMO member cities. In 2019 the *10 Things* brochure was updated and reprinted in partnership with Hennepin County.

The *Maintain Your Property the Watershed Friendly Way* handbook targets small businesses, multi-family housing properties, and common interest communities such as homeowners' associations. It contains tips for specifying and hiring turf and snow maintenance contractors, and includes checklists for BMP inspections.

The *Residential Snow and Ice Care* brochure is an educational piece designed to inform citizens of the chloride pollution problem and ways to reduce salt use. The *Commercial Snow and Ice* brochure is designed to inform HOAs, property managers and commercial applicators of the chloride pollution problem and ways to reduce salt use.

In 2021 WMWA began development of three new flyers to address MS4 permit education needs on the topics of Pet Waste, Water Softener Chlorides, and Deicer Chlorides. These flyers will be completed in 2022 and provided to member cities for distribution and addition to website/social media.

Watershed PREP and Community Events

Watershed PREP is a program of WMWA and stands for Protection, Restoration, Education, and Prevention. 2021was the ninth year of the program. Two contract educators with science education backgrounds are shared between the member watersheds. The focus of the program is two-fold - to present water resource-based classes to fourth grade students and to provide education and outreach to citizens, lake associations, other civic organizations, youth groups, etc. Goals of the program are 1) to have audiences gain a general understanding of watersheds, water resources and the organizations that manage them, and 2) to have audiences understand the connection between actions and water quality and water quantity. The ultimate goal is to make this program available to all fourth graders in the four WMWA watersheds and to other schools as contracted.

Fourth Grade Program. Three individual lessons meeting State education standards have been developed. **Lesson 1**, *What is a Watershed and Why do We Care?,* provides an overview of the watershed concept and is specific to each school's watershed. It describes threats to the watershed. **Lesson 2,** *Water Cycle - More than 2-dimensional!,* describes the movement and status of water as it travels through the water cycle. **Lesson 3,** *Stormwater Walk,* investigates movement of surface water on school grounds.

In 2021, due to COVID, only one classroom presentation was given in the fall. More classes have been scheduled for spring 2022.

Educators created a video of the presentation in 2020 for parents and teachers to use.

Due to COVID there were no community outreach events staffed by educators in 2021.

In 2021, Educator Sharon Meister tendered her resignation. Staff analyzed the hours dedicated to the project by past Educators and created a new Professional Services Agreement. In November 2021, Jessica Sahu Teli was contracted as the new Watershed PREP Educator. Sahu Teli is a wetland scientist and educator with a B.S. in aquatic biology/limnology and is currently pursuing her Masters of Environmental Science degree.

UPDATED WORK PLAN

In 2021 the WMWA Work Plan was updated to reflect current practices. The updated Work Plan included the following major revisions:

1. Added an equity statement affirming the group’s commitment to environmental justice for all and outreach to historically underrepresented groups.
2. Revised the general educational goals for non-single family property owners and managers to focus solely on providing information and guidance on appropriate BMPs.
3. Removed educational goals for developers as cities were seen as being the most appropriate points of contact with these stakeholders.
4. Removed educational goals for training city staff, as those are the responsibility of the cities.
5. Removed educational goals for agricultural property owners and operators as Hennepin County staff have taken on that role acting as the County Soil and Water Conservation District.

6. Added a key educational goal for all the stakeholders to "understand the relationship between climate and water quality and water quantity."
7. Revised the plan to replace references to the Hennepin County website with the WMWA website.
8. Eliminated Measuring and Monitoring Public Awareness as a major task. One of WMWA's first activities was sponsoring a professional opinion poll in the four watersheds regarding knowledge and behaviors. WMWA does not expect to repeat that poll due to cost but will build measuring and evaluating into individual activities.
9. Strengthened the Communication and Information Sharing activity to incorporate the website and social media.
10. Eliminated the Develop and Coordinate Regional or Countywide Activates task. Early on WMWA had sponsored a series of workshops for broader participation but found it to be an inefficient use of time and resources. The group will focus on spreading information about existing activities sponsored by other groups.

WMWA's 2020 and 2021 budgets reflect these activities and were approved by the members on January 8, 2019 and January 14, 2020, respectively. The budgets are included in this report as *Appendix C*.

SPECIAL PROJECT

In November 2020, Minnesota Pollution Control Agency approved the new 2020 MS4 general permit. WMWA member cities must apply for the new permit by April 15, 2021. Included in the new permit are several education requirements.

The 2021 Special Project was dedicated to helping member cities meet the new MS4 permit education requirements. The new permit requires cities to distribute educational materials or equivalent outreach to stakeholders at lease once per year regarding the impacts of deicing salt and pet waste on surface waters and ways to reduce these impacts.

In 2021 WMWA Special Project funds were approved for the creation of three one-page flyers to address pet waste, deicing chlorides, and water softener chlorides, as well as associated landing pages with further information on the WMWA website. Participating members created the content and hired Taurus Moon Graphic Design to complete the flyer design. The three flyers will be completed and available to member cities in early 2022.

WMWA COORDINATOR POSITION

In the fourth quarter of 2019, members re-evaluated spending on the current Special Project. Looking forward to the needs of 2020 and the future, members voted to use Special Project funding for 2020 to hire a WMWA Coordinator as members did not have enough time to dedicate to certain upcoming projects, such as a survey to inform the update of the Work Plan, planned for 2020. An applicant was hired for the position beginning January 1, 2020.

Due to difficulties with COVID, the applicant was unable to start the position in 2020. The new Educator may be able to take on some of the responsibilities this position was created for in 2022.

RESILIENT YARD WORKSHOPS

Due to COVID, Workshops were not held in-person. Metro Blooms did create an online webinar format of the workshop. WMWA did not sponsor workshops in 2021, though they are available to member cities through Metro Blooms directly.

WINTER MAINTENANCE TRAINING

In 2021, Winter Maintenance Training workshops were hosted via webinar by Plymouth on October 27 for the road applicator training and November 5 for the parking lot and sidewalk training, with about 60 attendees at each training. Attendees learned how to adjust the use of salt de-icing products to be effective without overuse

WMWA WEBSITE

The WMWA website www.westmetrowateralliance.org serves as a repository for documents and information for access by member cities and citizens, lists local events WMWA is participating in and/or otherwise promoting, stores Watershed PREP information for schools, and collects information for the *Pledge to Plant* campaign and newsletter subscriptions.

The website had 689 unique visitors engaged in 786 individual sessions with an average of 1.14 pages viewed per session for a total of 1,092 page views on the website in 2021. The website metrics can be found in Appendix B

2021 MARKETING ACTIVITY

In May 2016 WMWA created a social media campaign for the Pledge to Plant campaign and WMWA in general on Facebook and Twitter. As of December 31, 2020, the WMWA Twitter page had been discontinued As of December 31, 2021, the Facebook page had 204 followers and 258 posts resulting in 3,109 engagements and 287 shares.

To learn more about WMWA, contact:
Diane Spector, Stantec, 763.252-6880, diane.spector@stantec.com
or Amy Juntunen, JASS, 763.553.1144, amy@jass.biz

APPENDIX

APPENDIX A – WATERSHED PREP / EDUCATOR ACTIVITY

Table 1. 2021 schools and students participating in Lesson 1: What is a Watershed?

	Date	School	School District	City	Watershed	Classes	Students
1	10/26	Rice Lake	Osseo	Maple Grove	Elm	4	80
					Total:	**4**	**80**

Educators created a video of the presentation in 2020 for parents and teachers to use in distance learning during COVID. The video can be found on YouTube at https://www.youtube.com/watch?v=bq4zKMfc-pQ&t=763s. The video had 222 views as of December 31, 2021

Watershed PREP

Lesson 1: What is a Watershed and Why Do We Care?

Lesson 2: Project WET, The Incredible Journey

Year	Lesson 1 Classes	Lesson 1 Students	Lesson 2 Classes	Lesson 2 Students
2013	35	870	9	230
2014	73	1875	5	160
2015	118	3106	27	859
2016	107	2850	20	524
2017	125	3358	38	1072
2018	143	3593	69	1755
2019	103	2681	58	1516
2020	20	572	10	256
2021	4	80	0	0
Total	728	18985	236	6372

Appendix B – Website/Social Media Activity

Likes grew in 2021 to a total of 172 likes and 204 followers. In 2021 there were 188 posts resulting in 3,109 engagements and 287 shares. The maximum post reach was 83 and maximum post engagements was 47.

Appendix C – Budget

	2019	2020				2021				2022
	Balance	**Budget**	**Revenue**	**Expense**	**Balance**	**Budget**	**Revenue**	**Expense**	**Balance**	**Budget**
Admin/Tech Services Routine tasks, website, social media, meetings, etc	$401	$12,000	$12,000	$7,647	$4,754	$12,000	$12,000	$9,299	$7,455	$12,000
Special Projects	$9,199	8,000	4,000	2,482	10,717	8,000	4,000	0	14,717	8,000
Watershed Prep	$4,964	16,000	8,000	3,214	9,750	16,000	4,000	315	13,435	16,000
Resilient Yards Metro Blooms workshops		*Billed directly to cities*				*Billed directly to cities*				
TOTAL	$14,564	$42,000	$24,000	$13,343	$25,221	$36,000	$20,000	$9,614	$35,607	$36,000

CITY OF MINNEAPOLIS

Public Works - Street Maintenance Division

Standard Operating Procedure for Vehicle Related Spills (VRS)

March 28, 2022

The purpose of this document is to provide detailed standard operating procedures for the clean-up of VRS sites and the management/disposal of the impacted spill debris.

DEFINITION OF TERMS

9-1-1 : Minneapolis 9-1-1 Dispatch Center for Minneapolis Fire Department

FIS/MES: Fire Inspection Service / Minneapolis Environmental Service

MDO: Minnesota Duty Officer: The MDO Program provides a single answering point for local and state agencies to request state-level assistance for emergencies, serious accidents or incidents, or for reporting hazardous materials and petroleum spills. The MDO is available 24 hours per day, seven days per week.

MPCA: Minnesota Pollution Control Agency

MSMD: Minneapolis Street Maintenance Division (Minneapolis Public Works)

NRC: The National Response Center provided for assistance for non-vehicle related spills when a federal notification is required as directed by FIS/MES / MDO

SWLRT: Southwest Light Rail Transit

VRM: Vehicle Related Material: Petroleum products or other vehicle fluids that are inherently related to vehicular operations. This does not include materials that are being transported by a vehicle, unless the material is clearly labeled as being one of the aforementioned products.

VT: Volumetric Threshold: Minnesota has a 5-gallon minimum quantity for reporting petroleum spills. Spill of all other chemicals or materials in any quantity is reportable.

Spill debris: Sand that has been placed to absorb VRM and subsequently recovered for disposal.

Scenario 1: MPCA informs FIS/MES of VRM spill

The driver of a vehicle involved in a VRM spill is responsible for notifying the MDO at 651-649-5451. If the VT is exceeded, 9-1-1 should also be contacted. The MDO will notify the MPCA Emergency Response Unit and other agencies as required. If the spill is of the size and nature that the Emergency Response Unit determines should be handled by FIS/MES, then the MPCA will notify FIS/MES and provide them with incident details. The FIS/MES representative will decide based on the information how to proceed, and if appropriate (typically VRM in manageable quantities), they would contact MSMD.

The MSMD will dispatch personnel with appropriate equipment to apply sand to the spill site. The sand will be given time to absorb the sand and spill debris (VRM), and then will then be removed by a street sweeper. The VRM will then be deposited at the established disposal site in a designated VRM spill debris pile.

If a secondary sand application is required, the procedure would remain the same. Since the volume of the spill is greater than 5 gallons, a Hazardous Material Spill Data form (see below) must be completed as soon as possible (i.e. within 24 hours or the next business day). The completed form will be sent to the FIS/MES as soon as possible. A final report on the actions taken will be sent to the MPCA from FIS/MES.

Spill Debris Pile Management

Arrangements for disposal of the spill debris pile will be a collaborative effort by the MSMD and the City of Minneapolis Engineering Laboratory. After the spill debris pile reaches a size that becomes difficult to manage within the disposal container, the Engineering Laboratory will be contacted. The spill debris pile will be mechanically blended, and the Engineering Laboratory will select representative samples for laboratory analysis, as per MPCA regulations. The sampling and testing will require approximately one week to complete. After receiving the laboratory analysis data, the spill debris will be disposed of in a manner pre-approved by the MPCA and the Minneapolis Procurement Division.

Scenario II: The MSMD discovers a VRM spill

MSMD personnel discover a spill or are informed of a potential VRM spill from sources other than FIS/MES or MPCA. After arriving at the scene, they determine if the incident is a VRM spill, (possibly from a vehicle collision, a spill from a labeled container, etc.) and determine if the volume of the spill:

- **Less than 5 gallons**: If the spill quantity is judged to be less than 5 gallons, no contact with FIS/MES is necessary. Sand is applied and the procedure will continue as described in Scenario I (i.e. subsequent sanding/sweeping and stockpiling into the spill debris pile). A Hazardous Materials Spill Data form must be completed for record and documentation purposes and retained at MSMD, but is not to be sent to FIS/MES.

- **5 gallons or more**: If the MSMD representative determines that the spill volume is more than 5 gallons of VRM, MSMD must contact FIS/MES, the MDO and 9-1-1. The same procedures for clean up and reporting (using the Hazardous Material Spill Data form) as in Scenario I will be followed. This form must be sent to FIS/MES.

For both cases, the disposal of the VRM spill debris pile is as detailed in Scenario I.

Possible Modifications to Scenario I and II

Regulatory officials may require separate stockpiling of spill debris from specific spill incidents. Separate sampling and laboratory analysis will be required in these cases. This may also be requested to create a distinct tracking mechanism of a given spill of significant quantities and/or from a billable source. This scenario will be determined on a case-by-case basis. The process for disposal will be the same as previous scenarios.

Scenario III: The MSMD becomes aware of a spill of unknown material or composition, non-VRM Spill or material labeled as required reporting to the NRC for spill/release.

The MSMD shall contact 9-1-1, the MDO and FIS/MES before taking any action to clean up a spill of unknown composition. FIS/MES will manage these spills through their contracts with private entities specializing in these activities, or manage and coordinate the cleanup with the MSMD. If FIS/MES cannot be contacted, the MDO should be contacted immediately. FIS/MES and/or the MDO will determine if NRC is to be called.

ADDITIONAL INFORMATION

1. Currently the disposal site for spill debris is behind 198 Aldrich Ave N, Minneapolis MN 55405 during SWLRT construction. The material shall be placed in two 20 cubic-yard leak-proof roll-off containers with a counter-balanced lockable lids at the City site.

2. List of Potential Contacts:
   - **MN Duty Officer - Minnesota Department of Public Safety, Bureau of Criminal Apprehension (BCA):** 651-649-5451 (24 hours a day, 7 days a week)
   - **Fire Inspection Service / Minneapolis Environmental Service (FIS/MES)**
     Steve Kennedy: 612-685-8528 (work)
     Tom Frame: 612-685-8501 (work cell - call, leave a message or text)
     Emergency after-hours contacts:
     Tom Frame: 612-685-8501 (work-cell - call, leave a message or text)
   - **City of Minneapolis Engineering Laboratory**
     Paul Ogren: 612-673-2456
     Chris DeDene: 612-673-2823
   - **Minneapolis Street Maintenance Division (MSMD)**
     Steve Collin: 612-673-5720 (work)
     Gary Long, Jr: 612-673-5720 (work)
     After hours: 612-673-5720 (24 hours a day, 7 days a week)
   - **National Response Center** 800-424-8802

3. MSMD will be responsible for any billing of outside parties for services rendered for the clean-up and disposal of a spill event. The MSMD, FIS/MES and the Engineering Laboratory will develop a system for tracking costs associated with these operations. This information will be distributed as it becomes available.

4. This is a statement of policies and procedures, which will be revised and updated as new information becomes available.

CITY OF MINNEAPOLIS - STREET DEPARTMENT - OIL AND HAZARDOUS MATERIAL SPILL DATA FORM

DATE OF REPORT:	TIME OF REPORT:	NAME & ADDRESS OF RESPONSIBLE PARTY:
DATE OF INCIDENT:	TIME OF INCIDENT:	
POLLUTANT TYPE:	QUANTITY (Units):	CAUSE OF SPILL:
LOCATION:		NAME & NUMBER PERSON OF MAKING REPORT:
AREAS AFFECTED:		
PROBABLE FLOW DIRECTION:		PARTY REPORTING SPILL TO STREET DEPARMENT:
SOIL TYPE:		
WATERS POTENTIALLY AFFECTED:		**CONTACTED: Check and list name/number**
EFFECTS OF SPILL, WAS THERE IMMEDIATE DANGER TO HUMAN LIFE OR PROPERTY:		☐ MN Duty Officer 651-649-5451 ☐ 911 ☐ FIS ☐ MPCA ☐ FIRE ☐ POLICE ☐ OTHER
ACTION TAKEN:		PROXIMITY OF WELLS, SEWERS, BASEMENTS:
CONTAINMENT OF SPILL:		IS THIS FIRST NOTICE REGARDING SPILL?
CONTACT NAME & NUMBER FOR MORE INFORMATION:		

CLEAN-UP TO DATE		**COMMENTS:**
USED	MATERIALS:	
	LOADERS:	
	TRUCKS:	
	PICK-UP TRUCKS:	
	MACHINE SWEEPERS:	
LABOR	FOREMAN HOURS:	
	MAINTENANCE CREW LEADER:	
	CONSTRUCTION LABORER:	
	OTHER:	

ORIGINAL TO: When job is completed, send original to Street Accounting with daily time when labor/equipment first used.

COPY TO: MPCA NOTIFICATION COPY - send (interoffice or email) to Steve Kennedy (Stephen.kennedy@minneapolismn.gov), FIS, PSC Room 401 and Environmental Services (envservicesinfo@minneapolismn.gov), PSC Room 414

STREET JOB #:	LABOR COST $	
	EQUIPMENT COST $	
	MATERIAL COST $	
	TOTAL COST $	

MINNESOTA DUTY OFFICER

BCA Operations Center

651-649-5451 **1-800-422-0798**

TDD: 1-800-627-3529 **Satellite Phone: 1-254-543-6490**

About the Duty Officer

The Minnesota Duty Officer Program provides a single answering point for local and state agencies to request state-level assistance for emergencies, serious accidents or incidents, or for reporting hazardous materials and petroleum spills. The duty officer is available 24 hours per day, seven days per week.

If there is an immediate threat to life or property, call 911 first.

When to Call the Duty Officer

Examples of incidents the duty officer can assist with include (but are not limited to):

- Natural disasters (tornado, fire, flood etc)
- Requests for National Guard
- Hazardous materials incidents
- Search and rescue assistance
- AMBER Alerts
- Requests for Civil Air Patrol
- Radiological incidents
- Aircraft accidents/incidents
- Pipeline leaks or breaks
- Substances released into the air

Agency Resources Available

State Agencies

- Department of Agriculture
- Department of Commerce
- Department of Education
- Department of Health
- Department of Human Services
- Department of Military Affairs
- Department of Natural Resources
- Department of Transportation
- Minnesota Office of Enterprise Technology
- Minnesota Pollution Control Agency
- Department of Public Safety
  - Bureau of Criminal Apprehension
  - Homeland Security and Emergency Management
  - Minnesota Joint Analysis Center
  - Minnesota State Patrol
  - Office of Pipeline Safety
  - State Fire Marshal
- Other state agencies not listed

Other Resources

- Minnesota Arson Hotline
- Local bomb squads
- Chemical assessment teams
- Emergency response teams
- Fire and rescue mutual aid
- Amateur radio (ARES/RACES)
- Minnesota voluntary organizations
- Fire chiefs assistance teams
- Search-and-rescue dogs
- Interagency Fire Center
- U.S. Air Force Search and Rescue Center

MINNESOTA DUTY OFFICER

BCA Operations Center

1-800-422-0798 **FAX: (651) 296-2300** **(651) 649-5451**

Satellite Phone: 1-254-543-6490

Emergency Notification

If there is a spill of a hazardous material or a petroleum product in Minnesota, you must call:

Local Authorities	**Call 9-1-1 FIRST,** *when there is a threat to life or property*
Minnesota Duty Officer	*If there is a public safety or environmental threat and/or if state agency notification for reportable spills is required*
The National Response Center 1-800-424-8802	*When a federal notification is required*

The following information (if available) will be requested by the Minnesota Duty Officer:

- Name of caller
- Date, time and location of the incident
- Telephone number for call-backs at the scene or facility
- Whether local officials (fire, police, sheriff) have been notified of incident

Additional information will be requested in the following special circumstances:

Making Notification of Spills/Incidents

- Materials and quantity involved in incident
- Incident location (physical address, intersection, etc.)
- Responsible party of incident (property/business owner)
- Telephone number of responsible party
- Any surface waters or sewers impacted
- What has happened and present situation

Requesting State Assistance for Incidents

- Type of assistance requested (informational, specialized team **a**ssets, etc).
- Name of requesting agency/facility
- Materials, quantity and personnel involved in the incident
- Whether all local, county, mutual aid resources been utilized

Storm Drainage Areas by Receiving Waterbody
(within Minneapolis city limits)

Receiving Water	Area (acres)	Impervious %	Population 2020	Agricultural	Airport or Airstrip	Golf Course	Industrial or Utility	Institutional	Major Railway	Mixed Use Commercial	Mixed Use Industrial	Mixed Use Residential	Multifamily	Office	Open Water	Park, Recreational, or Preserve	Retail and Other Commercial	Right of Way	Seasonal/Vacation	Single Family Attached	Single Family Detached	Undeveloped
Mississippi River	20,315.3	57.6%	273,735	0.1%	0.0%	0.9%	9.0%	7.5%	2.3%	0.8%	1.4%	0.9%	5.3%	1.4%	0.1%	7.0%	3.8%	28.8%	0.0%	6.0%	22.7%	1.9%
Minnehaha Creek	3,340.3	38.6%	34,508	0.0%	0.0%	0.7%	0.1%	5.8%	0.0%	0.0%	0.1%	0.2%	0.6%	0.2%	0.0%	13.7%	1.1%	24.3%	0.0%	3.1%	49.8%	0.2%
Bassett Creek	1,630.8	40.8%	17,165	0.1%	0.0%	0.0%	3.8%	3.4%	1.7%	0.1%	0.2%	0.5%	1.1%	0.9%	0.0%	19.9%	0.9%	24.1%	0.0%	4.5%	36.1%	2.8%
Shingle Creek	1,457.7	44.8%	12,662	0.0%	0.0%	0.0%	8.2%	13.1%	3.6%	0.1%	0.0%	0.1%	1.0%	0.1%	0.3%	12.0%	0.8%	19.6%	0.0%	2.5%	37.6%	1.0%
Lake Hiawatha	1,246.7	43.1%	16,617	0.0%	0.0%	10.4%	0.0%	3.1%	0.0%	0.0%	0.0%	0.4%	2.4%	0.1%	0.0%	4.2%	1.7%	27.4%	0.0%	6.7%	43.2%	0.1%
Bde Maka Ska	1,246.0	45.1%	17,273	0.0%	0.0%	12.5%	0.1%	2.6%	0.0%	0.4%	0.0%	1.7%	7.7%	0.6%	0.0%	14.3%	4.0%	20.5%	0.0%	6.7%	28.6%	0.4%
Lake Harriet	1,120.2	39.4%	10,662	0.0%	0.0%	0.0%	0.1%	16.5%	0.0%	0.1%	0.0%	0.3%	1.5%	0.0%	1.1%	12.4%	1.1%	20.3%	0.0%	3.6%	42.8%	0.1%
Lake of the Isles	769.8	44.6%	13,231	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.4%	0.0%	0.9%	9.8%	0.1%	0.3%	17.0%	2.7%	23.8%	0.0%	9.5%	33.1%	0.3%
Lake Nokomis	695.8	35.1%	6,180	0.0%	0.1%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%	26.5%	0.3%	23.1%	0.0%	2.2%	45.3%	0.1%
Diamond Lake	670.9	48.3%	6,966	0.0%	0.0%	0.0%	7.2%	4.9%	0.0%	0.0%	0.6%	0.0%	4.1%	0.2%	0.0%	5.0%	3.5%	29.1%	0.0%	3.3%	41.4%	0.7%
Crystal Lake	421.3	41.8%	6,126	0.1%	0.0%	0.0%	0.0%	3.1%	0.0%	0.0%	0.0%	0.4%	1.4%	0.0%	0.0%	1.4%	0.7%	31.1%	0.0%	2.1%	58.9%	0.9%
Grass Lake	324.7	43.3%	2,928	0.0%	0.0%	0.0%	0.0%	3.1%	0.0%	0.0%	1.8%	0.0%	0.1%	0.0%	0.6%	4.7%	0.4%	29.9%	0.0%	2.1%	57.0%	0.1%
Powderhorn Lake	322.5	43.5%	6,356	0.1%	0.0%	0.0%	0.0%	4.0%	0.0%	0.1%	0.0%	0.3%	4.9%	0.3%	0.1%	17.5%	0.9%	27.4%	0.0%	15.0%	29.2%	0.3%
Cedar Lake	287.8	31.5%	1,804	0.0%	0.0%	0.0%	0.0%	1.9%	0.7%	0.0%	0.0%	0.0%	1.1%	0.1%	1.3%	37.6%	0.3%	18.7%	0.0%	3.8%	34.3%	0.2%
Taft Lake	131.7	42.3%	1,200	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	44.3%	0.0%	3.0%	52.1%	0.4%
Brownie Lake	93.9	40.3%	321	0.0%	0.0%	0.0%	0.0%	0.0%	3.1%	0.0%	0.0%	0.0%	0.2%	28.5%	0.6%	17.6%	0.3%	18.6%	0.0%	5.0%	26.1%	0.0%
Ryan Lake	60.6	42.2%	450	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	10.9%	0.0%	28.3%	0.0%	0.3%	50.0%	7.3%
Richfield Lake	57.6	65.1%	372	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%	0.0%	0.0%	28.8%	40.4%	0.0%	0.0%	27.3%	0.0%
Spring Lake	50.0	32.6%	237	0.0%	0.0%	0.0%	0.0%	6.5%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	37.6%	0.0%	15.7%	0.0%	10.4%	28.8%	0.4%
Wirth Lake	40.6	6.1%	32	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	99.8%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
Birch Pond	38.8	10.3%	5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mother Lake	30.5	45.4%	140	0.0%	8.7%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	64.2%	0.0%	2.0%	23.3%	0.3%
Loring Pond	25.4	13.0%	26	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	99.0%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%
Silver Lake	25.0	41.3%	224	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%	0.0%	0.0%	2.2%	28.3%	0.0%	0.8%	65.3%	0.0%
Hart Lake	3.3	50.3%	18	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	19.2%	52.7%	0.0%	0.0%	24.8%	3.3%
Legion Lake	2.1	43.0%	22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.0%	0.0%	0.0%	60.0%	0.0%
	34,409.3	**50.9%**	**429,260**	**0.1%**	**0.0%**	**1.5%**	**6.0%**	**6.8%**	**1.6%**	**0.5%**	**0.9%**	**0.7%**	**4.1%**	**1.0%**	**0.2%**	**10.0%**	**2.9%**	**26.8%**	**0.0%**	**5.3%**	**30.3%**	**1.4%**

Minneapolis
City of Lakes

Stormwater Retrofit Projects

2020 Projects

The city constructed voluntary water quality improvements in 2020 through road projects and a retrofit of an existing surge pond. The city also continued to work on assessment of the remainder of the stormwater ponds.

GSI Projects

The city passed a new stormwater ordinance in 2021 that requires linear projects to meet stormwater management. This ordinance is expected to affect linear projects built after 2021. The ordinance requires 0.55" of stormwater management (infiltration) as well as water quality treatment. GSI built on projects in 2021 or earlier will be considered voluntary. Summaries of the voluntary GSI built on road projects in 2020 and designed for construction in 2021 are provided below.

The city has adopted the term Green Stormwater Infrastructure (GSI) for stormwater management on road projects, as defined in the Transportation Action Plan Design Guide: https://sdg.minneapolismn.gov/design-guidance/boulevards-and-furnishings/green-stormwater-infrastructure. This section of the guide is intended to assist with the new stormwater ordinance adopted in 2021.

Voluntary GSI completed

The city completed GSI in conjunction with road projects in 2020 that are summarized in the following table:

Project	Location	Description	SW Treatment
S 8th Street	One block: 5th to Portland	Infiltration planter basins	29,200 sf 200 lbs TSS 1lb TP
Hoyer Heights	3 streets: Buchanan, Lincoln, and Fillmore	Tree Trenches with underdrains	4.89 ac impervious 2.9 lbs TP 566 lbs TSS
Girard Ave	One block: Lake to Lagoon	Curbless street bioretention swale	0.57 ac impervious 414 cf treatment
SW Windom	61st and 62nd	Bioretention cells and swale	28,712 sf impervious 2,233 cf treatment
29th and Bloomington	Intersection	Bumpout depressed boulevards	420 sf impervious
Talmage Diverter	Talmage Ave SE and 14th Ave SE	Traffic diverter bioretention	0.6 ac impervious 61,800 cf 928 lbs TSS 3 lbs TP

GSI projects in design

Projects expected to be built in 2021 were designed in 2020 and summarized below.

Project	Location	Description
Grand Ave S	Lake St W to 48th St W	Bioretention cells and underground infiltration
4th St N and S	2nd Ave N to 4th Ave S	Bioretention cells on three blocks, one cell with underdrain
Downtown East	3rd St S; 10th Ave S; 12th Ave S	Bioretention cells on 2 blocks, one larger infiltration basin
42nd Ave E	46th Ave S to Edmund Blvd.	Bioretention cells throughout corridor
Whittier/Lyndale Bikeway	Blaisdell Ave S (from 40th St W to 28th St W) and 1st Ave S (from 28th St W to 15th St E)	Bioswales within linear protected bikeway feature
Whittier SRTS	Grand Ave S and 26th St W	Bumpout depressed boulevards

Pond Retrofits

The Holland Basin is located southeast of the intersection of Quincy St and 22nd. This basin was originally constructed as a surge basin. The retrofit diverted low flow from 20.6 acres to the pond for infiltration. This results in annual volumes between 13.2 ac and 15.3 acres, or 53%-61% of the annual volume and removal of 14 pounds of phosphorus and 5,000 pounds of total suspended solids. The pond will be planted with native plants through a youth employment and training contract in 2021.

New Stormwater Management

The city completed stormwater management for flood control that also provides water quality treatment.

The city started construction in 2020 on a series of stormwater management facilities in the Columbia Golf Course and upstream neighborhoods in partnership with the MPRB and MWMO. The project goals are increasing flood resiliency in the upstream neighborhoods and in the park, reducing pollutant loading to the Mississippi River, and improving ecological function within the 1NE Watershed. Construction in the golf course includes three stormwater basins, more than 4200 feet of storm sewer, three hydrodynamic separators for pretreatment, and 19 acres of habitat restoration. The new stormwater infrastructure in the Columbia Golf Course allowed the construction 3800 feet of larger storm sewer on 35th Ave. NE and Tyler St. NE to address localized flooding in the Waite Park neighborhood. A new structure on Central Ave will also divert low flows from the neighborhood through the new pipes and basins constructed in the golf course. The project will be completed in August 2021 and is expected to remove more than 170 pounds of total phosphorus and 37 tons of total sediment annually.

Prioritization Tool Progress

The City passed the revised stormwater ordinance to take effect on January 1, 2022. The requirement for linear projects to manage stormwater eliminates then need to use the prioritization tool to evaluate which road projects to focus voluntary stormwater improvements on. The tool will remain in use for the other items listed in the retrofit plan; however, its use on transportation projects will shift to help determine where higher levels of treatment or treatment offsets may be most feasible. In addition, we are developing a process to prioritize addition or enhancement of landscaping on transportation projects, which we refer to as 'Sustainable Landscaping'.

Transportation Action Plan

The city released its street design guide (SDG). The SDG includes green infrastructure, which is categorized into Sustainable Landscaping (Greening) and Green Stormwater Infrastructure (GSI). Links to the documents are here:

https://sdg.minneapolismn.gov/design-guidance/boulevards-and-furnishings/green-stormwater-infrastructure

Planning Updates

Flood Mitigation and Comprehensive Stormwater Improvement Studies

A four-step process is being used to reduce flooding and improve surface water quality in a cost-effective manner.

1. **Hydrologic / Hydraulic Models**
   The first step in the process is developing hydrologic / hydraulic models for the entire city. These models are used to identify flood-prone areas and to quantify impacts that can be caused by flooding. The models can also be used to develop solutions that reduce flood impacts.

2. **Comprehensive Stormwater Improvement Study Prioritization**
   The next step of the process is to prioritize areas where a comprehensive stormwater improvement studies should occur. The process accounts for flood impacts, water quality deficiencies, and condition of sewer infrastructure. Areas with racially concentrated areas of poverty are prioritized higher than other areas. This process is evaluated annually, with the most recent prioritization completed in June 2019.

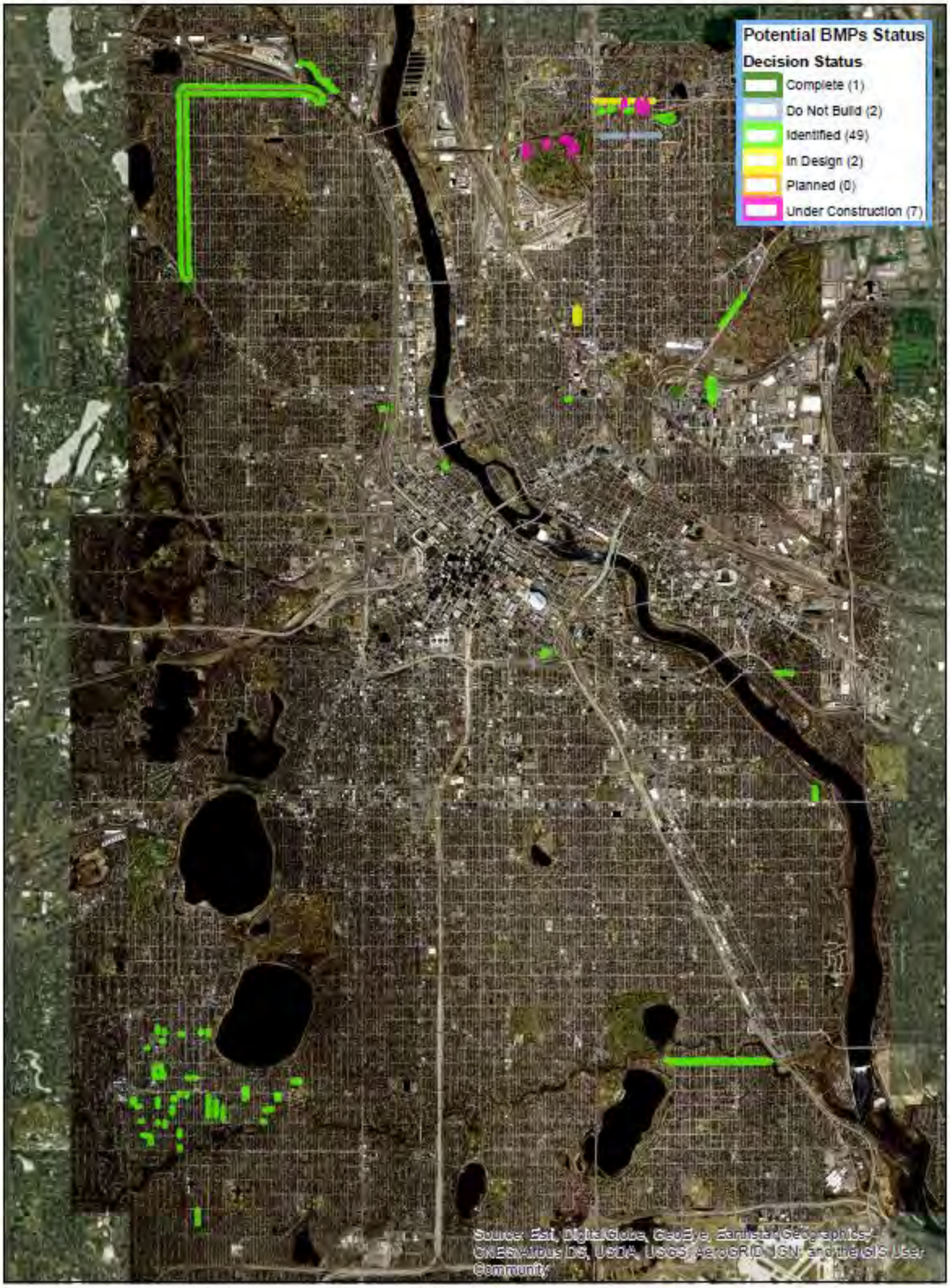
3. **Comprehensive Stormwater Improvement Study**
   Studies are conducted for priority areas to identify feasible stormwater improvement projects. These projects aim to reduce flooding and improve the quality of discharges to surface waters. Studies also consider the condition of existing drainage infrastructure and upcoming street improvement projects.

4. **Stormwater Improvement Projects**
   Favorable projects identified under comprehensive stormwater improvement studies are developed and built. Partnership and funding opportunities with watershed organizations, MPRB, and others will be considered as a part of project development.

Progress maps of Storm system modeling and flood mitigation study areas are available in Appendix B7 and B8.

Planning Tool Map Progress

The city developed a GIS map that compiles the potential stormwater facility opportunities. These opportunities are identified through a variety of sources, most comprehensively through stormwater studies. The GIS tool includes several sets of data including stormwater conveyance system, transportation projects, and the status of pipeshed study areas. The map below shows the status of potential stormwater opportunities.


Potential BMPs Status
Decision Status
Complete (1)
Do Not Build (2)
Identified (49)
In Design (2)
Planned (0)
Under Construction (7)
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Facility ID	Outfall ID	Location	Date Inspected	Notes	Water Body
441026	None	Humboldt Ave S	7/23/2021	Apron falling apart. Bank eroding to the side. Mud RCP joints and install a new apron.	Minnehaha Creek
None	None	1346 W Minnehaha Pkwy	7/23/2021	Unlisted and abandoned 12"CMP outfall. Filled with dirt.	Minnehaha Creek
441739	70-180	1340 W Minnehaha Pkwy	7/23/2021	Eroding bank around diffuser outfall. Rubble inside. Stabilize bank.	Minnehaha Creek
441084	70-185	1323 W Minnehaha Pkwy	7/23/2021	Separated RCP segments. Exposed aggregate. No obvious sink holes in the grass behind bank.	Minnehaha Creek
441311	70-190	Humboldt Ave S ped bridge	7/23/2021	Looks good. HDPE. Cobbles in good shape.	Minnehaha Creek
None	None	1343 W Minnehaha Pkwy	7/23/2021	21"CFM. GIS says "Abandoned", but it is still in place 7/23/2021.	Minnehaha Creek
441779	70-200	1344 W Minnehaha Pkwy	7/23/2021	Outfall is ok. MH has sink holes around the walls.	Minnehaha Creek
441670	70-225	Dupont Ave S	7/23/2021	Concrete invert is corroding. The concrete encasement for the sheet piling headwall is falling off. Eroding at east side.	Minnehaha Creek
None	None	1012 W Minnehaha Pkwy	7/23/2021	Unmapped broken 6"VCP. Leaking water.	Minnehaha Creek
None	None	1011 W Minnehaha Pkwy	7/23/2021	Unmapped 12"VCP. 2 segments visible. Segment under hill was ~85% full of dirt, but section in creek is separating.	Minnehaha Creek
None	None	Colfax Ave S	7/23/2021	Unmapped 6"corrugated HDPE. Trickling flow.	Minnehaha Creek
None	None	W of Bryant (2)	7/23/2021	Unmapped 6" DIP with grate and concrete outfall. Looks ok.	Minnehaha Creek

None	None	Bryant Ave S (North)	7/23/2021	Unmapped tiny PVC pipe with concrete outfall. Ok.	Minnehaha Creek
441700	70-240	Bryant Ave S (South)	7/23/2021	CMP flared end is failed and voiding. CMP pipe shape is ok. Need CCTV. Outfall needs stabilization.	Minnehaha Creek
441741	70-245	W of Aldrich (1)	7/23/2021	Outfall is above water, headwall z-rail is exposed. Concrete invert is corroded and pitted.	Minnehaha Creek
None	None	W of Aldrich (2)	7/23/2021	Unmapped leaking CMP outfall.	Minnehaha Creek
None	None	Aldrich Ave S	7/23/2021	Unmapped tiny separated PVC outfall structure.	Minnehaha Creek
568822	70-250	W of Lyndale (North)	7/23/2021	Owned by Hennepin County? Rip rap cobbles look good.	Minnehaha Creek
441412	70-253	E of Lyndale (South)	7/23/2021	Outfall was reconstructed in 2018, these ID numbers are old. Some cobbles moved by kids to make bike jumps... Geotextile fabric exposed on N side where cobbles were.	Minnehaha Creek
567112	70-253	E of Lyndale (South)	7/23/2021	Ok. A bit eroded but ok. 2018 project didn't include bank at the creek.	Minnehaha Creek
441220	70-255 (A)	506 W Minnehaha Pkwy	8/6/2021	This outfall wasn't found. Was removed.	Minnehaha Creek
441132	70-255 (B)	506 W Minnehaha Pkwy	8/6/2021	Flared end looks good. Cobbles in good shape.	Minnehaha Creek
441413	70-260 (A)	Near Grand Ave	8/6/2021	White 12"PVC bell end. Pipe in good condition, but slope is eroded. Bank needs stabilizing.	Minnehaha Creek
441135	70-260 (B)	Near Grand Ave	8/6/2021	Access MH for access to flared end has MH lid tipped 60 degrees and mostly buried, angle suggests MH is broken. Flared end is broken at back end and tipped backward. Most flow doesn't reach outlet, it would escape at broken connection. REPLACE OUTFALL STRUCTURE.	Minnehaha Creek

441414	70-265 (A)	307 W Minnehaha Pkwy	8/6/2021	Flared end with bent grate. Flared end invert is corroded, but 48"RCP looks ok. Creek is very deep at headwall.	Minnehaha Creek
441131	70-270	W side of Pratt St	8/6/2021	Diffuse, cobbles look good and pipe looks good. Invert not corroded.	Minnehaha Creek
441415	70-265 (B)	Btwn Pleasant & Nicollet	8/6/2021	Flared end access CB MH has concrete & cobble pad poured around it floating, soil underneath has scoured out. Flared end under water, pipe connection in CB MH looks fine.	Minnehaha Creek
441215	70-275	5300 W Minnehaha Pkwy	9/1/2021	Built 1974. Diffuser looks good. Fine debris building up in N side of structure. Clean?	Minnehaha Creek
441233	70-280	E side of Pratt St	9/1/2021	Diffuser looks good.	Minnehaha Creek
441123	70-285	Nicollet Ave Bridge	9/1/2021	Geotextile fabric visible. 36"RCP outfall in good condition.	Minnehaha Creek
441416	70-290	24 E Minnehaha Pkwy	9/1/2021	Diffuser is flowing under dry conditions, inform Liz Stout. Structure is ok.	Minnehaha Creek
441417	70-295	S of Stevens Ave	9/1/2021	Diffuser needs dredging.	Minnehaha Creek
441128	70-300	N of Stevens Ave	9/1/2021	Built 1995. Bank eroding on either side of diffuser. 4ft back on W side, 6ft back on E side. Headwall visible, but structure ok. Stabilize bank.	Minnehaha Creek
441232	70-305	W of 35W	9/1/2021	12"x20" arch RCP flared end. Structure looks good, but cobbles have fallen and geotextile fabric is visible. Could rehab / replace cobbles.	Minnehaha Creek
None	None	E of 35W	9/1/2021	6"DIP with concrete outfall and mesh grate. Pipe full of dirt upstream. Investigate source and clean pipe.	Minnehaha Creek
441418	70-307	Off 2nd Ave S	9/1/2021	Pipe and outfall are not as mapped. 3ft of PVC stubbed out of CB, then VCP. Cracks and fractures, hole at 11ft(D), pipe broken and drops at 18ft, railing base broken through	Minnehaha Creek

				pipe at 36ft. Replace pipe & outfall. Would be higher priority if it didn't only serve 2CBs. But it could void path.	
441125	70-310	3rd Ave S	9/1/2021	Diffuser outfall surrounded by ruins of creek wall. Bank and creek should be cleared of concrete debris.	Minnehaha Creek
441419	70-315	Tarrymore Ave & Clinton	9/1/2021	Built 1975. Diffuser has large hole in invert. Replace structure.	Minnehaha Creek
441133	70-320	50th St E & 4th Ave S (West)	9/1/2021	No holes yet, but concrete floor of diffuser is corroding from the inside and outside. Exposed aggregate.	Minnehaha Creek
None	None	50th St E & 4th Ave S (East)	9/1/2021	12"RCP segments fallen into creek. Pipe is clean and possibly functioning. Investigate. Stabilize bank and outfall. Remove pipe from creek bed.	Minnehaha Creek
441224	70-325	5th Ave S (West)	9/1/2021	Built 1941. 15" CMP outfall is bulkheaded at creek. Abandoned.	Minnehaha Creek
441126	70-330	5th Ave S (East)	9/1/2021	Limestone arch built 1937. Missing invert to 50ft back. Jagged rebar sticking up from spillway. Outfall needs heavy rehabilitation, probably can't replace because historic.	Minnehaha Creek
441134	70-335	W of Portland Bridge	9/1/2021	Built 1975. Large tree growing on diffuser. Outside bottom is corroding, partially filled with mud. Signs of corrosion under the mud. Rehab or repair within 10yrs.	Minnehaha Creek
441421	70-340	E of Portland Bridge	9/1/2021	Diffuser has scour pits in invert. Ok condition.	Minnehaha Creek
None	None	NW of Oakland Ave	9/1/2021	12"RCP unmapped and full of dirt.	Minnehaha Creek
441129	70-350	Btwn Portland & Park (N)	9/1/2021	Built 1988. Submerged pump station outfall. Very large diffuser. Even though creek level is low, only the top 2" of the opening is above water. OK.	Minnehaha Creek

441422	70-345	Oakland Ave	9/1/2021	24"CMP invert worn through. 4ft back RCP stubs into CMP outfall. Outfall needs replacement.	Minnehaha Creek
441423	70-355	Park Ave (West)	9/1/2021	Eroding bank, an RCP segment already fell in the creek, the next one is separating 4.5ft back from bank. Stabilize bank, replace outfall.	Minnehaha Creek
441120	70-360	Park Ave (East)	9/1/2021	42"RCP in large headwall. Railing and lookout above. Bank is eroding/scouring at west side, erosion is starting to swallow path. Pipe looks good. Stabilize sides of outfall structure. Pipe has heavy flow in dry conditions.	Minnehaha Creek
441231	70-365	Columbus Ave	9/1/2021	Built 1988. 12"RCP looks good.	Minnehaha Creek
441424	70-370	W of Chicago Bridge	9/1/2021	Built 1975. Bottom eroding from outside. Monitor this outfall.	Minnehaha Creek
441119	70-375	E of Chicago Bridge	9/1/2021	RCP flared end looks good.	Minnehaha Creek
441127	70-385	Btwn 10th & 11th Ave S	9/1/2021	Built 1975. Diffuser corroded invert. Monitor this outfall.	Minnehaha Creek
441425	70-380	11th Ave S	9/1/2021	24"RCP flared end. Fractures in invert from the headwall's bolted connection. Ok for now.	Minnehaha Creek
540490	70-390 (A)	12th Ave S (South)	10/7/2021	Not found. Removed?	Minnehaha Creek
441426	70-390 (B)	12th Ave S (South)	10/7/2021	Chunk of concrete in invert. 24" diameter RCP with flared end. 13ft back from headwall, the RCP turns to CMP. CMP invert is worn through. Outfall is good, CMP is bad.	Minnehaha Creek
441121	70-395	12th Ave S (North)	10/7/2021	Some exposed aggregate at invert. Some gaps at joints on bottom. Z-rail headwall is ok.	Minnehaha Creek
441298	70-400	13th Ave S	10/7/2021	RCP flared end. Joint is offset 6ft back from end. Next stick back is also a bit offset. Pipe is holding dirt.	Minnehaha Creek

None	None	15th Ave S	10/7/2021	30ft of 12"CMP running down small hill. Most of the pipe is not full of dirt. No obvious drainage use. Remove? Investigate.	Minnehaha Creek
441216	70-405	W of Bloomington Ave	10/7/2021	15" RCP flared end. Looks good	Minnehaha Creek
441297	70-407	W of Bloomington Ave	10/7/2021	10"PVC pipe outfall in good shape, looks clean. There is a bend 6.5ft back from end.	Minnehaha Creek
441130	70-408	E of Bloomington Bridge (S)	10/7/2021	15"CMP. Material changes to VCP 11.1ft back. VCP joints are offset. CMP outfall looks ok, but the bank is eroded around it.	Minnehaha Creek
None	None	E of Bloomington Bridge (N)	10/7/2021	Abandoned 15"CMP full of dirt. Investigate and remove.	Minnehaha Creek
441299	70-410	16th Ave S	10/7/2021	24"RCP with flared end. Outfall is good shape, looks new.	Minnehaha Creek
None	None	16th Ave S Sensor MH	10/7/2021	Abandoned sensor MH. Can remove. Bridge ramp is eroding in direction of sensor MH. Could remove this structure with any stabilizing project.	Minnehaha Creek
441217	70-415	E of 16th Ave S	10/7/2021	Diffuser looks good.	Minnehaha Creek
441122	70-420	18th Ave S Oxbow	10/7/2021	24" Corrugated HDPE outfall, 14.8ft in length. Then 15" Miller RCP with slightly offset joints, RCP alignment is poor. RCP to HDPE joint is messy.	Minnehaha Creek
568832	70-425	18th Ave S Pond	10/7/2021	RCP flared end with trash grate. Outlet into mucky pond. Looks ok.	Minnehaha Creek
441218	70-425	18th Ave S Oxbow	10/7/2021	Dirt/vegetative depression (channel?) connecting pond to creek. No pipes or outfall structure here.	Minnehaha Creek
559971	70-427	Cedar Ave S	10/7/2021	12" or 15" RCP Flared end looks ok. Tree on structure. Material around outfall has been blown out. Does this pipe pressurize?	Minnehaha Creek

441465	70-430	E Minnehaha Pkwy btwn Lk Nokomis & Lk Hiawatha	10/7/2021	Diffuser looks ok. Small rock slide covering N side of structure. Plastic sheets peeling from top of diffuser's inside.	Minnehaha Creek
441389	70-435	E Minnehaha Pkwy btwn Lk Nokomis & Lk Hiawatha	10/7/2021	Diffuser looks ok. Sediment in N side of structure. Plastic sheets peeling from top of inside.	Minnehaha Creek
441375	70-440	Entrance to Golf Course	10/7/2021	Large diffuser looks good. Some dry-weather flow, likely from golf course?	Minnehaha Creek
441372	70-443	In Hiawatha Golf Course	10/15/2021	Mapped incorrectly. HDPE, not RCP, is on other side of the bridge. This outfall is owned by Parkboard.	Minnehaha Creek
441371	70-445	28th Ave S & 47th St E	12/2/2021	15" dual wall HDPE pipe outfall, built 2019 or 2020. HDPE starts 9.5ft upstream is connected to original 15"CMP. Invert of old CMP is worn through. The full pipe should have been replaced with HDPE... Line CMP?	Minnehaha Creek
441393	70-446	28th Ave S Bridge	12/2/2021	Removed with 28th Ave S bridge project	Minnehaha Creek
441448	70-447	28th Ave S Bridge	12/2/2021	Removed with 28th Ave S bridge project	Minnehaha Creek
441407	70-449	28th Ave S Bridge	12/2/2021	Removed with 28th Ave S bridge project	Minnehaha Creek
441398	70-450	28th Ave S Bridge	12/2/2021	Removed with 28th Ave S bridge project	Minnehaha Creek
None	None	29th Ave S - N Outfall	12/2/2021	Unmapped (wrongly mapped) 12"PVC pipe outfall. White PVC starts 18.2ft back, where it connects to original 12"VCP. Looks ok. This outfall is actually FacilityID 568804 (mapped just East) it's just mapped wrong.	Minnehaha Creek
568804	None	29th Ave S - N Outfall	12/2/2021	Outfall isn't there. Is it mapped wrong? Is it really the unmapped outfall found just West?	Minnehaha Creek

568801	None	29th Ave S - S Outfall	12/2/2021	White PVC pipe outfall on steep slope. Bank is eroding to expose pipe.	Minnehaha Creek
576103	None	Btwn 29th & 30th Ave S	12/2/2021	10"PVC pipe as far back as one can see. Some settlement in the ground on either side of pipe.	Minnehaha Creek
441449	70-465	30th Ave S - S Outfall	12/2/2021	10"PVC pipe is uncovered 13ft back. The whole pipe run, from outlet to MH is only 19ft long. PVC looks good. The pipe upstream of the MH is CMP.	Minnehaha Creek
441450	70-467	30th Ave S - N Outfall	12/2/2021	10"VCP pipe. Broken segments of VCP were found at the end of the pipe. Segments have been separating for years. Outfall is hard to find... Eroded back and covered with leaves.	Minnehaha Creek
441386	70-470	30th Ave S - NE Outfall	12/2/2021	18" CMP outfall is deformed and the invert is rusted through as far back as is visible (~20ft). Replace outfall.	Minnehaha Creek
None	None	Btwn 10th & Nokomis	12/2/2021	12" PVC looks ok. 22ft back from the outfall, there is a manufactured bend joint. PVC pipe is stamped "2006". Bury pipe?	Minnehaha Creek
None	None	Nokomis Bridge	12/2/2021	Pipe outlet in bridge	Minnehaha Creek
None	None	Nokomis Bridge	12/2/2021	Pipe outlet in bridge	Minnehaha Creek
None	None	Nokomis Bridge	12/2/2021	Pipe outlet in bridge	Minnehaha Creek
None	None	Nokomis Bridge	12/2/2021	Pipe outlet in bridge	Minnehaha Creek
441385	70-475	Nokomis Ave	12/2/2021	60"RCP flared end built 1961. Invert is missing. East headwalls z-rail cap is gone, west headwall cap is corroding. Being replaced with project.	Minnehaha Creek
441436	70-480	31st Ave S	12/2/2021	Outfall not found.	Minnehaha Creek
441399	70-485	31st Ave S	12/2/2021	12"PVC is in good shape. Pipe is PVC as far back as is visible.	Minnehaha Creek
441451	70-490 (A)	31st Ave S	12/2/2021	Diffuser has exposed aggregate in the invert's center. Otherwise ok.	Minnehaha Creek
441452	70-490 (B)	31st Ave S	12/2/2021	RCP apron looks ok.	Minnehaha Creek

441453	70-495	32nd Ave S	12/2/2021	12"PVC looks ok, but is dirty. Pipe is shallow.	Minnehaha Creek
441390	70-505	32nd Ave S & 47th St E	12/2/2021	Tiny diffuser looks ok. Outlet is 6" tall x 30" wide.	Minnehaha Creek
441769	70-500	4716 32nd Ave S	12/2/2021	10"PVC outfall. Flashlight went out. Look at this again in Spring.	Minnehaha Creek
441403	70-510	3208 E Minnehaha Pkwy	12/2/2021	30" dual-wall HDPE pipe outfall. Pipe changes to RCP 10.7ft back from outlet, connection looks good. Outfall looks good.	Minnehaha Creek
441377	70-515	34th Ave S (West)	12/2/2021	30"RCP with apron. Apron segment has separated and is falling into creek. The 30"RCP pipe has some exposed aggregate, but mostly looks ok. Replace outfall.	Minnehaha Creek
441707	10-660	33rd St E	7/29/2021	There is a fracture ~5ft into old horseshoe-shaped concrete section of pipe. Tie-backs are holding CMP and concrete section together. Tie-backs are anchored far past fractured section. Temporary fix. Seal up that fracture, and/or Replace outfall structure.	Mississippi River
441708	10-670	36th St E	7/29/2021	Accessible by path. 36"RCP is in good condition. This pipe is not corrugated metal as GIS shows.	Mississippi River
441716	10-680	38th St E	7/29/2021	Outfall only accessible by boat. End of outfall fell of years (decades) ago, and sandstone around outlet is eroding back. Invert of outlet pipe is broken apart, so water flows out broken invert and erodes sandstone more. Should we repair invert in an attempt to slow sandstone erosion?	Mississippi River
441430	10-690	42nd St E	7/29/2021	36" corrugated metal built 1963. Pipe looks ok. Invert is rusty, but not worn through. Layers of stone are wearing away. Consider stabilizing before slope erodes up to the path's wall. GIS says there is energy dissipating Rip-Rap, but there is no Rip-Rap left.	Mississippi River

441397	10-700	44th St E	7/29/2021	36"RCP with flared end with trash grate. Has concrete spillway and Z-rail headwall. Outfall and visible pipe look ok. Headwall has trees growing through it and could use some stabilizing.	Mississippi River
441429	10-710	5424 Edmund Blvd	7/29/2021	RCP outfall looks ok. Limestone wall could use some stabilizing under the pipe. Soil is visible and eroding away under the pipe.	Mississippi River
441509	10-720	Minnehaha Tunnel Outfall	7/29/2021	13.75ft tall, 10.5ft wide tunnel with spillway made of granite pavers. Many granite pavers are sunken or missing. Restore spillway.	Mississippi River
540797	10-720 (A)	Minnehaha Tunnel Baseflow CIP	7/29/2021	30" Cast Iron Pipe built 1921. End segment's bell is chipped. Looks ok.	Mississippi River
441737	70-150	49th St W (West)	7/26/2021	Pump station outfall in good condition.	Overflow: Lake Harriet to Minnehaha Creek
441736	70-152	1401 Humboldt Ave S	7/26/2021	Diffuser blocked by mud. Needs dredging.	Overflow: Lake Harriet to Minnehaha Creek
441665	70-153	1401 Humboldt Ave S	7/26/2021	Built 1966? Small RCP pipe with crumbling block headwall. Replace outfall.	Overflow: Lake Harriet to Minnehaha Creek
441738	70-155	1416 Humboldt Ave S	7/26/2021	Built 1963. CMP outfall is corroded and needs replacement.	Overflow: Lake Harriet to Minnehaha Creek
441693	70-157	1437 Humboldt Ave S	7/26/2021	Built 1973. RCP with stabilizing slug of concrete around outlet. Stabilizing concrete is undermined. Clean up outfall.	Overflow: Lake Harriet to Minnehaha Creek
441735	70-165	48th St W	7/26/2021	Diffuser ok, right below path.	Overflow: Lake Harriet to Minnehaha Creek
441669	70-170	49th St W (East)	7/26/2021	Built 1973. Diffuser outfall ok, concrete corroding a bit. Edge chipping away.	Overflow: Lake Harriet to Minnehaha Creek

None	None	1401 Humboldt Ave S	7/26/2021	Unmapped HDPE pipe is 70% full of dirt. Investigate.	Overflow: Lake Harriet to Minnehaha Creek
None	None	Park Dr	7/26/2021	RCP Miller Pipe is ok.	Overflow: Lake Harriet to Minnehaha Creek
441734	None	Park Dr	8/26/2021	Lake Harriet overflow outfall with headwall and trash grate, mostly ok. Pipe ID 42”. Non reinforced concrete pipe? Interior SAV around invert, some JOS, some RBJ 10%. Appears to be chamber where brick building is. Must switch from brick to concrete between access points. Retaining wall fractured through at 3 points. Base concrete broken away, wear underneath. Bank eroding away.	Overflow: Lake Harriet to Minnehaha Creek
559405	Classified as an "inlet ID"	E Minnehaha Pkwy btwn 16th & 17th Ave S (W Sensor MH)	10/3/2021	Both PVC pipes are filled with dirt. Will that affect performance of the sensor MH?	Minnehaha Creek

Integrated Pest Management (IPM)
Vegetation Management Policy

Goals

- Public safety
- Prevent erosion
- Protect and improve water quality and ecological function
- Slow water movement, hold or convert pollutants, and enhance infiltration and evapotranspiration
- Conduct preventive maintenance for longevity of infrastructure
- Control invasive species (non-native and selected native species) growth and prevent the production and dispersal of seed
- Create wildlife habitat
- Provide a neat appearance

Herbicide Policy

Public Works – Surface Water & Sewers Division (PW-SWS) has adopted the Integrated Pest Management (IPM) Policy formulated by the Minneapolis Park and Recreation Board (MPRB) to guide the use of herbicides on public lands under their charge. Herbicide use shall be limited as directed in this document.

Management Guidelines

- Perpetuate the original intent of the species planted. On many sites the original intent was to establish a simplified native grassland community. Plant species were selected for their resilience, habitat value and beauty. These plants shall be managed for their proliferation.

- Control [1] all species listed on the MN Noxious Weed List and comply with the MN Noxious Weed Law.

- Control invasive species in order to prevent Public Works sites from becoming sources of invasive weed seed that can disperse and establish on neighboring properties. An example is Canada thistle, which produces copious amounts of wind-blown seed that can easily become a problem on nearby public and private lands.

- Control aggressive species that if allowed to exist on a site will quickly spread and overwhelm the site. Aggressive native species include but are not limited to Canada goldenrod, sandbar willow and cottonwood. Non-native species include but are not limited to Canada thistle,

---

[1] **Control means manage or prevent the maturation and spread of propagating parts of noxious weeds from one area to another by a lawful method that does not cause unreasonable adverse effects on the environment.** *MN Noxious Weed Law 2013 MS 18.75-18.91*

crown vetch, bird's-foot trefoil, reed canary grass, *Phragmites australis*, spotted knapweed, smooth brome, sweet clover, purple loosestrife, Siberian elm, buckthorn, and Tartarian honeysuckle.

- Control non-native cattails (hybrid and narrow-leaf). They are common weeds in stormwater treatment facilities that may clog inlet and outlet structures, and they reduce habitat function. They are to be controlled when a threat to structures occurs, primarily by cutting the plant below the water surface. Where this is not feasible, as a last resort wick application of an aquatic-safe herbicide may be warranted, however herbicide application over water shall be avoided where practicable.

- Control fast growing, rank, woody species such as willow, Siberian elm and box elder that can quickly establish and form a thicket around stormwater treatment facilities or can cause a public safety issue.

- Control species that are allelopathic [2]. These include but are not limited to spotted knapweed, garlic mustard, and leafy spurge.

Invasive Plant Management Tools (where feasible, use mechanical means such as pulling and mowing, in order to minimize chemical usage)

- Herbaceous Plantings
    - Pulling (preferred)
    - Mowing (preferred)
        - Flail mowing
        - Spot mowing
    - Herbicide application
        - Spot spraying
        - Wick application
- Woody Plants
    - Pulling (preferred)
    - Cutting with stump application of herbicide

[2] **Allelopathic means to produce a chemical in plant tissue that releases into the soil and prevents the growth of most other species**

INTEGRATED PEST MANAGEMENT – ADAPTED FROM MINNEAPOLIS PARK AND RECREATION BOARD POLICY (Revised July 24, 2008)

Integrated Pest Management (IPM) is a pest management strategy that focuses on long-term prevention or suppression of pest problems with minimum impact on human health, the environment and non-target organisms. In most cases, IPM is directed at controlling pests that have an economic impact on commercial crops; however, in the instance of mosquito control, IPM is used to control nuisance and potentially dangerous mosquito populations. The guiding principles, management techniques and desired outcomes are similar in all cases.

A number of concepts are vital to the development of a specific IPM policy goal:

1. Integrated pest management is not a predetermined set of practices, but a gradual stepwise process for improving pest management.
2. Integrated pest management programs use a combination of approaches, incorporating the judicious application of ecological principles, management techniques, cultural and biological controls, and chemical methods to keep pests below levels where they cause economic damage. (Laws of MN, 1989)
3. Implementing an integrated pest management program requires a thorough understanding of pests, their life histories, their environmental requirements and natural enemies, as well as establishment of a regular, systematic program for surveying pests, their damage and/or other evidence of their presence. When treatments are necessary, the least toxic and most target-specific plant protectants are chosen.

The four basic principles of IPM used in designing a specific program are:

1. Know your key pests
2. Plan ahead
3. Scout regularly
4. Implement management practices

<u>Selection of Management Strategies</u>

Selection of Management Strategies pest management techniques include:

- Encouraging naturally occurring biological control
- Adoption of cultural practices that include cultivating, pruning, fertilizing, maintenance and irrigation practices that reduce pest problems
- Changing the habitat to make it incompatible with pest development
- Using alternate plant species or varieties that resist pests
- Limiting monoculture plantings where possible
- Selecting plant protectants with a lower toxicity to humans or non-target organisms

The criteria used for selecting management options include:

- Minimization of health risk to employees and users
- Minimization of environmental impacts (e.g. water quality, non-target organisms)
- Risk reduction (losses to pests, or nuisance/threshold level)
- Ease with which the technique can be incorporated into existing management approaches
- Cost-effectiveness of the management technique

<u>Posting of Plant Protectant Applications</u>

Comply with the City of Minneapolis ordinance regarding pesticide application (Minneapolis Code of Ordinances Title 11 [Health and Sanitation] Chapter 230 [Pesticide Control])

Recordkeeping

Produce and maintain the necessary records of all pest management activities as required by the Minnesota Department of Agriculture.

Weed Control in Upland Plantings, Shrub Beds and Around Trees

Plants are selected and/or replaced in order to provide disease and insect resistant plantings, thereby reducing plant protectant applications. Weeds listed on the State of Minnesota's Noxious Weed List must be controlled as per state statute, and species will be controlled as listed in Management Guidelines above. Mechanical or manual means of weed control will be tried first when feasible. However, due to global climate change, increasing populations of tap-rooted and other perennial weeds are being transported by birds and other means. Pulling or digging of these weeds is usually not successful. Spot spraying of these tap-rooted weeds with a low toxicity herbicide will help prevent flowering, seeding and further dispersal of these pest weeds. Appropriate mulching of upland plantings, shrub beds and around trees will help decrease the number of pest weeds. If control of annual weeds in pathway or mulched areas is required, the proper pre- or post-emergent low toxicity herbicide will be applied on a spot spray basis. Posting of any plant protectant applications will be carried out according to City ordinance.

Turf Areas

PW-SWS follows the Minneapolis Park and Recreation Board's General Parks and Parkways threshold of 50% for broadleaf and/or grassy weeds in turf areas. When it has been determined that this percentage has been reached or exceeded, the appropriate post emergent or pre-emergent herbicide may be applied, preferably on a spot spray basis. Selection of the appropriate herbicide of choice will be determined by trained staff after evaluating the site, the hazard rating of the product and the specific location.

Future Pest Control Issues

With changes in climate, the environment will be subject to many changes, including the arrival of additional pests within open space areas. Following IPM principles, the City will refer to updates in MPRB policy and practice and will work with the appropriate local, state or national agencies to determine the best control approach for these new pests.

Resolution No. 2022R-029 **City of Minneapolis** **File No. 2022-00113**

Author: Ellison Committee: POGO Public Hearing: None

Passage: Feb 10, 2022 Publication: FEB 18 2022

RECORD OF COUNCIL VOTE				
COUNCIL MEMBER	AYE	NAY	ABSTAIN	ABSENT
Jenkins	✕			
Palmisano	✕			
Chavez	✕			
Chughtai	✕			
Ellison	✕			
Goodman	✕			
Johnson	✕			
Koski	✕			
Osman	✕			
Payne	✕			
Rainville	✕			
Vetaw	✕			
Wonsley Worlobah	✕			

MAYOR ACTION

☒ APPROVED ☐ VETOED

MAYOR FREY

FEB 11 2022

DATE

Certified an official action of the City Council

ATTEST:

CITY CLERK

Presented to Mayor: FEB 10 2022

Received from Mayor: FEB 14 2022

Amending Resolution 2021R-385 entitled "Designating the utility rates for water, sewer, stormwater, solid waste services effective with water meters read on and after January 1, 2022," passed December 8, 2021.

Resolved by The City Council of The City of Minneapolis:

Water Rate

Charges commence when the street valve is turned on for water service.

1) Three dollars and sixty-eight cents ($3.68) per one hundred (100) cubic feet for customers not otherwise mentioned.

2) Three dollars and eighty-three cents ($3.83) per one hundred (100) cubic feet to municipalities, municipal corporations, villages and customers outside the corporate limits of the city where service is furnished through individual customer meters.

3) Rates for municipalities, municipal corporations and villages, which are established by contract, shall continue on the existing contract basis.

4) In addition to the above rates a fixed charge based on meter size will be billed each billing period or fraction thereof as follows:

Meter Size	Fixed Charge
5/8-inch	$6.50
3/4-inch	$9.75
1-inch	$16.25
1 1/2-inch	$32.50
2-inch	$52.00
3-inch	$104.00
4-inch	$162.50
6-inch	$325.00
8-inch	$520.00
10-inch	$747.50
12-inch	$2,145.00

5) The fixed charge for a property serviced by a combined fire/general service line shall be based on the small side register of the combined meter, provided the volume of water used on the large side register does not exceed 45,000 gallons per year. The volume of water used on the large side register in the previous year will be used to establish the fixed rate in the current year.

The fixed charge for a property serviced by a combined fire/general service line shall be based on the large side register of the combined meter, when volume of water used on the large side register exceeds 45,000 gallons per year. The volume of water used on the large side register in the previous year will be used to establish the fixed rate in the current year.

The fixed charge for a combined fire/general service line shall remain in place for the entire year.

6) All fire standpipes, supply pipes and automatic sprinkler pipes with detector meters, direct meters or non-metered, shall be assessed according to size of connection at the following rates each per annum for the service and inspection of the fire protection pipes and meters installed, as follows:

Fire Line Pipe Size	Annual Charge
1½ inch pipe connection	$30.00
2-inch pipe connection	$30.00
3-inch pipe connection	$40.00
4-inch pipe connection	$60.00
6-inch pipe connection	$120.00
8-inch pipe connection	$190.00

10-inch pipe connection	$275.00
12-inch pipe connection	$790.00

When the seal of any of the valves connecting with such fire protection pipes shall be broken, it shall be resealed by authority of the director of the Minneapolis Water Treatment and Distribution Services Division. All connections for fire systems must have a post indicator valve installed at the curb if ordered by the director of the Minneapolis Water Treatment and Distribution Services Division. (98-Or-135, § 4, 11-13-98; 2012-Or-076, § 75, 11-16-12)

7) Rates for other services and materials provided shall be fixed as follows:

Description	Materials	Hourly Servicing Fee	Flat Rate Total
Sales and Installation of New Equipment Requested by the Customer (Includes Lost & Damaged Equipment)			
5/8" Water Meter	$ 54	$ 62	N/A
3/4" Water Meter	$ 70	$ 62	N/A
1" Water Meter	$ 95	$ 62	N/A
1 1/2" Water Meter	$ 221	$ 62	N/A
2" Water Meter	$ 289	$ 62	N/A
3" Water Meter	$ 1,089	$ 62	N/A
4" Water Meter	$ 1,471	$ 62	N/A
6" Water Meter	$ 2,418	$ 62	N/A
Meter Transmitting Unit (MTU)	$ 75	$ 62	N/A
Meter Couplings/Flanges			
5/8" Water Meter	$ 12	$ 62	N/A
3/4" Water Meter	$ 15	$ 62	N/A
1" Water Meter	$ 25	$ 62	N/A
1 1/2" Water Meter	$ 150	$ 62	N/A
2" Water Meter	$ 206	$ 62	N/A
Services			
Remove or Drain a Water Meter	N/A	$ 62	N/A
Water Meter Testing	N/A	$ 62	N/A
Water Meter Reading, Missed Appointments, and Posting Fees	N/A	$ 62	N/A
Shut Off Valve Flushing	N/A	$ 62	N/A
Water Turn-On or Shut-Off	N/A	$ 62	N/A
Winter Surcharge (December 1st - April 1st)	N/A	N/A	$ 25
Water Main Shut Down			
12" and Smaller	N/A	N/A	$ 520
16" and Larger	N/A	N/A	$ 936

Penalties			
Water Meter Tampering Penalty	N/A	N/A	$ 200
Water Meter Bypass Valve Tampering Penalty	N/A	N/A	$ 500
Unauthorized Water Service Turn-On Penalty	N/A	N/A	$ 500
Water System Valve Tampering Penalty	N/A	N/A	$ 500
Violation of Water Emergency Declaration Penalty	N/A	N/A	$ 90
Permits			
Water Hydrant Usage	N/A	N/A	$ 350
Hydrant Sanitation for Potable Water Usage	N/A	N/A	$ 160
Equipment Deposit	N/A	N/A	$ 3,200
Meter Set	N/A	N/A	$ 50
Temporary Water Meter	N/A	N/A	$ 350
Equipment Deposit	N/A	N/A	$ 3,200
Large Water Main Tap by Tap Size *			
6x4"	N/A	N/A	$ 1,755
6x6"	N/A	N/A	$ 1,943
8x4"	N/A	N/A	$ 1,862
8x6"	N/A	N/A	$ 2,004
8x8"	N/A	N/A	$ 2,487
10x4"	N/A	N/A	$ 2,122
10x6"	N/A	N/A	$ 2,174
10x8"	N/A	N/A	$ 2,216
12x4"	N/A	N/A	$ 2,003
12x6"	N/A	N/A	$ 2,205
12x8"	N/A	N/A	$ 2,506
12x12"	N/A	N/A	$ 3,659
16x4"	N/A	N/A	$ 1,905
16x6"	N/A	N/A	$ 2,135
16x8"	N/A	N/A	$ 2,719
16x12"	N/A	N/A	$ 3,659
24x4"	N/A	N/A	$ 2,296
24x6"	N/A	N/A	$ 2,495
24x8"	N/A	N/A	$ 3,184
24x12"	N/A	N/A	$ 5,080
30x4"	N/A	N/A	$ 2,770
30x6"	N/A	N/A	$ 2,770
30x8"	N/A	N/A	$ 5,381
36x4"	N/A	N/A	$ 3,382
36x6"	N/A	N/A	$ 3,382
36x8"	N/A	N/A	$ 3,512
36x12"	N/A	N/A	$ 6,464

Small Water Main Tap by Size *

3/4x3/4"	N/A	N/A	$ 247
1x1"	N/A	N/A	$ 267
1x1 1/4"	N/A	N/A	$ 285

Water Main Tap Discontinue by Size *

6x2"	N/A	N/A	$ 853
6x3"	N/A	N/A	$ 853
6x4"	N/A	N/A	$ 892
8x2"	N/A	N/A	$ 923
8x3"	N/A	N/A	$ 923
8x4"	N/A	N/A	$ 923
8x6"	N/A	N/A	$ 1,122
10x2"	N/A	N/A	$ 1,033
10x3"	N/A	N/A	$ 1,033
10x4"	N/A	N/A	$ 1,033
10x6"	N/A	N/A	$ 1,074
10x8"	N/A	N/A	$ 1,074
12x2"	N/A	N/A	$ 991
12x3"	N/A	N/A	$ 991
12x4"	N/A	N/A	$ 991
12x6"	N/A	N/A	$ 997
12x8"	N/A	N/A	$ 997
16x2"	N/A	N/A	$ 1,340
16x3"	N/A	N/A	$ 1,340
16x4"	N/A	N/A	$ 1,340
16x6"	N/A	N/A	$ 1,973
16x8"	N/A	N/A	$ 1,973
16x12"	N/A	N/A	$ 1,973
24x2"	N/A	N/A	$ 2,055
24x3"	N/A	N/A	$ 2,055
24x4"	N/A	N/A	$ 2,055
24x6"	N/A	N/A	$ 2,055
24x8"	N/A	N/A	$ 2,055
24x12"	N/A	N/A	$ 2,055

** When site specific circumstances preclude the use of standard methods, the fee will be based on the City's estimate. The standard fee includes installation and $50 permit fee but not excavation. Modifications to the work that may result in additional costs incurred are the responsibility of the customer.*
***All fees above are presented prior to application of sales tax.*

Sanitary Sewer Rate

The sanitary sewer rates to be charged properties within and outside the City of Minneapolis that are served directly by the City of Minneapolis sewer system and that are all served either directly or indirectly by the sewage disposal system constructed, maintained and operated by the Metropolitan Council Environmental Services under and pursuant to Minnesota Statutes Sections 473.517, 473.519 and 473.521, Sub. 2, are hereby set as follows:

1) The sanitary sewer rate applicable inside the City of Minneapolis is **five dollars and one cents ($5.01)** per one hundred (100) cubic feet.

2) In addition, a fixed charge based on water meter size will be billed each billing period or fraction thereof as follows:

Meter Size	Fixed Charge
5/8-inch	$7.30
3/4-inch	$10.95
1-inch	$18.25
1 1/2-inch	$36.50
2-inch	$58.40
3-inch	$116.80
4-inch	$182.50
6-inch	$365.00
8-inch	$584.00
10-inch	$839.50
12-inch	$2,409.00

3) The sanitary sewer rate applicable outside the City of Minneapolis for all sewage flow generated is five dollars and one cent ($5.01) per one hundred (100) cubic feet when the City of Minneapolis also provides water. In addition, the fixed charge sanitary sewer rate shall be based on meter size per section (b).

4) Sanitary sewer only service outside the City of Minneapolis shall be thirty-seven dollars and thirty-six cents ($37.36) per month.

5) The sanitary sewer charge for residential property not exceeding three (3) residential units shall be based on the volume of water used during the winter season which is defined as a four (4) month period between November 1 and March 31.

   a. The sanitary sewer charge for residential property not exceeding three (3) residential units may be based upon actual meter reading instead of AWC if usage comes from a different source than the residential general supply meter.

6) The sanitary sewer charge for residential property exceeding three (3) residential units and all other commercial and industrial property shall be based on measured sewage volume or the total water volume used during the billing period as is appropriate.

Stormwater Rate

The stormwater rate, subject to the provisions in Chapter 510, of the Minneapolis Code of Ordinances, is imposed on each and every Single-Family Residential Developed Property, Other Residential Developed

Property, Non-Residential Developed Property, and Vacant Property, other than Exempt Property, and the owner and non-owner users, and is hereby set as follows:

1) The Equivalent Stormwater Unit (ESU) rate is fourteen dollars and three cents ($14.03). The ESU measurement is 1,530 square feet of impervious area.
2) The stormwater rate imposed on Single-Family Residential Developed Properties shall be categorized into three tiers based on the estimated amount of impervious area as follows:

   High – Single-Family Residential Developed Property – greater than one thousand five hundred and seventy-eight (1,578) square feet of estimated impervious area. The ESU shall be 1.25 and the stormwater rate set at seventeen dollars and fifty-four cents ($17.54).

   Medium – Single-Family Residential Developed Property – equal to or greater than one thousand four hundred and eighty-five (1,485) square feet and less than or equal to one thousand five hundred and seventy-eight (1,578) square feet of estimated impervious area. The ESU shall be 1.00 and the stormwater rate set fourteen dollars and three cents ($14.03).

   Low – Single-Family Residential Developed Property – less than one thousand four hundred and eighty-five (1,485) square feet of estimated impervious area. The ESU shall be .75 and the stormwater rate set at ten dollars and fifty-three cents ($10.53).

3) Stormwater charges for all other properties will be based on the following calculation:

   (Gross Lot Size in sq.ft. X Runoff Coefficient) ÷ 1,530 sq. ft.= # of ESU

   \# of ESU X $ 14.03 = Monthly Fee

   The runoff coefficient assumed for each land use category is shown below.

Land Use	Coefficient Applied
Bar-Restaurant-Entertainment	.75
Car Sales Lot	.95
Cemetery w/Monuments	.20
Central Business District	1.00
Common Area	.20
Garage or Misc. Res.	.55
Group Residence	.75
Ind. Warehouse-Factory	.90
Industrial railway	.85
Institution-Sch.-Church	.90
Misc. Commercial	.90
Mixed Comm.-Res-Apt	.75
Multi-Family Apartment	.75
Multi-Family Residential	.40
Office	.91
Parks & Playgrounds	.20
Public Accommodations	.91
Retail	.91
Single Family Attached	.75
Single Family Detached	ESU

Sport or Rec. Facility	.60
Utility	.90
Vacant Land Use	.20
Vehicle Related Use	.90

Solid Waste Rate

1) The base unit charge shall be twenty-six dollars and fourty-six cents ($26.46) per dwelling unit per month.
2) The cart disposal charge shall be two dollars ($2.00) per month for each small cart.
3) The cart disposal charge shall be five dollars ($5.00) per month for each large cart assigned to a dwelling unit.

Minneapolis Stormwater Utility Fee FAQ

What is Stormwater?

Stormwater is runoff from a rainstorm or melting snow. City landscapes - unlike forests, wetlands, and grasslands that trap water and allow it to filter slowly into the ground - contain great areas of impermeable asphalt and concrete surfaces that prevent water from seeping into the ground. Because of this, large amounts of water accumulate above the surface. This water will run off before eventually entering into our lakes, rivers and streams.

Why is it important to manage stormwater?

Minneapolis, like other communities, needs to manage stormwater to protect people's homes and properties, the environment, lakes, streams & rivers. If this is not done, stormwater will cause flooding, erosion and pollution. Heavy rains that flood streets and yards can result in property damage. Stormwater runoff also picks up pollutants and debris from streets, parking lots & yards, carrying them into our lakes, rivers and streams.

What is the stormwater utility fee on my bill?

The stormwater utility fee pays for the City's current stormwater system and annual maintenance costs. This helps to prevent and correct stormwater runoff problems in Minneapolis. All properties within City limits (with very limited exceptions) are charged a monthly stormwater utility fee. This fee had existed prior to 2005, but was included as part of the combined sanitary sewer/stormwater fee.

Because the stormwater utility fee is a user fee and not a tax, all properties regardless of ownership are required to pay for the services provided by the Minneapolis stormwater management system. This includes non-profit entities such as churches, schools and institutions, as well as properties owned by the City of Minneapolis, the State of Minnesota, and the federal government.

How is the stormwater fee calculated?

The stormwater utility fee is based on impervious area and is charged on a per unit basis. Each ESU (**E**quivalent **S**tormwater **U**nit) is 1,530 square feet of impervious area on a property. The impervious area is calculated based on the size of the property, as well as the current use. Single family properties are billed using one of the following rates:

High	1.25 ESU	$17.03
Medium	1.00 ESU	$13.62
Low	.75 ESU	$ 10.22

All other properties are billed as follows: Gross Lot Size in square ft. X Runoff Coefficient (based on Land Use class) divided by 1,530 square ft = # of ESU's.

What is impervious area?

Surfaces where water cannot flow through freely. Examples of impervious surfaces include, but are not limited to the following:

- House footprints
- Driveways
- Parking Lots
- Sidewalks
- Patios
- Decks
- Detached garages
- Sheds
- Concrete air conditioner pads
- Brick pavers

It also includes all non-improved (vegetated or grass cover) areas that are used for parking storage or are driven upon. In an urban environment such as Minneapolis, a property's impervious area is the most significant factor affecting both stormwater quality and quantity.

Is there a way to reduce my stormwater fee?

Yes. Stormwater fees can be reduced through the City of Minneapolis Stormwater Credits Program. The credits program offers a reduction in fees to property owners who use approved methods to manage stormwater runoff on their property. Fees can also be reduced through the replacement of excess impervious area (such as unused parking lots) with landscaped green space.

How does the City's Stormwater Credits Program encourage helpful environmental practices?

The stormwater fee incorporates opportunities for property owners to reduce their stormwater bill by taking environmentally friendly steps. Stormwater utility fee reductions, also called credits, are available to those who are using or installing stormwater management tools/practices on their properties. Installing rain gardens or other materials, such as impervious pavers, allows stormwater to soak into the ground, rather than run into storm sewers.

How can I get a stormwater credit on my utility bill?

Credit guidelines and application forms can be found on the on the Stormwater - City of Minneapolis (minneapolismn.gov). If you need additional information, please contact (612) 676-2226.

Last updated June 23, 2022

2021 CU YDs removed from Grit Chambers			
Grit Chamber ID	Location	Volume of Sediment Removed	Date Maintained / Inspected
GC 1	UPTON AVE N & 53RD AVE N	0.5	5/17/21
GC 2	RUSSELL AVE N & 53RD AVE N	2	4/7/21
GC 3	SHERIDAN AVE N, N OF 52ND AVE N	1	5/25/21
GC 4	RUSSELL AVE N NORTH OF 52ND AVE N	0.5	5/26/21
GC 5	PENN AVE N & 52ND AVE SO OF CREEK IN STREET	1.5	5/26/21
GC 6	PENN AVE N & 52ND AVE N	1.5	6/2/21
GC 8	NEWTON AVE N & SHINGLE CREEK	1	6/7/21
GC 9	OLIVER AVE N & 51ST AVE N	2	6/3/21
GC 10	MORGAN AVE N & 51ST AVE N	0.5	6/3/21
GC 11	KNOX AVE N & 51ST AVE N	1.5	6/16/21
GC 12	KNOX AVE N & 50TH AVE N	4.5	6/8/21
GC 13	IRVING AVE N & 50TH AVE N	0.5	6/14/21
GC 14	JAMES AVE N NORTH OF 49TH AVE N	0.5	6/14/21
GC 15	21ST AVE N & 1ST ST N	10	12/7/21
GC 17	XERXES AVE N & GLENWOOD AVE	5	6/22/21
GC 18	MORGAN AVE N & CHESTNUT AVE	3	6/23/21
GC 21	LAKE OF THE ISLES PKWY & LOGAN AVE	12	10/4/21
GC 22	W 22ND ST & JAMES AVE S	4	7/13/21
GC 24	DREW AVE S & W LAKE ST	4	8/3/21
GC 26	W LAKE ST & ALDRICH AVE S	4	10/14/21
GC 27	W 32ND ST & BRYANT AVE S	4	9/16/21
GC 28	W 33RD ST & HOLMES AVE S	6	10/1/21
GC 30	YORK AVE S & W LAKE CALHOUN PKWY	2	6/24/21
GC 31	CHOWEN AVE S & W 41ST ST	0	10/19/21
GC 35	E 44TH ST & OAKLAND AVE S	3	8/4/21
GC 36	E 46TH ST. & 31ST AVE S	3	9/15/21
GC 38	W 47TH ST & YORK AVE S	2	7/27/21
GC 46	MORGAN AVE S & W 53RD ST	8	11/4/21

GC 47	E 55TH ST & PORTLAND AVE S	2	7/12/21
GC 48	E 56TH ST & PORTLAND AVE S	5	7/12/21
GC 49	E 57TH ST & PORTLAND AVE S	2.5	7/20/21
GC 50	E 58TH ST & PORTLAND AVE S	3.5	7/21/21
GC 51	GIRARD AVE S BETWEEN W 59TH ST & W 60TH ST	4	7/26/21
GC 52	E 59TH ST & 12TH AVE S	4	10/6/21
GC 53	GIRARD AVE S & W 60TH ST	2	7/15/21
GC 54	GIRARD AVE S BETWEEN W 60TH & DUPONT AVE S Use two Vacs	40	8/19/21
GC 56	GRASS LAKE SERVICE ROAD BEHIND JAMES AVE S	1.5	7/15/21
GC 57	GRASS LAKE SERVICE ROAD BEHIND JAMES AVE S	1	7/14/21
GC 58	GRASS LAKE SERVICE ROAD BEHIND W 61ST ST	1	7/14/21
GC 59	W 61ST ST & GRASS LAKE SERVICE ROAD	1.5	7/14/21
GC 61	E RIVER ROAD & CECIL ST	12	7/20/21
GC 62	HIAWATHA PARK REFECTORY TURN-A-ROUND	2	9/13/21
GC 63	33RD AVE N & 1ST ST N/RAILROAD TRACKS	1	9/9/21
GC 64	NORTH TRANSFER STATION	1	9/7/21
GC 66	MAPLE PLACE & EAST ISLAND	1	9/30/21
GC 67	DELASALLE DRIVE & EAST ISLAND	1	9/29/21
GC 69	EASTMAN AVE & W ISLAND	1	9/30/21
GC 70	ROYALSTON & 5TH AVE N	1	9/28/21
GC 71	THE MALL & E LK OF THE ISLES Use two Vacs	64	8/17/21
GC 72	S OF 37TH AVE NE & ST ANTHONY PKWY	5	10/18/21
GC 78	SHINGLE CREEK WETLAND - WEST SIDE	4	10/6/21
GC 79	SHINGLE CREEK WETLAND - EAST SIDE	4	10/6/21
GC 80	WOODLAWN BLVD & E 50TH ST	4	10/26/21
GC 83	13TH AVE S & POWDERHORN TERRACE	4	9/28/21
GC 85	3329 14TH AVE S	1.5	9/16/21
GC 87	3318 10TH AVE S	3	8/4/21
GC 88	ACROSS THE STREET FROM 702, NO. BD. VAN WHITE BLVD.	1	8/17/21
GC 89	ACROSS THE STREET FROM 706, NO. BD. VAN WHITE BLVD.	1	8/17/21
GC 91	SO. BD. VAN WHITE BLVD., 200' SO. OF 8TH AVE. NO.	1	7/7/21
GC 92	ACROSS THE STREET FROM 701, SO. BD. VAN WHITE BLVD.	3.5	7/8/21
GC 93	SO. BD. VAN WHITE BLVD, 250' SO. OF 10TH AVE. NO.	4	6/28/21
GC 94	10TH AVE. NO. & NO. BD. VAN WHITE BLVD. (S.W.C.)	6	8/18/21
GC 95	WEST SIDE OF ALDRICH AVE. NO. & 9TH AVE. NO.	1.5	7/27/21
GC 96	8TH AVE. NO. & NO. BD. VAN WHITE BLVD. (N.E.C.)	0.25	10/28/21
GC 98	MALMQUIST LANE & HUMBOLDT NO.	1	10/4/21
GC 99	SHINGLE CREEK DR. & HUMBOLDT NO.	1	10/5/21
GC 100	SO. OF 49TH AVE. NO. & HUMBOLDT NO.	5	11/3/21

GC 109	22ND AVE NO-WEST RVER RD	1.5	10/20/21
GC 111	RICHFIELD RD. (near w. corner of pkg. lot no. of wm berry pkwy)	1	6/23/21
GC 112	W. 36TH ST. (30' w. of e. calhoun pkwy.	4	6/28/21
GC 113	20' E OF VAN WHITE BLVD ON 5 TH AVE NO	2	8/4/21
GC 114	DUPONT AVE N AND 4TH AVE N	4	9/16/21
GC 115	VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	3	8/3/21
GC 119	11TH AVE N AND VAN WHITE MEM. BLVD (N.B.)	1	9/7/21
GC 120	VAN WHITE MEM. BLVD (S.B.)	1	6/30/21
GC 121	50' NORTH (EAST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND FREMONT AVE N	1	6/30/21
GC 122	MINNEHAHA PARKWAY @ 39TH AVE S NORTH SIDE OF PKWY	3	10/1/21
GC 128	W. 27TH ST AND LAKE OF THE ISLES PKWY - no as-builts	2.5	8/9/21
GC 134	W 22ND ST @ E LAKE OF THE ISLES BLVD, no as-builts	8	7/16/21
GC 137	W 44TH ST & W LAKE HARRIET PKWY EAST (Installed on existing 54" Concrete Pipe	11	8/12/21
GC 138	EWING AVE S @ FRANKLIN AVE S	0.25	10/5/21
GC 139	EWING AVE S @ FRANKLIN AVE S	3	10/5/21
GC 140	E LAKE ST WEST OF 14TH AVE S (Hennepin County const. Lake St.)	3	11/9/21
GC 141	E LAKE ST EAST OF 14TH AVE S (Hennepin County const. Lake St.)	1.5	11/8/21
GC 142	18TH AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.)	1.5	9/22/21
GC 143	LONGFELLOW AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.)	2	9/14/21
GC 144	31ST AVE S NORTH OF E LAKE ST (Hennepin County const.. Lake St.)	2	10/22/21
GC 146	4522 LAKE ST. (HENN CO)	2	10/20/21
GC 147	4610 LAKE ST. (HENN CO)	2	10/19/21
GC 148	42ND LAKE ST. (HENN CO)	3.5	9/21/21
GC 149	W 44TH ST AND ALDRICH AVE S (SWC) (added 11/28/07)	3.5	9/30/21
GC 150	W. RIVER ROAD & 23RD AVE. N., no as-builts	2.5	11/3/21
GC 151	DIAMOND LAKE ROAD & CLINTON AVE SO.	8	10/8/21
GC 152	3RD AVE S & 2ND ST S	2	11/24/21
GC 153	W. LAKE ST AND BLAISDELL AVE S (west curbline) Hennepin County	8	10/15/21
GC 154	W LAKE ST AND DUPONT AVE S (east of east curbline) Hennepin County	4	10/12/21
GC 155	PLEASANT AVE S AND LAKE ST (south of south curbline) Hennepin County	1.5	9/2/21
GC 156	W. 43RD ST & EAST LAKE HARRIET PARKWAY	3	8/23/21
GC 158	E. 61ST ST. & COLUMBUS AVE. S.	6	6/22/21
GC 162	DOWLING AVE N & OLIVER AVE N	1	6/25/21
GC 163	PLYMOUTH AVE N (westside of River)	1	9/21/21
GC 166	THOMAS AVE S & DEAN PARKWAY (to Kenilworth lagoon)	6	7/8/21
GC 167	E RIVER ROAD , NORTH OF WASHINGTON AVE SE	5	9/27/21
GC 168	Dowling ave n. &between Newton ave and Morgan ave n. by alley	0.5	7/26/21
GC 169	DOWLING AVE N & between Oliver ave and Newton ave n by alley	0.5	7/26/21
GC 171	NEWTON AVE N @ DOWLING AVE N sump MH	0.5	7/26/21

GC 176	176 16th Ave S and 6th St S (North Side @ 6th St.)	0.25	8/5/21
GC 177	16th Ave S and 6th St S (North Side Midblock)	0.25	8/6/21
GC 178	16th Ave S and 6th St S (North Side @ RR Tracks)	1	8/6/21
GC 179	16th Ave S and 6th St S (South Side @ 6th St.)	0.25	8/6/21
GC 180	16th Ave S and 6th St S (South Side Midblock)	0.25	8/6/21
GC 181	16th Ave S and 6th St S (South Side @ RR Tracks)	1	8/6/21
	Total Volume Removed (CU. Yds)	410	

NPDES Report - Appendix A12

Stormwater Monitoring Results and Data Analysis

Lake Monitoring

In 2021, MPRB scientists monitored 11 of the city's most heavily used lakes. The data collected were used to calculate a Trophic State Index (TSI) score for each of the lakes. Lower TSI scores indicate high water clarity, low levels of algae in the water column, and/or low phosphorus concentrations. Changes in lake water quality can be tracked by looking for trends in TSI scores over time. In **Table 1** and **Figure 1** TSI trends for Minneapolis lakes from 1991 to 2021 are shown, and in **Table 2** the trend in TSI is shown for Minneapolis lakes for the most recent ten years. A negative slope indicates improving water quality, while a positive slope indicates declining water quality.

These values are especially important for monitoring long-term trends (10+ years). Historical trends in TSI scores are used by lake managers to assess improvement or degradation in water quality. Trends are also used by the Minnesota Pollution Control Agency to assess non-degradation goals.

Most of the lakes in Minneapolis fall into either the mesotrophic or eutrophic category. Bde Maka Ska, Harriet, and Wirth are mesotrophic having moderately clear water and potential for hypolimnetic anoxia during the summer. Lake of the Isles, Cedar, and Hiawatha are eutrophic having an anoxic hypolimnion and potential for nuisance growth of aquatic plants. Nokomis, Loring, and Powderhorn are also eutrophic with high algal productivity. Blue-green algae dominates the phytoplankton community on Lake Nokomis and Powderhorn Lake, resulting in periodic appearance of algal scum on these lakes. Brownie Lake was also classified as eutrophic in 2020 but was not sampled in 2021. Spring Lake is hypereutrophic with very high nutrient concentrations. Scores for Diamond and Grass Lake are not included since these lakes are too shallow to calculate the Secchi portion of the TSI index.

Table 1. Water quality trends in Minneapolis lakes from 1991-2021.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
Bde Maka Ska	Brownie Lake	No lakes with declining trend
Wirth Lake	Cedar Lake	
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Loring Pond	
	Lake Nokomis	
	Powderhorn Lake	
	Spring Lake	

Table 2. Water quality trends in Minneapolis lakes from 2012-2021.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
No lakes with improving trend	Bde Maka Ska	Cedar Lake
	Brownie Lake	Spring Lake
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Loring Pond	
	Lake Nokomis	
	Powderhorn Lake	
	Wirth Lake	

Most of the Minneapolis lakes have no directional trend in water quality indicators when all years of data are taken into consideration, as shown in **Table 1**. Most of the major water quality improvement projects done in the lake's watersheds were completed by the early 2000's. Chemical treatments, like alum, have a life span after which water quality and TSI reflects the new internal and external loading regime of the watershed.

There was significant improvement in water quality indicators in Bde Maka Ska after watershed projects were built and the lake was treated with alum (linear regression, $p < 0.05$). TSI scores after 2006 have stabilized. TSI scores at Bde Maka Ska between 2017 and 2020 were higher than the previous few years due to higher chlorophyll-*a* and total phosphorus concentrations but were still below the early 1990s scores. In 2021, the TSI score decreased due to deeper water clarity and lower chlorophyll-*a* concentrations.

The water quality in Brownie Lake has been relatively stable, with no significant trend since 1993. Brownie Lake is monitored every other year and was not monitored in 2021. There were no Clean Water Partnership projects in the Brownie Lake watershed. Significant amounts of redevelopment projects have reduced the external load to this lake. The lake is meromictic and highly enriched bottom waters may control water quality at this lake.

Cedar Lake showed improvement following restoration efforts through the late 1990s, particularly after chemical treatment with alum. Since the end of alum effectiveness, estimated as 7-10 years post-treatment, TSI scores gradually increased. When looking at the last ten years of TSI scores for Cedar Lake there is an increasing trend in TSI. Cedar Lake TSI scores between 2017 and 2021 have been the highest they have been since the early 1990s due to higher chlorophyll-*a* concentrations and shallower Secchi depths. Increased frequency in algae blooms potentially connected to increased external loading due to high rainfall may partially explain this change.

Diamond Lake and Grass Lake are not included in this analysis, since TSI scores are only appropriate for deeper lake systems and these lakes are too shallow to measure Secchi depth. Except right after storms, the Secchi disk is clearly visible when sitting on the bottom of these two wetlands.

Lake Harriet experienced a few years with very clear water and low TSI scores following a littoral alum treatment in the mid-2000s. TSI scores remained relatively stable for several years since that time. Low TSI scores and very clear water occurred again in 2016 and 2020. The recent TSI trend in Lake Harriet was not significant in 2021 (linear regression, $p > 0.05$).

Water quality at Lake Hiawatha is heavily influenced by the inflow from Minnehaha Creek. The lake has poorer water quality during drought years, and better water quality in years with high flow from Minnehaha Creek. In 2021, there was less precipitation compared to previous years and the TSI score in Lake Hiawatha was high due to shallower water clarity and increased chlorophyll-*a* and total phosphorus concentrations.

The water quality in Lake of the Isles fluctuates with no time dependent trend. In 2021, the lake had a lower TSI compared to previous years due to deeper water clarity, but there was no significant trend (linear regression, $p > 0.05$). Even after an alum treatment and watershed intervention, there was no significant water quality trend in any direction since 1991. External loading in this waterbody likely exceeded any benefit of internal load reduction.

Water quality in Loring Pond fluctuates. The TSI score at Loring Pond was lower in 2021 compared to the previous two years due to deeper water clarity and lower total phosphorus concentrations. Extensive duckweed growth, and augmentation with groundwater effect clarity and nutrient concentrations at this shallow lake.

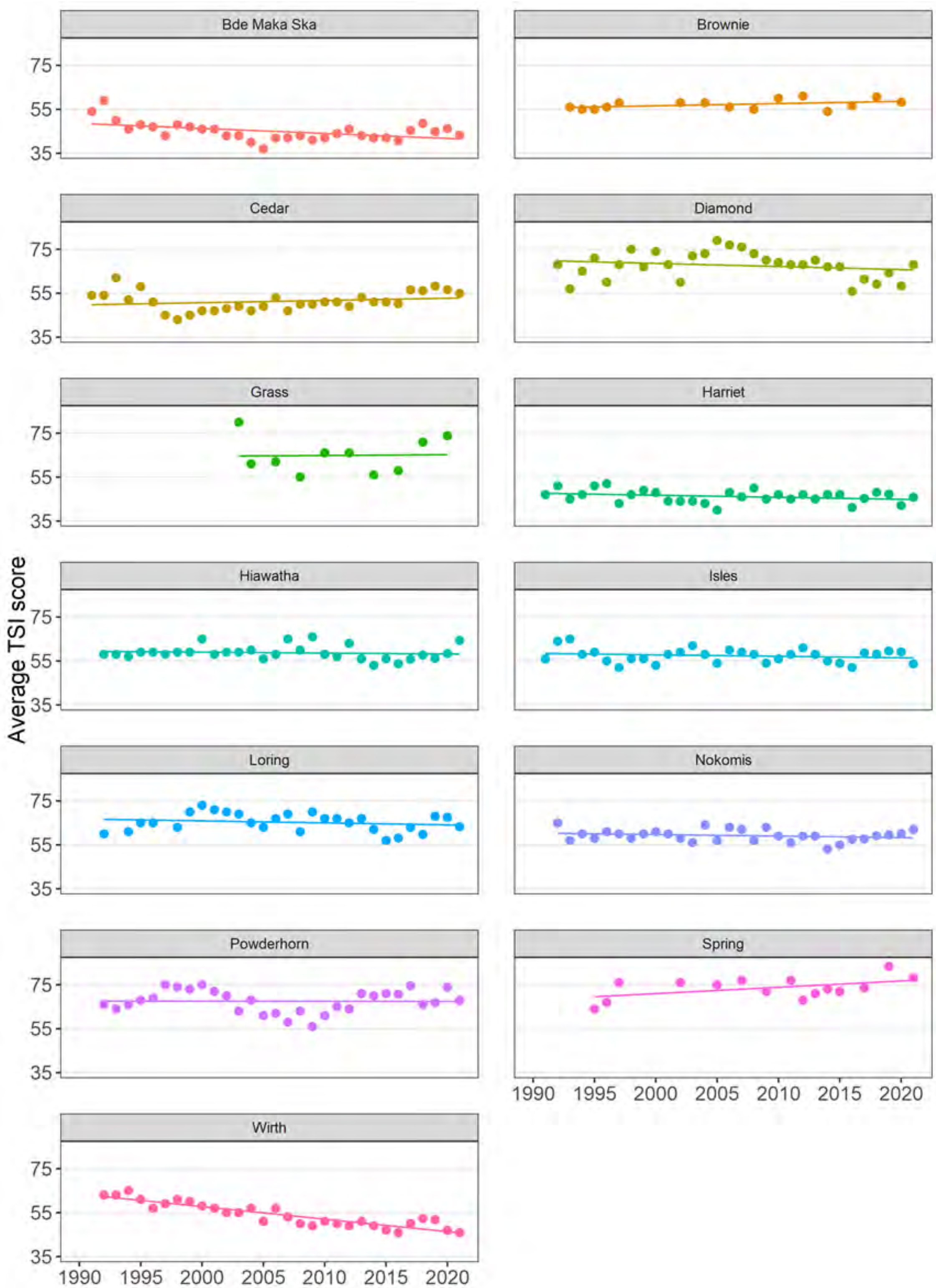
Immediately following a biomanipulation project that was completed in 2013, Lake Nokomis had improvement in water quality; however, with higher algal concentrations in recent years, TSI scores have stabilized and there is no statistically significant trend (linear regression, $p > 0.05$).

Powderhorn Lake has experienced a wide variation in water quality. The lake was placed on the 303d list for exceeding nutrient standards, was removed, and then re-listed after water quality declined. The worst measured TSI scores at this lake occurred in the late 1990s and the best scores in the late 2000s when the lake met standards for several years. Powderhorn had poor water quality again from 2013 -2017, and again in 2020, with blue green algae blooms leading to low water clarity. The TSI score was lower in 2021 due to deeper water clarity and lower chlorophyll-*a* concentrations.

Water quality in Spring Lake is variable, but there is no significant trend in any direction since 1994. Spring Lake is monitored every other year and was monitored in 2021. The TSI score increased in 2019 and 2021 due to higher chlorophyll-*a* and total phosphorus concentrations. Spring Lake is a highly nutrient-enriched and chemically stratified lake that is unlikely to respond to nutrient load reduction.

Water quality improvement at Wirth Lake has been occurring since 1992, going from a eutrophic system dominated by algal growth to a moderately clear mesotrophic system (linear regression, $p < 0.05$). The lake was delisted from the 303d list based on meeting standards for Secchi, chlorophyll-*a*, and total phosphorus. TSI scores at Wirth Lake between 2017 and 2019 were slightly higher than the previous few years due to increased chlorophyll-*a* and total phosphorus concentrations but improved again in 2020 and 2021.

There are no lakes in Minneapolis with water quality indicators worse than conditions in the early 1990s. Recent higher TSI scores in some lakes may be connected to several years of record precipitation leading to increases in external nutrient.



Source – Minneapolis Park and Recreation Board

Figure 1. TSI scores and regression analysis for selected Minneapolis lakes 1991–2021. Lower TSI scores indicate high water clarity, low levels of algae in the water column, and/or low phosphorus concentrations. A negative slope indicates improving water quality, while a positive slope indicates declining water quality. Only Bde Maka Ska and Wirth have statistically significant trends (p <0.05).

Pond Screening and Monitoring

BACKGROUND

Introduction

In 2020, the City of Minneapolis, working with Stantec Engineering, conducted a city-wide screening study of 22 dry and retention stormwater ponds. The purpose of the study was to determine if any of the ponds had internal phosphorus loading and should be prioritized for future monitoring or retrofit projects that would increase pollutant removal.

Accompanying this study, in 2020, the Minneapolis Park and Recreation Board (MPRB) carried out a pond screening study of 16 retention ponds, that largely overlapped and augmented the Stantec study. The 2020 study included wet pond water chemistry monitoring, bathymetric surveys, and oxygen/temperature water column profiles. Ponds could then be prioritized for future monitoring and projects if they had evidence of high phosphorus return from the sediment or sediment resuspension. These conditions ultimately reflect the pond's effectiveness as a treatment device. Note, the 25th Ave SE Pond in 2020 was mistakenly called 25th Ave NE in MPRB 2020 reports.

In 2021, four ponds were prioritized for additional monitoring based on the 2020 pond screening data, as shown in **Table 24-1.** Water chemistry and microcystin samples were collected in 2021, along with Hydrolab/YSI sonde profiles and Secchi transparency from May through October. Pond water level was monitored at 15 min intervals from June through October. The pond level data can inform when the pond discharged water from the outlet to the downstream storm sewer system.

The 2021 pond study attempted to:

1. Determine the potential for internal phosphorus release from the pond sediments within each stormwater pond.
2. Determine chloride (Cl) levels of the ponds to assess the potential for aquatic habitat.
3. Using chlorophyll-*a* (Chl-*a*) and the cyanotoxin microcystin to determine the potential for Harmful Algal Blooms (HABs) in the ponds.

Table 24-1. Ponds that were monitored by MPRB in 2021.

Pond Monitored	Construction Year	Watershed Area	Predominant Land Use	Last Dredged	Reason for Monitoring
Park and 44th W	2002	109 acres	Park Residential/Single Family	Never	Potential for HABs, Potential for Internal Phosphorus Release
25th Ave SE	2011	4 acres	Park Commercial Industrial	Never	High Cl levels, Potential for Internal Phosphorus Release
Heritage Park #5	2004	116 acres	Residential Single Family/Multifamily Institutional	2014	High phosphorus levels, Potential for HABs, Potential for Internal Phosphorus Release
Camden	2007	235 acres	Cemetery Park Residential	Never	Potential for HABs, Potential for Internal Phosphorus Release

Internal Release of Phosphorus Monitoring

The first goal of the 2020 - 2021 Pond Screening and Monitoring program was to determine the potential for internal phosphorus release from the pond sediments within each stormwater pond. Stormwater ponds receive both external loads and internal loads of phosphorus throughout the year. Internal load is caused by the release of phosphorus from the pond sediments throughout the year. Iron-bound phosphorus in pond sediments can be released into the water column when the pond bottom water was less than 2 mg/L oxygen content. Unmixed stormwater ponds can become anoxic during the summer months as bacteria and microorganisms consume oxygen. Dissolved oxygen usually remains high at the pond surface due to mixing with oxygen-rich air, but thermal stratification prevents this oxygen from circulating to the pond bottom. This thermal stratification can also prevent sediment released phosphorus from reaching the pond surface. Thus, the amount of phosphorus at the pond surface can reflect the extent of mixing that occurs within the pond or sediment resuspension throughout the year. Resuspension of sediments can also cause internal release of phosphorus. Sediment resuspension can occur due to sediment disturbance from fish, wind mixing, or inlet hydraulic velocity.

Given that stormwater ponds are designed to trap and settle out phosphorus, a significant internal release of phosphorus from the sediment, followed by mixing, means that the pond is not working effectively. However, if the phosphorus released remains near the pond bottom and does not migrate to the pond surface, it is less likely to impact the downstream water body. Thus, monitoring the internal release of phosphorus gives insight into which ponds are working effectively and which ponds need retrofitting.

Chloride (Cl) Monitoring: Effect on Aquatic Habitat

The second goal of the 2020 – 2021 Pond Screening and Monitoring program was to determine chloride (Cl) levels to assess the potential for pond aquatic habitat. Chloride content above the Minnesota Pollution Control Agency (MPCA) 5-day chronic threshold of 230 mg/L is an impairment to aquatic life and is an indication that a pond is poor aquatic habitat. The 230 mg/L Cl chronic threshold is a standard applied to MN Class 2B waters used for fishing and swimming. Stormwater ponds do not currently have standards for Cl content; however, it is often a desire that stormwater ponds provide a habitat benefit. High Cl is detrimental to aquatic life and may be a limitation on habitat suitability of ponds.

Chl-a, microcystin and Harmful Algal Blooms (HABs) Monitoring

The third goal for 2021 was to use chlorophyll-*a* (Chl-*a*) and the cyanotoxin microcystin to determine the potential for Harmful Algal Blooms (HABs) in the ponds. Chl-*a* and the cyanotoxin microcystin were measured in surface samples collected at the four stormwater ponds. Chl-*a* concentrations over 30 µg/L are considered an indicator of moderate or greater likelihood for potential HABs (Heiskary and Lindon, 2009). The MPCA recreational health risk advisory toxin concentration level for microcystin is 6 ug/L and was used as a reference for the stormwater ponds. Stormwater ponds are not constructed or intended for recreational body contact. Sampling was intended to determine if the cyanotoxin microcystin levels were elevated above the MPCA recommendations.

Blue-green algae, also referred to as cyanobacteria, are photosynthetic microorganisms that occur naturally in lakes, streams, and other waterbodies. When cyanobacteria reproduce rapidly under certain conditions, they can form blooms, or high concentrations of cyanobacteria that can create streaks of accumulation along the shore, or open water discoloration. Blooms can look like green paint in the waterbody. Certain taxa of cyanobacteria have the capability to produce toxins called cyanotoxins, and these toxins can reach harmful levels during blooms. Wildlife, pets, and humans can be harmed if they ingest or otherwise come into close contact with cyanotoxins (US EPA, 2017). HABs in neighborhood ponds could be a potential health hazard for people or animals visiting the pond. It is not well understood when or why cyanobacteria make cyanotoxins.

While the studies ponds are intended to store runoff volume, the City of Minneapolis is also interested in the potential for ponds to function as aquatic habitat and greenspace. HABs could have a detrimental effect on the recreational space of citizens. Thus, ponds could also be prioritized for additional monitoring or retrofit if they had a high potential of HABs that could affect the pond's secondary benefits as habitat and greenspace.

METHODS

Aerial photographs and sampling locations of 25th Ave NE, Camden, Park and 44th W, and Heritage Park #5, the four ponds studied in 2021, are presented in **Figures 24-1** through **24-4**. The sampling location at each pond is indicated by a yellow circle. The sampling points were chosen to be the deepest points in each pond, determined by the 2020 pond bathymetry study.

Figure 24-1. An aerial photograph of 25th Ave NE Pond and sampling location.

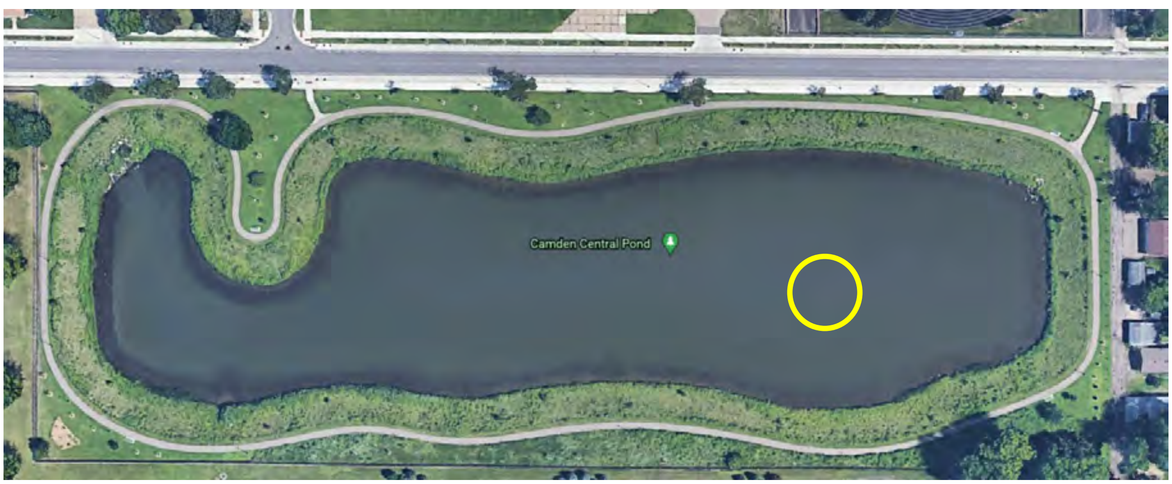


Figure 24-2. An aerial photograph of Camden Pond and sampling location.

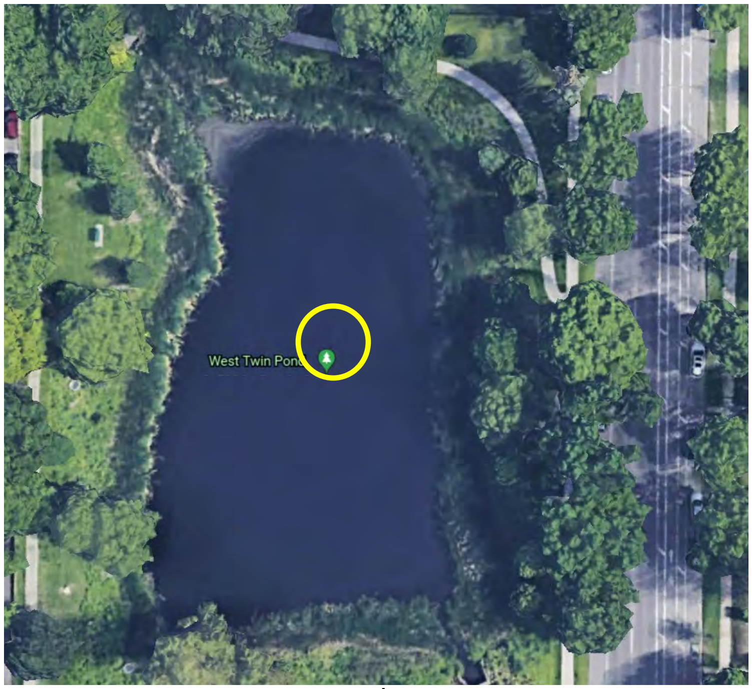


Figure 24-3. An aerial photograph of Park and 44th W Pond and sampling location.

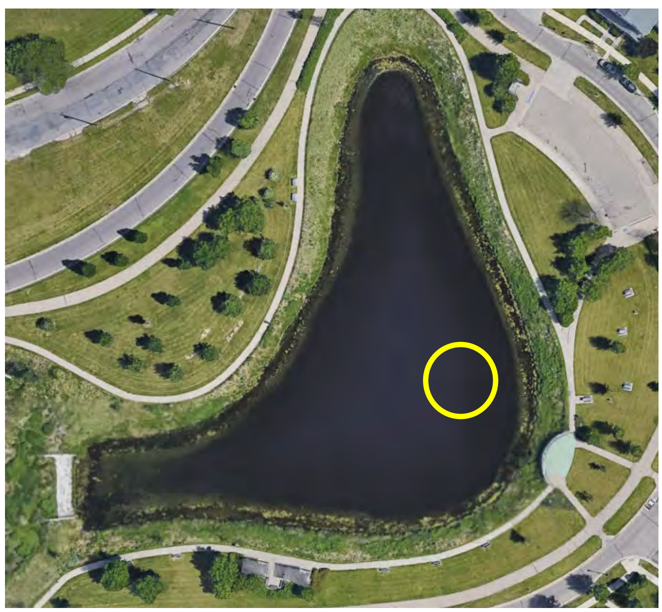


Figure 24-4. An aerial photograph of Heritage Park Pond #5 and sampling location.

In 2021 MPRB staff collected samples monthly from May to October, for chlorophyll-*a* (Chl-*a*), Biochemical Oxygen Demand (BOD), Chloride (Cl), and Total Phosphorus (TP) seen in **Figure 24-5**. The analytical methods used are presented in **Table 24-2**. Secchi transparencies were collected in meters with a black and white 30-cm Secchi disk. All water chemistry samples and Secchi transparencies were collected from a canoe anchored at the pre-determined sampling location. All surface samples were collected 6-inches below the surface. Chl-*a* samples were collected in opaque brown 2L bottles that were rinsed once with pond water prior to sampling. Chlorophyll-*a* and microcystin samples were collected just below the water's surface. Sub-surface samples were collected by plunging the sample bottle into the water upside-down and inverting it 6-inches beneath the surface until the bottle was filled. This method limited the amount of surface scum or debris present in the sample. BOD, Cl, and TP samples were collected in clear high-density polypropylene 250 mL bottles that were rinsed once with pond water prior to sampling. Microcystin samples were also collected in clear 250 mL bottles and not rinsed prior to sampling per lab protocol. BOD, Cl, and TP samples were collected both at the pond sub-surface and the pond bottom. Bottom samples were collected using a Kemmerer sampler at the maximum depth at each sampling location.

All TP chemistry samples were preserved with 5N sulfuric acid. All water chemistry samples were stored on ice and delivered to the laboratory where they were stored at 4 degrees Celsius until analyzed.

The first microcystin samples were frozen prior to analysis. Subsequent microcystin samples were not frozen prior to analysis and run within 5 days. The unfrozen samples were able to determine the microcystin that was free in the water, but misses toxin contained within cells. To determine the total microcystin in both the water and inside the cyanobacteria cells, samples should be frozen and thawed three times to lyse the cyanobacteria cells.

Figure 24-5. A photograph of MPRB staff collecting pond samples and taking YSI/Hydrolab sonde measurements at the 25th Ave SE Pond in 2021.

Table 24-2. Pond chemistry parameters, analytical methods, reporting limits, and holding times.

Parameter	Method	Reporting Limit	Holding Time
Chlorophyll-*a* (Chl-*a*)	SM 10200 H	0.50 ug/L	24-48 hours unfiltered, 28 days filtered in the dark
Total Phosphorus (TP)	SM 4500-PE	0.01 mg/L	48 hours
Chloride (Cl)	SM 4500-Cl^- B	2.0 mg/L	28 days
Biochemical Oxygen Demand (BOD)	SM 5210 B-01	1.0 mg/L	24 hours
Microcystin	Enzyme linked immunosorbent assay (ELISA)	0.15 ug/L	24 hours

A YSI or Hydrolab multiprobe sonde was used to collect profiles of dissolved oxygen (DO), temperature, specific conductivity, pH, and depth at each of the ponds during sample collection. The sonde was calibrated the morning of sampling and measurements were taken at 1-meter intervals throughout the water column.

Field blanks accompanied all sampling trips. All samples were immediately stored and transported on ice in a cooler prior to delivery to the laboratory for analysis. Field notes included air temperature, wind and weather conditions, pond conditions, visual monitoring index (VMI), water color, smell/odors, algae presence, trash, percent algae, percent duckweed, and any waterfowl present.

The water level of each of the four ponds was recorded continuously every 15 minutes from early June through November. Level data was collected to determine any outflow from the pond to downstream waterbodies. Each site had an ISCO 2105ci modem with antenna, 2150 datalogger, battery module, and area velocity (AV) level probe installed to record the pond level. Above ground doghouses/equipment boxes were used with conduit to protect the equipment and cables at Camden, Park and 44th W, and 25th Ave SW of the ponds. These three ponds had U-metal fence posts driven securely into the sediment near the pond outfalls. The AV level probes were securely attached, below water, to the U-post. A laser level and story pole were used to shoot an elevation mark of the outfall invert, to the pond fence post. The pond zero level was the invert of the outlet pipe. At Heritage Pond #5, equipment was hung below grade inside of a manhole with an AV level probe secured behind the overflow weir wall using a modified C-clamp.

Results

The temperature, dissolved oxygen (DO), pH, specific conductivity, turbidity, Secchi, total phosphorus (TP), dissolved oxygen (DO), chloride (Cl), chlorophyll-*a* (Chl-*a*), and microcystin data are presented below for each pond. Surface and bottom concentrations of TP, DO, and Cl data are plotted below for each pond. Chloride data for each pond are plotted and include the 5-day 230 mg/L standard set by the MPCA as the threshold for adverse impacts to aquatic life. Chl-*a* and microcystin data were only collected at the pond surface. Chl-*a* data are plotted for each pond, and graphs indicate the 30 ug/L level that is thought to correlate to a greater likelihood of HABs (Hieskary and Lindon, 2009). Microcystin data are plotted for each pond and graphics include the 6 µg/L reference standard set by the MPCA for water recreational health risk advisory.

It should be noted that the reference standards shown for chloride and microcystin serve as reference points for what is considered harmful for waters of the state. Exceeding these thresholds does not currently trigger any warnings or management actions since stormwater ponds do not promote human contact, and are not waters of the state, but in the case of this study exceedance indicates that habitat quality in the ponds is low.

Camden Pond

The results from Camden Pond, which is pictured in **Figure 24-6,** are presented in **Table 24-3,** and **Table 24-4**.

Figure 24-6. Camden Pond in 2021.The equipment doghouse and fencepost securing the level probe are both visible in the foreground.

Table 24-3. Camden Pond profile results. Obtained with a YSI or Hydrolab sonde and Secchi disk during sampling events. ND = No Data.

Date	Depth (M)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Specific Conductivity (µS/cm)	Turbidity (NTU)	Secchi (M)
5/18/2021	0	22.1	13.04	8.9	745	9.8	0.41
5/18/2021	1	19.1	14.62	8.9	746	10.6	ND
6/3/2021	0	22.6	10.26	8.7	598	6.1	0.62
6/3/2021	1	21.1	11.17	8.6	602	8.8	ND
7/21/2021	0	27.1	15.57	9.6	528	41.8	0.33
7/21/2021	1	23.3	0.59	6.7	640	3.9	ND
8/17/2021	0	23.4	7.53	9.3	506	77.9	0.10
9/9/2021	0	20.4	4.53	7.9	243	35.4	0.21
9/9/2021	1	20.2	3.24	7.9	243	34.0	ND
10/6/2021	0	18.2	4.36	7.7	269	69.3	0.21
10/6/2021	1	18.0	4.82	7.7	269	102.0	ND

Table 24-4. Camden Pond chemistry sampling results. ND = No Data.

Date	Depth (M)	Chlorophyll-*a* (µg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	BOD (mg/L)	Microcystin (µg/L)
5/18/2021	0	14	0.072	155	9	4.60
5/18/2021	1	ND	0.084	155	10	ND
6/3/2021	0	16	0.108	110	5	1.40
6/3/2021	1	ND	0.138	105	6	ND
7/21/2021	0	186	0.192	100	31	5.40
7/21/2021	1	ND	0.216	100	32	ND
8/17/2021	0	360	0.367	105	42	3.10
8/17/2021	1	ND	0.386	100	45	ND
9/9/2021	0	108	0.222	40	17	2.80
9/9/2021	1	ND	0.233	48	17	ND
10/6/2021	0	108	0.307	32	20	<0.15
10/6/2021	1	ND	0.341	66	8	ND

Phosphorus levels did not vary significantly between the surface and bottom of Camden Pond throughout the year, as can be seen in **Figure 24-7**. Total phosphorus was highest in August at the top 0.367 mg/L and 0.386 mg/L at bottom. The highest phosphorus measurement correlated with lower oxygen conditions at the pond bottom that began in July. These data support that anoxic conditions at the pond bottom are a driver of phosphorus release, and that this released phosphorus mixes throughout the water column. The consistent DO measurement show Camden

Pond was well-mixed throughout the year, except in July when DO was likely supersaturated (15.6 mg/L) at the pond surface and anoxic (0.6 mg/L) at the pond bottom which is shown in **Figure 24-7** and **24-7 b**. Supersaturation occurs when photosynthesizing algae are producing more oxygen than the water can hold at a given temperature. The August bottom DO sample point was not collected.

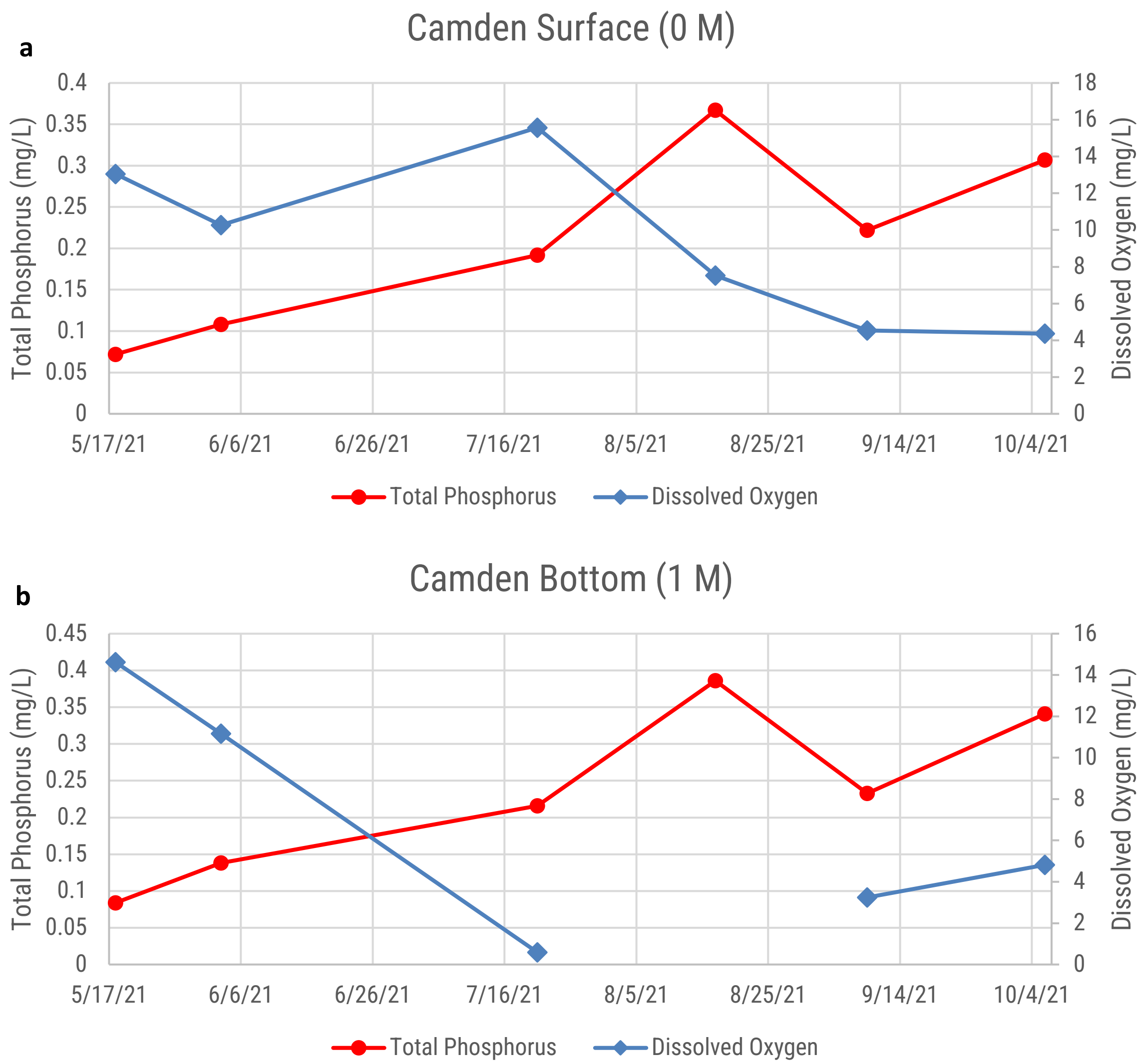


Figure 24-7. Phosphorus and dissolved oxygen at the surface (a) and bottom (b) of Camden Pond. August bottom DO data were not collected.

Chloride levels did not vary significantly between the surface and bottom of Camden Pond, **Figure 24-8**. Cl were well-mixed throughout the water column. In the data set chloride was highest in the May sample and then decreased in subsequent samples. Chloride levels remained below the MPCA's 230 mg/L standard throughout the year. The TP and DO data were also well mixed as shown in **Figure 24-7**.

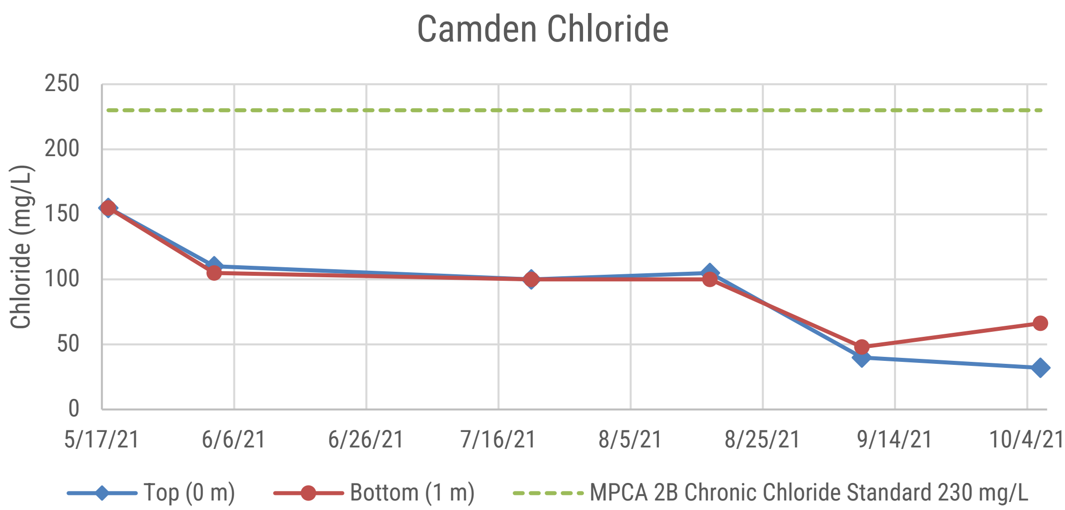


Figure 24-8. A graph of Cl levels at the surface and bottom of Camden Pond as compared to the MPCA 2B Chronic Cl Standard of 230 mg/L.

The highest phosphorus level shown in **Figure 24-7** correlates with the higher measurements of Chl-*a* for the pond shown in **Figure 24-9**. The Chl-*a* in Camden Pond was highest in August at 360 µg/L, which was much higher than the 30 µg/L potential concern level for potential HABs. Despite the high levels of Chl-*a*, microcystin levels remained below the MPCA advisory of 6 µg/L throughout the year. A correlation with TP data suggests that phosphorus is a driver of Chl-*a* in Camden Pond. High amounts of Chl-*a* did not correspond to significantly higher levels of microcystin or a HAB event.

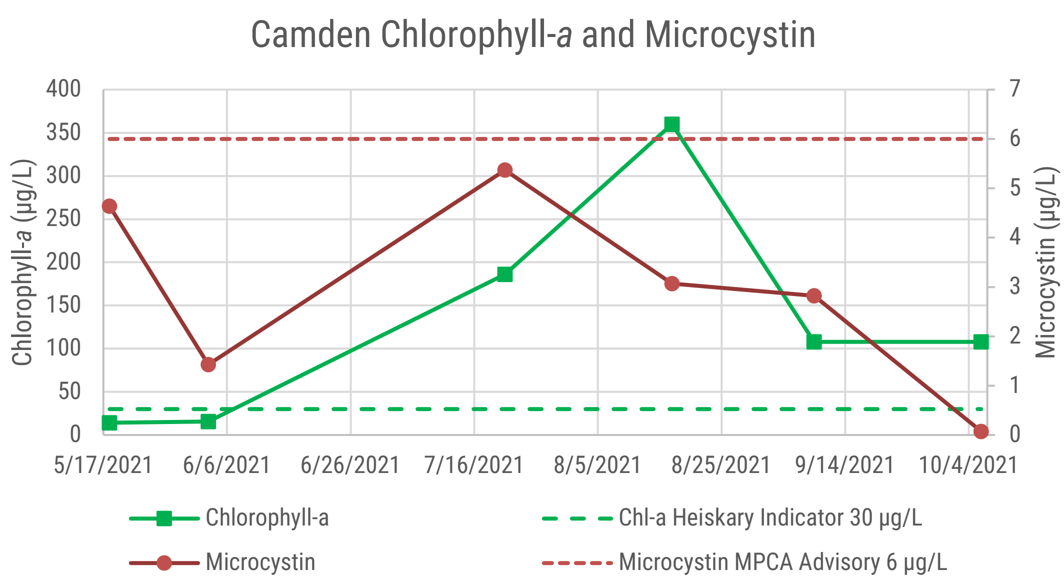


Figure 24-9. A graph of chlorophyll-*a* and microcystin at Camden Pond. The 30 µg/L chlorophyll-a indicator is the green reference line (Heiskary and Lindon, 2009). The MPCA advisory for microcystin is 6 µg/L and is the brown reference line.

The pond level data in **Figure 24-10** shows that Camden Pond was above the outlet level in late August/early September. The outflow period coincided with elevated TP at the pond surface and bottom. This suggests that the pond discharged high levels of phosphorus at this time.

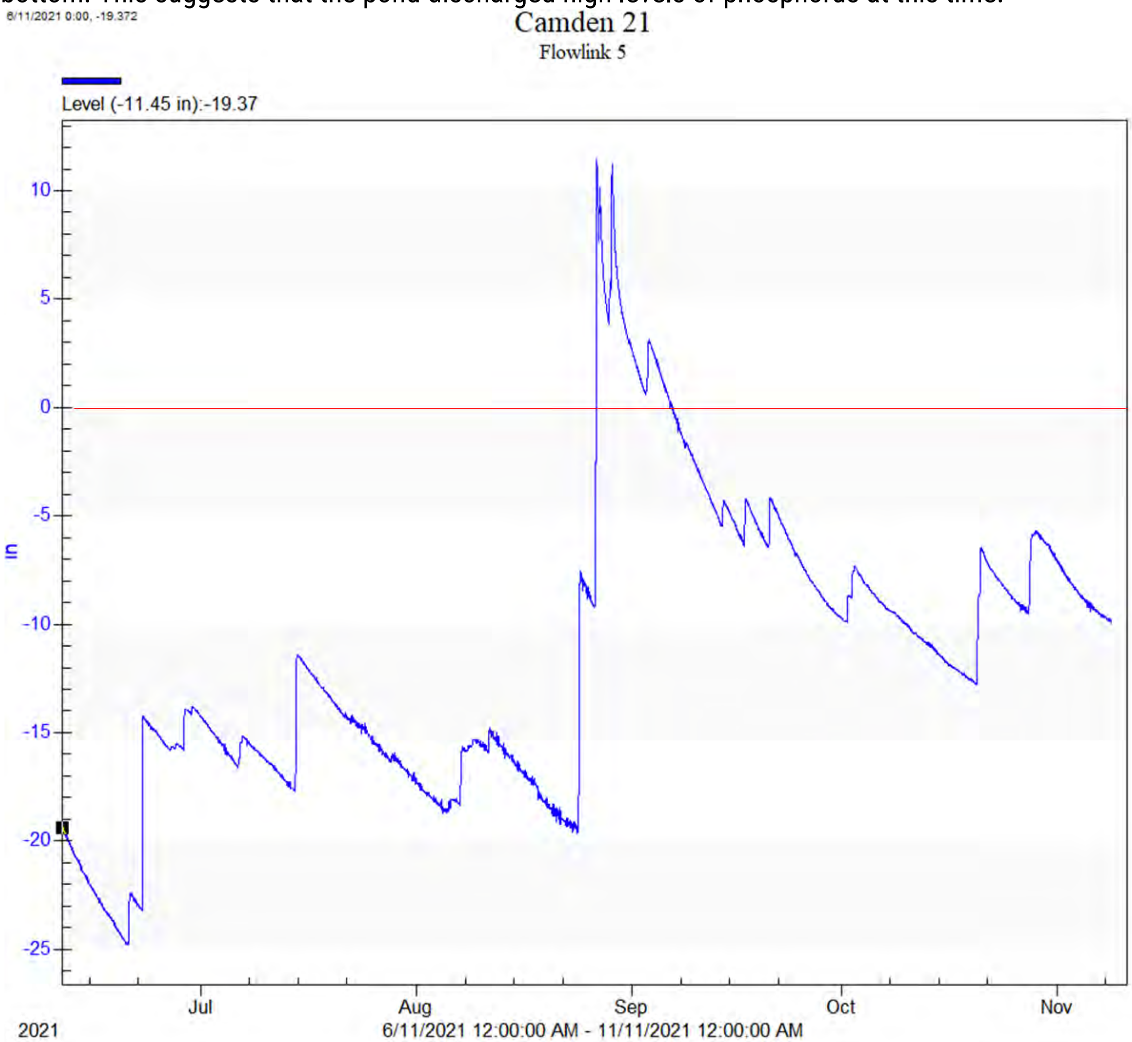


Figure 24-10. Surface level at Camden Pond. Levels above 0 inches indicate when the pond was outflowing.

Park and 44th W

Figure 24-11 shows a photograph of the Park and 44th W Pond. **Table 24-5** shows the Park and 44th W Pond multiprobe 1 meter profile results and Secchi data. **Table 24-6** shows the Park and 44th W Pond chemistry results.

Figure 24-11. The Park and 44th W Pond 2021.

Table 24-5. Park and 44th W Pond multiprobe profile results obtained with a YSI or Hydrolab sonde and Secchi disk during sampling events. ND = No Data.

Date	Depth (M)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Specific Conductivity (µS/cm)	Turbidity (NTU)	Secchi (M)
5/18/2021	0	21.0	8.33	7.3	849	1.8	1.10
5/18/2021	1	17.9	6.26	7.1	918	2.28	ND
5/18/2021	2	11.8	0.39	6.4	3,868	78.0	ND
6/3/2021	0	21.4	8.88	7.5	427	1.9	1.08
6/3/2021	1.5	15.6	0.88	6.5	1,118	20.9	ND
7/21/2021	0	26.2	9.55	8.5	474	10.7	0.42
7/21/2021	1	23.3	0.14	6.3	514	25.5	ND
7/21/2021	2	18.2	0.21	5.8	1,598	42.8	ND
8/17/2021	0	23.6	7.56	7.1	341	4.9	0.74
8/17/2021	1	23.2	0.52	6.5	349	17.2	ND
8/17/2021	1.5	21.6	0.15	6.1	472	18.3	ND
9/9/2021	0	20.2	7.19	7.3	107	6.9	0.62
9/9/2021	1	20.2	6.85	7.3	107	8.0	ND
9/9/2021	1.9	19.6	0.42	7.2	125	11.5	ND
10/6/2021	0	17.9	4.78	6.6	151	5.9	0.75
10/6/2021	1	17.9	4.38	6.5	151	6.5	ND
10/6/2021	2	16.9	0.42	6.0	200	10.4	ND

Table 24-6. Park and 44th W Pond chemistry sampling results. ND = No Data.

Date	Depth (M)	Chlorophyll-*a* (µg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	BOD (mg/L)	Microcystin (µg/L)
5/18/2021	0	7	0.078	210	3	0.20
5/18/2021	2	ND	0.093	390	7	ND
6/3/2021	0	46	0.139	90	6	0.10
6/3/2021	1.4	ND	0.362	360	16	ND
7/21/2021	0	157	0.167	80	20	0.40
7/21/2021	2	ND	0.704	280	53	ND
8/17/2021	0	64	0.187	65	9	1.00
8/17/2021	1.5	ND	0.37	90	21	ND
9/9/2021	0	50	0.197	14	7	0.10
9/9/2021	1.9	ND	0.145	15	7	ND
10/6/2021	0	50	0.125	11.5	7	0.40
10/6/2021	2	ND	0.138	11	6	ND

Total phosphorus levels differed between the surface and bottom of Park and 44th W Pond throughout the year shown in **Figure 24-12**. At the pond bottom, TP fluctuated throughout the year and the highest measured value was 0.704 mg/L in July. In contrast, TP was highest, at 0.197 mg/L, at the pond surface in September. Overall, TP levels were more consistent at the pond surface. The disparity between TP at the surface and bottom in the summer months illustrates that phosphorus is not well-mixed throughout the water column during the growing season.

The DO is shown for the top and bottom in **Figure 24-12 a** and **Figure 24-12 b**. The DO at the pond bottom was consistently low throughout the year shown in **Figure 24-12 b**. Thus, while the increase in TP at the pond bottom occurred under anoxic conditions, it did not necessarily occur in response to a significant drop in oxygen, as happened in September and October.

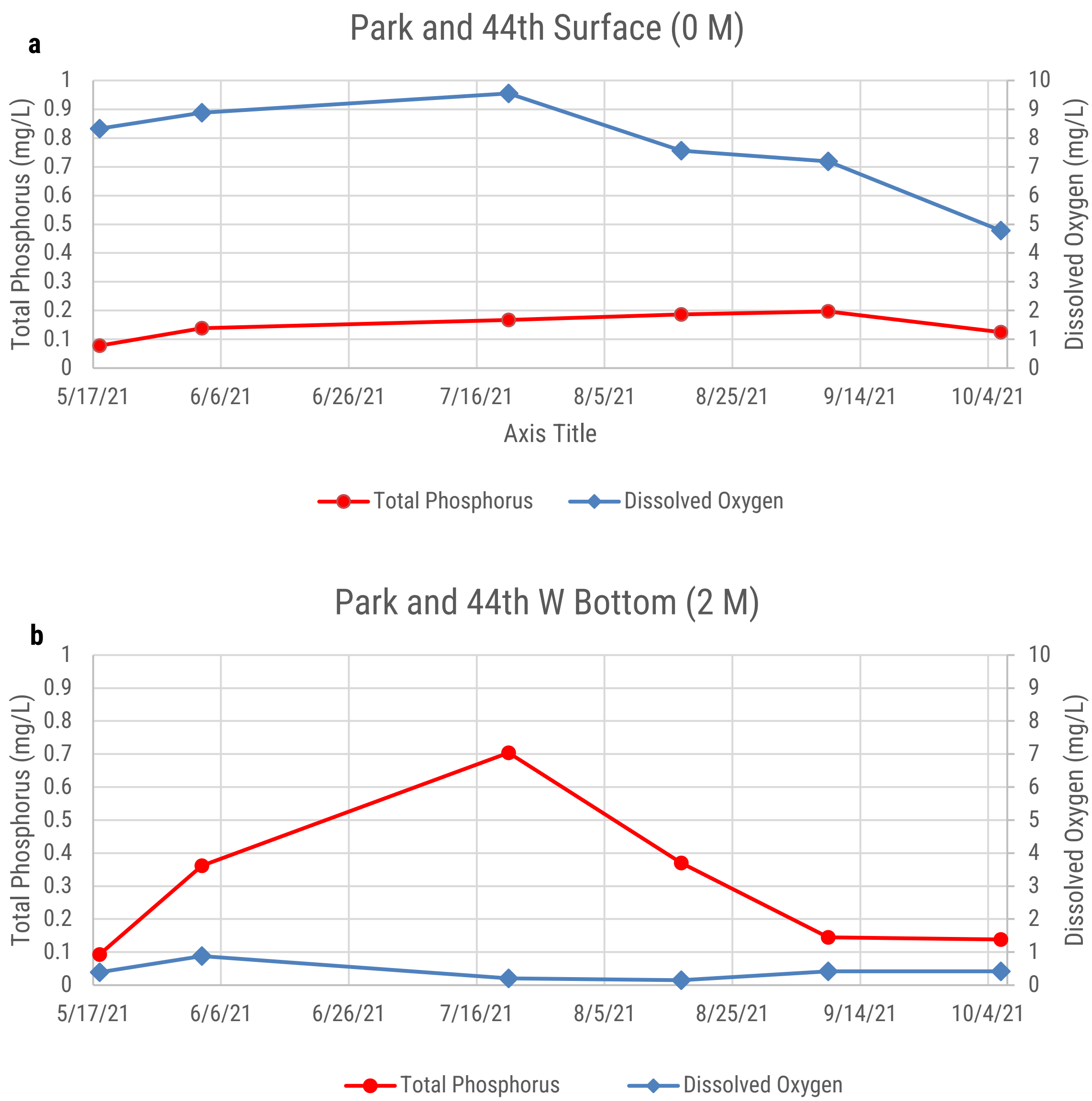


Figure 24-12. Phosphorus and dissolved oxygen at the surface (a) and bottom (b) of Park and 44th W Pond.

Chloride levels differed between the surface and bottom from May to July shown in **Figure 24-13.** Chloride at the pond bottom was above the 230 mg/L standard during this time. Chloride at the pond top remained below the 230 mg/L standard in each of the samples with the largest decrease occurring between May and June. The difference in chloride level between the surface and bottom of the pond between May and July indicate lack of mixing and potential chemical stratification, the same pattern seen in the TP and DO data shown in **Figure 24-12 a** and **Figure 24-14 b**.

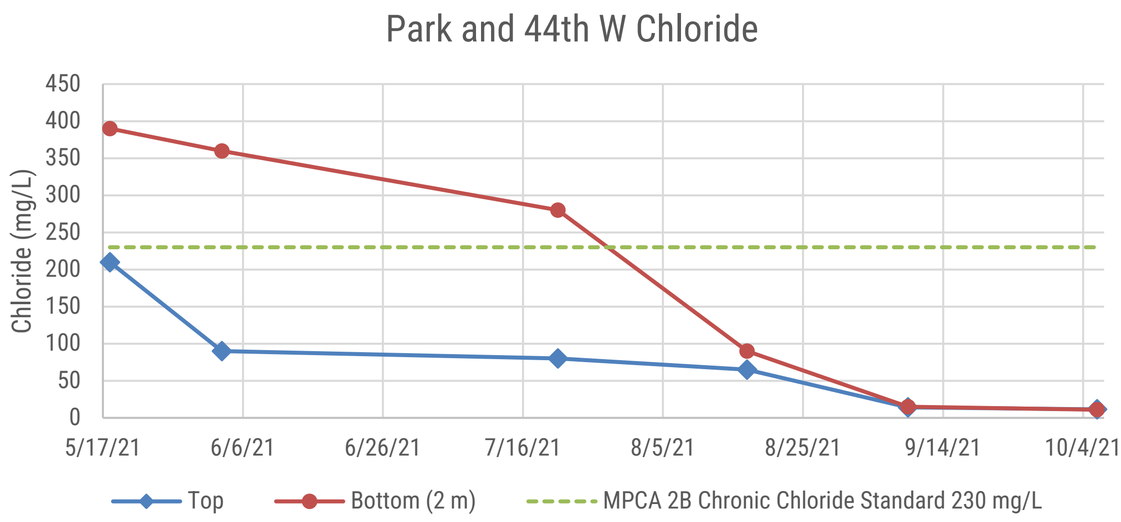


Figure 24-13. A graph of Cl levels at the surface and bottom of Park and 44th W Pond as compared to the MPCA 2B Chronic Cl Standard of 230 mg/L.

Other than in May, Chl-*a* levels in the pond were consistently above the threshold 30 µg/L indicator for potential HABs shown in **Figure 24-14**. Chlorophyll-a increased from May to July and then dropped significantly from July to August. Microcystin levels were consistently below the 6 µg/L advisory recommendation by the MPCA.

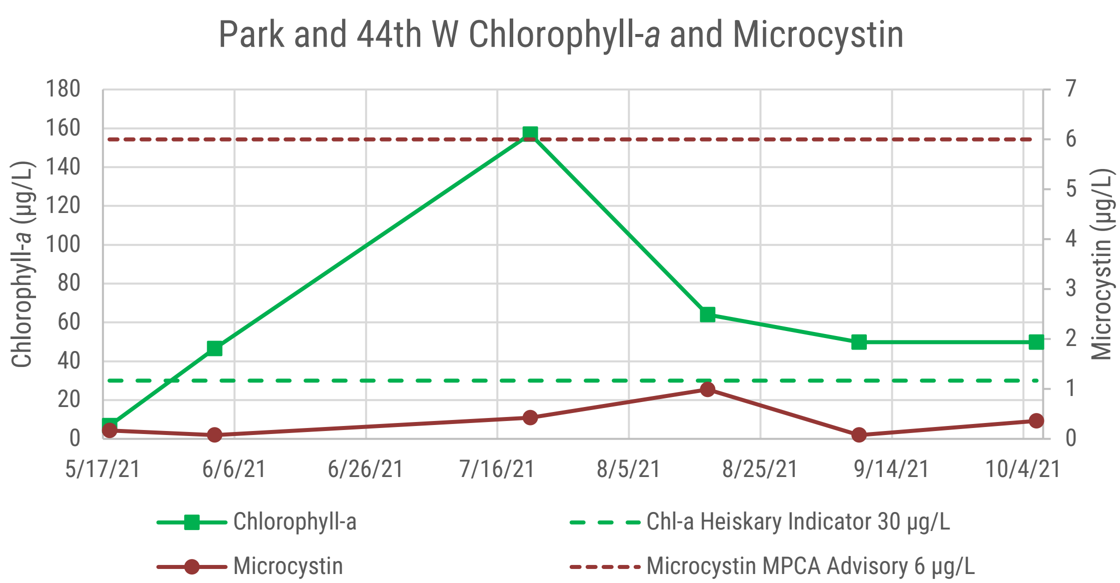


Figure 24-14. A graph of chlorophyll-*a* and microcystin at Park and 44th W Pond. The 30 µg/L chlorophyll-a indicator is the green reference line (Heiskary and Lindon, 2009). The MPCA advisory for microcystin is 6 µg/L and is the brown reference line.

The Park and 44th W Pond level was measured at the SE inlet. The pond zero level was the top of a cement weir within a large structure pictured in **Figure 24-15**. Level data from the Park and 44th W pond shown in **Figure 24-16** indicate that the pond inflowed frequently.

The Park and 44th W site was the only location where level data could not be directly tied to the pond outlet. The pond outlet at this location is submerged and is not accessible. A survey tying the invert of the outlet structure to the top of the cement inlet weir would be needed to determine pond outflow.

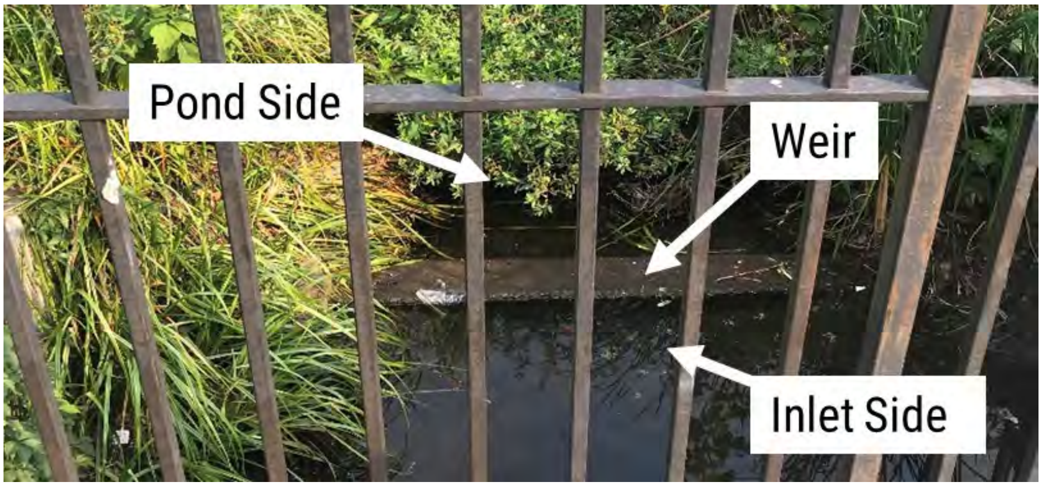


Figure 24-15. A photograph of the inlet weir, where pond level was measured, at the Southeast inlet of Park and 44th W Pond.

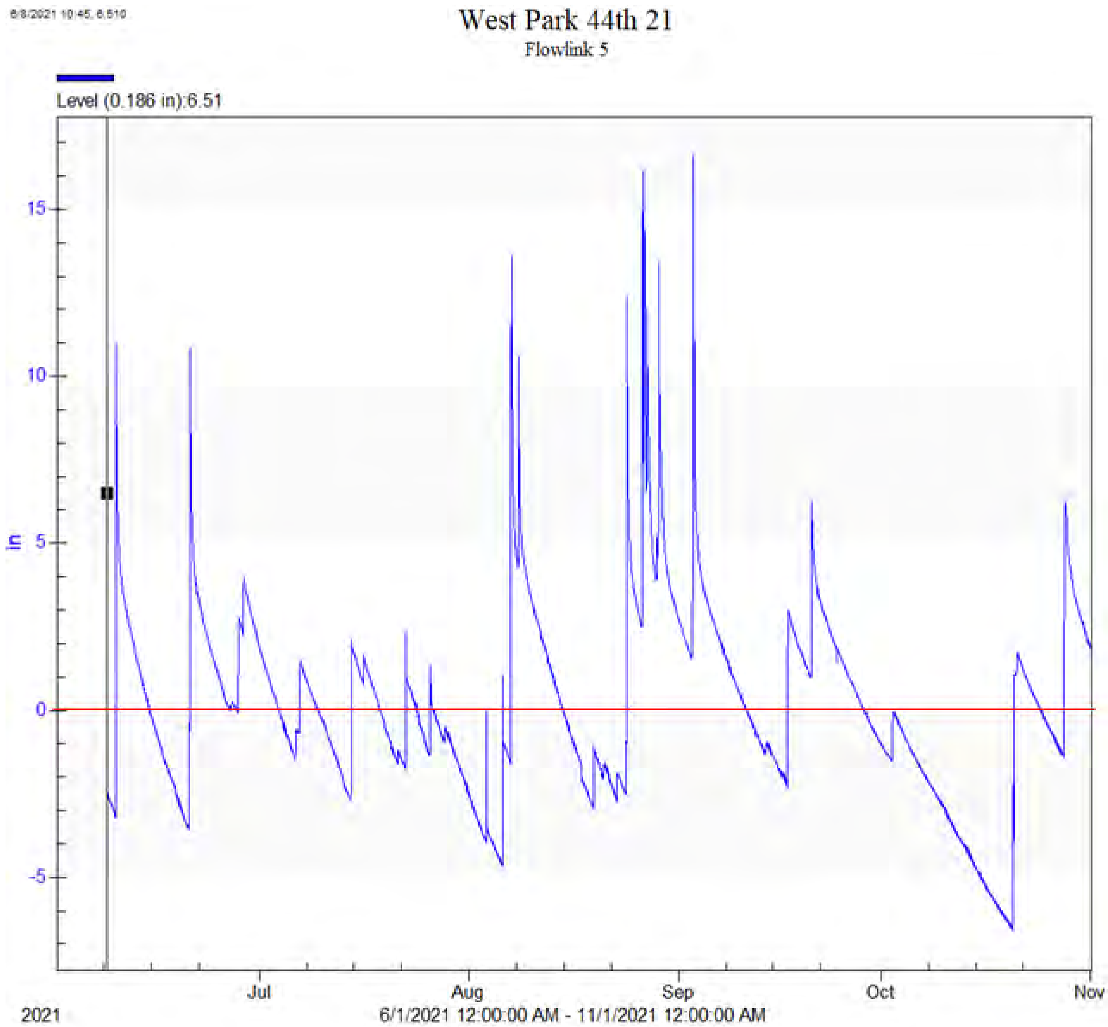


Figure 24-16. Surface level at Park and 44th W Pond. Levels above 0 inches indicate when the pond was inflowing and zero was at the top of the Southeast weir inlet.

Heritage Park #5

Figure 24-17 shows a photograph of Heritage Park #5 Pond in 2021. This pond is the downstream pond in a series of ponds south of Olson Memorial Highway. **Table 24-7** shows the Heritage Park #5 Pond profile data. **Table 24-8** shows the Heritage Park #5 Pond chemistry data.

Figure 24-17. Heritage Park #5 Pond in 2021.

Table 24-7. Heritage Park #5 Pond multiprobe profile results obtained with a YSI or Hydrolab sonde and Secchi disk during sampling events. ND = No Data.

Date	Depth (M)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Specific Conductivity (µS/cm)	Turbidity (NTU)	Secchi (M)
5/18/2021	0	21.3	12.15	9.3	1,114	2.2	1.01
5/18/2021	1	19.1	13.22	9.2	1,114	2.9	ND
5/18/2021	1.5	16.9	8.06	8.5	1,172	5.8	ND
6/3/2021	0	22.3	17.94	10.2	861	8.1	1.49
6/3/2021	1.7	14.3	0.33	7.0	1,046	16.1	ND
7/21/2021	0	28.0	17.91	9.6	759	21.4	0.37
7/21/2021	1	21.9	0.19	7.0	804	30.6	ND
8/17/2021	0	24.2	10.12	9.1	776	12.4	0.62
8/17/2021	1	23.1	0.91	7.8	795	20.4	ND
8/17/2021	1.9	17.4	0.14	6.4	1,419	174	ND
9/9/2021	0	20.5	6.39	8.0	419	13.1	0.54
9/9/2021	1	20.3	6.88	7.9	414	12.6	ND
9/9/2021	2	19.3	0.37	7.1	608	73.2	ND
10/6/2021	0	18.9	7.91	8.4	420	13.5	0.61
10/6/2021	1	18.6	2.1	7.3	436	16.6	ND
10/6/2021	1.5	18.1	0.35	7.0	466	19.8	ND

Table 24-8. Heritage Park #5 Pond chemistry sampling results. ND = No Data.

Date	Depth (M)	Chlorophyll-*a* (µg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	BOD (mg/L)	Microcystin (µg/L)
5/18/2021	0	8	0.093	280	3	<0.15
5/18/2021	1.5	ND	0.155	290	5	ND
6/3/2021	0	50	0.114	180	7	<0.15
6/3/2021	1.7	ND	0.328	200	11	ND
7/21/2021	0	113	0.228	140	28	0.70
7/21/2021	1	ND	0.371	140	32	ND
8/17/2021	0.3	61	0.180	180	7	0.70
8/17/2021	1.9	ND	1.22	240	17	ND
9/9/2021	0.5	91	0.310	75	10	<0.15
9/9/2021	2	ND	0.340	82	8	ND
10/6/2021	0	91	0.229	62	7	0.80
10/6/2021	1.5	ND	0.341	66	8	ND

Total phosphorus levels varied between the surface and bottom of Heritage Park #5 Pond throughout the year, except in September as shown in **Figure 24-18 a** and **Figure 24-18 b**. TP at the pond bottom was observed in August at 1.22 mg/L. Except for this one observation, TP remained relatively constant between 0.32 mg/L and 0.38 mg/L in the other samples. TP at the pond surface increased slightly from May to September and was highest in September at 0.31 mg/L. The difference between surface and bottom TP levels throughout the year show that the water column was not fully mixed. The high TP value observed on 8/17/21 at 1.22 mg/L at the pond bottom was likely caused by sediment disturbance during sampling. This conclusion is supported by the bottom turbidity value on 8/17/22 of 174 NTU's. It is likely that the Kemmerer sampler or anchor hit the pond bottom and resuspended phosphorus laden sediment that was then captured in the sample and in the turbidity measurement from the sonde, as can be seen in **Table 24-7.**

The pond bottom was anoxic, where the DO was < 2 mg/L throughout the year except for in May. In contrast, DO at the pond surface was at or above saturation throughout most of the year except for September and October. The discrepancy in DO between the surface and bottom is evidence that the pond was not well-mixed throughout the year. Given the low oxygen and high phosphorus levels at the pond bottom, it is likely that anoxic conditions at the sediment-water interface caused internal release of phosphorus. Phosphorus did not mix significantly throughout the water column until September as can be seen in **Figure 24-18 a** and **Figure 24-18 b**.

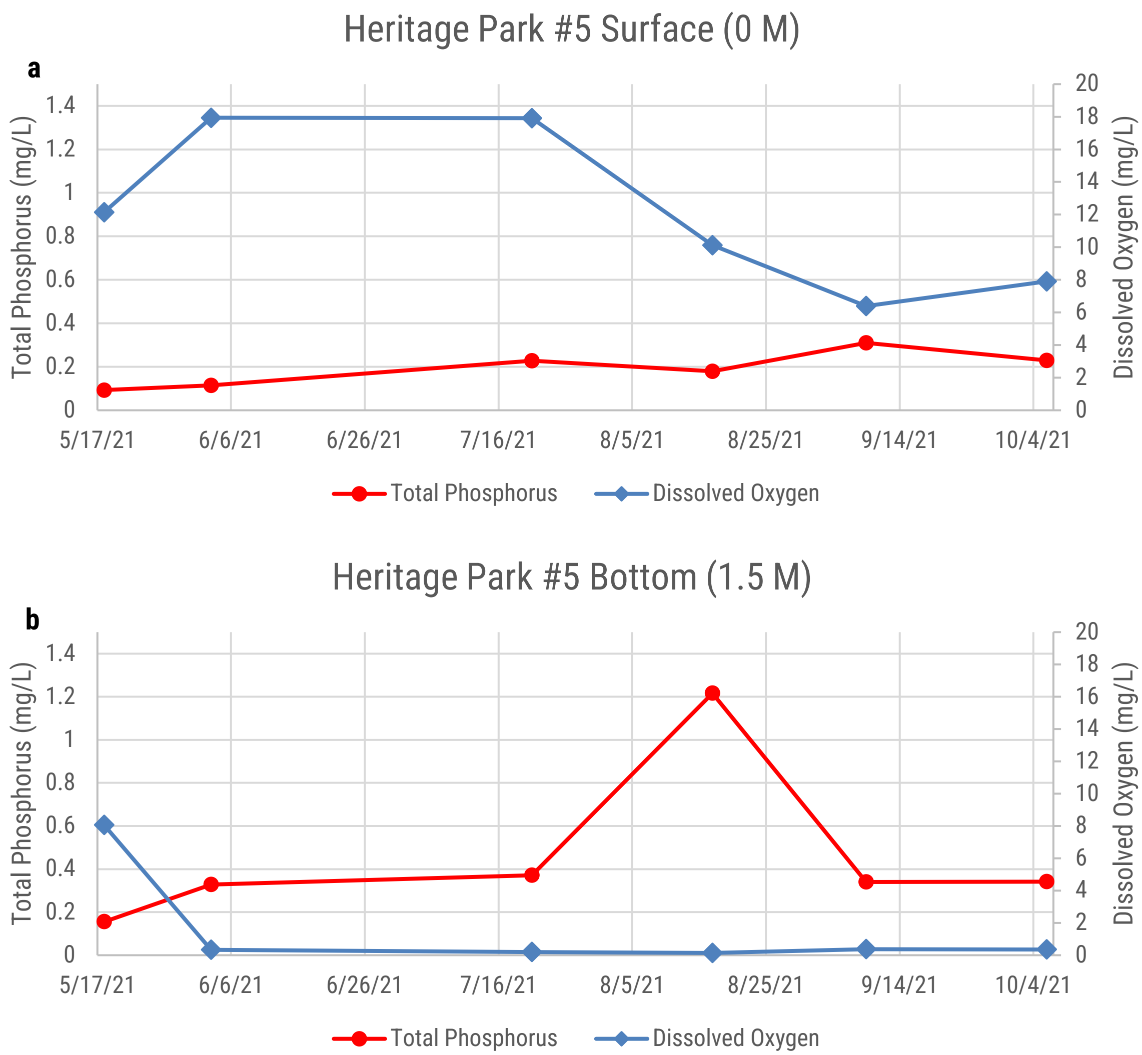


Figure 24-18. A graph of phosphorus and dissolved oxygen at the surface (a) and bottom (b) of Heritage Park #5 Pond.

Chloride in Heritage Park #5 Pond gradually decreased throughout the year, other than one sample in August, as shown in **Figure 24-19**. Chloride levels at the pond bottom exceeded the 230 mg/L MPCA standard in May and August. At the pond surface, Cl only exceeded the 230 mg/L standard in May. Chloride levels at the pond surface and bottom did not substantially differ, except in one sample in August where the bottom value exceeded the chloride levels at the surface.

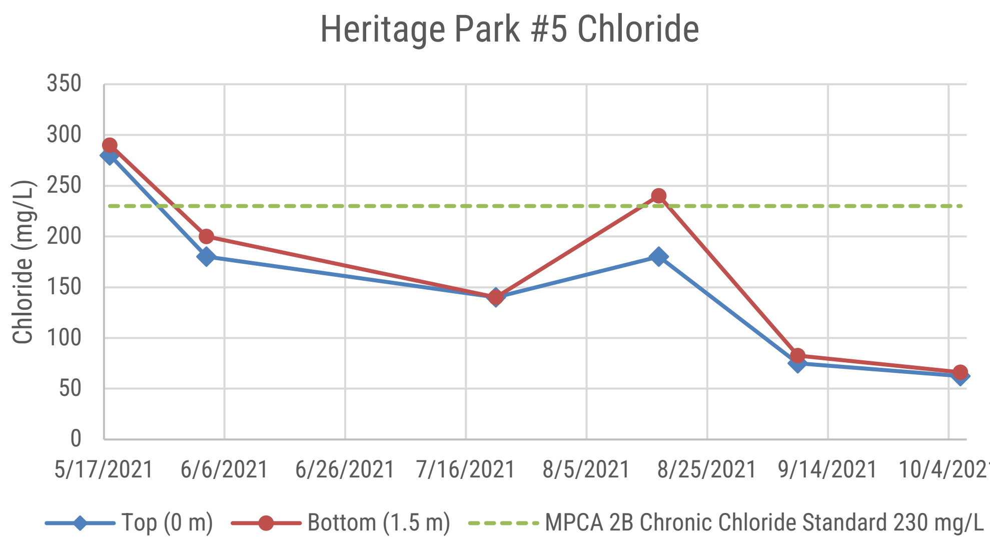


Figure 24-19. A graph of surface and bottom Cl levels at Heritage Park Pond #5 as compared to the MPCA 2B Chronic Cl Standard of 230 mg/L.

Chlorophyll-*a* values in Heritage Park #5 Pond were high throughout the year, exceeding the HAB indicator level of 30 µg/L suggested by Heiskery and Lindon (2009) in every month except May **Figure 24-20**. The highest observed chlorophyll-a level was 113 µg/L in the July sample. Despite high levels of Chl-*a*, microcystin was low throughout the year. Microcystin levels were consistently below the 6 µg/L MPCA advisory level. Based on these data, Chl-*a* levels did not correlate to cyanotoxin production in the Heritage Park #5 Pond.

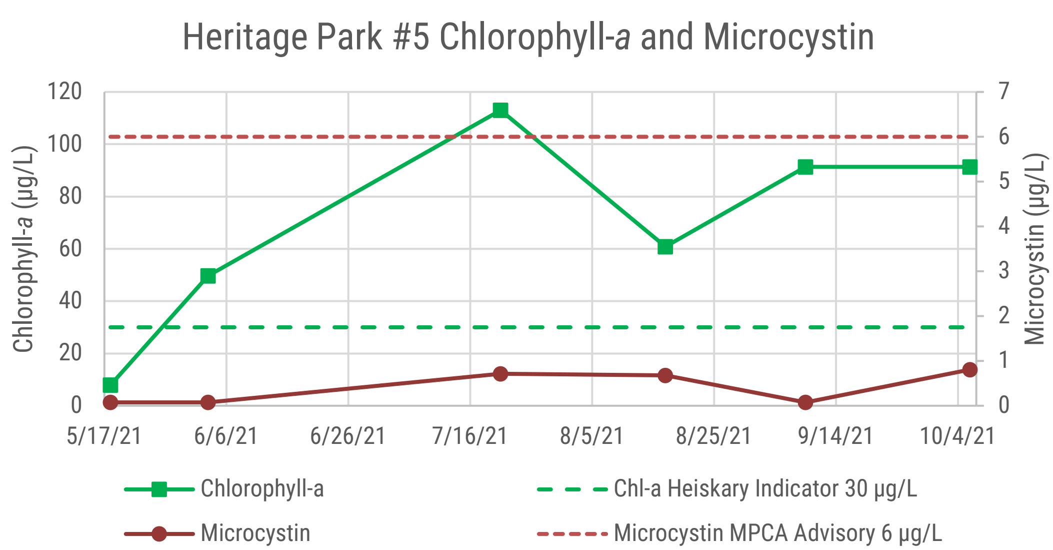


Figure 24-20. A graph of chlorophyll-*a* and microcystin observations at the Heritage Park #5 Pond. The 30 µg/L chlorophyll-a indicator is the green reference line (Heiskary and Lindon, 2009). The MPCA advisory for microcystin is 6 µg/L and is the brown reference line.

Figure 24-21 shows a photograph of the Heritage Park #5 Pond outlet structure weir. A level probe was secured on the upstream side of the cement weir to record pond level.

Pond level data from Heritage Park #5 Pond shows that the pond outflowed frequently, as shown in **Figure 24-22**. The Heritage Park #5 Pond zero level is the top of the cement outlet weir.

Figure 24-21. A photograph of the outlet weir structure at Heritage Park #5 Pond. The red C-clamp has been modified with a foot to accommodate the level probe on the upstream/pond side of the weir.

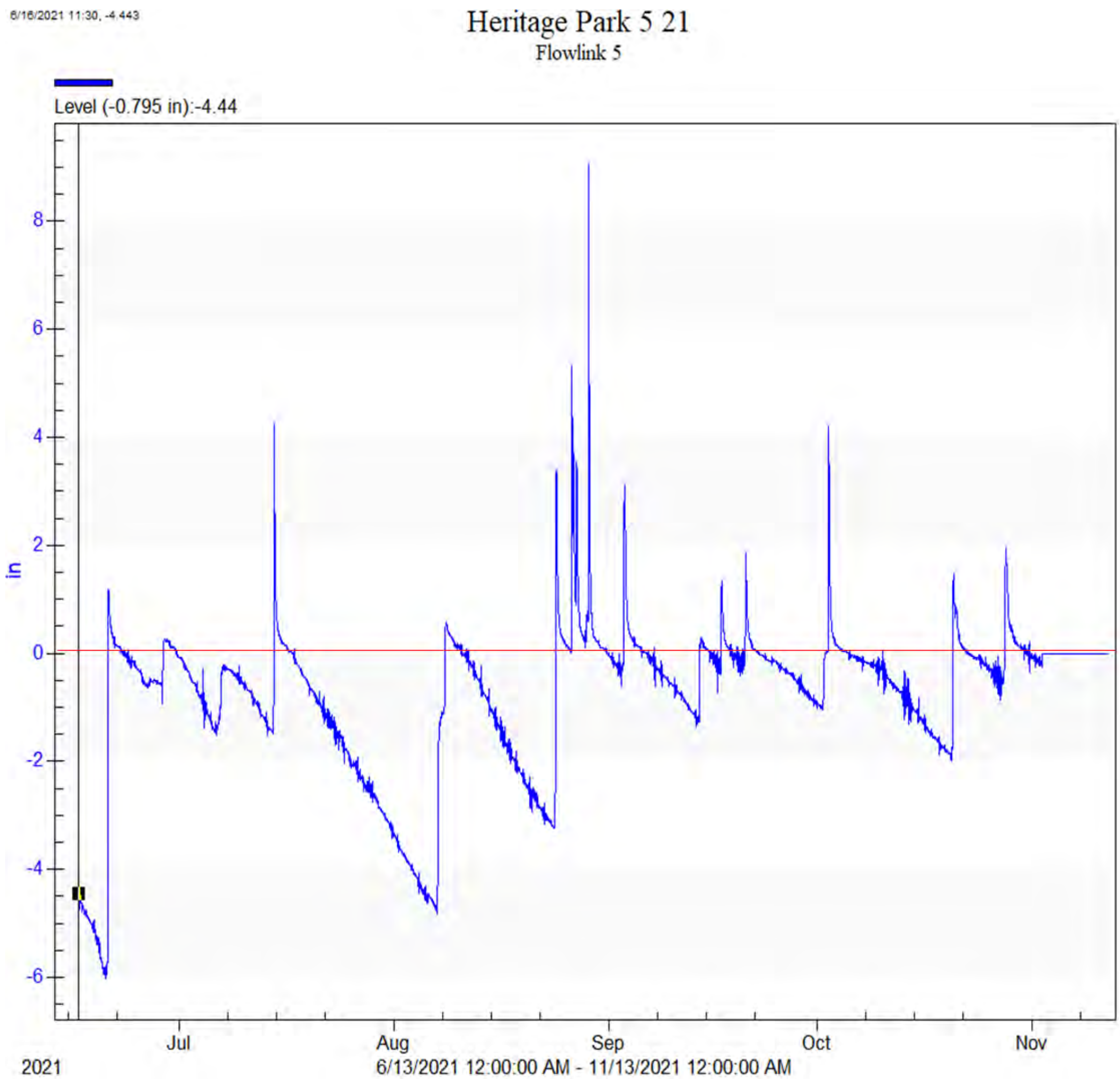


Figure 24-22. Surface level at Heritage Park #5 Pond. Levels above 0 inches indicate when the pond was outflowing. Zero inches was the top of the weir.

25th Ave SE Pond

Figure 24-23 shows the 25th Ave SE Pond located near the University of Minnesota. **Table 24-9** contains the 25th Ave SE Pond multiprobe profile results. **Table 24-10** contains the 25th Ave SE Pond chemistry results.

Figure 24-23. A photograph of the 25th Ave SE Pond in 2021. The equipment doghouse and fencepost securing the level probe are visible in the foreground.

Table 24-9. The 25th Ave SE Pond multiprobe profile data obtained using a YSI or Hydrolab sonde and Secchi disk during sampling events. ND = No Data.

Date	Depth (M)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Specific Conductivity (µS/cm)	Turbidity (NTU)	Secchi (M)
5/18/2021	0	20.4	10.89	7.3	2,420	2.0	1.45
5/18/2021	1	19.1	10.79	7.2	2,428	2.8	ND
6/3/2021	0	21.4	11.31	7.4	2,239	1.9	1.52
6/3/2021	1	19.3	6.79	7.0	2,349	3.0	ND
7/21/2021	0	24.6	15.32	7.0	2,313	0.6	1.00
7/21/2021	1	20.3	0.54	6.5	2,701	3.9	ND
8/17/2021	0	21.5	0.70	6.8	2,388	9.1	1.00
8/17/2021	1	20.1	0.42	6.6	2,803	6.0	ND
9/9/2021	0	19.0	4.30	7.0	2,223	3.7	1.80
9/9/2021	1	19.3	0.52	6.7	2,918	6.1	ND
10/6/2021	0	17.9	5.99	7.0	2,263	1.8	1.10
10/6/2021	1	18.0	1.00	6.4	3,114	9.3	ND

Table 24-10. 25th Ave SE Pond chemistry sampling events. ND = No Data.

Date	Depth (M)	Chlorophyll-*a* (µg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	BOD (mg/L)	Microcystin (µg/L)
5/18/2021	0	2.65	0.056	530	3	0.19
5/18/2021	1	ND	0.094	540	3	ND
6/3/2021	0	2.72	0.033	490	4	0.25
6/3/2021	1	ND	0.043	470	5	ND
7/21/2021	0	7.53	0.024	520	5	0.51
7/21/2021	1	ND	0.061	500	8	ND
8/17/2021	0	5.13	0.021	560	<1.00	0.63
8/17/2021	1	ND	0.030	600	12	ND
9/9/2021	0	7.18	0.023	600	<1.00	<0.15
9/9/2021	1	ND	0.145	620	5	ND
10/6/2021	0	7.18	0.027	490	2	0.21
10/6/2021	1	ND	0.031	480	3	ND

Total phosphorus in 25th Ave SE Pond was relatively low compared to the other three ponds **Figure 24-24**. TP was less than 0.1 mg/L at the pond surface and bottom except for the September bottom sample. The highest TP value of 0.145 mg/L was seen in September at this pond and was the lowest compared to the other four ponds. TP values did not differ significantly between the pond surface and bottom except in September, which suggests that TP was somewhat well-mixed throughout the year, except for a period in September.

The DO decreased gradually from May to July at the pond bottom, at which point the pond bottom became anoxic for the remainder of the sampling season, **Figure 24-24 b**. At the pond surface dissolved oxygen remained relatively high throughout the year except in August when the entire water column became anoxic, **Figure 24-24 a**. These conditions may have driven the TP increase that occurred in September and is shown in **Figure 24-24 b**.

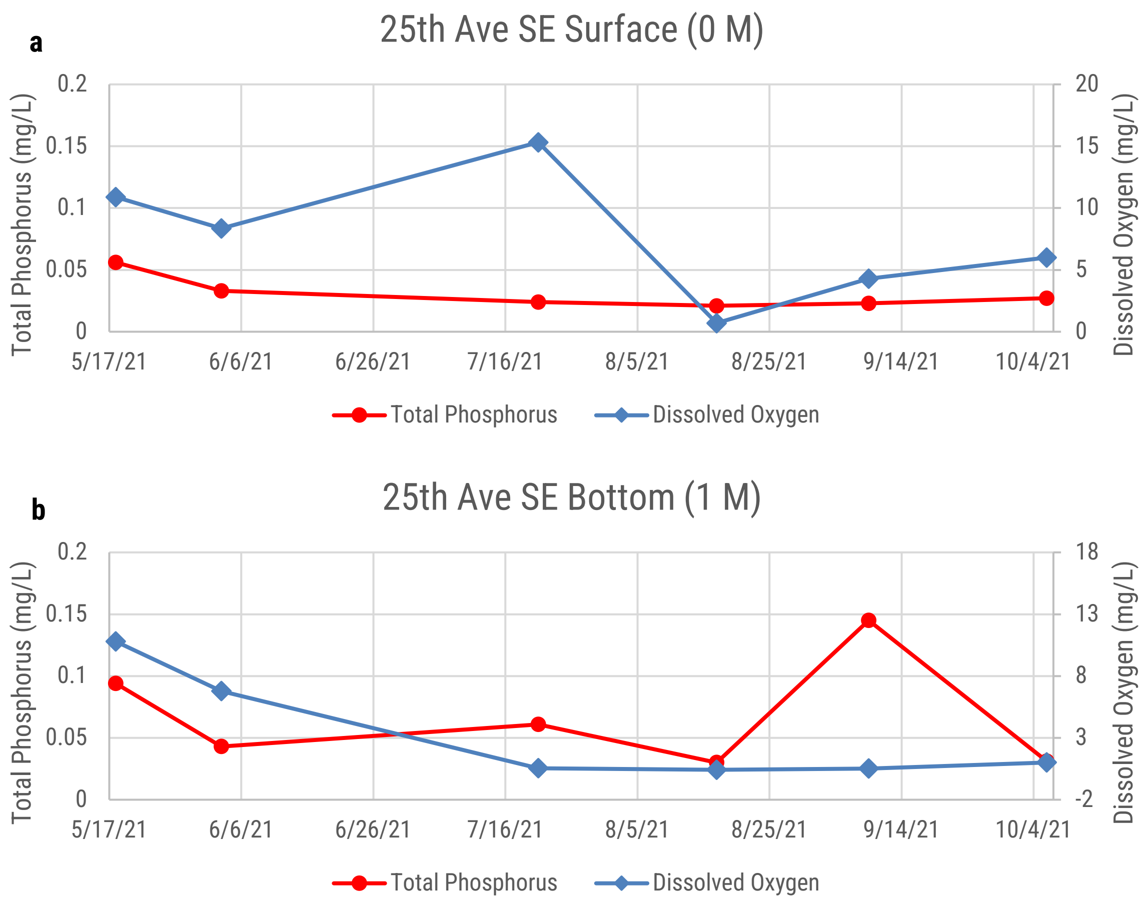


Figure 24-24. A graph of phosphorus and dissolved oxygen at the surface (a) and bottom (b) of 25th Ave SE Pond.

Chloride in the 25th Ave SE Pond, around 500-600 mg/L as shown in **Figure 24-25**, was significantly higher than measured in the other three ponds. Chloride at the pond surface and bottom did not vary, indicating that chloride was well-mixed throughout the water column. Chloride concentrations were highest in September with a level at the surface of 600 mg/L and 620 mg/L at the pond bottom. Lack of stratification in both the Cl and TP data both suggest that the pond mixed throughout the season as shown in **Figure 24-24 a** and **Figure 24-24 b**.

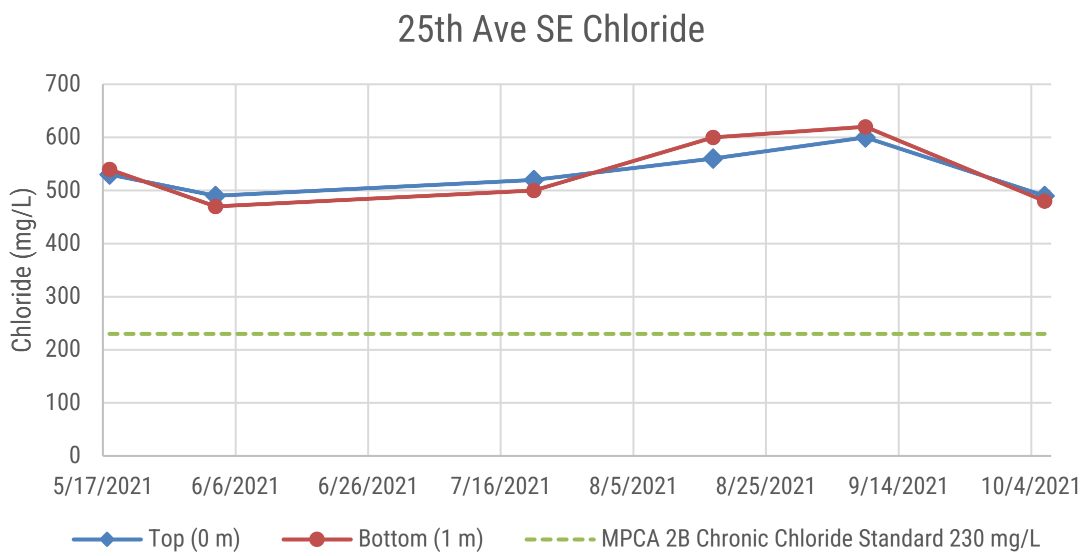


Figure 24-25. A graph of surface Cl levels at the surface and bottom of 25th Ave SE Pond as compared to the MPCA 2B Chronic Cl Standard of 230 mg/L.

The lower levels of TP in 25th Ave SE Pond correlate to lower Chl-*a* levels at the pond surface **Figure 24-24**. The Chl-*a* was consistently below the 30 ug/L advisory of concern for potential HABs. Microcystin levels were consistently below the 6 µg/L advisory recommendation by the MPCA.

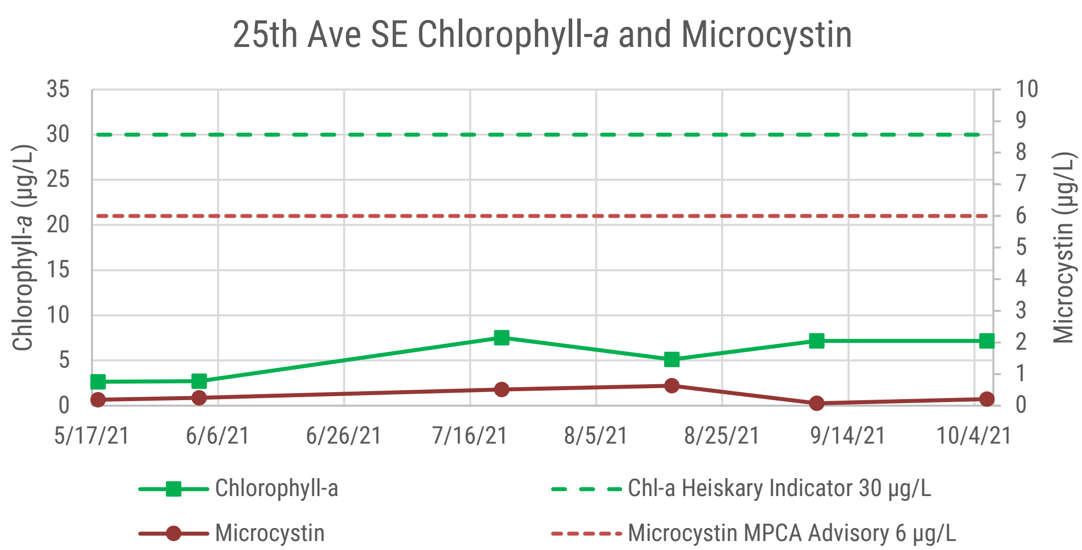


Figure 24-26. A graph of chlorophyll-*a* and microcystin at 25th Ave SE Pond. The 30 µg/L chlorophyll-a indicator is the green reference line (Heiskary and Lindon, 2009). The MPCA advisory for microcystin is 6 µg/L and is the brown reference line.

Pond level data from 25th Ave SE Pond indicates that the pond was almost constantly outflowing, except in mid-July **Figure 24-27**. Since 2022 was a drought year, it is likely that the pond outlet is below the level of the local groundwater table.

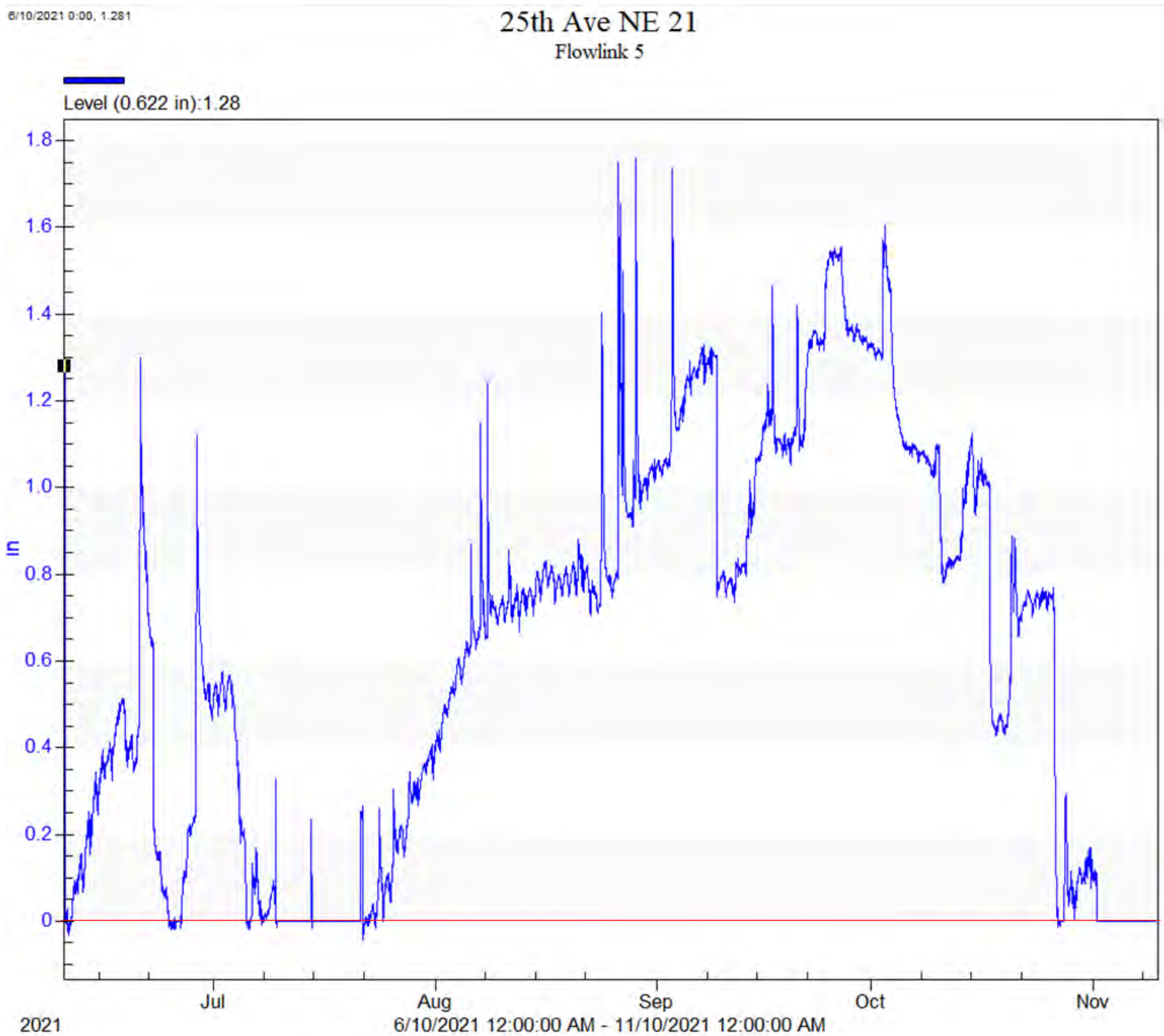


Figure 24-27. Surface level at 25th Ave SE Pond. Levels above 0 inches indicate when the pond was outflowing.

Conclusions

Pond Internal Phosphorus Release

All four ponds showed some increase in phosphorus at the pond bottom throughout the year. However, the timing of this increase varied between the ponds. For example, phosphorus levels at the bottom of Park and 44th W increased in July. Heritage Park #5 bottom phosphorus levels increased in mid-August, and phosphorus levels at the bottom of 25th Ave SE did not increase until September, likely due to the pond bottoms becoming anaerobic at different times. In contrast, phosphorus levels at the pond surfaces remained relatively low in comparison to the pond bottoms, except for Camden Pond. Camden Pond appeared to mix, the top and bottom phosphorus samples closely tracked each other throughout the year.

There was a decline in DO throughout the year in the bottom of every pond except Park and 44th W Pond, where the DO was less than 2 mg/L the entire sampling period. This is likely because the Park and 44th W Pond is a prolific wetland with organic sediments that likely have a high oxygen demand. The Heritage Park Pond #5 bottom DO was higher in May but then quickly became less than 2 mg/L the rest of the year. The bottom of every pond was less than 2 mg/L by July, which correlated to increases in TP at the pond bottoms. The extent of phosphorus release varied across the ponds, but all ponds had internal release of phosphorus.

The following ponds stratified and had low oxygen levels at the bottom which led to internal phosphorus release.

- Heritage Park #5
- 25th Ave SE, and
- Park and 44th W

The following pond has internal release and was well-mixed through the year.

- Camden

All of the ponds showed signs of internal phosphorus release. Camden pond likely had continuous mixing bringing nutrients to the surface and likely driving high algae production, as evidenced by the high chlorophyll-a concentrations. The evidence of internal phosphorus release indicates that these four ponds did not function optimally as water quality ponds. These data corroborate findings from Taguchi et al. (2020) which indicated that certain stormwater ponds may lose their effectiveness over time as they accumulate phosphorus. Internal release of this phosphorus is "considerably more prevalent than previously assumed", according to Taguchi et al. (2020).

Chloride Concentrations and Suitability for Aquatic Habitat

The 5-day 230 mg/L MPCA 2B chronic Cl standard was used as a reference for aquatic habitat suitability in this study. If aquatic environments remain at or above 230 mg/L Cl for 5 days or more, aquatic life is impacted.

The following ponds showed decreasing chloride concentrations throughout the year and only exceeded the 230 mg/L MPCA 5-day 2B chronic standard in May or June. The pond habitat is likely unsuitable for aquatic life during spring. Chloride decreased over the course of the season and habitat may be suitable for aquatic life later in the year. The ponds may more suitable as aquatic habitat if chloride inputs from spring snowmelt were lowered.

- Heritage Park #5
- Park and 44th W
- Camden

The following pond had chloride concentrations well above levels tolerated by aquatic life and does not provide aquatic habitat. Groundwater appeared to be the source of chloride to this pond. If confirmed, a reduction in chloride inputs via snowmelt would likely have no impact on habitat suitability.

- 25th Ave SE, and

One of the primary reasons for monitoring the 25th Ave SE Pond in 2021 was the elevated Cl levels found in the 2020 pond screening study. The consistently high levels of Cl throughout the year and continuous outflow indicate the Cl may be coming from groundwater input to the pond. Given that the land use in the surrounding area is mostly park/commercial/industrial, the ultimate source of chloride is unknown. It is possible that local shallow groundwater in the area is contaminated with Cl and that the 25th Ave SE Pond acts as a release point for some of this shallow groundwater. Ponds could also be prioritized for additional monitoring or retrofit if they had a high level of Cl that may affect downstream natural waterbodies.

Chlorophyll-a and Microcystin to Determine the HAB Potential

Chlorophyll-*a* and the cyanotoxin microcystin were measured to determine the potential for Harmful Algae Blooms (HABs) and whether microcystin production in the ponds reached the MPCA advisory threshold. Although Chl-*a* values in the ponds exceeded the 30 µg/L threshold suggested by Heiskary and Lindon (2009), where there could be a concern for blue-green algae blooms, the microcystin levels in water were not observed over the MPCA threshold of 6 ug/L in any of the four ponds in 2021. In these ponds the Heiskary 30 µg/L threshold does not correlate with an increase in microcystin.

One caveat to these microcystin data is that the analysis was on whole water samples, and not on samples that had been through a lysing step. The highest microcystin level observed in the study was on July 21 where Camden Pond's microcystin level was 5.4 µg/L.

Blue green algae growth varies depending on weather and changes in local conditions.

Observations on bloom conditions should be continued. In the future, samples may be lysed, frozen and thawed three times, to determine the maximum exposure potential at the ponds. Samples could also be collected from any blue green algae scum, if present, to determine maximum levels of toxin that could be present.

Suggested Future Pond Monitoring

The following ponds could be monitored in the future for TP, DO, Temp, BOD, and COD. Phosphorus loads into and out of the ponds should be determined since each pond showed evidence of internal release.

- 25th Ave SE
- Camden
- Heritage Park #5
- Park Ave & 44th W

The 2020 Stantec pond bathymetric report also showed that many of the older ponds had little sedimentation and required the least dredging. This finding was surprising, as it indicates solids may not be captured by the ponds.

For example, Camden Pond was one of these older ponds showing little sediment deposition. Camden Pond also had the highest pond Chl-*a* observed in 2021, at 360 µg/L. The source of the nutrients supporting this very high Chl-*a* value are unknown. A comprehensive study monitoring the inlets and outlets should be done at Camden. With these monitoring data a more definitive mass balance, removal efficiency, and load can be calculated.

Stormwater Quarterly Grab Monitoring

Background

As part of the federal Clean Water Act, the Minneapolis Park and Recreation Board (MPRB) and the City of Minneapolis are co-signatories on the Environmental Protection Agency (EPA) issued National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit. The permit requires quarterly grab samples for NPDES chemistry, pH, *E. coli*, and a pilot project to monitor Fat, Oils, and Grease (FOG). The purpose of this monitoring is to characterize the seasonality of runoff for parameters that cannot be collected with flow-weighted composite auto-monitoring (e.g., pH, *E. coli*, FOG). Criteria for snowmelt sample collection was a winter snowpack melt event. Criteria for spring, summer, and fall grab sample collection was precipitation event greater than 0.10" separated by at least 8 hours from other rain events.
The NPDES permit requires quarterly grab stormwater event monitoring to be attempted, but it is not always possible to carry out. Rain events must occur when staff are working, and the laboratory is open to receive samples. Ideally, annual quarterly grab monitoring includes two snowmelt grab samples, and a one each spring, summer and fall grab sample. Quarterly grab monitoring includes pH, *E. coli*, NPDES water chemistry, and a Fat Oil and Grease (FOG) sample. The grab water chemistry samples are analyzed for the chemistry parameters outlined in the NPDES permit.
Grab sampling characterizes a point in time of a snowmelt or rain event. The first snowmelt event in a year usually has higher pollutant concentration than subsequent snowmelt events. The chemical concentrations can change over time throughout the hydrograph as the rising limb usually mobilizes fine particles and FOG material previously deposited on hard surfaces first. Chemical concentrations can vary not only throughout the individual hydrograph but also from storm to storm, largely driven by the time since the last precipitation. It can be helpful to think of stormwater runoff pollution in a watershed as behaving like dust. It accumulates over time and then washes off in a melt or rain event. The longer the time between snowmelt or rain the more pollutants accumulate.

As part of the NPDES permit, a study of quarterly FOG grab sampling was conducted along with regular grab sample monitoring with the intent to sample six sites. The latest NPDES permit prescribed that if a FOG sample was measured greater than 15 mg/L at a site, then that site would continue to be monitored throughout the permit cycle. FOG in stormwater can come from a variety of sources such as: vehicles, industry, food waste, gas stations, etc. Elevated levels of hydrocarbons can be harmful to aquatic plants and animals. It is important to minimize FOG in stormwater through best practices in industry, public education about vehicle maintenance, and the prevention of improper waste disposal.

In 2018 quarterly grabs were collected at representative land use sites. Following snowmelt, grab samples could not be collected from the Pershing land use site since auto-monitoring equipment was housed in an equipment box on top of the manhole. 61st and Lyndale had extensive road construction and stormwater pipe replacement beginning mid-summer 2018 that restricted access. In 2019, the grab sites were changed to the Powderhorn Lake Inlets: SE, S, and W and the 24th Ave. SE & Elm St. SE infiltration basin Inlets: N and S. The intention was to continue sampling at the 61st and Lyndale site, but the site was again inaccessible due to the stormwater pipe replacement and road reconstruction.

In 2020, the quarterly grab sites were, 24th Ave. SE & Elm St. SE Inlets: N and S and Powderhorn Inlets: SE, S, and W, and 61st & Lyndale. In 2020, after several unsuccessful attempts were made, the Powderhorn Inlet N site was deemed physically inaccessible to collect grab samples and dropped from any grab sampling. 2020 was also a difficult year for field work with the COVID-19 pandemic restrictions, and the significant social unrest in Minneapolis.
In 2021 grab sampling was completed at six sites: three locations at Powderhorn Lake Inlets (SE, S, and W), two sites at 24th Ave SE & Elm St SE infiltration basin Inlets (N and S), and a location at 61st and Lyndale were all successfully monitored.

Methods

Grab Sampling

A grab sample bottle was either attached to a modified pool skimmer pole or a clean white 5-gallon bucket on a rope. The bucket was necessary if adequate flow was not available to use the pool skimmer. If the bucket was used, it was lowered into the storm sewer, rinsed one time, and a second aliquot collected which was sub-sampled. If the protocol required rinsing, one rinse was done, if rinsing was not protocol samples were collected without rinsing, for example *E. coli* and FOG.
The pH grab sample was analyzed in the field by a hand-held Oakton pH meter. The pH meter was calibrated prior to sampling using a two-point calibration. The pH probe was rinsed with the grab sample water and the pH measurement was taken directly from the aliquot.

The *E. coli* samples were collected in sterile 100 mL bottes and not rinsed. These samples were immediately stored directly on ice in a cooler.

Standard FOG sampling protocol was followed, and FOG samples were collected in an unrinsed amber glass bottle. Rinsing could introduce additional FOG material which would stick to the inside glass container walls and produce artificially high results.

NPDES water chemistry grab samples were collected in a 2-liter Nalgene bottle that was rinsed once with the stormwater prior to filling.

A 2-liter field blank of DI (De-Ionized) water accompanied all samples while in the field. All samples were stored and transported on ice to the laboratory within holding times.

Samples could only be collected when enough flow was present to collect a sample. Snowmelt and precipitation needed to produce at least 1" of stage in the pipe to be sampled. Precipitation events needed to be greater than 1/10" to produce enough runoff.

Quarterly grab samples were attempted at all sites, but no samples could be collected at some sites due to limited flow on 2/22/21, 2/23/21, 5/20/21, and 7/14/21 shown in **Table 25-5**. Staff continued to attempt to collect samples at subsequent melt events if previous attempts did not

result in samples collected.
All FOG, NPDES water chemistry, and *E. coli* samples were analyzed at Instrumental Research Incorporated (IRI) Laboratory in Fridley, Minnesota. All metals and DOC samples were analyzed by Pace Laboratory in Minneapolis, MN.

Table 25-1 shows the NPDES chemistry parameters analyzed in each sample collected. **Table 25-2** shows approved methods, reporting limits, and holding times for each parameter as reported by the contract laboratory Instrumental Research, Inc. (IRI). Pace Laboratory analyzed all metals and DOC samples.

Table 25-1. The list of required NPDES permit chemistry parameters to be monitored.

Parameter	Abbreviation	Units
Chemical Oxygen Demand	COD	mg/L
Dissolved Organic Carbon	DOC	mg/L
Chloride, Total	Cl	mg/L
E. coli (Escherichia Coli)	*E. coli*	MPN/100mL
Hardness	Hard	mg/L
Copper, Total	Cu	µg/L
Lead, Total	Pb	µg/L
Zinc, Total	Zn	µg/L
Nitrite+Nitrate, Total as N	NO_3NO_2	mg/L
Total Nitrogen	TN	mg/L
pH	pH	standard unit
Fat, Oil, and Grease (FOG)	FOG	mg/L
Phosphorus, Total Dissolved	TDP	mg/L
Phosphorus, Total	TP	mg/L
Solids, Total Dissolved	TDS	mg/L
Solids, Total Suspended	TSS	mg/L
Solids, Volatile Suspended	VSS	mg/L

Table 25-2. Analysis method, reporting limit, and holding times for parameters used by Instrumental Research, Inc. and Pace‡ Laboratories.

Parameter	Method	Reporting Limit	Holding Times
COD	SM 5220-D	20 mg/L	28 days
DOC‡	SM 5310-C-00	1.5 mg/L	28 days
Chloride, Total	SM 4500-Cl^- B	2.0 mg/L	28 days
E. coli (Escherichia Coli)	SM 9223 B	1 MPN per 100mL	< 24hrs
Hardness	SM 2350 C	5.0 mg/L	6 months
Copper, Total‡	EPA 200.8	1 µg/L	6 months
Lead, Total‡	EPA 200.8	0.10 µg/L	6 months
Zinc, Total‡	EPA 200.7	20 µg/L	6 months
Nitrite+Nitrate, Total as N	SM 4500-NO_3 E	0.030 mg/L	28 days
Total Nitrogen	Alk Persulfate Oxidation method	0.500 mg/L	28 days
pH	SM 4500 H^+ B	0.01 units	15 minutes
Fat, Oil, and Grease (FOG)	EPA 1664A	5.0 mg/L	28 days
Phosphorus, Total Dissolved	SM 4500-PE	0.010 mg/L	48 hours
Phosphorus, Total	SM 4500-PE	0.010 mg/L	48 hours
Solids, Total Dissolved	SM 2540 C	5.0 mg/L	7 days
Solids, Total Suspended	SM 2540 D	1.0 mg/L	7 days
Solids, Volatile Suspended	EPA 160.4	2.0 mg/L	7 days

The 2021 grab sampling sites are shown below in **Figures 25-1** through **Figures 25-3. Figure 25-1** shows the location of the 61st & Lyndale site. **Figure 25-2** show the location of the Powderhorn Lake Inlets SE, S, and W, and **Figure 25-3** show the location of the 24th Ave. SE & Elm St. SE infiltration basin Inlets N and S.

Figure 25-1. Aerial photo of the 61st & Lyndale stormwater quarterly grab monitoring site.

Figure 25-2. Aerial photo of the Powderhorn quarterly grab monitoring sites.

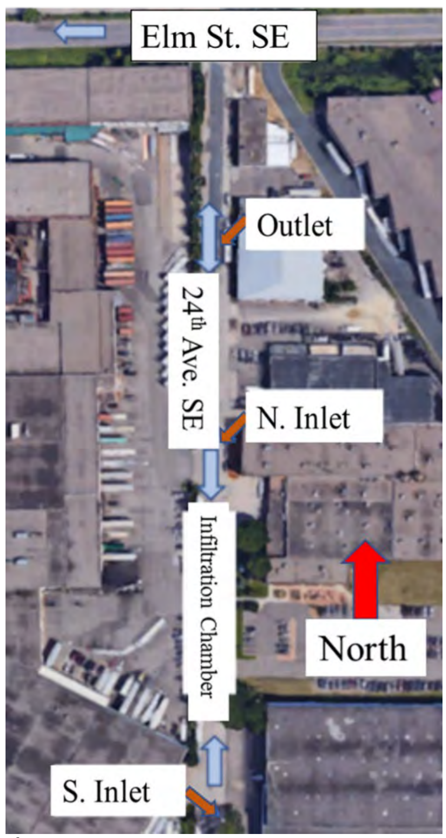


Figure 25-3. Aerial photo of 24th Ave. SE & Elm St. SE Infiltration Chamber and its two inlets and outlet. Blue arrows show the direction of flow.

Table 25-3 shows the land use and drainage area for the sampled sites at the Powderhorn inlets and 61st & Lyndale. **Table 25-4** shows the 24th Ave. SE & Elm St. SE, North and South Inlet land use and drainage area.

Table 25-3. The Powderhorn Inlets SE, S, and W and 61st & Lyndale sites monitored quarterly for NPDES chemistry, *E. coli*, pH, and FOG, and their location, land use, and drainage area.

Site ID	Powderhorn Inlet Southeast	Powderhorn Inlet South	Powderhorn Inlet West	61st & Lyndale
Location	3421 15th Ave S.	13th Ave S. and E. 35th St.	3318 19th Ave S.	335 ft. east of 61st St and Harriet Ave S.
Land Use	Multi–Family, Residential, Mixed Use	Residential, Mixed Use	Residential, Mixed Use	Commercial/ Industrial
Drainage Area	68.8 acres	81.2 acres	99.4 acres	34.9 acres

Table 25-4. The 24th Ave. SE & Elm St. SE sites monitored for NPDES chemistry, *E. coli*, pH, and FOG.

Site ID	24th Ave. SE & Elm St. SE Infiltration Basin North Inlet	24th Ave. SE & Elm St. SE Infiltration Basin South Inlet
Location	24th Ave SE	24th Ave SE
Land Use	Light Industrial	Light Industrial
Drainage Area	3.9 acres	10.3 acres

Field Quality Assurance Samples

A variety of quality assurance quality control (QAQC) measures were taken to ensure defensible data. Ten percent of the samples were laboratory quality assurance samples e.g., duplicates, spikes. A field blank was also generated for each sampling trip and was analyzed for all NPDES chemical parameters. Field blanks consisted of deionized water which accompanied samples from the field sites to the analytical laboratory. All field blank parameters were below the reporting limits in 2021. As part of the overall QAQC program, blind monthly performance samples of known concentration were made for all monitored parameters and delivered to IRI. If any parameter failed that month all the data for that parameter were flagged for the entire month. There were no failures in 2021.

Field measurements were recorded on a Field Measurement Form in the 2021 Field Logbook. Electronic data from the laboratory were forwarded to the MPRB in preformatted spreadsheets via email. Electronic data from the laboratory were checked and passed laboratory quality assurance procedures. Protocols for data validity followed those defined in the Stormwater Monitoring Program Manual (MPRB, 2001). For statistical calculations data reported below the reporting limit, the reporting limit value was divided in half.

Manual transcription of data was minimized to reduce error introduction. A minimum of 10% of the final data were checked by hand against the raw data sent by the laboratory to ensure there were no errors entering, manipulating, or transferring the data. See **Chapter 31,** Quality Assurance

Assessment Report for details.

A Chain of Custody form accompanied each set of sample bottles delivered to the lab. Each sample container was labeled indicating the date and time of collection, the site location, and the field personnel initials. Samples were transported to the laboratory on ice in a cooler. The time that each grab sample was collected was recorded onto field sheets. A complete description of methods can be found in the Stormwater Monitoring Program Manual (MPRB, 2001). Common statistics were calculated using Microsoft Excel.

Results and Discussion

The 2021 quarterly snowmelt grab sampling schedule is shown in **Table 25-5**. The 2021 quarterly precipitation grab sampling schedule and associated precipitation event data are shown in **Table 25-6**.

Snowmelt usually has the highest geometric mean concentrations for most chemical parameters. This is as expected as snowmelt is the release of 4-5 months of deposition and debris from the watershed. Snowmelt usually has the lowest geometric mean for *E. coli*. The *E. coli* concentrations are temperature dependent because bacteria do not survive well in cold conditions.

The 2021 quarterly NPDES chemistry grab sample results are shown in **Table 25-7**. Snowmelt shows more pollutants than the summer grab samples, but lower *E. coli*. Each of the Powderhorn SE, S, and W Inlet snowmelt phosphorus and metals samples are high in comparison to the other sites sampled. All sites monitored had quarterly grab samples measured that ranged in pH between 6.4 and 9.7.

The 2021 grab sampling associated statistics of geometric mean, arithmetic mean, maximum value, minimum value, standard deviation, number of samples collected, and the standard deviation are shown in **Table 25-8**. The geometric mean is a valuable statistic as it accurately controls for data with a wide range and outliers.

Table 25-5. Snowmelt grab samples collected in 2021. NS = No sample collected.

Date	Powderhorn In S	Powderhorn In SE	Powderhorn In W	24th Elm In N	24th Elm In S	61st & Lyndale
2/22/2021	NS	NS	Grab	Grab	Grab	Grab
2/23/2021	NS	NS	Grab	Grab	Grab	Grab
2/24/2021	Grab	Grab	NS	NS	NS	NS
2/25/2021	Grab	Grab	NS	NS	NS	NS
4/8/2021	Grab	Grab	Grab	Grab	Grab	Grab

Table 25-6. The 2021 stormwater precipitation grab samples collected with event precipitation data.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr)	Hours since last Rain	Powderhorn In S	Powderhorn In SE	Powderhorn In W	24th Elm In N	24th Elm In S	61st & Lyndale
5/27/2021	4:30	5/28/2021	6:45	0.77	26.25	0.03	49	Grab	Grab	Grab	Grab	Grab	Grab
7/14/2021	11:30	7/14/2021	15:45	0.30	4.25	0.07	180	Grab	Grab	Grab	Grab	Grab	Grab
8/24/2021	3:15	8/24/2021	11:00	0.68	7.75	0.09	380	Grab	Grab	Grab	Grab	Grab	Grab

Table 25-7. The 2021 quarterly NPDES chemistry grab sample results. NA=data not available. Red FOG data are > than 15 mg/L.

Date Sampled	Time Sampled	Location	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	pH Std Unit	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
2/22/2021	14:20	24th & Elm N	0.249	0.036	NA	2.69	<0.030	2199	156	16	9	3428	81	11	<1	7.8	9	1	<20.0	12
2/23/2021	14:30	24th & Elm N	0.142	0.052	NA	2.35	0.796	700	72	32	11	85	85	<5.00	<1	8.2	21	3	72	11
4/8/2021	12:10	24th & Elm N	0.213	0.026	NA	1.23	0.183	22	48	60	14	117	93	<5.00	<10	7.6	14	11	74	5
5/27/2021	10:00	24th & Elm N	0.135	0.022	NA	0.845	0.315	3	24	76	19	43	54	<5.00	504	7.8	15	7	83	5
7/14/2021	19:00	24th & Elm N	0.174	0.056	0.031	2.19	0.91	9	44	52	20	117	93	<5.00	310	7.4	22	5	123	24
8/24/2021	9:48	24th & Elm N	0.112	0.022	0.014	1.04	0.231	2	24	11	4	40	21	<5.00	2755	7.2	13	1	32	5
2/22/2021	14:15	24th & Elm S	0.358	0.045	NA	6.98	0.215	6998	184	47	21	11945	379	14	<1	7.9	20	2	80	17
2/23/2021	14:20	24th & Elm S	0.300	0.055	NA	7.12	0.393	8197	184	37	16	561	561	31	<1	7.8	19	2	81	20
4/8/2021	12:05	24th & Elm S	0.148	0.035	NA	1.20	0.141	16	20	24	7	90	94	<5.00	86	7.8	8	3	59	5
5/27/2021	9:45	24th & Elm S	0.085	0.051	NA	0.642	0.115	2	18	8	5	43	25	<5.00	404	7.7	4	1	<20.0	3
8/24/2021	9:40	24th & Elm S	0.072	0.028	0.028	0.637	0.231	<2.00	22	9	5	40	11	<5.00	1842	7.1	10	1	<20.0	5
2/22/2021	13:00	61st & Lyndale	0.511	0.086	NA	5.85	1.82	8797	316	270	71	14883	560	16	<10	9.7	50	13	285	44
2/23/2021	12:55	61st & Lyndale	0.592	0.101	NA	18.9	2.24	4399	296	473	82	473	473	15	<1	9.7	51	13	260	61
4/8/2021	11:07	61st & Lyndale	0.342	0.032	NA	1.25	0.125	70	60	182	34	203	124	6	2382	9.3	21	14	122	4
5/27/2021	8:30	61st & Lyndale	0.240	0.067	NA	1.00	<0.030	14	32	75	19	100	71	<5.00	7701	8.5	11	3	48	6
7/14/2021	12:25	61st & Lyndale	0.971	0.214	0.1	7.77	1.38	120	288	189	57	700	322	<5.00	68670	8.1	34	12	229	96
8/24/2021	8:30	61st & Lyndale	0.257	0.090	0.081	0.852	0.162	9	40	77	14	59	35	<5.00	7270	8.4	23	4	79	5
2/24/2021	13:20	POW IN S	0.930	0.199	NA	6.30	0.411	2199	90	266	105	3828	348	23	<10	8.0	53	44	350	22
2/25/2021	13:10	POW IN S	0.774	0.337	NA	6.34	0.217	1600	90	252	169	2860	220	18	84	7.9	35	25	209	22
4/8/2021	11:40	POW IN S	0.294	0.055	NA	1.70	0.127	9	20	52	24	70	90	5	24196	7.3	17	31	76	8
5/27/2021	9:15	POW IN S	0.406	0.23	NA	1.72	0.089	<2.00	18	32	19	58	60	<5.00	3654	7.3	15	8	47	13
7/14/2021	13:40	POW IN S	1.81	0.469	0.391	5.59	<0.030	17	132	290	148	305	552	15	19180	6.7	66	60	266	135
8/24/2021	9:15	POW IN S	0.223	0.101	0.084	1.04	0.1	<2.00	18	20	9	35	24	<5.00	17329	6.9	12	8	54	7

Table 25-7. (continued) The 2021 quarterly NPDES chemistry grab sample results. NA=data not available. Red FOG data are > than 15 mg/L.

Date Sampled	Time	Location	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	pH Std Unit	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
2/24/2021	13:15	POW IN SE	1.36	0.328	NA	7.1	0.468	2099	140	474	123	3265	473	14	364	9.3	52	43	338	32
2/25/2021	12:58	POW IN SE	1.03	0.486	NA	8.43	0.401	2899	150	230	60	5325	293	17	199	8.8	48	22	199	29
4/8/2021	11:30	POW IN SE	0.245	0.112	NA	1.62	0.119	12	22	41	17	88	65	5	377	7.9	11	12	62	9
5/27/2021	9:10	POW IN SE	0.527	0.232	NA	1.86	<0.030	<2.00	18	30	25	50	84	11	>24200	7.4	11	5	54	16
7/14/2021	15:30	POW IN SE	1.56	0.360	0.616	5.89	0.036	34	152	85	32	395	394	<5.00	11450	6.4	41	14	178	152
8/24/2021	9:10	POW IN SE	0.232	0.099	0.088	1.04	0.163	<2.00	18	19	8	38	31	<5.00	11199	6.8	12	5	32	8
2/22/2021	13:45	POW IN W	1.50	0.058	NA	5.00	0.127	11996	260	539	230	19877	951	63	86	8.2	110	78	678	35
2/23/2021	14:00	POW IN W	0.497	0.091	NA	4.46	0.077	3199	470	508	414	239	239	85	55	8.2	44	27	239	25
4/8/2021	11:00	POW IN W	0.229	0.049	NA	1.71	0.135	15	24	32	14	90	57	<5.00	24196	7.3	12	20	54	10
5/27/2021	8:50	POW IN W	0.577	0.308	NA	2.35	<0.030	3	26	41	30	63	80	<5.00	24196	7.7	17	10	66	22
7/14/2021	13:45	POW IN W	1.27	0.188	0.138	5.39	<0.030	16	120	100	65	290	269	9	155310	6.7	65	78	252	86
8/24/2021	8:50	POW IN W	0.252	0.096	0.091	1.17	0.109	<2.00	18	42	13	35	99	<5.00	15531	6.9	16	10	45	7

Table 25-8. The 2021 quarterly stormwater grab sampling associated statistics.

Parameter	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	pH Std Unit	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
MEAN (geometric)	0.371	0.092	0.087	2.54	0.157	54	60	69	27	264	123	15	408	7.8	21	8	89	15
MEAN (arithmetic)	0.531	0.138	0.151	3.75	0.350	1590	103	134	55	1995	212	21	11746	7.82	28	16.9	139	27.6
MAX	1.81	0.486	0.616	18.9	2.24	11996	470	539	414	19877	951	85	155310	9.7	110	78.2	678	152
MIN	0.072	0.022	0.014	0.637	0.015	1	18	8	4	35	11	5	1	6.4	4	0.6	10	3.4
MEDIAN	0.300	0.090	0.088	2.19	0.152	16	48	52	20	117	93	15	454	7.8	18.9	10	79.2	12.5
Standard Deviation	0.474	0.130	0.185	3.64	0.515	2991	110	157	82	4522	218	21	28716	0.826	22.6	20.5	136	36.3
NUMBER	35	35	11	35	34	35	35	35	35	35	35	17	34	35	35	35	35	35
Coefficient of Variation	0.892	0.945	1.22	0.971	1.47	1.88	1.07	1.17	1.5	2.27	1.03	1	2.44	0.106	0.808	1.21	0.983	1.32

FOG (Fat, Oil, and Grease) Pilot Study

The FOG study was initially a 2-year study to gather FOG data over the course of the NPDES permit. If no FOG values were found > 15 mg/L the study would end. If a FOG value was > 15 mg/L that site would continue FOG monitoring. A single FOG sample was noted > 15 mg/L, so sampling has continued. Each year of FOG sampling data is shown below. **Table 25-9** contains 2018 data, **Table 25-10** contains 2019 data, **Table 25-11** contains 2020 data, and **Table 25-12** contains the 2021 FOG data. Any FOG data > 15 mg/L are marked in red.

In 2018 none of the FOG data were above 15 mg/L. In 2019, the only FOG data above 15 mg/L was a sample from 61st & Lyndale snowmelt. In 2020, the data reported above 15 mg/L were from snowmelt samples collected at Powderhorn Inlets S and W. In 2021, the samples above 15 mg/L were from 24th & Elm Inlet S, 61st & Lyndale, and the Powderhorn Inlets S, SE, and W snowmelt samples. All other FOG samples were below 15 mg/L. Snowmelt appears to have the highest FOG values.

Table 25-9. The 2018 FOG event dates and grab samples collected. NS = No Sample.

Location	1/10/2018	1/19/2018	1/26/2018	3/19/2018	3/26/2018	7/12/2018	7/13/2018	10/1/2018
14th & Park	<5.00	6	NS	NS	NS	<5.00	NS	<5.00
22nd & Aldrich	8	8	NS	6	NS	NS	<5.00	<5.00
61st & Lyndale	NS	<5.00	9	NS	NS	NS	NS	NS
Pershing	NS	NS	NS	<5.00	<5.00	NS	NS	NS

Table 25-10. The 2019 FOG event dates and grab samples collected. Attempted = ⸙ and refers to sampling that was attempted but could not be collected. Red FOG data are > 15 mg/L. NS = No Sample.

Location	3/12/2019	3/13/2019	3/19/2019	3/20/2019	5/8/2019	6/27/2019	8/26/2019	9/12/2019
14th & Park	9	10	NS	NS	NS	NS	NS	NS
22nd & Aldrich	⸙	7	NS	NS	NS	NS	NS	NS
61st & Lyndale	21	19	NS	NS	NS	NS	NS	NS
Pershing	NS	NS	<5.00	<5.00	NS	NS	NS	NS
24th & Elm In N	NS	NS	NS	NS	<5.00	<5.00	<5.00	<5.00
24th & Elm In S	NS	NS	NS	NS	<5.00	<5.00	<5.00	<5.00
Winter Basin In S	NS	NS	NS	NS	<5.00	<5.00	6	6
Winter Basin In W	NS	NS	NS	NS	5	5	5	<5.00

Table 25-11. 2020 FOG event dates and grab samples collected. Attempted = ⸙ and refers to sampling that was attempted but could not be collected. Red FOG data are > 15 mg/L. NS = No Sample.

Location	2/24/2020	3/3/2020	3/4/2020	7/7/2020	7/14/2020	7/21/2020
61st & Lyndale	NS	NS	NS	6	NS	<5.00
24th & Elm In N	⸙	<5.00	<5.00	NS	<5.00	<5.00
24th & Elm In S	⸙	<5.00	<5.00	NS	<5.00	<5.00
24th & Elm N Out	NS	NS	NS	NS	7	NS
POW In N	⸙	⸙	NS	NS	NS	NS
POW IN SE	⸙	6	6	5	NS	<5.00
POW IN S	31	14	NS	3	NS	<5.00
POW IN W	109	13	NS	4	NS	<5.00

Table 25-12. 2021 FOG event dates and grab samples collected. Attempted = ⸙ and refers to sampling that was attempted but could not be collected. Red FOG data are > 15 mg/L. NS = No Sample.

Location	2/22/2021	2/23/2021	2/24/2021	2/25/2021	4/8/2021	5/27/2021	7/14/2021	8/24/2021
61st & Lyndale	16	14.8	NS	NS	6	<5.00	<5.00	<5.00
24th & Elm N	11	<5.00	NS	NS	<5.00	<5.00	<5.00	<5.00
24th & Elm S	14	31	NS	NS	<5.00	<5.00	NS	<5.00
POW IN SE	⸙	⸙	14	17	5	11	<5.00	<5.00
POW IN S	⸙	⸙	23	18	5	<5.00	14.7	<5.00
POW IN W	63	85	NS	NS	<5.00	<5.00	9	<5.00

Conclusions

Grab samples of stormwater represent event chemistry at a point in time on the hydrograph. Following sampling protocol, some parameters can only be characterized by a grab sample, e.g., pH, *E. coli*, and FOG. Timing of a runoff event is critical for grab sample collection. Flow must occur when staff are available, travel between sites during a storm is possible, and the laboratory is available to receive samples with short holding times like *E. coli*.

In 2021, six sites were successfully monitored quarterly for NPDES water chemistry, *E. coli*, pH, and FOG. The sites included:

- 24th & Elm Inlets N and S.
- 61st & Lyndale.
- Powderhorn Inlets SE, S, and W.

The 2021 quarterly grab sampling data show that snowmelt generally had high values for all chemical parameters when compared to runoff at other times of the year. Phosphorus, solids, metals, and FOG data were much higher during snowmelt. The snowmelt chemistry values were particularly high at the Powderhorn Inlet W site for almost all chemical parameters. The *E. coli* MPN levels were low for snowmelt and higher in the warmer months. This was expected since *E. coli* are temperature-dependent organisms. Chloride values were all high during snowmelt, and then were lower the rest of the year. The chloride source is likely salt application over the winter months.

The 2021 pH values ranged between 6.4 and 9.7. The pH values were consistently high at 61st & Lyndale

compared to the other sites. High pH values at 61st and Lindale were likely due to the cement plant runoff located across the street from the sampling location, which is likely alkaline.
FOG data have been collected for the four years from 2018 - 2021. The only FOG samples that were greater than 15 mg/L were seen during the 2019 - 2021 snowmelt events. The only non-snowmelt FOG sample that came close to 15 mg/L was on 7/14/21 where the Powderhorn Inlet S sample was 14.7 mg/L. It appears that FOG values greater than 15 mg/L generally do not occur outside of snowmelt. Snowmelt is a unique event that contributes pollution from 4-5 months over a few low-flow events. Snowmelt samples are polluted from material deposited in the watershed over the winter, and it is common to see an oily sheen on a snowmelt grab sample.

Powderhorn Lake Inlet Monitoring

Background

The City of Minneapolis Public Works (MPW) and the Minneapolis Park and Recreation Board (MPRB) developed a major restoration plan for Powderhorn Lake in 1999. In 2001, five continuous deflective separation (CDS) grit chambers were installed to remove solids from stormwater inflow see **Figure 26-3**. A drawing of a CDS unit is shown in **Figure 26-1**. The Powderhorn Lake watersheds are shown in **Figure 26-2**.

Despite this and other restoration work, the lake was listed as impaired and placed on the Environmental Protection Agency (EPA) 303d list based on eutrophication and biological indicators in 2001. Powderhorn Lake later trended towards better water quality and met state standards for several years, it was subsequently removed from the 303d list in 2012. After relapsing to poor water quality, Powderhorn was relisted on the EPA 303d list as impaired for nutrients in 2018.

The purpose of monitoring the stormwater inlets into Powderhorn Lake was to:

1. Comply with the NPDES Permit provision to monitor stormwater runoff.
2. Measure the pollutant load of the main tributaries to Powderhorn Lake. This information can be used to assist in any future external load reduction plans.
3. Trouble shoot the CDS unit functionality, since 2020 work discovered that the CDS units were malfunctioning.

In 2021, four of the largest Powderhorn Lake watershed inlets, with CDS units, were all auto-monitored downstream of the CDS units as part of the NPDES stormwater monitoring permit.

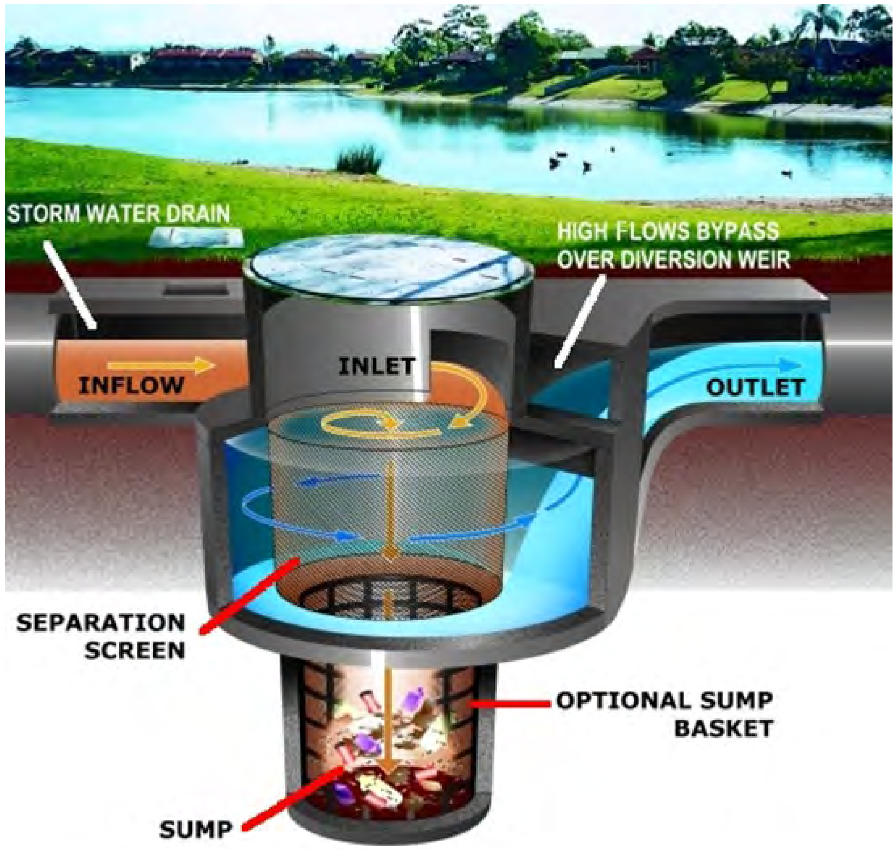


Figure 26-1. Cross section showing components of a CDS grit chamber unit. Image source: https://prismatech.com.my/products-ecoclean-cds.php

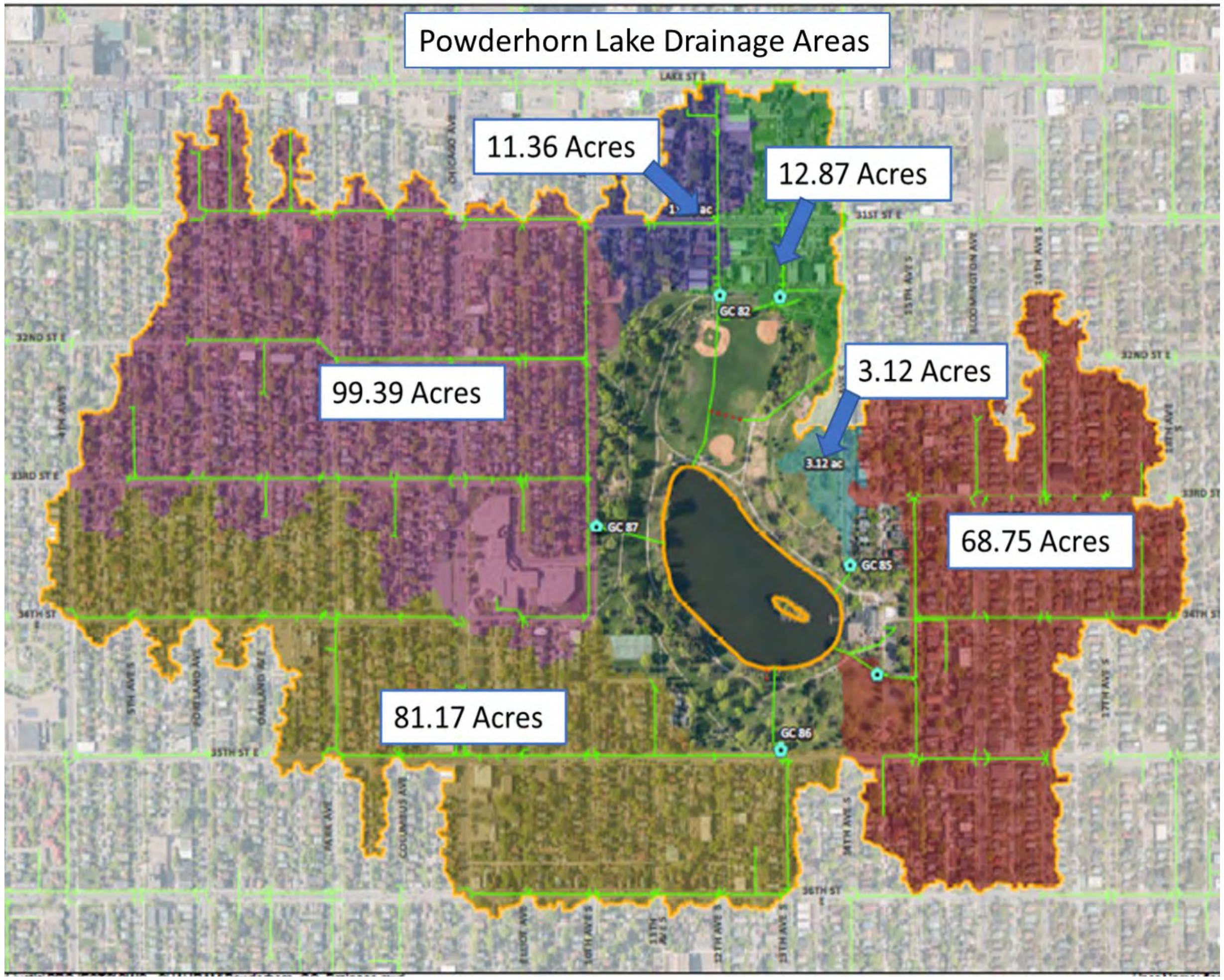


Figure 26-2. Powderhorn Lake watershed drainage areas with subwatershed sizes. All inlets have CDS units except the 3.12 acre NE area which has a sump.

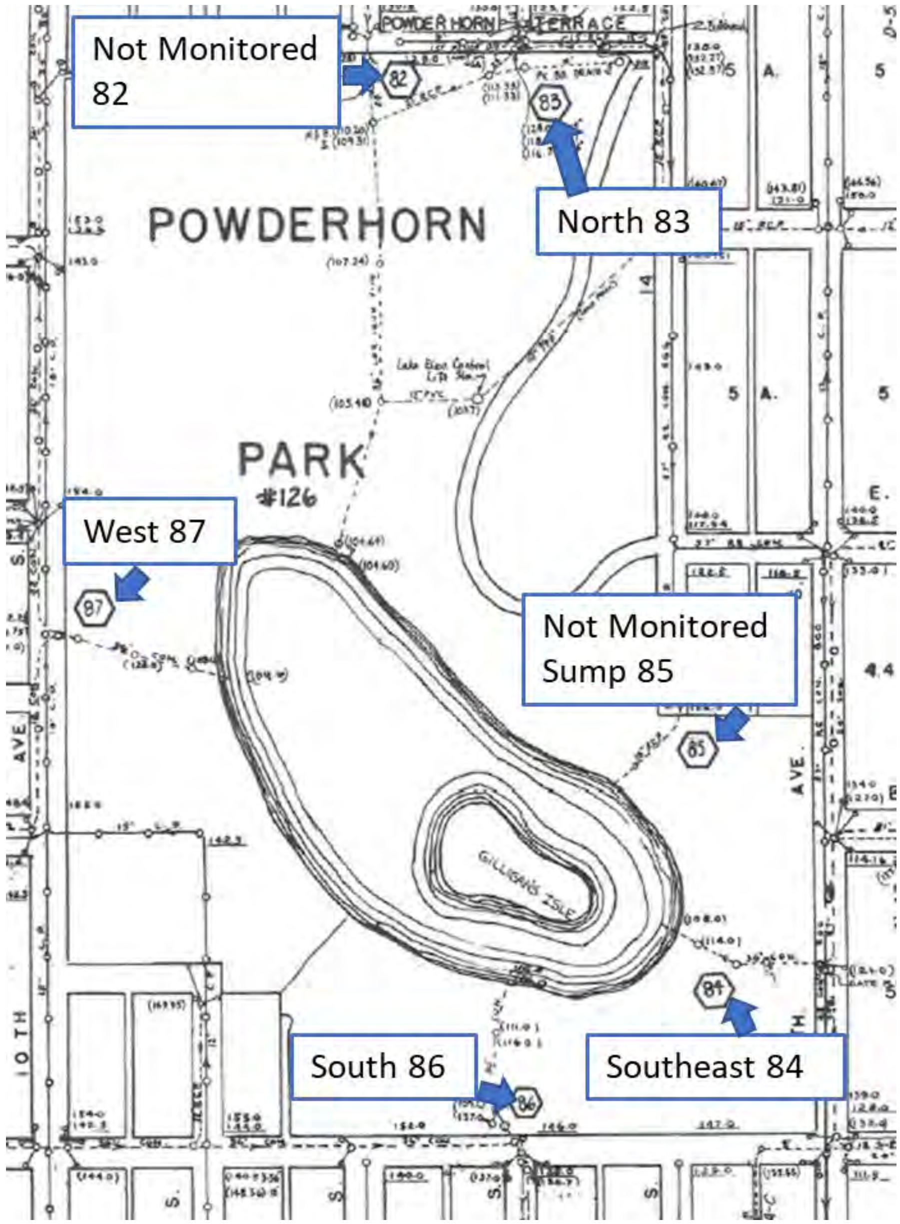


Figure 26-3. Map of CDS surrounding Powderhorn Park with Minneapolis Public Works ID numbers.

There are five CDS grit chambers and one sump structure installed in-line with stormwater pipes leading to Powderhorn Lake. A sump is a pit, typically in a catch basin, that traps solids. **Table 26-1** shows the Powderhorn CDS grit chambers with Minneapolis Public Works ID numbers, location, and drainage areas for each unit. CDS unit 82 was not monitored since it is adjacent to and has an almost identically sized watershed to CDS unit 83. Sump 85 was not monitored because its watershed is only 3.1 acres which is about 1% of the entire Powderhorn watershed and less likely to contribute a significant portion of the nutrient loading to Powderhorn Lake.

Table 26-1. A list of the Best Management Practices (BMP's) surrounding Powderhorn Lake, their MPRB name, Minneapolis ID number, BMP type, associated drainage area, location, and pipe size.

MPRB Site Name	Minneapolis Grit ID Number	BMP Type	Drainage Area (Acres)	Location	Outlet Pipe Size (Inches)
-	82	CDS Hydrodynamic Separator	11.4	12th Ave S and Powderhorn Terrace	24
Powderhorn Inlet North	83	CDS Hydrodynamic Separator	12.9	13th Ave S and Powderhorn Terrace	21
Powderhorn Inlet Southeast	84	CDS Hydrodynamic Separator	68.8	3421 15th Ave S	36
-	85	Sump Manhole	3.1	3329 14th Ave S	15
Powderhorn Inlet South	86	CDS Hydrodynamic Separator	81.2	13th Ave S and East 35th Street	30
Powderhorn Inlet West	87	CDS Hydrodynamic Separator	99.4	3318 10th Ave S back of sidewalk opposite of house #3318	36

Methods

Site Installation

Monitoring equipment at each of the sites included: ISCO 2150 datalogger, 2015ci combined interface module/modem, low-profile AV probe, and a 3700 ISCO sampler complete with tubing and intake strainer. AV probes and intake strainers were pointed upstream, **Figure 26-4**. The equipment at the Inlet North was hung from eyebolts below grade in the manhole, while all of the other sites had above-grade monitoring boxes with access holes for tubing and cables drilled through the manhole collars. Monitoring boxes were rectangular 4' x 3' x 3' locking wooden boxes which safely protected and housed both the sampler and datalogger equipment.

The dataloggers used cell phone modems to remotely upload data to the MPRB ISCO database server from Monday through Friday. A cell phone antenna was installed at each site to allow communication with the datalogger. The datalogger could also be remotely programmed to turn the samplers on/off, adjust the level, pacing, or triggers, or download data.

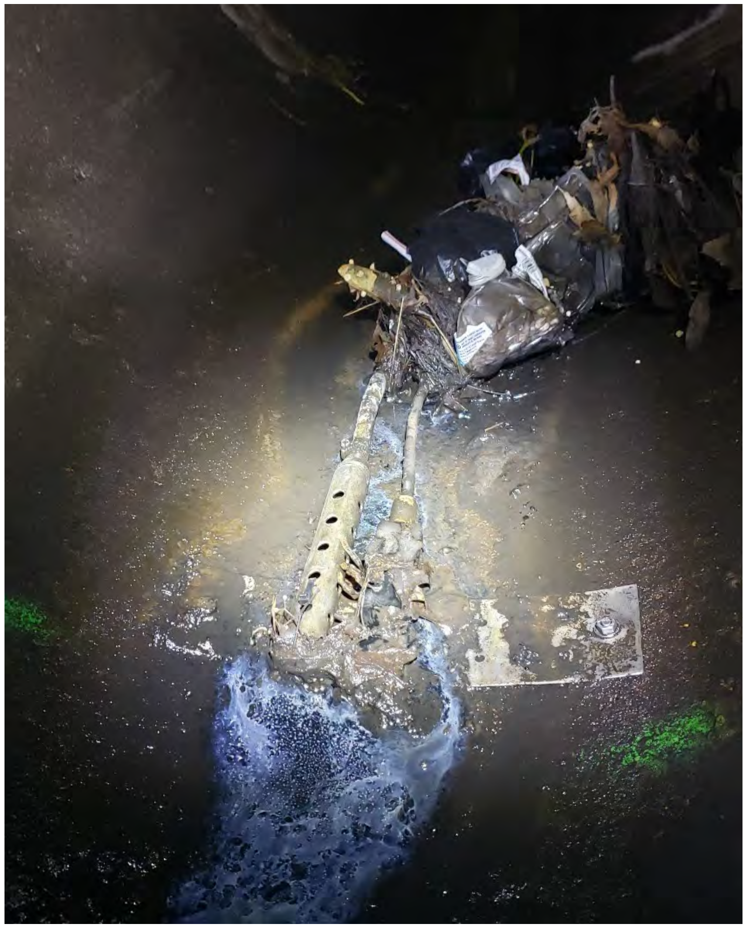


Figure 26-4. MPW photo of the AV probe and intake strainer at Powderhorn Inlet West 8/4/21. Note the debris caught on the downstream cable and tubing is larger than the 3/8-inch tubing.

Sample Collection

The samplers were multiplexed, flow-paced, equipped with 24 one-liter bottles, 3/8" inner-diameter vinyl tubing, and an intake strainer. Samplers that were multiplexed collected four samples per 1-L bottle, and each sampler contained 24 1-L bottles. This allowed a maximum of 96 samples to be collected over a storm hydrograph and create a flow-weighted composite. The cable and tubing were anchored with zip-ties to the sidewall eyebolts or side-iron manhole ladders. The dataloggers were programmed to pulse the samplers after a 1" trigger and after a set volume or pacing had passed.

In 2021, all Powderhorn inlet site sample monitoring was done downstream of the CDS units to enable sampling of nutrient inputs to the lake. The samplers collected material of <3/8" size that by-passed over the internal weir or went through the CDS chamber screen. All solids material >3/8" were not sampled, for example; leaf litter, cigarette butts, plastic bags, or various other debris, **Figure 26-4.**

The South, West, and Southeast Inlets had significant by-pass flows at the internal CDS overflow weirs. It is believed that this is caused by the CDS screens becoming plugged or when the units need to be cleaned. When routine by-pass occurs, water backs up the upstream pipes, past the CDS unit, and sand and solids settle in the upstream pipe.

MPW is aware that the CDS screens clog. On August 4th, 2021 crews vacuumed out the West CDS Unit and entered the stormsewer to photograph the outlet of the CDS where the screens are visible during a maintenance and trouble-shooting visit, see **Figure 26-5**.

Figure 26-5. MPW photo of the outside of the West Powderhorn Inlet CDS screen as seen from the outlet of the CDS unit on 8/4/21.

Monitoring Parameters and Methods

A list of the NPDES permit required chemistry analysis for auto-monitoring stormwater hydrograph composite samples and sampled in this project is shown in **Table 26-2**. NPDES permit-required chemistry methods, reporting limits and holding times for auto-monitored composite samples used in this project are shown in **Table 26-3.**

Table 26-2. The list of required NPDES permit auto-monitoring chemistry parameters to be monitored.

Parameter	Abbreviation	Units
Chemical Oxygen Demand	COD	mg/L
Dissolved Organic Carbon	DOC	mg/L
Chloride, Total	Cl	mg/L
Hardness	Hard	mg/L
Copper, Total	Cu	µg/L
Lead, Total	Pb	µg/L
Zinc, Total	Zn	µg/L
Nitrite+Nitrate, Total as N	NO_3NO_2	mg/L
Total Nitrogen	TN	mg/L
Phosphorus, Total Dissolved	TDP	mg/L
Phosphorus, Total	TP	mg/L
Solids, Total Dissolved	TDS	mg/L
Solids, Total Suspended	TSS	mg/L
Solids, Volatile Suspended	VSS	mg/L

Table 26-3. Analysis method, reporting limit, and holding times for parameters analyzed by Instrumental Research, Inc. and Pace Laboratories. ǂ Metals and DOC were analyzed by Pace Laboratories.

Parameter	Method	Reporting Limit	Holding Time
COD	SM 5220-D	20 mg/L	28 days
DOCǂ	SM 5310-C-00	1.5 mg/L	28 days
Chloride, Total	SM 4500-Cl^- B	2.0 mg/L	28 days
Hardness	SM 2350 C	5.0 mg/L	6 months
Copper, Totalǂ	EPA 200.8	1 µg/L	6 months
Lead, Totalǂ	EPA 200.8	0.10 µg/L	6 months
Zinc, Totalǂ	EPA 200.7	20 µg/L	6 months
Nitrite+Nitrate, Total as N	SM 4500-NO_3 E	0.030 mg/L	28 days
Total Nitrogen	Alkaline Persulfate Oxidation	0.500 mg/L	28 days
Phosphorus, Total Dissolved	SM 4500-PE	0.010 mg/L	48 hours
Phosphorus, Total	SM 4500-PE	0.010 mg/L	48 hours
Solids, Total Dissolved	SM 2540 C	5.0 mg/L	7 days
Solids, Total Suspended	SM 2540 D	1.0 mg/L	7 days
Solids, Volatile Suspended	EPA 160.4	2.0 mg/L	7 days

Results & Discussion

Sample Collection

In 2021, Powderhorn samples were collected from storms ranging from 0.26” to 1.48’’. Snowmelt samples were collected from four snowmelt events at the Powderhorn Inlets S, SE, and W sites via grabs. The Powderhorn North Inlet was inaccessible for snowmelt monitoring. **Table 26-4** shows the snowmelt grab samples collected. **Table 26-5** shows the precipitation and flow-weighted composite storm samples collected. Precipitation was measured by a rain gauge at MPRB's service center at 3800 Bryant Ave. S. Minneapolis, MN. A precipitation event was defined as a storm greater than 0.10" and separated by eight hours or more from other precipitation.

The 2021 NPDES chemical concentrations and associated statistics for the Powderhorn Inlets S, SE, W and N can be seen in **Table 26-6** through **Table 26-9**. If less than values were present, half the value was used for statistical calculations. The statistics calculated for each site were the geometric mean, arithmetic mean, maximum, minimum, standard deviation, number of samples, and coefficient of variation. If a sample was not analyzed and no data are presented it is marked NS for no sample or NES for not enough sample, due to low volume. The geometric means in **Tables 26-6** through **Table 26-9** were used in the load calculations.

Table 26-4. The 2021 snowmelt events staff sampled or attempted to sample at the Powderhorn Inlets. Grab = quarterly grab samples. NS = No Sample.

Sample Collection Date	Powderhorn Inlet S	Powderhorn Inlet SE	Powderhorn Inlet W	Powderhorn Inlet N
2/22/2021	NS	NS	Grab	NS
2/23/2021	NS	NS	Grab	NS
2/24/2021	Grab	Grab	NS	NS
2/25/2021	Grab	Grab	NS	NS
4/8/2021	Grab	Grab	Grab	NS

Table 26-5. The 2021 stormwater events sampled or attempted to be sampled at the four Powderhorn Inlets. Grab = quarterly grab samples, Grab/X = Quarterly grab samples with a flow-paced composite. NS = No Sample.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr)	Hours since last Rain.	Powderhorn Inlet S	Powderhorn Inlet SE	Powderhorn Inlet W	Powderhorn Inlet N
5/19/2021	16:45	5/19/2021	22:00	0.26	5.25	0.05	11	X	X	X	X
5/20/2021	23:45	5/21/2021	11:45	0.36	12	0.03	14	X	X	X	X
5/27/2021	4:30	5/28/2021	6:45	0.77	26.25	0.03	49	Grab/X	Grab/X	Grab/X	X
6/20/2021	6:15	6/20/2021	19:45	0.72	13.5	0.05	551	X	X	NS	NS
6/27/2021	18:45	6/28/2021	14:00	0.40	19.25	0.02	167	X	NS	X	NS
7/14/2021	11:30	7/14/2021	15:45	0.30	4.25	0.07	180	Grab/X	Grab	Grab	X
8/7/2021	5:00	8/8/2021	7:00	1.13	26	0.04	374	X	X	X	NS
8/24/2021	3:15	8/24/2021	11:00	0.68	7.75	0.09	380	Grab/X	Grab/X	Grab/X	X
8/26/2021	13:15	8/27/2021	6:45	1.48	17.5	0.08	50	X	X	X	X
8/28/2021	15:45	8/29/2021	0:45	0.98	9	0.11	33	X	X	X	X
9/2/2021	18:00	9/3/2021	9:15	0.93	15.25	0.06	113	X	NS	X	X
10/20/2021	11:15	10/21/2021	0:30	0.51	13.25	0.04	1130	X	X	X	X
10/27/2021	21:30	10/28/2021	21:30	0.71	24	0.03	165	X	X	X	X

Stormwater Chemistry

Table 26-6. The Powderhorn Inlet North 2021 chemistry and statistics. NS = no sample. TP = Total Phosphorus, TDP = Total Dissolved Phosphorus, SRP = Soluble Reactive Phosphorus, TN = Total Nitrogen, NO_3NO_2 = Nitrate Nitrite, Cl = Chloride, TSS = Total Suspended Solids, VSS = Volatile Suspended Solids, TDS = Total Dissolved Solids, COD = Chemical Oxygen Demand, FOG = Fat Oil and Grease, Cu = Copper, Pb = Lead, Zn = Zinc, DOC = Dissolved Organic Carbon.

Sample End Date/Time	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
5/19/2021 23:48	0.677	0.045	0.005	3.5	0.096	6	36	116	49	98	222	NS	NS	40	26	141	22
5/21/2021 8:15	0.254	0.054	0.037	1.71	0.138	5	26	38	19	85	74	NS	NS	23	6	54	12
5/28/2021 5:26	0.212	0.119	NS	1.43	0.051	1	16	29	18	42	51	NS	NS	16	4	53	8
7/15/2021 17:32	0.381	0.056	0.006	3.12	0.189	36	40	93	44	118	129	NS	NS	27	11	148	22
8/22/2021 12:12	0.884	0.094	NS	4.02	0.085	6	38	204	92	137	370	NS	NS	NS	NS	NS	NS
8/24/2021 8:47	0.464	0.071	0.047	2.66	0.212	2	28	174	66	58	150	NS	NS	25	36	127	10
8/26/2021 20:49	0.248	0.054	0.025	2.06	0.015	1	18	97	34	38	71	NS	NS	22	12	54	5
8/27/2021 6:48	0.127	0.036	0.031	0.96	0.015	1	12	23	11	28	24	NS	NS	14	3	23	4
8/29/2021 0:42	0.210	0.034	0.012	1.88	0.294	1	16	77	30	33	62	NS	NS	21	13	51	5
9/3/2021 3:28	0.170	0.05	0.041	1.34	0.097	1	16	30	14	25	24	NS	NS	15	5	5	5
9/21/2021 15:20	0.510	0.069	0.004	3.03	0.066	2	34	189	75	68	198	NS	NS	33	26	146	19
10/21/2021 1:10	0.834	0.068	0.014	0.25	0.041	13	72	194	90	197	281	NS	NS	34	23	182	61
10/28/2021 4:19	0.261	0.144	0.106	1.24	0.061	5	32	30	17	78	53	NS	NS	11	5	44	14
MEAN (geometric)	0.337	0.063	0.019	1.74	0.075	3	26	75	34	64	94	NS	NS	22	10	61	11
MEAN (arithmetic)	0.402	0.069	0.030	2.09	0.105	6	30	99	43	77	132	NS	NS	23	14	86	16
MAXIMUM	0.884	0.144	0.106	4.02	0.294	36	72	204	92	197	370	NS	NS	40	36	182	61
MINIMUM	0.127	0.034	0.004	0.250	0.015	1	12	23	11	25	24	NS	NS	11	3	5	4
MEDIAN	0.261	0.056	0.025	1.88	0.085	2	28	93	34	68	74	NS	NS	23	12	54	11
STANDARD DEVIATION	0.255	0.032	0.030	1.10	0.083	10	16	70	29	50	108	NS	NS	9	11	59	16
NUMBER	13	13	11	13	13	13	13	13	13	13	13	NS	NS	12	12	12	12
COEFFICIENT of VARIATION	0.633	0.472	0.991	0.526	0.793	1.56	0.54	0.703	0.680	0.655	0.821	NS	NS	0.377	0.780	0.688	1.02

Table 26-7. The Powderhorn Inlet South 2021 chemistry and statistics. NS = no sample. NES = not enough sample. TP = Total Phosphorus, TDP = Total Dissolved Phosphorus, SRP = Soluble Reactive Phosphorus, TN = Total Nitrogen, NO_3NO_2 = Nitrate Nitrite, Cl = Chloride, TSS = Total Suspended Solids, VSS = Volatile Suspended Solids, TDS = Total Dissolved Solids, COD = Chemical Oxygen Demand, FOG = Fat Oil and Grease, Cu = Copper, Pb = Lead, Zn = Zinc, DOC = Dissolved Organic Carbon.

Sample End Date/Time	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
2/24/2021 13:20	0.93	0.199	NS	6.30	0.411	2,199	90	266	105	3,828	348	23	5	53	44	350	22
2/25/2021 13:10	0.774	0.337	NS	6.34	0.217	1,600	90	252	169	2,860	220	18	83.6	35	25	209	22
4/8/2021 11:40	0.294	0.055	NS	1.70	0.127	9	20	52	24	70	90	5	24,196	17	31	76	8
5/20/2021 0:53	0.812	0.067	0.020	3.28	0.015	11	50	144	72	135	252	NS	NS	35	32	158	36
5/21/2021 9:26	0.314	0.085	0.050	1.74	0.047	6	28	40	22	98	92	NS	NS	20	11	50	11
5/27/2021 9:15	0.406	0.230	NS	1.72	0.089	1	18	32	19	58	60	3	3,654	15	8	47	13
5/27/2021 13:08	0.366	0.185	NS	1.94	0.015	3	28	39	27	70	67	NS	NS	15	10	57	12
6/20/2021 17:37	1.12	0.079	0.020	4.01	0.015	9	48	149	67	110	218	NS	NS	32	54	145	26
6/27/2021 23:07	0.463	0.100	0.032	2.51	0.149	5	40	64	35	103	129	NS	NS	26	17	77	21
6/28/2021 16:52	0.396	0.094	0.045	2.23	0.128	5	32	58	30	88	99	NS	NS	26	15	65	13
7/14/2021 13:40	1.81	0.469	0.391	5.59	0.015	17	132	290	148	305	552	15	19,180	66	60	266	135
7/15/2021 17:37	0.733	0.099	0.044	3.08	0.064	4	48	146	70	115	169	NS	NS	32	30	141	23
8/7/2021 6:38	0.737	0.168	0.105	3.75	0.015	5	36	258	94	68	273	NS	NS	39	83	151	18
8/19/2021 15:54	0.744	0.087	NS	4.88	0.338	35	98	65	36	223	65	NS	NS	NS	NS	NS	NS
8/20/2021 22:54	0.872	0.334	NS	4.62	0.062	30	86	57	32	247	129	NS	NS	NS	NS	NS	NS
8/22/2021 22:03	1.15	0.348	NS	4.54	0.015	12	86	73	40	250	202	NS	NS	NS	NS	NS	NS
8/24/2021 9:15	0.223	0.101	0.084	1.04	0.100	1	18	20	9	35	24	3	17,329	12	8	54	7
8/24/2021 12:43	0.352	0.145	0.088	2.29	0.119	2	24	79	28	48	72	NS	NS	26	21	66	9
8/26/2021 19:48	0.333	0.054	0.046	2.06	0.015	3	22	110	40	53	71	NS	NS	34	27	71	5
8/29/2021 3:41	0.194	0.033	0.030	1.47	0.087	1	18	60	23	40	31	NS	NS	17	18	38	4
9/3/2021 8:22	0.168	0.058	0.042	1.08	0.147	1	14	41	16	18	28	NS	NS	12	8	29	4
10/21/2021 2:59	0.915	0.126	0.256	0.250	0.036	16	76	160	79	200	278	NS	NS	34	23	105	68
10/28/2021 4:49	0.410	0.241	0.230	1.34	0.015	6	46	49	19	105	66	NS	NS	12	9	45	NES

Table 26-7 (Continued). The Powderhorn Inlet South 2021 statistics. NS = no sample. NES = not enough sample. TP = Total Phosphorus, TDP = Total Dissolved Phosphorus, SRP = Soluble Reactive Phosphorus, TN = Total Nitrogen, NO_3NO_2 = Nitrate Nitrite, Cl = Chloride, TSS = Total Suspended Solids, VSS = Volatile Suspended Solids, TDS = Total Dissolved Solids, COD = Chemical Oxygen Demand, FOG = Fat Oil and Grease, Cu = Copper, Pb = Lead, Zn = Zinc, DOC = Dissolved Organic Carbon.

Sample End Date/Time	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
MEAN (geometric)	0.526	0.127	0.064	2.39	0.056	8	41	83	40	125	112	8	1,519	25	21	87	15
MEAN (arithmetic)	0.631	0.161	0.099	2.95	0.097	173	50	109	52	397	154	11	10,741	28	27	110	24
MAXIMUM	1.81	0.469	0.391	6.34	0.411	2,199	132	290	169	3,828	552	23	24,196	66	83	350	135
MINIMUM	0.168	0.033	0.020	0.250	0.015	1	14	20	9	18	24	3	5	12	8	29	4
MEDIAN	0.463	0.101	0.046	2.29	0.064	5.5	40	65	35	103	99	10	10,492	26	22	74	13
STANDARD DEVIATION	0.394	0.116	0.108	1.75	0.105	552	33	84	43	945	126	9	10,721	14	20	84	31
NUMBER	23	23	15	23	23	23	23	23	23	23	23	6	6	20	20	20	19
COEFFICIENT of VARIATION	0.624	0.724	1.09	0.594	1.07	3.19	0.659	0.773	0.814	2.38	0.823	0.800	1.00	0.510	0.753	0.768	1.28

Table 26-8. The Powderhorn Inlet Southeast 2021 stormwater chemistry and statistics. NS = no sample. NES = not enough sample. TP = Total Phosphorus, TDP = Total Dissolved Phosphorus, SRP = Soluble Reactive Phosphorus, TN = Total Nitrogen, NO_3NO_2 = Nitrate Nitrite, Cl = Chloride, TSS = Total Suspended Solids, VSS = Volatile Suspended Solids, TDS = Total Dissolved Solids, COD = Chemical Oxygen Demand, FOG = Fat Oil and Grease, Cu = Copper, Pb = Lead, Zn = Zinc, DOC = Dissolved Organic Carbon.

Sample End Date/Time	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
2/24/2021 13:15	1.36	0.328	NS	7.10	0.468	2,099	140	474	123	3,265	473	14	364	52	43	338	32
2/25/2021 12:58	1.03	0.486	NS	8.43	0.401	2,899	150	230	60	5,325	293	17	199	48	22	199	29
4/8/2021 11:30	0.245	0.112	NS	1.62	0.119	12	22	41	17	88	65	5	377	11	12	62	9
5/20/2021 8:43	0.794	0.065	0.035	3.25	0.015	7	42	140	77	108	273	NS	NS	38	29	163	32
5/21/2021 8:55	0.322	0.061	0.050	1.60	0.015	3	26	50	26	85	94	NS	NS	23	10	67	13
5/27/2021 9:10	0.527	0.232	NS	1.86	0.015	1	18	30	25	50	84	11	>24,200	11	5	54	16
5/27/2021 15:36	0.325	0.183	NS	1.95	0.015	3	20	47	30	43	76	NS	NS	37	19	56	12
6/20/2021 19:34	0.726	0.138	0.056	3.60	0.015	3	42	106	50	92	195	NS	NS	34	31	125	24
7/14/2021 15:30	1.56	0.360	0.616	5.89	0.036	34	152	85	32	395	394	3	11,450	41	14	178	152
8/7/2021 10:40	0.379	0.175	0.118	1.54	0.096	5	36	48	21	70	58	NS	NS	20	7	51	6
8/20/2021 20:53	1.40	0.470	NS	7.24	0.015	19	NES	167	91	327	428	NS	NS	NS	NS	NS	NS
8/20/2021 20:42	0.882	0.412	NS	4.29	0.015	11	NES	147	73	245	296	NS	NS	NS	NS	NS	NS
8/24/2021 9:10	0.232	0.099	0.088	1.04	0.163	1	18	19	8	38	31	3	11,199	12	5	32	8
8/24/2021 11:45	0.357	0.157	0.082	1.90	0.037	2	22	84	30	50	82	NS	NS	15	15	64	10
8/26/2021 20:47	0.352	0.051	0.042	2.08	0.015	1	22	146	48	43	93	NS	NS	21	19	59	5
8/27/2021 12:10	0.128	0.064	0.052	0.806	0.015	7	26	13	5	53	10	NS	NS	NES	NES	NES	NES
8/29/2021 2:50	0.253	0.052	0.045	1.85	0.047	3	20	74	26	40	43	NS	NS	19	14	43	6
10/21/2021 3:27	0.560	0.277	0.239	0.25	0.015	14	68	33	30	195	135	NS	NS	NES	NES	NES	NES
10/28/2021 10:12	0.337	0.186	0.182	0.998	0.015	6	32	33	18	83	70	NS	NS	17	7	50	27

Table 26-8. (Continued) The Powderhorn Inlet Southeast 2021 stormwater statistics. NS = no sample. NES = not enough sample. TP = Total Phosphorus, TDP = Total Dissolved Phosphorus, SRP = Soluble Reactive Phosphorus, TN = Total Nitrogen, NO_3NO_2 = Nitrate Nitrite, Cl = Chloride, TSS = Total Suspended Solids, VSS = Volatile Suspended Solids, TDS = Total Dissolved Solids, COD = Chemical Oxygen Demand, FOG = Fat Oil and Grease, Cu = Copper, Pb = Lead, Zn = Zinc, DOC = Dissolved Organic Carbon.

Sample End Date/Time	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
MEAN (geometric)	0.492	0.159	0.088	2.19	0.035	9	37	70	32	131	111	7	1,285	23	14	81	16
MEAN (arithmetic)	0.619	0.206	0.134	3.02	0.081	270	50	104	42	557	168	9	4,718	27	17	103	25
MAXIMUM	1.56	0.486	0.616	8.43	0.468	2,899	152	474	123	5,325	473	17	11,450	52	43	338	152
MINIMUM	0.128	0.051	0.035	0.25	0.015	1	18	13	5	38	10	3	199	11	5	32	5
MEDIAN	0.379	0.175	0.069	1.90	0.015	6	26	74	30	85	93	8	377	21	14	62	13
STANDARD DEVIATION	0.437	0.144	0.164	2.43	0.132	797	48	107	31	1,365	146	6	6,032	14	11	84	36
NUMBER	19	19	12	19	19	19	17	19	19	19	19	6	5	15	15	15	15
COEFFICIENT of VARIATION	0.706	0.700	1.23	0.807	1.64	2.95	0.953	1.04	0.741	2.45	0.868	0.711	1.28	0.520	0.647	0.821	1.43

Table 26-9. The Powderhorn Inlet West 2021 stormwater chemistry and statistics. NS = no sample. TP = Total Phosphorus, TDP = Total Dissolved Phosphorus, SRP = Soluble Reactive Phosphorus, TN = Total Nitrogen, NO_3NO_2 = Nitrate Nitrite, Cl = Chloride, TSS = Total Suspended Solids, VSS = Volatile Suspended Solids, TDS = Total Dissolved Solids, COD = Chemical Oxygen Demand, FOG = Fat Oil and Grease, Cu = Copper, Pb = Lead, Zn = Zinc, DOC = Dissolved Organic Carbon.

Sample End Date/Time	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
2/22/2021 13:45	1.50	0.058	NS	5.00	0.127	11,996	260	539	230	19,877	951	63	86	110	78	678	35
2/23/2021 14:00	0.497	0.091	NS	4.46	0.077	3,199	470	508	414	239	239	85	55	44	27	239	25
4/8/2021 11:00	0.229	0.049	NS	1.71	0.135	15	24	32	14	90	57	3	24,196	12	20	54	10
5/20/2021 0:11	0.673	0.075	0.023	2.85	0.015	8	34	100	51	117	171	NS	NS	32	28	116	23
5/21/2021 8:49	0.233	0.076	0.049	1.23	0.125	6	26	25	16	80	86	NS	NS	19	7	38	10
5/27/2021 8:50	0.577	0.308	NS	2.35	0.015	3	26	41	30	63	80	3	24,196	17	10	66	22
5/28/2021 1:04	0.266	0.140	NS	1.15	0.038	2	18	21	14	47	47	NS	NS	21	8	44	7
6/29/2021 6:38	0.326	0.131	0.009	2.20	0.015	5	32	38	21	83	87	NS	NS	27	12	52	15
7/14/2021 13:45	1.27	0.188	0.138	5.39	0.015	16	120	100	65	290	269	9	155,310	65	78	252	86
8/8/2021 16:55	0.183	0.074	0.041	1.14	0.291	2	24	21	10	55	31	NS	NS	17	9	32	9
8/24/2021 8:50	0.252	0.096	0.091	1.17	0.109	1	18	42	13	35	99	3	15,531	16	10	45	7
8/24/2021 11:57	0.276	0.099	0.071	1.42	0.015	3	22	58	20	40	80	NS	NS	21	18	49	7
8/27/2021 6:26	0.226	0.037	0.035	1.59	0.015	1	22	79	28	43	48	NS	NS	20	20	50	1
8/27/2021 23:51	0.089	0.050	0.041	0.668	0.015	1	20	6	3	35	10	NS	NS	11	2	10	3
8/29/2021 1:37	0.184	0.042	0.035	1.42	0.223	1	20	59	22	48	27	NS	NS	18	20	43	4
9/3/2021 3:59	0.200	0.066	0.064	1.08	0.015	3	18	34	11	35	28	NS	NS	14	11	31	4
9/21/2021 1:01	0.466	0.120	0.020	2.73	0.051	3	36	139	48	60	134	NS	NS	23	39	108	12
10/21/2021 5:14	0.721	0.117	0.127	0.250	0.043	13	68	98	51	168	166	NS	NS	28	24	101	59
10/28/2021 4:29	0.277	0.145	0.143	0.564	0.015	7	36	19	10	81	46	NS	NS	14	6	35	24

Table 26-9 (Continued). The Powderhorn Inlet West 2021 stormwater statistics. NS = no sample. TP = Total Phosphorus, TDP = Total Dissolved Phosphorus, SRP = Soluble Reactive Phosphorus, TN = Total Nitrogen, NO_3NO_2 = Nitrate Nitrite, Cl = Chloride, TSS = Total Suspended Solids, VSS = Volatile Suspended Solids, TDS = Total Dissolved Solids, COD = Chemical Oxygen Demand, FOG = Fat Oil and Grease, Cu = Copper, Pb = Lead, Zn = Zinc, DOC = Dissolved Organic Carbon.

Sample End Date/Time	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
MEAN (geometric)	0.343	0.089	0.049	1.57	0.041	7	37	54	26	96	80	10	4340	23	15	65	11
MEAN (arithmetic)	0.444	0.103	0.063	2.02	0.071	804	68	103	56	1131	140	27	36562	28	22	108	19
MAXIMUM	1.50	0.308	0.143	5.39	0.291	11,996	470	539	414	19877	951	85	155,310	110	78	678	86
MINIMUM	0.089	0.037	0.009	0.250	0.015	1	18	6	3	35	10	3	55	11	2	10	1
MEDIAN	0.276	0.091	0.045	1.42	0.038	3	26	42	21	63	80	6	19,864	20	18	50	10
STANDARD DEVIATION	0.376	0.064	0.045	1.48	0.079	2,807	113	152	100	4,540	209	37	59,182	24	22	153	21
NUMBER	19	19	14	19	19	19	19	19	19	19	19	6	6	19	19	19	19
COEFFICIENT of VARIATION	0.845	0.618	0.707	0.732	1.12	3.49	1.66	1.48	1.78	4.02	1.50	1.34	1.62	0.851	0.970	1.42	1.13

Stormwater Hydrographs

The hydrographs for level and flow measured from May through November at the Powderhorn Inlets N, SE, S, and W are presented in **Figures 26-6** through **Figures 26-9**.

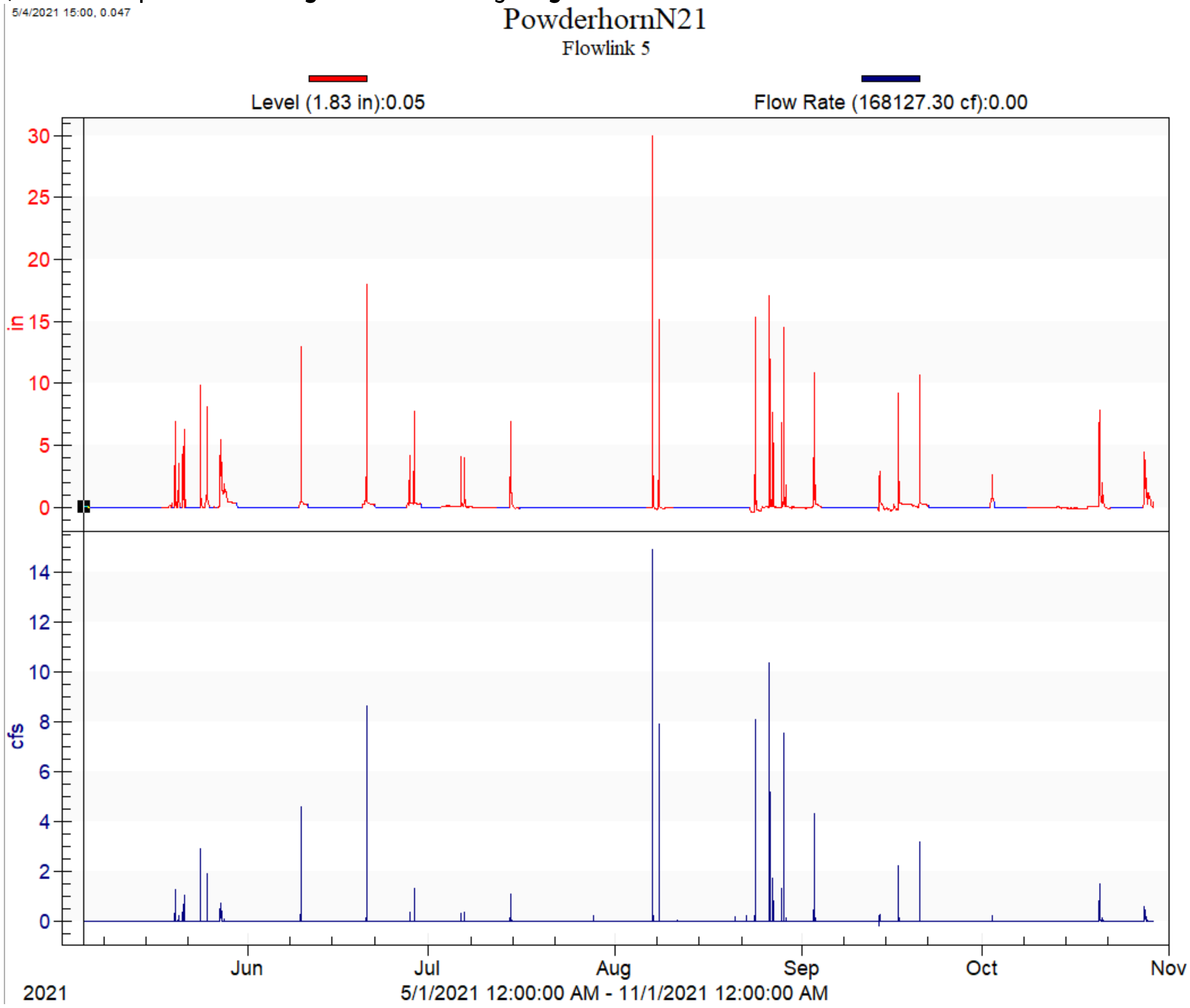


Figure 26-6. Powderhorn Inlet North hydrograph of level and flow from May to October 2021.

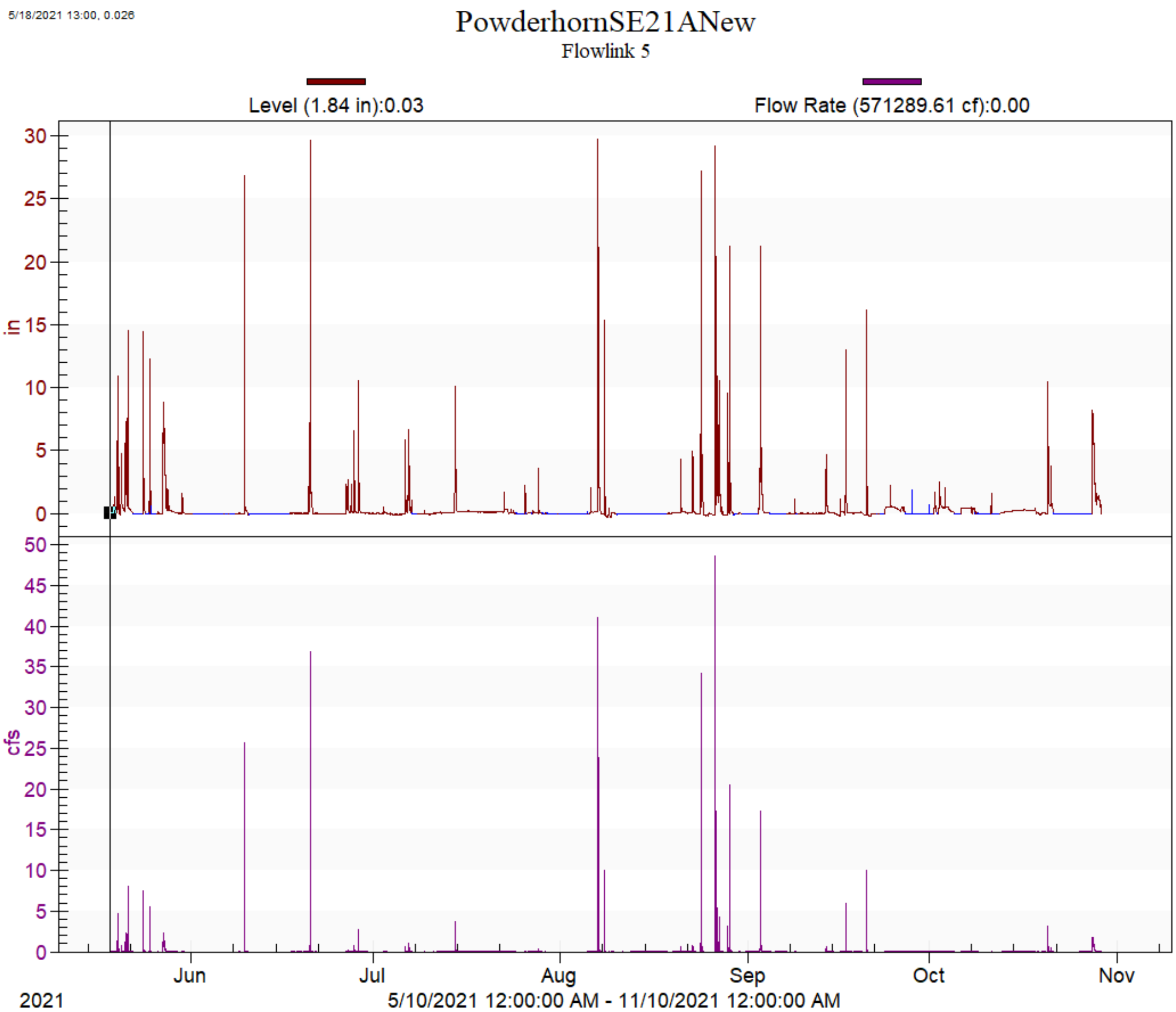


Figure 26-7. Powderhorn Inlet Southeast hydrograph of level and flow from May to October 2021.

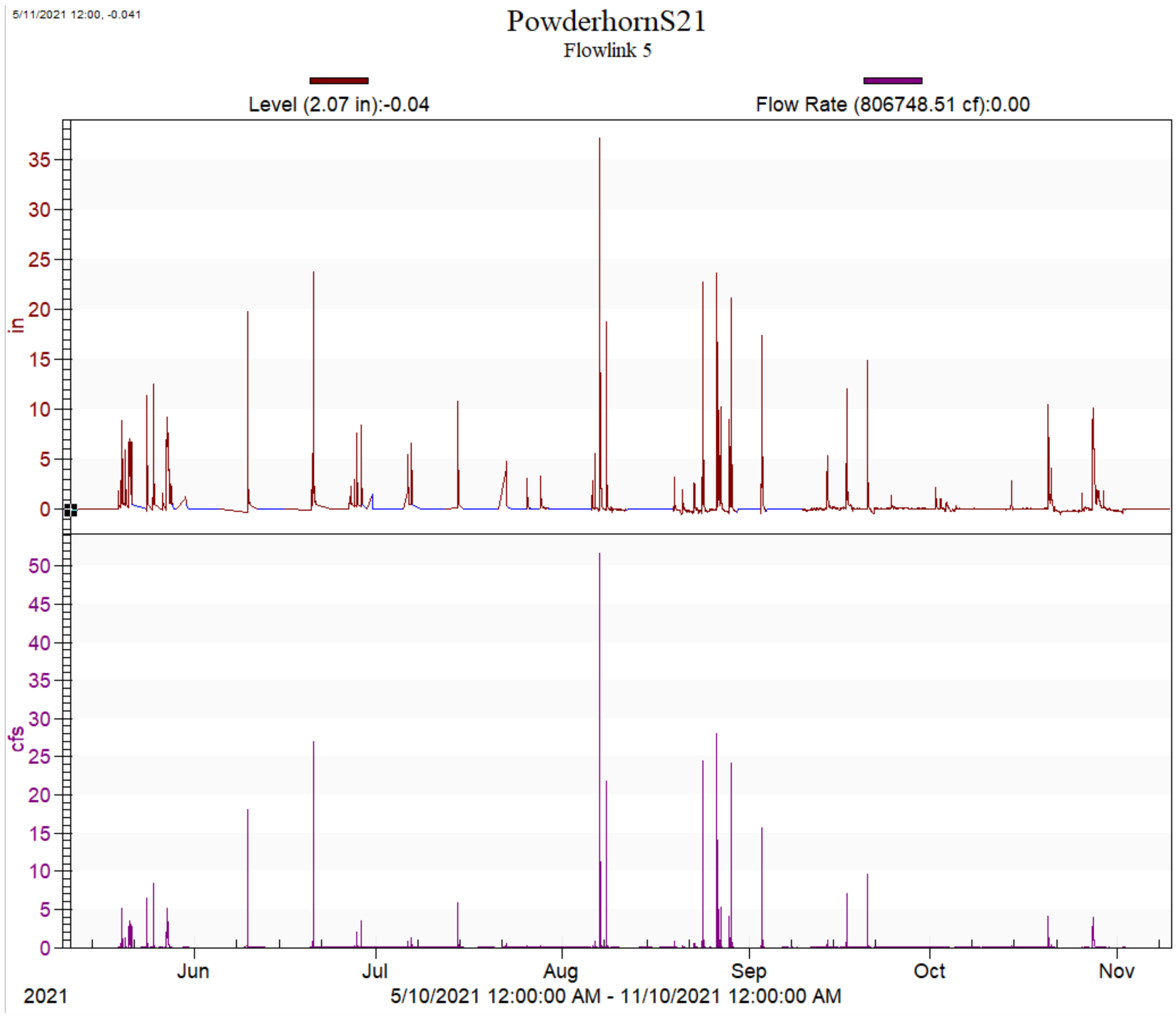


Figure 26-8. Powderhorn Inlet South hydrograph of level and flow from May to October 2021.

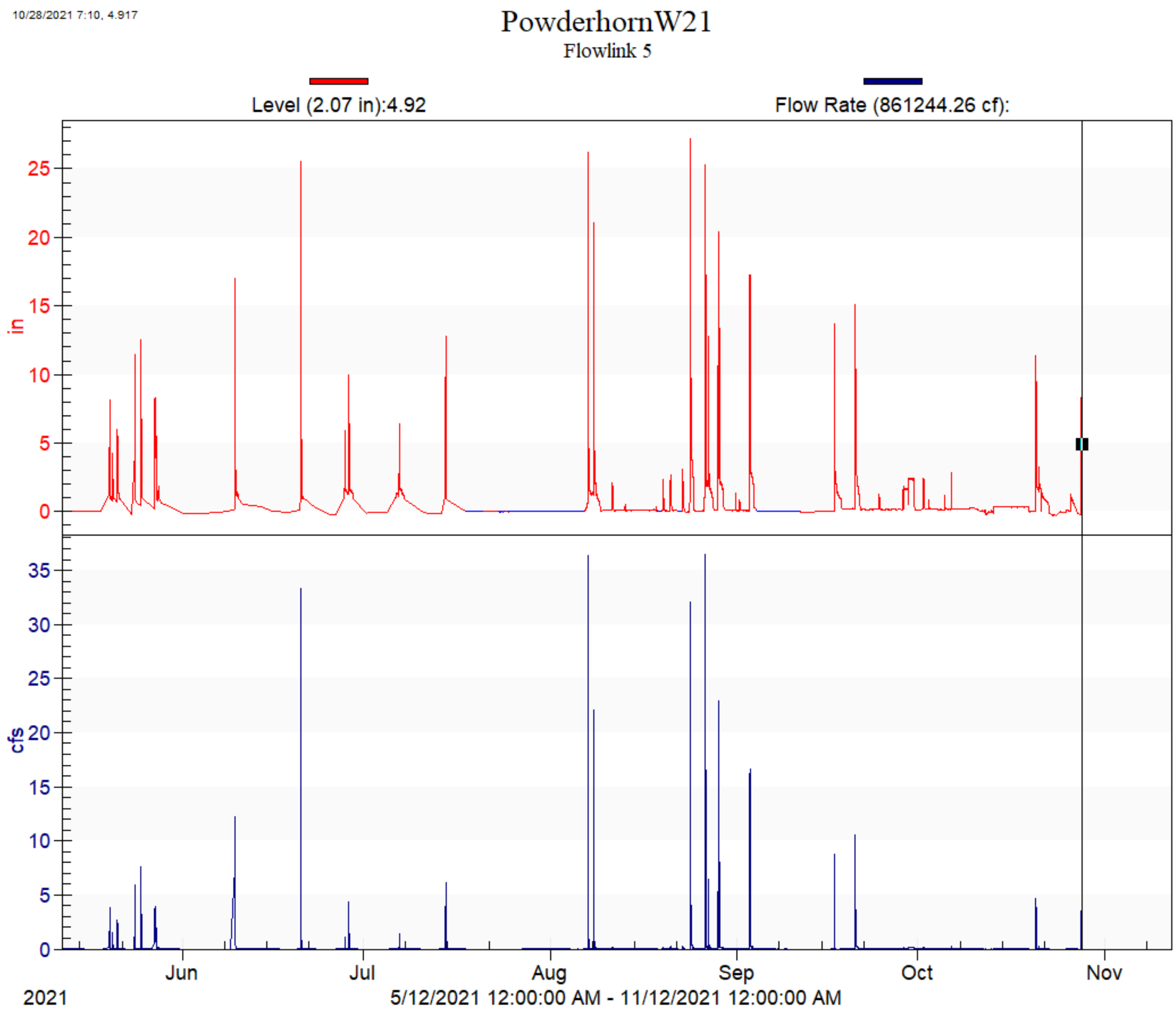


Figure 26-9. Powderhorn Inlet West hydrograph of level and flow from May to October 2021.

Load calculations using the geometric mean for each chemical parameter at each site are shown in **Table 26-10**. The yellow highlights in the table mark the largest calculated load in pounds for that parameter to Powderhorn Lake. The green highlights in the table denote the largest calculated load in pounds per acre for that parameter to Powderhorn Lake.

It should be noted that while these load inputs are measured data, the flow-weighted samples were only collected between May through October, and the snowmelt samples were grab samples. The measurement period between May through October of 2021 had approximately 16.45” of precipitation, while the yearly total was 25.96”. In 2021, Minneapolis received less precipitation than the 29-year annual average precipitation of 31.61” (NWS/NOAA).

Load Table

Table 26-10. The 2021 flow totals and load calculations for Powderhorn Inlets N, S, SE, and W. Chemical geometric means were used to calculate loads. Yellow highlights indicate the largest load for a parameter. Green highlights indicate the largest load per acre for a parameter. NS = no sample.

Site Location	Flow (May -Oct) CF	TP	TDP	SRP	TN	NO_3NO_2	Cl	Hardness	TSS	VSS	TDS	COD	FOG	Cu	Pb	Zn	DOC
Powderhorn Inlet N Load lbs	168,127	3.53	0.660	0.199	18.3	0.79	32	275	785	355	667	988	NS	0.228	0.108	0.638	116
Powderhorn Inlet N Load lbs/acre (12.9 ac)	-	0.274	0.051	0.015	1.42	0.061	2	21	61	28	52	77	NS	0.018	0.008	0.049	9
Powderhorn Inlet S Load lbs	806,749	26.8	6.27	2.99	121	2.88	401	2,046	4,382	2,067	6,170	5,803	385	1.26	1.1	4.53	760
Powderhorn Inlet S Load lbs/acre (81.2 ac)	-	0.33	0.077	0.037	1.49	0.036	5	25	54	25	76	71	5	0.016	0.014	0.056	9
Powderhorn Inlet SE Load lbs	571,290	17.6	5.68	3.14	78.0	1.24	317	1312	2,495	1,132	4,663	3,973	238	0.833	0.487	2.88	564
Powderhorn Inlet SE Load lbs/acre (68.8 ac)	-	0.255	0.083	0.046	1.13	0.018	5	19	36	16	68	58	3	0.012	0.007	0.042	8
Powderhorn Inlet W Load lbs	861,244	18.4	4.80	2.62	84.3	2.19	401	1988	2,920	1,394	5,148	4,315	516	1.22	0.826	3.49	598
Powderhorn Inlet W Load lbs/acre (99.4 ac)	-	0.186	0.048	0.026	0.850	0.022	4	20	29	14	52	43	5	0.012	0.008	0.035	6

Conclusion

Monitoring

The purpose of monitoring the stormwater inlets into Powderhorn Lake was to:

1. Comply with the NPDES Permit provision to monitor stormwater runoff.
    - All monitoring for the NPDES permit as it applied to this project was completed. Continuous flow monitoring from May thought October and at least ten flow-weighted composite storms were collected and analyzed for NPDES chemistry.

2. Measure the pollutant load of the main tributaries to Powderhorn Lake. This information can be used to assist in any future external load reduction plans.
    - Load calculations were done for each Powderhorn Lake watershed monitored.

3. Trouble shoot the CDS unit functionality, since 2020 work discovered that the CDS units were malfunctioning.
    - Multiple troubleshooting visits to the sites were performed by MPW and MPRP. Photo documentation of the unit interior was done. MPW is working on plans to retrofit the CDS units for better performance.

Chemical Load Calculations

The largest overall external load to Powderhorn Lake appears to be coming from Powderhorn Inlet S. This watershed produced the largest overall load for the following chemical parameters:

- TP
- TDP
- TN
- NO_3NO_2
- Cl
- Hardness
- TSS
- VSS
- TDS
- COD
- Cu
- Pb
- Zn
- DO

When breaking down the load calculations into load/acre, the Powderhorn Inlet N load had the highest load per acre for the following chemical parameters:

- NO_3NO_2
- TSS
- VSS
- COD
- Cu

The largest watershed is Powderhorn Inlet W and is 99.4 acres and only had the largest load for FOG. The Powderhorn Inlet SE had the largest load for SRP.

The second largest watershed, Powderhorn Inlet S, should be a high priority in reducing any external load to Powderhorn Lake. It is unclear why this mostly residential watershed would be producing such a large external load.

CDS Unit troubleshooting

The CDS units around Powderhorn Lake are malfunctioning due to significant clogging and sediment deposition in the upstream pipes and within the units themselves. When the units clog, they become anoxic, solids break down into smaller sized or dissolved material which then exits through the CDS screens during the next storm event. A clogged CDS unit provides little to minimal treatment since the bypass occurs frequently when water cannot exit through the screen.

The City of Minneapolis has observed that the external side of the CDS screens can become clogged, but there are no access ports to clean the outside of the screens. The units should have manholes added to allow for cleaning of the outside of the clogged screens. City of Minneapolis staff are exploring options that will allow access and cleaning of the CDS outside screens. A retrofit of Powderhorn Inlet W is currently being considered by the City of Minneapolis.

In 2021 individual CDS unit inlet/outlet efficacy was not evaluated. In the short-term, to reduce the external load to Powderhorn Lake the CDS units should be retrofit to allow for thorough cleaning and maintained more frequently. Future monitoring of individual CDS unit inlet/outlet and any bypass may be needed to determine if the units are working effectively and to determine a maintenance schedule. Due to higher amounts of overall loading coming from the S, W, and SE drainage areas these could be designated priority watersheds for enhanced street sweeping and public educational activities or other best management practice installation.

Hoyer and Windom Green Stormwater Infrastructure (GSI) Monitoring

Background

The purpose of the Hoyer and Windom Green Stormwater Infrastructure (GSI) monitoring is to better understand the Hoyer and Windom basins' ability to minimize the impacts of stormwater runoff. Due to an ordinance change, the City of Minneapolis is building numerous small-footprint infiltration/filtration basins throughout the City. Many of these GSI Best Management Practices (BMPs) treat less than 1 acre of impervious surface. The City of Minneapolis chose two GSI sites to be monitored in 2021, Hoyer and Windom.

The Hoyer GSI site is in Northeast Minneapolis at the southeast corner of 36 ½ Avenue NE and Fillmore Street NE and is shown in **Figure 27-1**. It drains approximately 0.072 acres of a residential watershed (0.0407 acres impervious). The GSI has an uncapped underdrain which flows to the storm sewer system. The Hoyer GSI site was built for flood control.

Figure 27-1. The Hoyer GSI basin in Fall of 2021 in Northeast Minneapolis.

The Windom GSI site, shown in **Figure 27-2,** is in Southwest Minneapolis on West 62nd Street and Dupont Avenue South. It drains approximately 3.67 acres of a residential watershed (0.506 acres impervious). The Windom site has a capped underdrain and is built for stormwater infiltration.

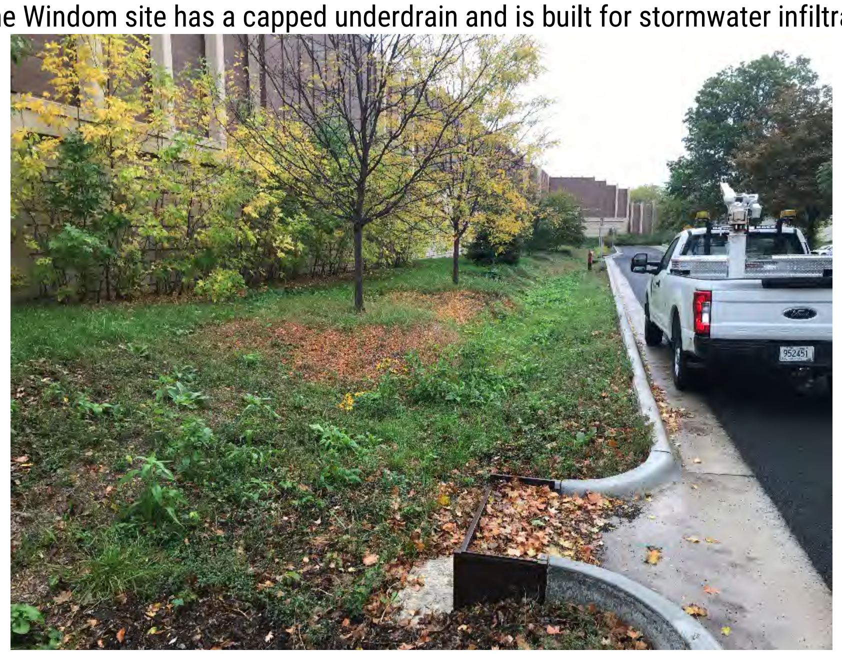


Figure 27-2. The Windom GSI basin in Fall of 2021 in southwest Minneapolis.

The Hoyer Windom GSI monitoring project is a partnership between the City of Minneapolis, Saint Anthony Falls Hydrology Laboratory (SAFL) at the University of Minnesota, and the Minneapolis Park and Recreation Board (MPRB). The funding, survey, and GIS data used in the project were supplied by the City of Minneapolis. Monitoring of rainfall, flow, infiltration tests, and flood functionality tests were the responsibility of both the City and SAFL. Confined space entry, soil sampling/testing, and monthly observational field inspection data were the responsibility of the MPRB.

Methods

Equipment Setup

Nova Lynx tipping bucket rain gauges were installed at each site with HOBO Pendant dataloggers, shown in **Figure 27-3**. HOBO MX2001-01-SS water level loggers were installed at the surface grade of both sites to determine ponding drawdown time as seen in **Figure 27-4**. One HOBO MX2001-04-SS water level logger was installed in the underdrain behind a spring ring V-notch weir at Hoyer, shown in **Figure 27-5**. A HOBO water level logger was not installed in the Windom underdrain in 2021, but it may be installed in 2022. Hoyer and Windom had HOBO surface level and rain gauge equipment installed on 9/30/21.

Figure 27-3. A rain gauge being installed at the Hoyer GSI site.

Figure 27-4. The surface HOBO water level logger being installed at the Windom GSI site. A surface HOBO water level logger was installed at Windom and Hoyer.

Figure 27-5. The underdrain outlet HOBO water level logger with V-notch weir spring ring installed at the Hoyer GSI site 9/30/21.

Infiltration Testing

The sites were flooded using a hydrant, water meter, and fire hose to discharge water of a known quantity into the GSI curb-cut inlet. The purpose of the infiltration test was to flood the GSI basin and measure: 1) the time it took for saturation and ponding to occur, and 2) the time it took for any ponding to draw down to the surface. The intention was to first simulate a 1.1" design storm, to see if there was ponding or infiltration in the GSI. Then, additional water was added to test the limits of the BMP by inundating it beyond its design capacity and observe the effects. A flood/hydrant test was conducted at Hoyer on 11/3/21, shown in **Figure 27-6**. A flood/hydrant test was conducted at Windom on 11/9/21, shown in **Figure 27-7**.

Figure 27-6. A flood/hydrant test on 11/3/21 at the Hoyer GSI site.

Figure 27-7. A flood/hydrant test on 11/9/21 at the Windom GSI site.

Due to poor infiltration capacity in the natural soils the Hoyer GSI site underdrain was left uncapped to allow water to exit the practice. During the Hoyer flood test, it was noticed that the underdrain discharge water was brown and darker compared to the clear inlet water. It was assumed the coloration was due to the compost added to the Hoyer GSI. Because of this observation, grab samples were collected from both the inlet and the underdrain outlet, shown in **Figure 27-8.** NPDES water chemistry parameters were analyzed for both the inlet and outlet samples to determine whether the practice was adding nutrients or pollutants to runoff.

Figure 27-8. Samples of the clear inlet water, left, and colored underdrain outlet water, right, during the Hoyer GSI flood/hydrant test on 11/3/21. Photograph courtesy of Shahram Missaghi.

Soil Sampling

Soil samples were collected monthly from July through August at the Hoyer site and June through August at the Windom site. The soil samples were collected from three predetermined sub-sample locations at the bottom of the basin and composited, shown in **Figure 27-9**. The sampling protocol was: 1) surface debris was cleared, 2) a 4" diameter hole was dug 6" of depth, and 3) soil samples were collected with a trowel. Three sub-samples were combined into one Ziplock bag constituting one composite sample. The Ziplock bags were labeled with the site name and the date collected. Soil samples were then frozen until the end of the season then analyzed by the University of Minnesota Soil Lab.

The GSI soil chemistry tests performed at the University of Minnesota Soils Laboratory were:

- phosphorus, Bray P-1
- loss on Ignition %
- total nitrogen %
- chloride
- total solids moisture %
- total solids %
- elemental metals shown in **Table 27-4**

Figure 27-9. A soil sub-sample being collected at the Windom GSI site.

Field Observations

Monthly field observations and measurements were taken at each GSI site as shown in **Table 27-1**.

Table 27-1. Field observational data collected monthly at each GSI site. - = No Data.

Parameter	Metric				
Weather Conditions	Wind Direction	Wind Speed	Air Temperature	% Cloud Cover	_
Plant Health	% Alive	% Stressed	% Dead	_	_
Inlet Conditions	Photograph	% Pretreatment Basin Filled	Sediment Material Inches	Sediment Material Makeup	Evidence of Erosion After Pretreatment
General GSI Conditions	Signs of Inlet Bypass	Signs of Ponding	Soil Sample Collected	_	_

Results

Hoyer Water Chemistry

The water chemistry results from the Hoyer flood/hydrant test on 11/13/21 are shown in **Table 27-2a** and **27-2b**. The inlet samples were taken directly from the discharge end of the hydrant fire hose leading to the Hoyer inlet. The outlet samples were taken from the street manhole where the underdrain outlets to the storm sewer system. Outlet sample concentrations were higher than the inlet sample concentrations for: TP, TDP, SRP, TN, NO_2NO_3, TDS, COD, Cu, and DOC. As water passed through the Hoyer GSI filter, some of the dissolved constituent concentrations increased significantly. For example, SRP increased by 1,274 percent and COD increased by 3,733 percent as water flowed through the GIS media. Chemical constituents that decreased or did not change during the flood test were: Cl, Hardness, TSS, VSS, and Pb.

Table 27-2a. Water chemistry data from the Hoyer flood/hydrant test on 11/3/21.

Location	TP mg/L	TDP mg/L	SRP mg/L	TN mg/L	NO_2NO_3 mg/L	Cl mg/L	Hardness mg/L
Hoyer Inlet	0.453	0.267	0.166	2.01	0.968	33	86
Hoyer Outlet	2.70	2.29	2.29	7.70	4.67	28	96
Percent Increase/Decrease	496%	757%	1,274%	283%	383%	-15%	12%

Table 27-2b. Water chemistry data from the Hoyer flood/hydrant test on 11/3/21. NA = calculation not available.

Location	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	Cu µg/L	Pb µg/L	Zn µg/L	DOC mg/L
Hoyer Inlet	28	11	188	10	2.2	1.4	<20.0	1.2
Hoyer Outlet	31	16	483	139	13	1.8	<20.0	46
Percent Increase/Decrease	10%	39%	157%	1,264%	491%	29%	NA	3,733%

GSI Soil Sample Chemistry

The Hoyer and Windom GSI sites are new installations, so soil elemental chemistry data were collected to create a baseline dataset for each site. In the future, as more stormwater infiltrates, it would be expected that soil chemistry may change. **Table 27-3** shows the GSI baseline soil sample results for phosphorus, nitrogen, chloride, solids, and organic matter. **Table 27-4** shows a list of the elemental chemistry components analyzed at the University of Minnesota Soils lab. **Table 27-5a and b** shows the elemental chemistry of the GSI soil samples.

The soil tests for each GSI sites showed the Hoyer and Windom GSI site soils were similar, but had differences in nitrogen, organic matter, total solids moisture, total solids moisture %, and total solids content. The Hoyer GSI site had more organic matter, % total nitrogen, and soil moisture than the Windom site. The Hoyer GSI site had more organic matter, % total nitrogen, and soil moisture than Windom. The Hoyer GSI site had more Ca, Mg, Na, S, Si, and Sr than Windom. The Windom GSI site had more Co, Cr, Ni, and Ti than Hoyer. The Windom GSI site also had more total solids than Hoyer.

Table 27-3. The 2021 soil test data from each of the GSI sites. LOI = Loss on ignition. OM = organic matter.

Date	Site	Bray P mg/kg soil	LOI OM %	Total N, % N	Chloride mg/kg soil	Total Solids Moisture %	Total Solids %
6/28/2021	Windom	44	1.4	0.081	8.50	8.75	91.3
7/21/2021	Windom	55	1.4	0.098	11.5	5.21	94.8
8/19/2021	Windom	46	1.4	0.082	9.32	6.49	93.5
7/23/2021	Hoyer	43	1.9	0.118	9.63	15.0	85.1
8/20/2021	Hoyer	55	2.2	0.117	13.5	18.9	81.1

Table 27-4. List of the GSI soil chemistry element symbols and element names analyzed at the University of Minnesota Soils Laboratory.

SYMBOL	ELEMENT
Al	Aluminum
As	Arsenic
B	Boron
Ba	Barium
Be	Beryllium
Ca	Calcium
Cd	Cadmium
Co	Cobalt
Cr	Chromium
Cu	Copper
Fe	Iron
K	Potassium
Li	Lithium
Mg	Magnesium
Mn	Manganese
Mo	Molybdenum
Na	Sodium
Ni	Nickel
P	Phosphorus
Pb	Lead
Rb	Rubidium
S	Sulfur
Si	Silicon
Sr	Strontium
Ti	Titanium
V	Vanadium
Zn	Zinc

Table 27-5a. The 2021 GSI soil elemental chemistry data. The Limit of Detection, batchwise instrument detection limit, is expressed in units of mg/L solution, independent of dilution factors used to calculate sample concentrations.

Date	Site	Al mg/kg	As mg/kg	B mg/kg	Ba mg/kg	Be mg/kg	Ca mg/kg	Cd mg/kg	Co mg/kg	Cr mg/kg	Cu mg/kg	Fe mg/kg	K mg/kg	Li mg/kg
6/28/2021	Windom	2780	<0.013	<0.001	34.2	<0.001	9583	<0.001	4.15	8.56	9.73	9984	419	3.98
7/21/2021	Windom	2248	<0.013	<0.001	18.4	<0.001	9691	<0.001	3.29	7.79	7.20	6627	288	3.24
8/19/2021	Windom	2424	<0.013	<0.001	24.1	<0.001	10951	<0.001	3.07	7.60	6.82	7224	350	3.64
7/23/2021	Hoyer	1785	<0.013	<0.001	21.3	<0.001	28819	<0.001	1.85	5.25	4.81	5781	327	2.88
8/20/2021	Hoyer	2263	<0.013	<0.001	24.1	<0.001	29225	<0.001	2.84	6.44	6.25	7865	362	3.23
Limit of Detection (mg/L)*		**<0.018**	**<0.013**	**<0.001**	**<0.001**	**<0.001**	**<0.064**	**<0.001**	**<0.001**	**<0.001**	**<0.006**	**<0.007**	**<0.027**	**<0.003**
Method Detection limit (MDL) (mg/L)		**0.074**	**0.010**	**0.029**	**0.001**	**0.000**	**0.200**	**0.001**	**0.001**	**0.001**	**0.005**	**0.031**	**0.4**	**0.001**

Table 27-5b. The 2021 GSI soil elemental chemistry data. The Limit of Detection, batchwise instrument detection limit, is expressed in units of mg/L solution, independent of dilution factors used to calculate sample concentrations.

Date	Site	Mg mg/kg	Mn mg/kg	Mo mg/kg	Na mg/kg	Ni mg/kg	P mg/kg	Pb mg/kg	Rb mg/kg	S mg/kg	Si mg/kg	Sr mg/kg	Ti mg/kg	V mg/kg	Zn mg/kg
6/28/2021	Windom	4072	390	<0.001	66.4	10.6	362	8.30	4.16	282	583	9.48	130	12.7	18.1
7/21/2021	Windom	4250	149	<0.001	62.9	7.09	303	3.36	<0.003	264	566	8.84	146	11.3	14.6
8/19/2021	Windom	3731	218	<0.001	55.9	7.69	350	4.14	<0.003	285	608	9.32	109	10.5	14.0
7/23/2021	Hoyer	7423	181	<0.001	85.0	4.71	474	3.10	2.36	596	754	21.6	87.9	8.57	11.9
8/20/2021	Hoyer	8714	216	<0.001	80.8	5.99	320	4.85	<0.003	604	731	15.9	121	10.0	15.0
Limit of Detection (mg/L)		**<0.020**	**<0.010**	**<0.001**	**<0.011**	**<0.004**	**<0.024**	**<0.004**	**<0.003**	**<0.006**	**<0.002**	**<0.001**	**<0.004**	**<0.006**	**<0.020**
Method Detection limit (MDL) (mg/L)		**0.067**	**0.006**	**0.001**	**0.034**	**0.008**	**0.023**	**0.005**	**0.076**	**0.018**	**0.147**	**0.001**	**0.005**	**0.007**	**0.026**

Maintenance Activity

Site maintenance was done by a contractor at each GSI site in 2021. **Figure 27-10** shows a water truck at Hoyer. **Figure 27-11** shows subcontractors at Hoyer cleaning the site and leaf blowing the inlets. These activities were done many times in 2021 to help ensure vegetation establishment and make the site aesthetically pleasing. The tradeoff was that the level of maintenance needed for site establishment complicated site observations as conditions were changed by the maintenance practices being performed. Since the sites were watered and inlets were cleaned regularly, the site's natural functionality could not be ascertained by the observations collected in 2021.

Figure 27-10. A photograph of the Hoyer GSI site being watered by a subcontractor.

Figure 27-11. A photograph of the Hoyer GSI site being cleaned, and inlet being leaf blown by a subcontractor.

Conclusions

The Hoyer GSI was built for flood control and has an open underdrain. Some nutrients were significantly increased in the Hoyer outlet samples collected during the flood test. The Hoyer GSI appears to be adding nutrients to water as it passes through the practice, and negatively impacting quality of water flowing downstream. Auto-monitoring the water from the inlet and open underdrain at the Hoyer GSI will be important to better determine the effects of GSI sites on stormwater quality. Data collected could help determine when to design a GSI with an open underdrain and if low-nutrient materials should be used to reduce impacts to water quality downstream.

Baseline soils data was collected in 2021, and comparisons will be made with these data once additional years of data have been collected.

The function of the sites could not be ascertained from the site observational data due to frequency of site maintenance and disturbance. This information will be archived to compare with future site observations.

Much of the 2021 season involved problem solving equipment installation issues and learning the individual site characteristics. Now that site characteristics are better understood, equipment can be installed earlier in the year and 2022 monitoring should create a fuller understanding of the Hoyer and Windom GSIs functionality. Detailed analysis of flood test data, infiltration tests, and monitoring data will be provided by SAFL in a future report.

Frog & Toad Calling Surveys:
Minneapolis Stormwater Ponds, 2021


American toad (*Anaxyrus americanus*). Photograph by J. Winkelman

April 2022

Prepared for MaryLynn Pulscher, Minneapolis Park & Recreation Board

By Jenny Winkelman

Funding for this survey was provided by the City of Minneapolis Department of Public Works.

Background and Objectives

The presence and abundance of frogs and toads is a useful indicator of water and habitat quality, as well as short and long-term environmental changes. Long-term surveys by natural resource agencies have resulted in standardized methods of collecting data. The Minnesota Department of Natural Resources (DNR) implements statewide monitoring using the Minnesota Frog & Toad Calling Survey (MFTCS), which contributes to the nation-wide North American Amphibian Monitoring Program (NAAMP).

The question has been raised whether or not stormwater ponds, constructed to intercept and treat runoff, can also function as a refuge for amphibians. Furthermore, the public has complained about the absence of formerly abundant frogs and toads calling from Hiawatha Golf Course and the surrounding area. To evaluate these concerns, preliminary frog and toad listening surveys were conducted at Lake Hiawatha golf course in 2016 and 2017, and formalized in 2018 to the present. Additional stormwater ponds were added to the surveys in 2018 and again in 2019 to reflect different types and locations of stormwater ponds with standing water throughout Minneapolis.

The purpose of these surveys is to:

1. Determine if any frog and toad species (anurans) are found in or near stormwater ponds.
2. Use the Minnesota Frog and Toad Calling Survey protocols adapted for Theodore Wirth Park to Identify species and abundance in stormwater ponds.
3. Generate ideas about why or why not species may use stormwater ponds.
4. Involve volunteers and concerned citizens in monitoring Hiawatha Golf Course ponds in a systematic way.

Funding for this project was provided by the City of Minneapolis Department of Public Works.

Methods

Survey methods for this study were adapted from the MFTCS survey protocols (see Appendix 1 for a comparison). Modifying the MFTCS protocol for this study enabled the documentation of species presence and was done in a way that can still be compared with statewide survey data. Surveys began in Theodore Wirth Park in 2015, piloted a survey at the ponds in Hiawatha Golf course in 2016, and expanded to other stormwater ponds in 2018.

At least three sampling runs (hereafter "runs") are conducted each year based on calendar date and temperature (per MFTCS guidelines). Minneapolis Park and Recreation Board (MPRB) staff identified sites and added or dropped sites as more was learned. Stormwater pond sites and sampling effort by year are shown in Table 1.

At each site, species presence and abundance, based on strength of calling (calling index of 1-3), was recorded. In some cases, a "1" may also indicate a species was seen but not heard, to capture the

Table 1. Sampling effort at each stormwater pond location, 2016–21.

Location	Total no. surveys	Number of times sampled					
		2016	2017	2018	2019	2020	2021
South Minneapolis							
37th and Chicago	5	–	–	2	3	–	–
East Twin Pond (43rd St S and Park Ave)	7	–	–	2	3	–	2
West Twin Pond (43rd St S and Park Ave)	7	–	–	2	3	–	2
60th S and 1st (north of 62, west of 35W)	7	–	–	–	3	1	3
Bde Maka Ska (southwest ponds)	6	–	–	–	2	1	3
Hiawatha Golf Course, corresponds to pond 1	10	1	–	1	4	1	3
Hiawatha Golf Course, corresponds to pond 5	11	1	–	2	4	1	3
Hiawatha Golf Course pond 2	8	–	–	–	4	1	3
Hiawatha Golf Course pond 3	9	–	–	1	4	1	3
Hiawatha Golf Course pond 4	8	–	–	–	4	1	3
Nokomis SE pond	5	–	–	–	2	–	3
Nokomis SW pond	6	–	–	–	2	1	3
Roberts Bird Sanctuary	2	–	–	–	–	1	1
North Minneapolis							
52nd N and Upton (two ponds)	9	–	–	2	3	1	3
Camden pond (42nd N and Morgan)	7	–	–	–	3	1	3
Columbia Golf Course	6	–	–	–	2	1	3
Heritage Park N (north of 55, outlet to Mississippi River)	7	–	–	–	3	1	3
Heritage Park S (south of 55)	7	–	–	–	3	1	3

information that it was present. Variability among observers was reduced by having the same lead observer and passing the USGS frog calling identification each year.

In past years, an early run was added to determine whether or not early breeders (namely wood frogs) were present. In 2019, more stormwater locations were added across the city. In 2020, the pond at 37th St E and Chicago Ave S was dropped from the study because only one toad was heard once in two years and there are a lot of lights, noise and even an active fountain, and there were safety concerns. Robert's Bird Sanctuary was added in 2020. Due to pandemic restrictions (curfews, road closures, etc) and civil unrest, stormwater sites were only sampled once, instead of three times; and the ponds at 43rd and Park and southeast of Lake Nokomis were not sampled at all.

Findings

- Seven species of anurans (frogs and toads)—of 14 total known in MN—were reported across all sites. Not more than three species were found at any single location (Table 2).

- The highlight of 2021 surveys was hearing a single spring peeper (*Pseudacris crucifera*) at the Columbia Golf Course ponds. This is highly significant as spring peepers have not been heard elsewhere in Minneapolis since these surveys began in 2015 (suspected but not confirmed in Wirth Park). Furthermore, no records turned up for spring peepers in Minneapolis on either

- Cope's gray treefrogs (*Hyla chrysoscelis)* continue to be found only at Columbia Golf Course near the pond with the widest riparian zone and vegetated with shrubs and small trees (probably because mowing is not possible on the steep bank).

  Cope's gray treefrogs inhabit the edges of woodlands and fields; whereas, gray treefrogs live in predominantly wooded areas. Cope's gray treefrogs are also found, abundantly, in Theodore Wirth Park at a golf course pond, with a diverse and vegetated shoreline near Regency Hospital. This species would likely be found at Hiawatha Golf Course also if the riparian areas were improved. The current practice is to mow them as close as possible to the shoreline. Similarly, increasing connectivity and width of riparian areas is likely key to increasing the abundance of Cope's gray treefrogs at Columbia Golf Course.

- Green frogs (*Lithobates clamitans*), an aquatic frog, continue to be abundant—with a chorus of 3—in the stormwater pond at Upton Ave N and 52nd Ave N. Green frogs have not been heard elsewhere including in seven years of similar surveys at Theodore Wirth Park (2015-21).

  Nearby Shingle Creek and Lion's Park Pond may be the source of green frogs, which were heard breeding for the first time in 2019. These ponds were created relatively recently; by 2019, the riparian habitat was finally becoming established, creating vegetated cover and corridors for dispersing froglets. Green frogs (and Northern leopard frogs) overwinter in water that does not freeze solid, and require an ongoing supply of oxygen, making them dependent on high quality water resources. As a result, they are also more vulnerable to urbanization than the more terrestrial anurans, which by overwintering on land avoid the toxic first flush of stormwater in spring.

- American toads (*Anaxyrus americanus*) are still the most widespread and abundant species in stormwater ponds; and heard at least once in all but one stormwater pond, West Twin Pond (Robert's Bird Sanctuary has not been sampled yet at the time that toads are active; Table 2). Toads are also the only species heard in full chorus (index of 3) at any of the stormwater ponds.

  Toads are largely terrestrial (except for egg laying); overwinter in soil below the frostline; and breed in mid-season. Consequently, they are less susceptible to poor water quality during "first flush" stormwater runoff and thus, are likely more resilient to urbanization as long as other habitat needs are met.

- As of 2021, the best stormwater ponds for amphibians are Upton Ave N and 52nd Ave N, Columbia Golf Course, southwest Bde Maka Ska, as indicated by having three species, and each with one species not found in other stormwater ponds.

Table 2. Toad and frog species heard only in 2021, compared to records from all ponds, all years, 2016–21.

		Species						
	Total No. species	American Toad *Anaxyrus americanus*[1]	Gray Treefrog *Hyla versicolor*	Cope's Gray Treefrog *Hyla chrysoscelis*	Green Frog *Lithobates clamitans*[2]	Northern Leopard Frog *Lithobates pipiens*[2]	Boreal Chorus Frog *Pseudacris maculata*	Spring Peeper *Pseudacris crucifers*
Species heard in 2021	**4**	**X**		**X**	**X**			**X**
Species heard all years 2016–21	**7**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
South Minneapolis								
37th & Chicago	**1**	X						
East Twin Pond (43rd St S and Park Ave)	**2**	X	X					
West Twin Pond (43rd St S and Park Ave)	**0**							
60th S and 1st —north of 62, west of 35W	**1**	X						
Bde Maka Ska SW ponds	**3**	X	X				X	
Roberts Bird Sanctuary	**0**							
Hiawatha Golf Course, corresponds to ponds 1-4	**1**	X						
Hiawatha Golf Course, corresponds to pond 5	**2**	X	X					
Nokomis SE pond	**1**	X						
Nokomis SW pond	**1**	X						

North Minneapolis								
52nd N and Upton, two ponds	**3**	X	X		X			
Camden pond—42nd N & Morgan	**1**	X						
Columbia Golf Course	**3**	X		X				X[3]
Heritage Park N— north of 55, outlet to Mississippi River	**2**	X				X		
Heritage Park S— south of 55	**1**	X						

* Includes all species seen or heard at each site, including outside of the 5-minute sampling.
[1]The genus *Anaxyrus* was formerly called *Bufo*.
[2] The genus *Lithobates* was formerly called *Rana.*
[3] Recorded for the first and only time in 2021. This is the only location where spring peepers have been recorded in Minneapolis during surveys conducted since 2015.

Considerations for Management

The intent of stormwater ponds is to treat runoff prior to discharge, so water quality is intended to be "bad" going in and "better" coming out; stormwater ponds also manage water volume. Amphibians have highly permeable skin and are extremely sensitive to water quality. Consequently, habitat management guidelines (HMG) consider the underlying function of stormwater ponds as incompatible with amphibian conservation and discourage their use as a habitat creation strategy[1]. And yet, amphibians are tolerating and using some stormwater ponds as habitat. Much remains to be known about the long-term use of stormwater ponds by amphibians, and while conditions are not optimal, wherever possible, opportunities should be sought to manage the ponds in ways that benefit amphibians.

- Water quality. Nonpoint source pollution (NPS)such as salt, heavy metals, oils, and other chemicals that wash off roads and the surrounding landscape can be deadly to all life stages of amphibians and likely limit their use of stormwater ponds for breeding. Also salt and other pollutants accumulate in ponds intensifying their effects.

  Preventing NPS at its source; intercepting runoff with wide shoreline buffer strips/riparian areas vegetated with deeply rooted native species; maintaining land and water connections to other habitats; and maintaining water levels in ponds are ways to mitigate water quality impacts on amphibians found in stormwater ponds.

- Irrigation. At golf course ponds, sprinkler irrigation at night creates a humid microhabitat at golf course pond locations, creating unique habitat conditions, with potential for benefitting amphibians. The moist environment facilitates amphibian movement between ponds.

  Golf courses pose unique opportunities, with dedicated staff and surrounding green space, as well as challenges, with high visibility and aesthetic standards. Quality of runoff and ability to connect habitat is different than for a pond surrounded by residential or commercial development.

[1] Kingsbury, B.A. and J. Gibson (editors). 2011. Habitat Management Guidelines for Amphibians and Reptiles of the Midwestern United States. Partners in Amphibian and Reptile Conservation Technical Publication HMG-1, 2nd Edition. 161 pp.

- Riparian areas. Preserve and expand shoreline areas. Create vegetated connections between nearby ponds. Riparian areas are being reduced incrementally by mowing, evident in the plants cut. This disturbance reduces important habitat and corresponds with invasive species growing at the newly mowed edges. The Columbia Golf Course uses red stakes pounded into the ground surrounding the ponds to delineate mowing edges; however, as it is minimal, stake placement appears to mostly prevent mowers from collapsing the shoreline than for defining an adequate riparian buffer for habitat.

- Flooded areas. Avoid mowing areas that flood seasonally and encourage their predisposition to function as vernal ponds. Low-lying areas on golf courses, near the Lake Nokomis and Bde Maka Ska stormwater ponds and along parkways are flooded during spring rains and expand amphibian breeding habitat. These wet meadow areas/ vernal ponds (usually managed as turf) are generally warmer (at least three degrees) than the nearby stormwater ponds and when sampled side by side were preferred by calling/breeding toads.

  - Pond design and maintenance. Figure out what works best in pond design and try to replicate it in new ponds and retrofit existing ponds. Aquatic frogs were found in only two stormwater ponds—Upton and 52nd and Heritage Park (north). Something, yet unknown, about these ponds enables them to support breeding aquatic frogs, green and leopard frogs. Aquatic frogs overwinter in areas that don't freeze solid and have oxygenated water. Since these two ponds are somewhat distant from suitable overwintering habitat, there must be some places in the ponds themselves that are deep enough and possibly have some flow creating suitable overwintering conditions.

  - Maintenance activities. The timing and how maintenance is conducted matters in and around a stormwater pond designated to support amphibians. For example, ponds without aquatic frogs, can be dewatered and cleaned out after juveniles disperse from the breeding ponds. Ponds with aquatic frogs should not be dewatered in the hottest days of summer, nor dredged in winter.

Recommendations Moving Forward

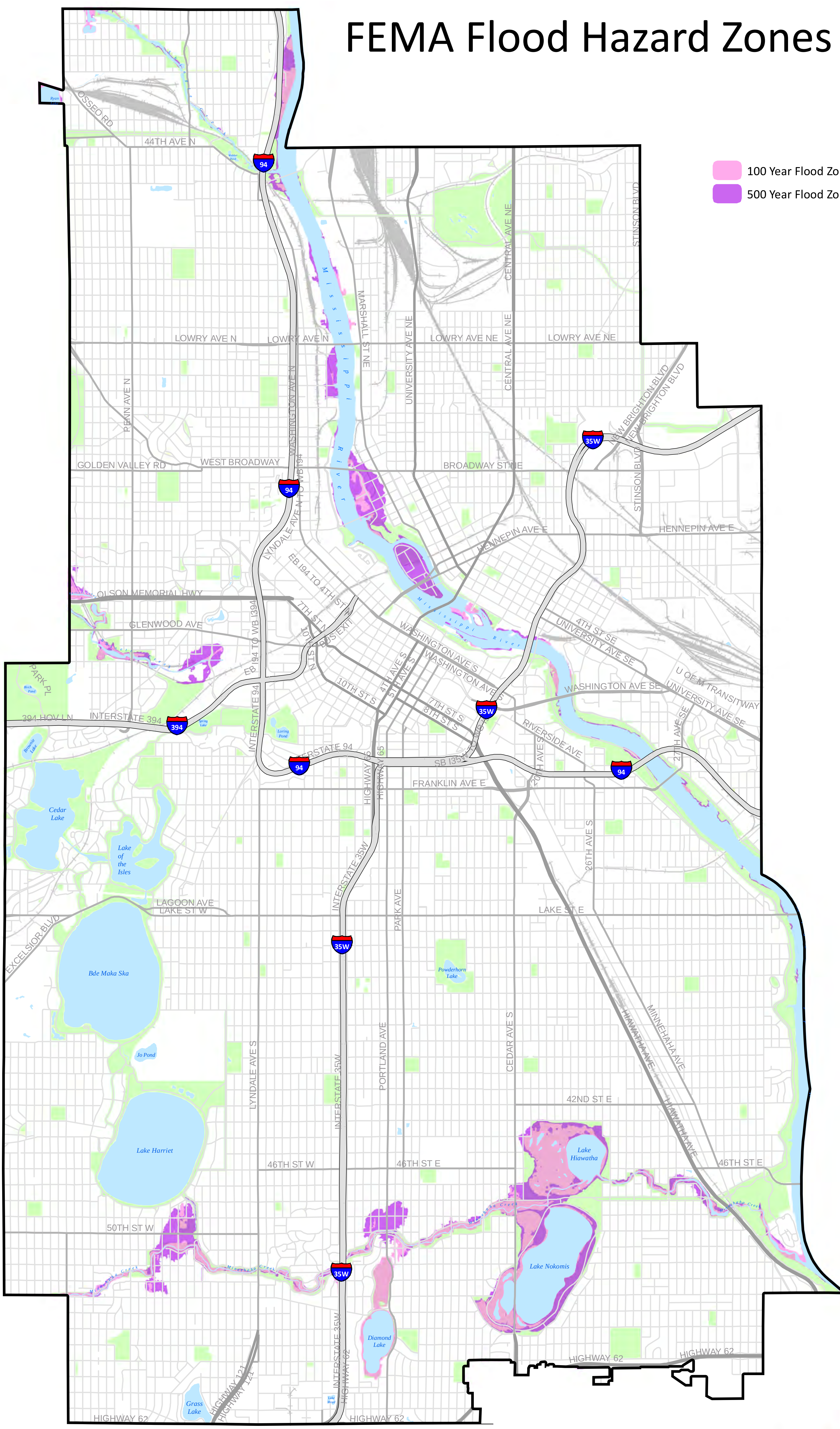
- Continue to conduct surveys. Sampling variability emphasizes the importance of multiyear, ongoing surveys. Some sites were recently added and have a shorter sampling history. As stormwater ponds age, negative effects of water quality may intensify and reduce or preclude amphibian use. Likewise, after dredging and maintenance, amphibian use may improve. Long term surveys will help describe these effects.

- Collect additional habitat information such as water quality data in winter and/or at first sampling, and vegetation information to assess extent and structure of existing riparian vegetation.

- Fine-tune and educate managers regarding amphibian habitat considerations when planning and implementing maintenance activities in and around the pond. Share and coordinate information so that changes in survey data can be associated, or not, with maintenance activities.

Appendix B

FEMA Flood Hazard Zones



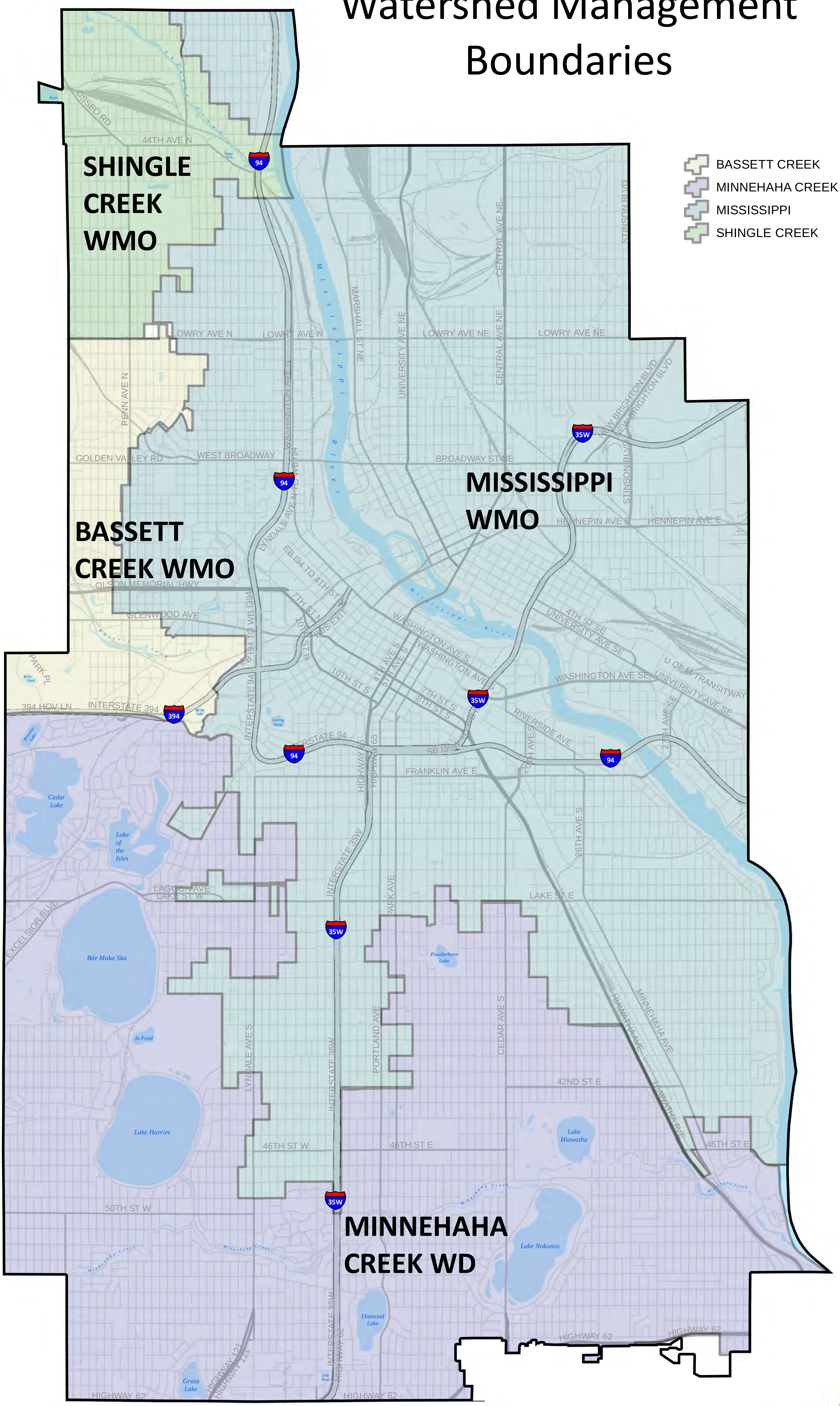
Date: 5/11/2020

Source: National Flood Hazard Layer - Federal Emergency Management Agency
Effective Date : 11-04-2016; Accessed : 06-19-2019

Appendix B1

Minneapolis
Public Works

Watershed Management Boundaries

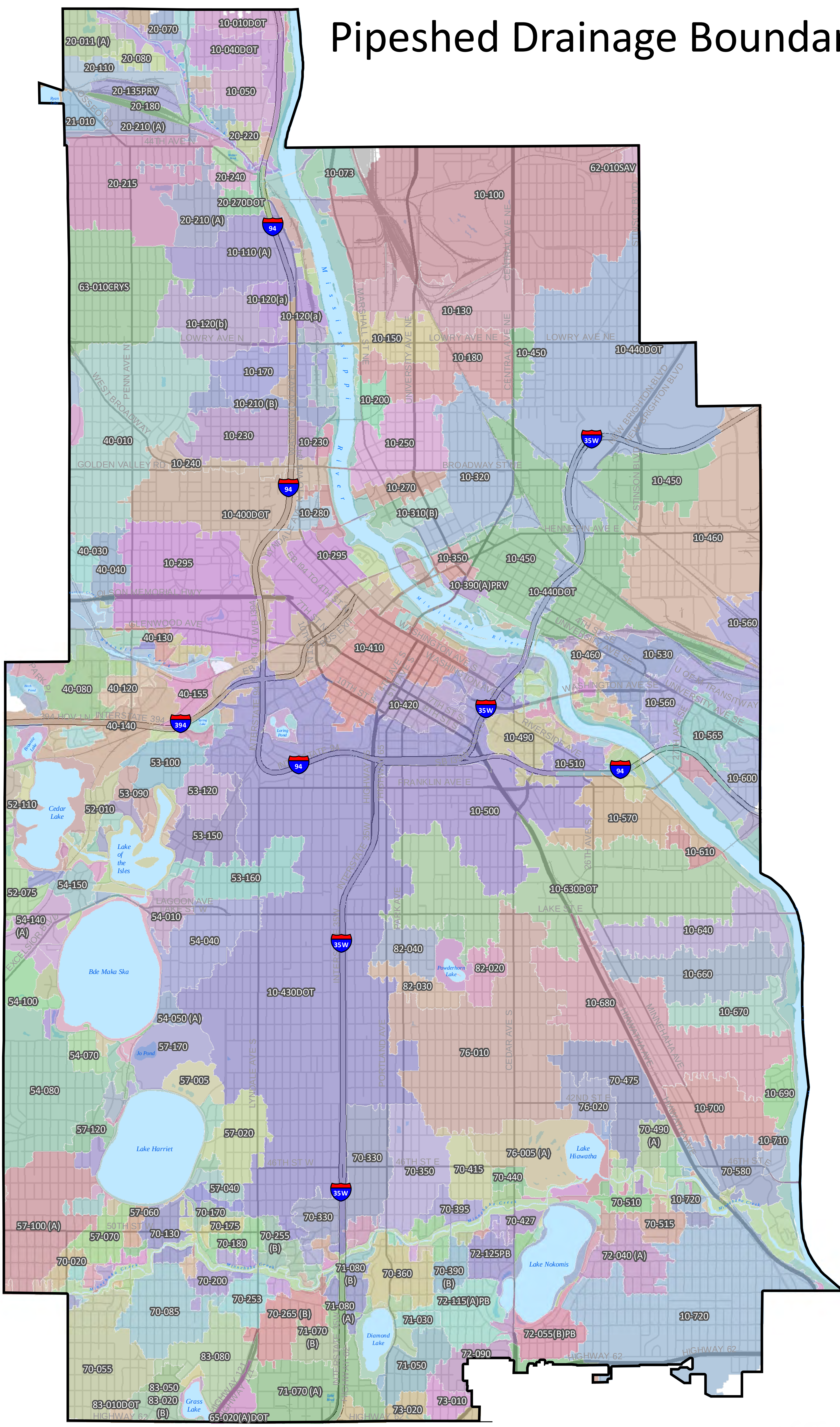


Date: 5/11/2020

Source: Board of Water and Soil Resources
Effective Date : 02-12-2020
Accessed : 05-06-2020

Minneapolis Public Works

Pipeshed Drainage Boundaries

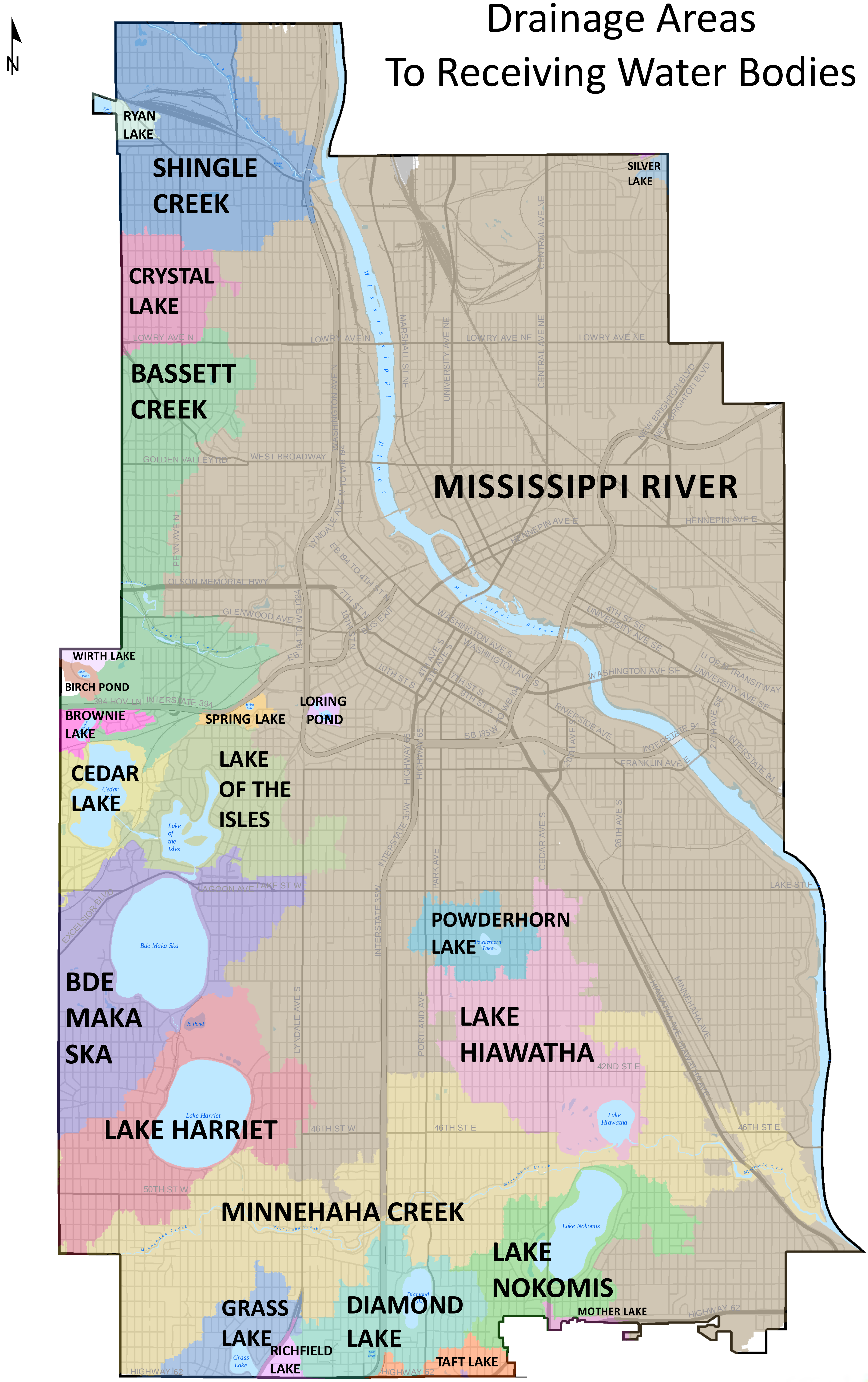


Date: 4/15/2022
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 04-15-2022; Accessed : 04-15-2022

Appendix B3

Minneapolis
Public Works

Drainage Areas
To Receiving Water Bodies

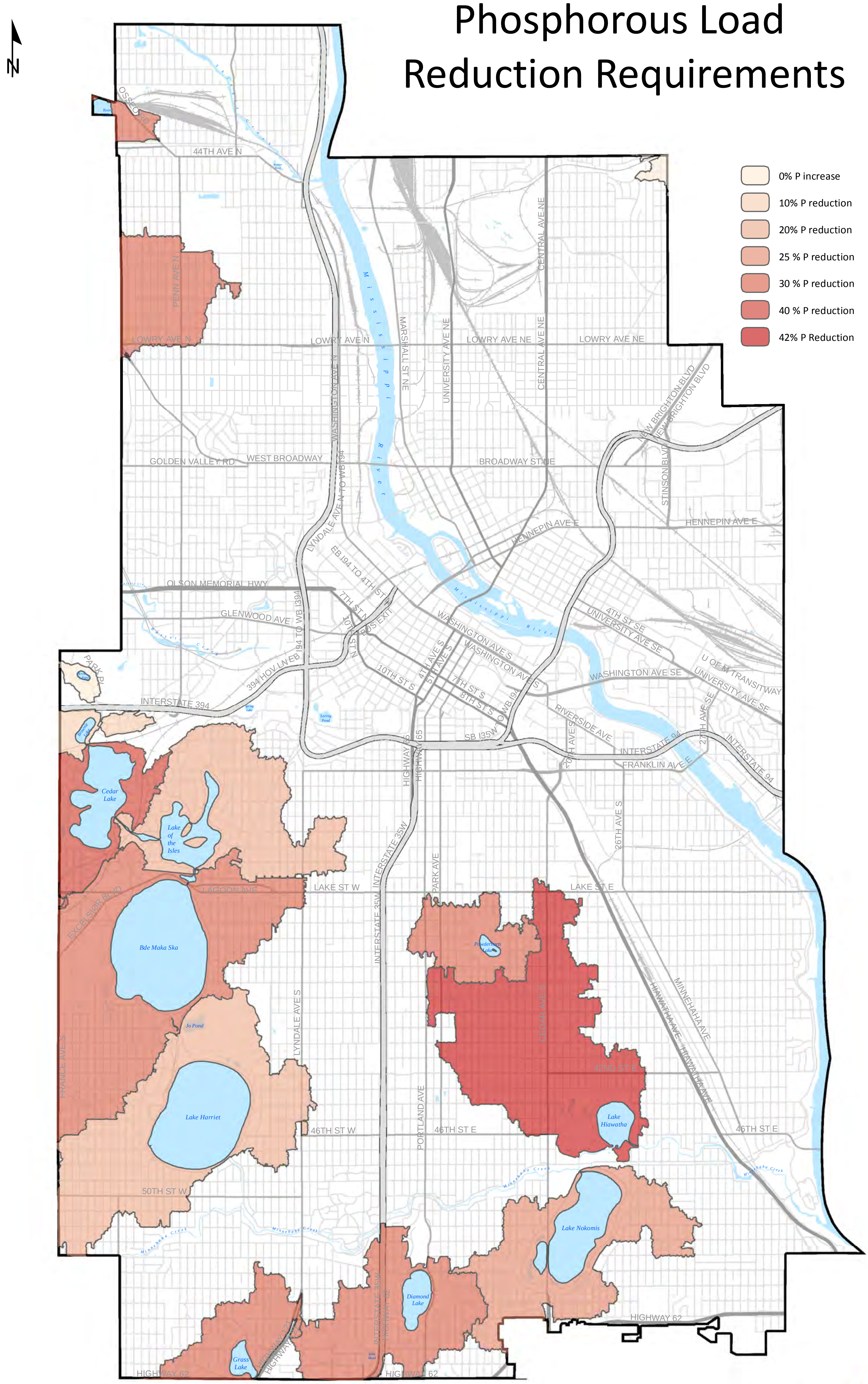


Date: 4/15/2022
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 04-15-2022; Accessed : 04-15-2022

Appendix B4

Minneapolis
Public Works

Phosphorous Load Reduction Requirements

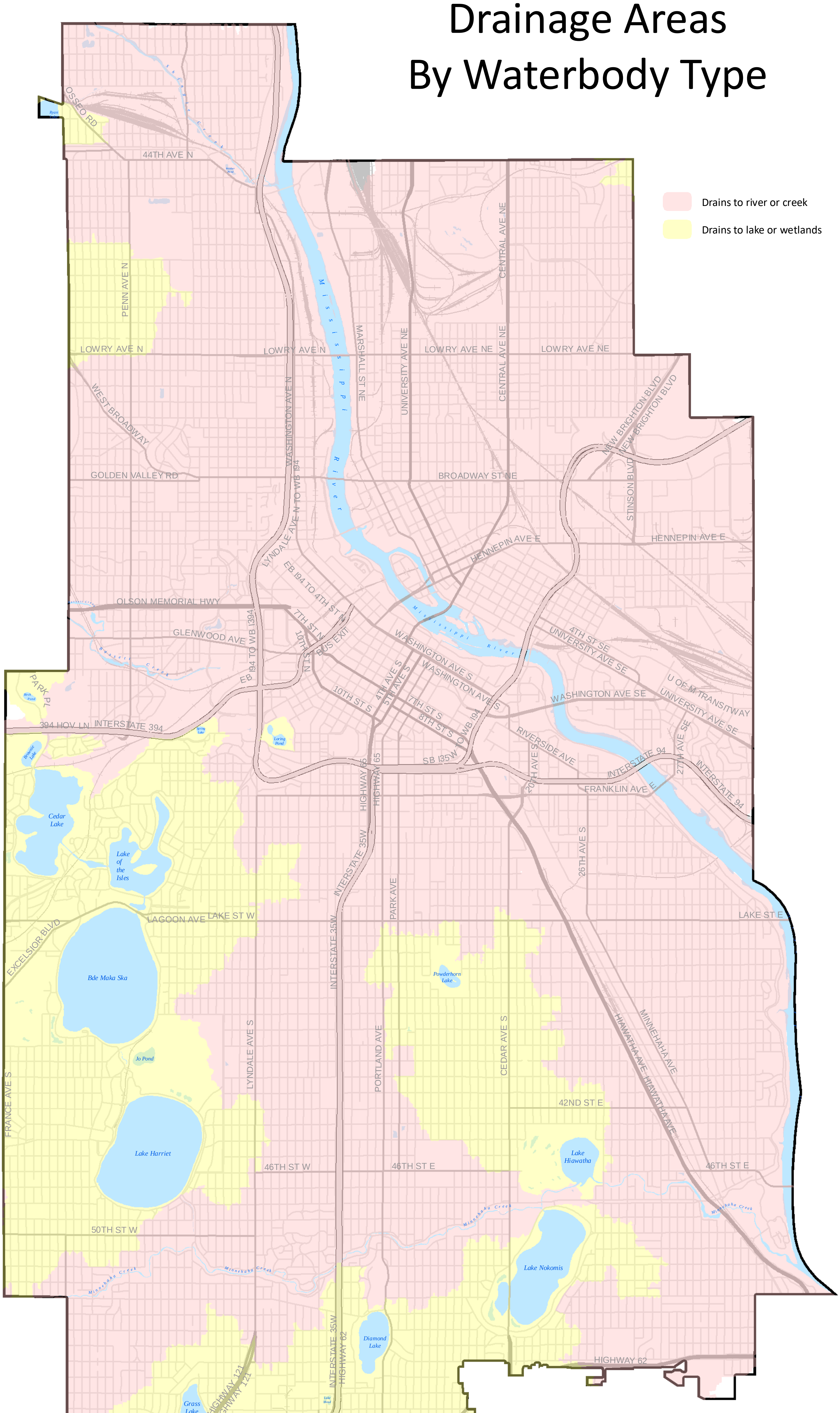


Date: 5/11/2020
Source: Minneapolis Public Works - Surface Water & Sewers

Appendix B5

Minneapolis Public Works

Drainage Areas By Waterbody Type

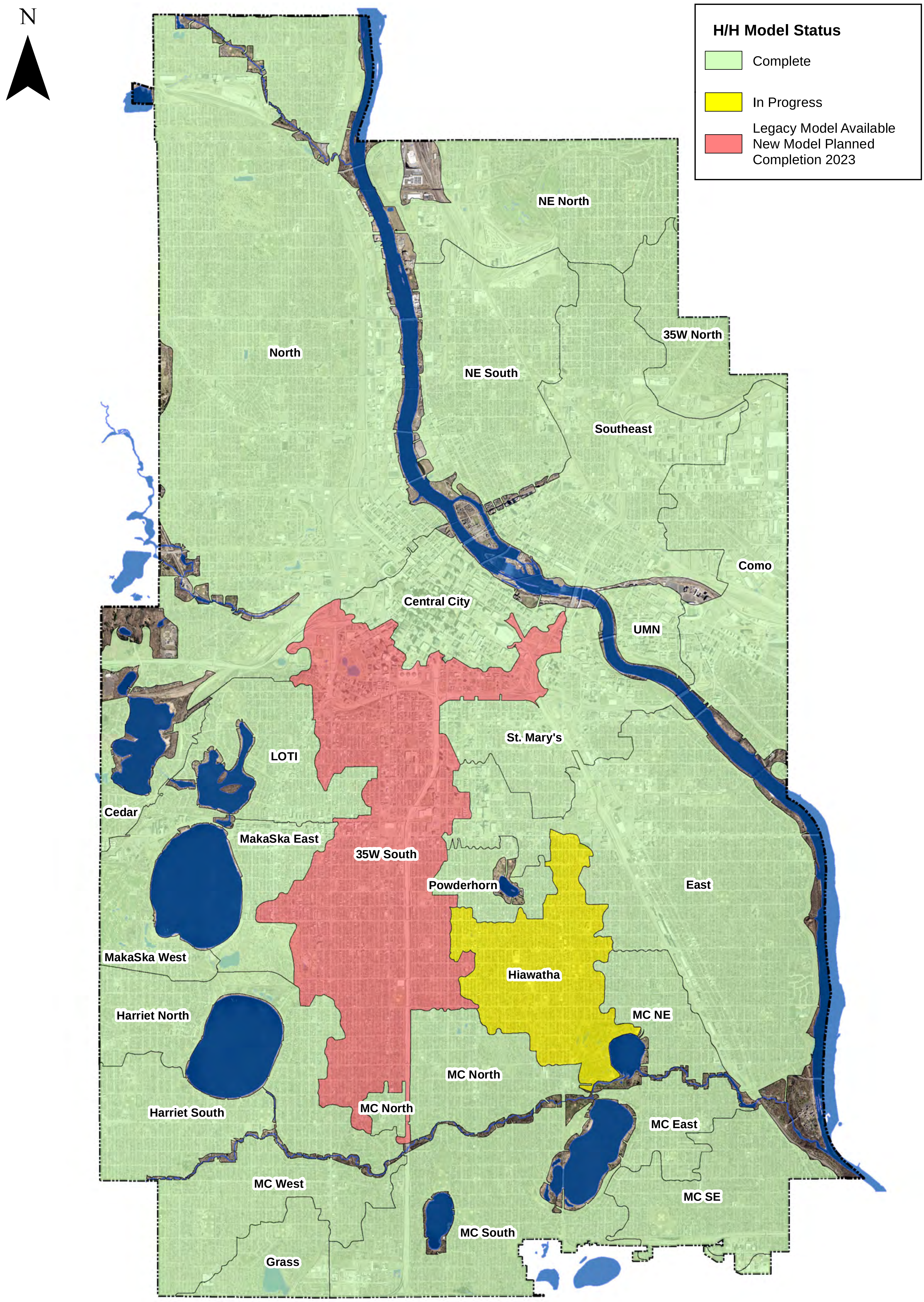


Date: 4/15/2022
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 04-15-2022; Accessed : 04-15-2022

Appendix B6

Minneapolis Public Works

Hydrologic / Hydraulic Storm Modeling Status



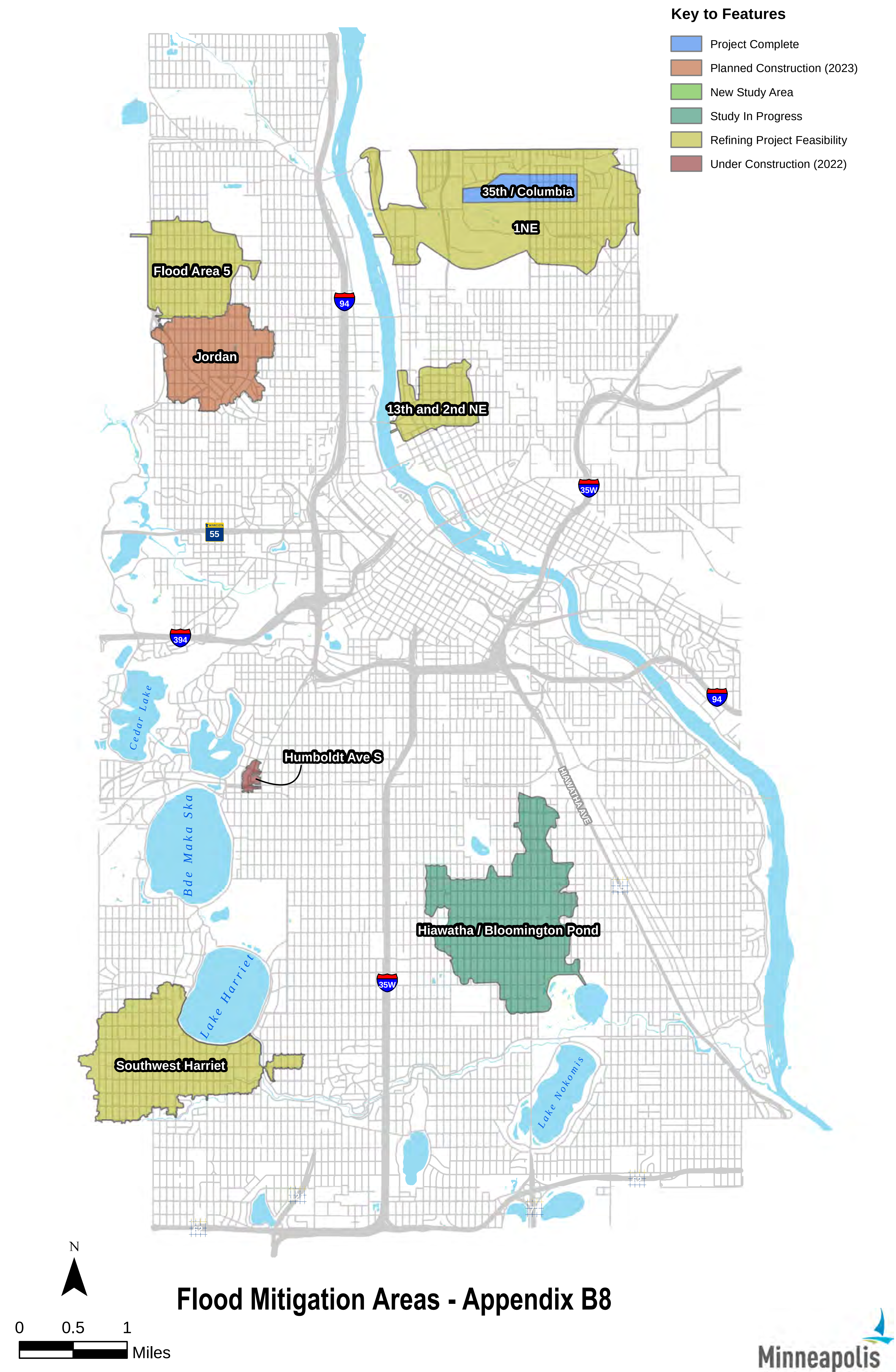
Storm Modeling Status - Appendix B7

Minneapolis
City of Lakes

Surface Water & Sewers Division
Regional Hydrologic / Hydraulic Model
March 2022 Project Status

0.8 0.4 0 0.8
Miles

Current Flood Mitigation Study Areas



Flood Mitigation Areas - Appendix B8

M:\PWSWS\ES_Directory\Grp2PatWrase\Grp2Shared\SewerReports\NPDES Reports\2022 Report\GIS Files\2022_04_Flood_Mitigation_Study_Areas.mxd

Appendix C

Minneapolis
City of Lakes

Appendix C: Public Comment

As part of the NPDES permit process the permittees are required to opportunities for public input on the adequacy of the Stormwater Management Program. This input is gathered annually through written comments and through a public hearing before the Minneapolis City Council. All comments and the response to comments are submitted to the MPCA with the Annual Report.

Notice of the public hearing was sent to environmental groups, related governmental entities, all Minneapolis neighborhood groups, and other interested parties on May 5, 2022, and was also published in Finance and Commerce. This year's public hearing was held on June 9, 2022.

The comments that were received are on the following pages, along with the City's responses, in keeping with permit requirements for the Annual Report. Due to time constraints and the level of detail in the comments submitted in 2021 those comments will also be addressed in this annual report.

2021 Comments:

Friends of Lake Hiawatha:

1. Revise SWMP per input from SWMP Annual Meeting and public comments received. Include trash and plastics as a pollutant to be addressed in the SWMP. Methods to mitigate trash pollution and its impacts (on habitat, biota and humans) are needed.
    - ***Response:*** *The City of Minneapolis and the Minneapolis Park and Recreation Board are proposing to modify the Stormwater Management Program (SWMP) to include trash and litter as pollutants of concern under the following sections in the SWMP: Public Education and Outreach, Public Participation and Involvement, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff Controls, and Pollution Prevention and Good Housekeeping for Municipal Operations. The updated SWMP is being submitted to the Minneapolis City Council for approval and then will be sent to the MPCA.*
2. Install temporary trash capture device at north pipe/43rd street outfall at Lake Hiawatha, until comprehensive stormwater treatment can be implemented as laid out in the Hiawatha Golf Course Area Masterplan.
    - ***Response:*** *The City of Minneapolis, the Minneapolis Park and Recreation Board, Freshwater Society, and the Friends of Lake Hiawatha have recently been discussing a grant opportunity through River Network to install a litter capture device at this location. More work needs to be done but there is a commitment from all of the parties to utilize this grant opportunity to make progress on litter removal from the lake*.
3. Hire staff to assist in trash cleanup at Lake Hiawatha.
    - ***Response:*** *The MPRB has staff that regularly collects trash and litter from the public beach at Lake Hiawatha. The MPRB and the City also sponsor clean up events around the lake and golf course and the city manages a city-wide Adopt-a-Drain program to minimize litter entering into the lake. There are no plans at this time to add additional staff dedicated to clean up at Lake Hiawatha.*

Sierra Club, North Star Chapter

1. In reviewing the SWMP, we find no reference to trash as a concern.

   a. ***Response:*** *The City of Minneapolis and the Minneapolis Park and Recreation Board are proposing to modify the Stormwater Management Program (SWMP) to include trash and litter as pollutants of concern under the following sections in the SWMP: Public Education and Outreach, Public Participation and Involvement, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff Controls, and Pollution Prevention and Good Housekeeping for Municipal Operations. The updated SWMP is being submitted to the Minneapolis City Council for approval and then will be sent to the MPCA.*
2. Trash must be viewed as a pollutant and methods to mitigate trash pollution and its impacts (on habitat, biota and humans) are needed.
   - ***Response:*** *The City of Minneapolis, the Minneapolis Park and Recreation Board, Freshwater Society, and the Friends of Lake Hiawatha have recently been discussing a grant opportunity through River Network to install a litter capture device at this location. More work needs to be done but there is a commitment from all of the parties to utilize this grant opportunity to make progress on litter removal from the lake*.

Friends of Cedar Lake

Section 1: General Issues

1. Develop a comprehensive, online Water Quality Coordination Document. Contents to include infrastructure maps, run-off and water flow maps, responsible entities and contact info, and maintenance and treatment schedules.
   - ***Response:*** *The City of Minneapolis and MPRB coordination documents for water resources are the Stormwater Management Program (SWMP) and the Water Resources Management Plan (WRMP). These documents contain the requested information.*
2. Evaluate the frequency of filtration pond(s) testing and maintenance. FOCL has observed that every 5 years may not be adequate.
   - ***Response:*** *The Stormwater Management Program outlines how the City of Minneapolis and MPRB maintain facilities. The stormwater management objective of this program is to minimize the discharge of pollutants through proper and cost-effective operational management and maintenance of the MS4 storm drain conveyance and treatment system. General operations and maintenance efforts include operations, inspections, cleaning, repairs, rehabilitation, and reconstruction.*
3. Create data driven rapid response strategies to prevent and mitigate contaminations.
   - ***Response:*** *The Stormwater Management Program contains this information. Specifically please see: Illicit Discharge and Elimination Program (SMP 3.3) and a Spills Response Program (SMP 3.4).*
4. Collaborate with Neighborhood Organizations and other community groups to further public education initiatives.
   - ***Response:*** *Thank you for your comment. Minneapolis and MPRB seek out new opportunities to collaborate with the public on education initiatives. Stormwater education is a required part of the Stormwater Management Program. See also pages 11-30 of the 2021 NPDES Annual Report for information on current education and collaborative activities ranging from water quality education in parks, environmental focused publications in Spanish language local media, do not feed the ducks campaign, lawn to legumes, and the city-wide adopt-a-drain and stormwater stenciling programs.*

5. Increase the length of time to retain records from 3 years to 7 years. Given the lag time of issuance of the annual report and noted analysis errors, maintaining the records beyond 3 years is important.
   - ***Response:*** *City of Minneapolis and MPRB follow State of Minnesota Data Practices policies for document retention. In addition, all lake water quality data is submitted to MPCA for retention in MPCA's database, as well as annual submittal to local watershed and county partners.*
6. Establish adequate funding to complete the ongoing and timely maintenance stormwater infrastructure. Delays in necessary maintenance should not be the norm and reliance on volunteers to accomplish time sensitive and time intensive tasks should not be the cornerstone of keeping the waters healthy.
   - ***Response:*** *The Stormwater Management Program (SWMP) defines operations and maintenance of stormwater infrastructure. The Minneapolis City Council and the MPRB Board of Commissioners set funding levels for programs and departments.*
7. Ensure public notifications are posted at recreational lakes in the case of contaminated water. Signs should be multilingual, posted immediately, and indicate the problem and safety warning. Information related to the risks of eating contaminated fish should be included.
   - ***Response:*** *Minneapolis Park and Recreation Board manages the beach bacteria testing program in the City of Minneapolis. Testing occurs once per week, and bilingual (Spanish/English) signage is deployed at the beach if state guidelines are exceeded. If beaches close, this information is also distributed in a Gov Delivery news release. An online map of beach status is kept updated for those who desire information about the beach status prior to traveling to a specific beach. Beaches also occasionally close due to sewer line breaks or porta potty vandalism. In these cases, MPRB closes the as soon as information can practically be acted upon.*

     Health Risks of consuming fish is determined by the Minnesota Department of Health: https://www.health.state.mn.us/communities/environment/fish/#materials

Section 2 – Cedar Lake TSI Scores and Impairment Comments

1. Section 2 of comment letter regarding Cedar Lake TSI Scores and Impairment Concerns. Comments in this section generally dealt with concerns regarding the Trophic State Index graphic in the MPRB annual report and the statement that Cedar Lake is impaired due to a trend in TSI scores. It is assumed that the submitted comment regarding Cedar Lake impairment refers to a potential nutrient impairment due to lake eutrophication because of algae that occurred in the spring of 2020 and the commentor's assessment of TSI scores which take phosphorus, chlorophyll-a, and clarity into consideration.
   - ***Response:*** *The Minnesota Pollution Control Agency is the sole agency responsible for determining the impairment status of Minnesota Lakes. MPCA's 2022 Impaired Waters List can be found here: https://www.pca.state.mn.us/sites/default/files/wq-iw1-73.xlsx*

     Cedar Lake in Hennepin County is currently designated as impaired for aquatic consumption (of fish) due to excess mercury. The impairment is part of the statewide mercury impairment.

MPCA assesses the most recent 10-year period when determining impairments. MPRB submits all water quality data collected on lakes to MPCA annually for assessment purposes.

MPCA uses the Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment when determining whether or not lakes meet standards or are impaired, which can be found here: *https://www.pca.state.mn.us/sites/default/files/wq-iw1-04l.pdf*

According to MPCA's guidance document regarding eutrophication impairment (nutrients), to be considered impaired, a lake must both exceed the phosphorus standard and not meet either the Chlorophyll-a standard or the water clarity standard (Secchi).

Although Cedar Lake has had poorer water quality, particularly from 2017-present, the June-Sept summer mean phosphorus level has met state standards for class 2b NCHF deep lakes. Cedar Lake sometimes does not meet the chlorophyll-a standard and sometimes does not meet the clarity standard for the summer period.

The commentor should note that the MPRB annual report Trophic State Index score (TSI) graphic displays TSI data from all years for illustrative purposes and not for determining impairments. MPRB will continue to clarify that TSI scores are reported to show general trends and to compare scores with Clean Water Partnership Goals. MPRB has already added more clarity to the report text in the 2020 Annual report and forthcoming 2021 annual report when comparing MPRB lake data to state standards. Box and whisker plots in the report have been updated to denote the summer mean averages with a red dot. MPRB Water Resources Annual Reports can be found here: *https://www.minneapolisparks.org/park_care__improvements/water_resources/lake_water_resources/*

MPRB agrees that Cedar Lake water quality has declined, particularly since 2017, and will continue to strengthen this assertion as additional data is collected. The commentor should note that this work has been ongoing. For example, in the 2020 Water Resources Report:

1. *On page iv of the Executive Summary, it is stated that Cedar Lake has had declining water quality indicators in the most recent decade.*
2. *It is noted on page v that Cedar Lake's trend is towards poorer water quality, particularly due to the conditions from 2017 on.*
3. *Page v also notes the severe blue green algae bloom experienced in 2020, and that higher levels of algae are leading to poorer conditions.*
4. *The Cedar Lake chapter notes that the 2020 TSI score exceeds Cedar's Long Term goal set by the Clean Water Partnership, and that water clarity (Secchi) is worse than expected for the Ecoregion. It should also be noted that both Chlorophyll-a and Total Phosphorus measurements are within the expected range for the ecoregion.*

5. *The 2020 blue green algae bloom at Cedar Lake is extensively documented in the "events report" section.*
6. *The "Comparison Among Lakes" chapter notes that Cedar Lake has changed from a stable trend to a lake with declining water quality indicators based on the 10-year trend.*

Similar statements with additional levels of clarity will be in the 2021 Annual Report.

2. The Friends of Cedar Lake note that a fish kill was found in 2019 but was not noted in the 2019 Annual Report or MSMP19.
   - ***Response:*** *MPRB investigates and tracks fish kills and reports fish kills to the State Duty Officer.*

     In 2019, MPRB staff reported fish kills on Cedar Lake, Lake Harriet, and Bde Maka Ska and Brownie Lake in early to mid-July. State Duty Officer reports on these incidents were 184675 (Bde Maka Ska /Brownie), 184675 (Lake Harriet), and 184478 (Cedar Lake). Because of MPRB's timely reporting, MN DNR was able to investigate the Cedar Lake fish kill pathology. Pathology can only be carried out if the fish kill is found and reported very quickly, as the fish deteriorate rapidly in summer temperatures can be too degraded to collect data. A DNR pathology report noted the cause of fish death in this incident to be multiple bacterial infections including Flaviobacteria and A. hydrophila, which are naturally occurring fish diseases.

     A 2020 fish kill that occurred concurrently with a cyanobacteria bloom was determined by the University of Minnesota to be due to Carp Edema Virus, a virus that is relatively new to the state of Minnesota.

     More information on fish kills and typical causes of fish kills in Minneapolis lakes is available in the Fish Kill Section Chapter 1 of all volumes of the MPRB Annual Report.

     Since most fish kills in Minneapolis are not directly related to stormwater, point source or nonpoint source pollution, a SWMP update is not needed at this time.
3. In sections 2,3 and 4 of the comment letter it is noted that cyanobacteria have been present in Cedar Lake, including an extensive bloom in 2020, and included the Friends' desire for an alum treatment of the lake sediments.
   - ***Response:*** *MPRB recognizes that cyanobacteria blooms have been more prevalent in Minneapolis lakes and has taken action. In 2020, MPRB began using a Visual Monitoring Index developed by the State of Vermont to assess water at beaches at least weekly. When conditions warrant, MPRB updates a live map and changes the beach symbol to "advisory". The live map was promoted to the public via MPRB's ActiveNet to all registrants of aquatics-based programs, on all of MPRB's beach and lake-related webpages, and by City of Minneapolis in their newsletter. The map became one of the most used webapps on the MPRB website. In 2021, MPRB expanded blue green algae monitoring with a pilot program assessing microcystin concentrations at the Nokomis and Cedar Lake beaches. With this information, visual monitoring could be compared to actual concentrations of algae-produced toxins. In 2021, no beach water samples at Cedar Lake exceeded State of Minnesota Advisory guidelines for microcystin, and many samples had undetectable levels of*

the toxin. The cyanobacteria results are forthcoming in the 2021 MPRB Water Resources Report. During the summer of 2022, MPRB will expand the pilot program to include microcystin testing at all MPRB beaches. Additionally, in 2022 MPRB is undertaking the Lake Nokomis and Cedar Lake Blue-Green Algae (Cyanobacteria) Bloom Mitigation Strategies Project which seeks to understand the driving factors of blue green algae blooms on these two impacted lakes and to determine strategies to interrupt or eliminate the blooms. MPRB's goal is to determine strategies that can be implemented in-lake, in-park, and in-watershed with emphasis on strategies that can be implemented locally by MPRB.

4. Section 4 of the comment letter notes concerns with trash and plastic refuse in Cedar Lake.
    - ***Response:*** *The City of Minneapolis and the Minneapolis Park and Recreation Board are proposing to modify the Stormwater Management Program (SWMP) to include trash and litter as pollutants of concern under the following sections in the SWMP: Public Education and Outreach, Public Participation and Involvement, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff Controls, and Pollution Prevention and Good Housekeeping for Municipal Operations. The updated SWMP is being submitted to the Minneapolis City Council for approval and then will be sent to the MPCA.*

5. Section 5 of the comment letter notes concerns regarding SWLRT construction and concerns over potential water quality impacts due to the SWLRT construction.
    - ***Response:*** *As a part of project planning, Met Council was required to complete an Environmental Impact Statement (EIS) on the SWLRT corridor and project proposal. The EIS is required under the National Environmental Policy Act (NEPA) and the Minnesota Environmental Policy Act (MEPA) for certain actions that affect the environment. The EIS provides a means to analyze environmental, social, and economic factors and consider environmental impacts, alternatives, and mitigation strategies in the planning and decision-making process. The EIS completed by Met Council in 2016 can be found here:* https://metrocouncil.org/Transportation/Projects/Light-Rail-Projects/METRO-Green-Line-Extension/Environmental.aspx

      The Federal Transit Administration's (FTA) determined that the requirements of the National Environmental Policy Act of 1969 (NEPA) were satisfied for the Southwest Light Rail Transit (LRT) Project, and a Record of Decision was signed by FTA on July 15, 2016, and included the agency's decision regarding compliance with relevant environmental requirements.

      In February of 2018, Met Council completed a Supplemental Environmental Assessment which evaluated the significance and the potential impacts of proposed project changes made after the Record of Decision. The FTA issued an Amended Record of Decision for the SWLRT on May 15, 2018 that covered project modifications described in the 2018 Supplemental Environmental Assessment.

Information on the Supplemental Environmental Assessment and Amended Record of Decision can be found here: https://metrocouncil.org/Transportation/Projects/Light-Rail-Projects/Southwest-LRT/Environmental/SEA.aspx

2022 Comments

Emer Griffin, Paul Bladl, B Turk, Jennifer Sippel, Kristen Olsen, Mary Broman, Nancy Olesen, Nathan Lind, Sarah Santiago, Dick Mabbs, Julia Smith, Lauren Kinsey, Patricia Klucas, Billy Menz, Matt Ryan

1. Revise SWMP per input from SWMP Annual Meeting and public comments received. Include trash and plastics as a pollutant to be addressed in the SWMP. Methods to mitigate trash pollution and its impacts (on habitat, biota and humans) are needed.
    - ***Response:*** *The City of Minneapolis and the Minneapolis Park and Recreation Board are proposing to modify the Stormwater Management Program (SWMP) to include trash and litter as pollutants of concern under the following sections in the SWMP: Public Education and Outreach, Public Participation and Involvement, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff Controls, and Pollution Prevention and Good Housekeeping for Municipal Operations. The updated SWMP is being submitted to the Minneapolis City Council for approval and then will be sent to the MPCA.*
2. Install temporary trash capture device at north pipe/43rd street outfall at Lake Hiawatha, until comprehensive stormwater treatment can be implemented as laid out in the Hiawatha Golf Course Area Masterplan.
    - ***Response:*** *The City of Minneapolis, the Minneapolis Park and Recreation Board, Freshwater Society, and the Friends of Lake Hiawatha have recently been discussing a grant opportunity through River Network to install a litter capture device at this location. More work needs to be done but there is a commitment from all of the parties to utilize this grant opportunity to make progress on litter removal from the lake*.

Sierra Club

1. Install trash capture device at north pipe/43rd street outfall at Lake Hiawatha, until comprehensive stormwater treatment can be implemented as laid out in the Hiawatha Golf Course Area Masterplan.
    - ***Response:*** *The City of Minneapolis, the Minneapolis Park and Recreation Board, Freshwater Society, and the Friends of Lake Hiawatha have recently been discussing a grant opportunity through River Network to install a litter capture device at this location. More work needs to be done but there is a commitment from all of the parties to utilize this grant opportunity to make progress on litter removal from the lake*.
2. Revise SWMP per input from SWMP Annual Meeting and public comments received. Include trash and plastics as a pollutant to be addressed in the SWMP. Methods to mitigate trash pollution and its impacts (on habitat, biota and humans) are needed.

- ***Response:*** *The City of Minneapolis and the Minneapolis Park and Recreation Board are proposing to modify the Stormwater Management Program (SWMP) to include trash and litter as pollutants of concern under the following sections in the SWMP: Public Education and Outreach, Public Participation and Involvement, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff Controls, and Pollution Prevention and Good Housekeeping for Municipal Operations. The updated SWMP is being submitted to the Minneapolis City Council for approval and then will be sent to the MPCA.*

Date received	Sender	Email address
5/26/2022	Emer Griffin	emer.griffin@gmail.com
6/5/2022	Paul Bladl	paul@bladl.com
6/6/2022	Ed Felien	edfelien@southsidepride.com
6/7/2022	B Turk	rp46532@gmail.com
6/7/2022	Jennifer Sippel	jennyfurs7@gmail.com
6/7/2022	Kristen Olsen	kolsenjd@gmail.com
6/7/2022	Mary Broman	mgbroman2003@yahoo.com
6/7/2022	Nancy Olesen	nolesen004@gmail.com
6/7/2022	Nathan Lind	nathanlind@gmail.com
6/8/2022	Billy Menz	BMenz@minneapolisparks.org
6/8/2022	Dick Mabbs	dvm472727@gmail.com
6/8/2022	Julia Smith	jls@liralyn.org
6/8/2022	Lauren Kinsey	laurenkinsey@gmail.com
6/8/2022	Patricia Klucas	paklucas@gmail.com
6/8/2022	Sarah Santiago	ssantiago3@gmail.com
6/8/2022	Sierra Club North Star Chapter	joshua.houdek@sierraclub.org
6/9/2022	Matt Ryan	matt.d.ryan@gmail.com

Subject: Lake Hiawatha

From: Emer Griffin <emer.griffin@gmail.com>
Sent: Thursday, May 26, 2022 10:39 AM
To: Stout, Elizabeth A. (she/her) <Elizabeth.Stout@minneapolismn.gov>; Frey, Jacob <Jacob.Frey@minneapolismn.gov>
Subject: Lake Hiawatha

Good Morning--
I am writing to demand the city address the ongoing pollution of Lake Hiawatha. At this time 10,000 pounds of trash have been removed by volunteers since 2015. The community has been asking for solutions to this infrastructure problem created by the lack of stormwater treatment since 2015. The city has chosen to ignore the problem, and the Parks Board has not acted on the Hiawatha Master plan that could address this issue. The city is in violation of the Clean Water Act and has a responsibility to this community as well as all the others impacted downstream. The Hiawatha Master Plan represents concrete solutions that should be acted on immediately.
Emer Griffin
3824 16th Ave S
Minneapolis, MN 55407

From: Paul Bladl
To: Council Comment
Subject: [EXTERNAL] Storm Water Management Program - June 9 Meeting
Date: Sunday, June 5, 2022 7:50:40 AM

Hello,

I am writing in regards to the public comment meeting for the Storm Water Management Program on June 9, 2022.

The City of Minneapolis needs to implement options to keep trash and other pollutants out of Lake Hiawatha. The storm water from 900 acres of South Minneapolis goes unfiltered into the Lake. This runoff includes the litter from the streets along with oil and other liquids that leak from cars. Every year, hundreds of volunteers clean up as much litter as possible that has come to shore from the Lake. Even more pollution stays in the lake or goes down stream and ends up in the Mississippi, the Gulf of Mexico, and ultimately the oceans.

The City of Minneapolis has many goals to reduce air pollution, however this is negated when the City does not give the same level of attention to water pollution. Without clean lakes, we are just as bad off as we are with dirty air.

Thanks,

Paul Bladl
4101 24th Ave S
Minneapolis MN 55406

From:	Ed Felien
To:	ryan.anderson@state.mn.us; mckim.krista@epa.gov; Council Comment; katrina.kessler@state.mn.us; Koski, Emily; Johnson, Andrew; Kesti, Dylan; Nelson, Kate R. (she/her); Hill, Melissa; Horowitz, Corinne
Subject:	[EXTERNAL] Storm Water Management Program (SWMP) Public Hearing, June 9
Date:	Monday, June 6, 2022 8:15:15 PM

The dam/weir at 27th Avenue holds back five feet of water. That water has saturated the peat soil around Lake Hiawatha, and since that peat soil is connected to the peat soil around Lake Nokomis, and since water likes to run downhill, and if there's no place for the water to go since the water table keeps rising, then doesn't it make sense to pull the plug on this overflowing bathtub?
The Minnesota Department of Natural Resources says, "Federally-owned dams and dams determined by the DNR to be non-hazardous are exempt from the dam safety rules. Dams not subject to the dam safety rules will still require state and federal permits if they involve filling of public waters or wetlands." The dam/weir at 27th Avenue is definitely filling in the public water of Lake Hiawatha and the surrounding wetland, but when we asked, the DNR could not find any evidence that the Park Board has a permit to do so.
They did find evidence of the rejection of a permit to build a pumping station near the dam/weir in 1969. The permit was denied by the Department of Conservation (the predecessor of the DNR) because sanitary sewer lines were obstructing water flowing out of Lake Hiawatha. They could find no permit for the sewer lines: "As you undoubtedly know, all construction projects and utility crossings which encroach upon and otherwise affect public waters of the state require a permit from the Commissioner of Conservation. Projects which affect the outlet control of lakes are especially critical." So, the dam/weir and the sanitary sewer lines are illegal. They require a permit to obstruct the outlet from Lake Hiawatha, and there is no evidence that they even applied for a permit.
What are the options for people concerned about the flooding of homes around Lake Nokomis and Lake Hiawatha?
The Park Board should take down the dam/weir. If they won't take it down, then citizens should file a Writ of Mandamus lawsuit against the Park Board ordering them to either comply with the law and get a permit to flood the wetlands surrounding Lake Hiawatha and Lake Nokomis or take down their dam/weir.
The Minnesota Pollution Control Agency has legal responsibility for sewer lines in Minnesota. They should be contacted and informed that their sewer lines are obstructing the flow of water out of Lake Hiawatha. They need to either get a permit to flood the area or support the sewer lines and dredge under the pipes to allow Minnehaha Creek to flow naturally.

If the City removed the obstructions to the natural flow of Minnehaha Creek and thereby lowered the water level of Lake Hiawatha by 4.5 to 5 feet, that would allow for an additional 80 million gallons of stormwater in the case of heavy storms.

Ed Felien

Don't miss an issue. Subscribe to Southside Pride here.

From:	B T
To:	Council Comment
Subject:	[EXTERNAL] Storm Water Management Program
Date:	Tuesday, June 7, 2022 1:31:43 PM

I am aware that you will be having an annual hearing on the SWMP this Thurs June 9th 2022. I am unable to attend the meeting in person, but respectfully ask that you address the following concerns:

The current SWMP does not address the reduction of trash, plastic, or many other pollutants from storm
water flowing into Lake Hiawatha. As a result, storm water runoff from over 900 acres flows unfiltered through the 43rd Street pipe, depositing all kinds of trash and hazardous chemicals (fertilizers, used motor oil, antifreeze, etc.) into Lake Hiawatha. Please include these toxic pollutants in your storm water management program as part of your “environmental stewardship.”

Thank you.

B turk

From:	jennifer sippel
To:	Council Comment
Cc:	katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; mckim.krista@epa.gov; Johnson, Andrew
Subject:	[EXTERNAL] Lake Hiawatha concerns and requests!
Date:	Tuesday, June 7, 2022 2:51:46 PM

Hello Council Members~

I live just a few blocks north of Lake Hiawatha, and pass by the lake multiple times per week on walks/runs/bike rides. I now bring my recently adopted dog, Amy, with me on walks/runs! I also play at the nearby park with my kiddo, and enjoy sunsets over the lake with my sweetheart.

Most of the time, when I pass by the lake, I see trash, and/or signs saying the lake is too polluted for human or animal use (swim in, drink from, etc.)

I have helped (though not enough) with trash cleanup in the past, and have been proud of neighbors who have worked very hard to advocate for the lake and all the biodiversity in and around the lake!

I am writing to ask that the SWMP include treatment and additional best management practices for reducing trash, plastic, and other pollutants from the 43rd Street pipe, to be developed, implemented, and enforced by the City and Park Board. I would like to see trash and plastic be added to the SWMP as a pollutant of concern.

I am asking you to listen to the voices of my knowledgeable and concerned neighbors who have advocated on behalf of the lake (and surrounding environment) for years!!! Please make decisions that help make our lakes and parks cleaner, more accessible, less toxic, and sustainable (environmentally and financially) for years to come!

Regards,
jenny (and Jon and Dylan)
3845 21st Ave S, Standish

From:	Kristen Olsen
To:	Council Comment
Cc:	katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; mckim.krista@epa.gov; Johnson, Andrew
Subject:	[EXTERNAL] Reduce trash and other pollutants at Lake Hiawatha through SWMP
Date:	Tuesday, June 7, 2022 11:14:17 AM

To the Public Works and Infrastructure Committee of the Minneapolis City Council:

I am writing to urge you to change the Storm Water Management Program (SWMP) to address the trash, plastic, and other pollutants that currently flow unfiltered through the 43rd St. pipe directly into beautiful Lake Hiawatha.

I live a block from Lake Hiawatha and visit the lake nearly every day. I have long been sickened by the trash I've observed and collected over the past several years: tampons, syringes, a half-full can of oven cleaner, countless straws, masks, cigarillo holders, wrappers, bottles, rusted pop cans, and plastic of every color, shape, and size. I am aware, too, of less visible pollution: the motor oil, fertilizer, antifreeze, and other chemicals that rain washes down over 900 acres of city streets into the lake, unfiltered, through the 43rd St. pipe. The problem will worsen in the future as climate change brings more frequent rain storms. I'm concerned about the deterioration of a significant neighborhood asset (the lake) if nothing is done.

Volunteers have picked up over 10,000 pounds of trash from the lake shore, but that is not a solution. No matter how much trash we collect, more harms the lake with every rainfall. I'm enraged that the city and park board let trash and pollutants contaminate a city lake unabated. Children swim in the water. Birds and animals depend on the lake and nearby habitat to survive. Our neighborhood and all its residents (human and non-human) deserve a clean lake and beach.

The city and park board should add trash and plastic as a pollutant of concern to the SWMP. The SWMP ought to include treatment and other best management practices for reducing trash, plastic, and other pollutants from the 43rd Street pipe. Both the city and the park board should develop, manage, and enforce these standards.

Of all the environmental problems in the world, this is one we can solve. Amending the SWMP to address trash and other pollutants will be a significant step forward toward a cleaner Lake Hiawatha.

Thank you.

A concerned constituent,
Kristen Olsen
4515 29th Ave. S.
Minneapolis, MN 55406
(612) 964-6065

From: mary broman
To: Council Comment
Subject: [EXTERNAL] Lake Hiawatha SWMP
Date: Tuesday, June 7, 2022 11:59:26 AM

As life long residents of this area we have seen the waste problem grow continuously over 50+ years.

The problem begins in the western most part of the Minnehaha Watershed area - Minnetonka, Wayzata, etc. Many comment that Lake Hiawatha is the end dumping ground for the whole system but no one ever proposes solutions to address the start of the flow.

Hopefully, this is a NEW BEGINNING of this discussion AGAIN!

Mary and Ron Broman
4216 Standish Ave
Mpls., MN 55407

From:	nolesen004@gmail.com
To:	Council Comment
Subject:	[EXTERNAL] Storm Water Management Project concern
Date:	Tuesday, June 7, 2022 7:00:52 PM

To whom it may concern:
When I walk to Lake Hiawatha from my home, I enjoy seeing the beauty of the trees, flowers, and wildlife along the shores and in the lake. It is peaceful and relaxing after a a long days' work however, what is stressful and concerning is to see trash around and in the lake which is not being addressed as an area of concern by the city. I ask the the Storm Water Management Project (SWMP) include treatment and additional best management practices for reducing trash, plastic, and other pollutants from the 43rd Street pipe, to be developed, implemented, and enforced by the City and Park Board. Lake Hiawatha, like all of our lakes in Minnesota are in our care and they are vulnerable to our treatment of them. We must make sure they are valued and respected in ways that ensure they are here for years to come.
Thank you for your time and attention to this very important matter.

Nancy Olesen

Sent from my iPhone

From:	Nathan
To:	Council Comment; katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; mckim.krista@epa.gov; Johnson, Andrew
Subject:	[EXTERNAL] SWMP
Date:	Tuesday, June 7, 2022 2:03:54 PM

Hello,
I support cleaning up Lake Hiawatha with all options, and hope you will support using the Storm Water Management Plan as one tool to reduce trash and pollutants from poisoning our precious local lake and the surrounding waters.
Thank you.
Nathan Lind
3939 Standish Ave
Minneapolis, MN 55407

From: Menz, Billy C.
To: Sarah Santiago; Council Comment
Cc: katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; Johnson, Andrew; mckim.krista@epa.gov; Thompson, Becka R.; Abene, Catherine L.; Alper, Becky L.; Forney, Meg A.; Musich, Steffanie D.; Olsen, Thomas J.; Shaffer, Elizabeth A.; Smith, Alicia D.
Subject: [EXTERNAL] Re: [External]Hiawatha Master Plan Support and SWMP Recommendations
Date: Wednesday, June 8, 2022 2:16:43 PM

Thank you Sarah. That is a great suggestion.

Get Outlook for iOS

From: Sarah Santiago <ssantiago3@gmail.com>
Sent: Wednesday, June 8, 2022 12:36:13 PM
To: councilcomment@minneapolismn.gov <councilcomment@minneapolismn.gov>
Cc: katrina.kessler@state.mn.us <katrina.kessler@state.mn.us>; ryan.anderson@state.mn.us <ryan.anderson@state.mn.us>; andrew.johnson@minneapolismn.gov <andrew.johnson@minneapolismn.gov>; mckim.krista@epa.gov <mckim.krista@epa.gov>; Thompson, Becka R. <bthompson@minneapolisparks.org>; Abene, Catherine L. <CAbene@minneapolisparks.org>; Alper, Becky L. <BAlper@minneapolisparks.org>; Forney, Meg A. <MForney@minneapolisparks.org>; Menz, Billy C. <BMenz@minneapolisparks.org>; Musich, Steffanie D. <SMusich@minneapolisparks.org>; Olsen, Thomas J. <TOlsen@minneapolisparks.org>; Shaffer, Elizabeth A. <EShaffer@minneapolisparks.org>; Smith, Alicia D. <ASmith@minneapolisparks.org>
Subject: [External]Hiawatha Master Plan Support and SWMP Recommendations

Hello,

I am an East Phillips resident writing to you regarding Lake Hiawatha, I support the Hiawatha Master Plan. I urge you to include treatment and additional best management practices for reducing trash, plastic, and other pollutants from the 43rd Street pipe, to be developed, implemented, and enforced by the City and Park Board (both manage the program). I also ask that trash and plastic be added to the SWMP as a pollutant of concern.

Thank you for your attention to this important matter.

Sarah Santiago
2649 Longfellow Avenue

From: D V Mabbs
To: Council Comment; katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; mckim.krista@epa.gov; Johnson, Andrew
Subject: [EXTERNAL]
Date: Wednesday, June 8, 2022 8:47:57 PM

We moved into a beautiful neighborhood 30+ years ago and it is still beautiful, but there has always been a conspicuous and glaring contradiction to that beauty that became evident the closer one got to Lake Hiawatha.

The amount of floating and shoreline trash, replenished and added to after every rainstorm made exploration the shoreline, usually a rewarding treasure hunt, instead a daily confrontation with endless repulsive eyesores.

It was evident that the Lake had become and still is, the settling pond for all the trash that flows into it. Trash flows in but is never washed further downstream.

I naively assumed that the citizen participation and good governance Minnesota and Minneapolis was renowned for surely had this environmental issue somewhere on its way to being fixed. That's how it's supposed to work.

I also decided I should do my part to clean it up. Initially I focused on a single area. I soon realizing the futility of ever exhausting the supply of trash both accumulated and incoming , I switched to a visual triage that allowed me to keep moving around the lake picking up just the largest and most visually glaring objects on each walk. So it looked better, I felt better, but the the Lake was not any better.

I researched trash traps that others had devised for similar situations. And thought surely they would work here.

I came to understand that in our city it had become a responsibility dodged by all the overlapping government entities that should be working together to fix it.

It is well past time to fix this.

I support the Friends of Lake Hiawatha and ask:

1. the SWMP include treatment and additional best management practices for reducing trash, plastic, and other pollutants from the 43rd Street pipe, to be developed, implemented, and enforced by the City and Park Board (both manage the program).

2. that trash and plastic be added to the SWMP as a pollutant of concern.

Dick Mabbs

From: Julia Liralyn Smith
To: Council Comment
Cc: katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; Johnson, Andrew; mckim.krista@epa.gov
Subject: [EXTERNAL] Input on Storm Water Management Program
Date: Wednesday, June 8, 2022 5:47:24 PM

Good afternoon, City Council comment reader,

I am a resident of Minneapolis, and I want the City of Minneapolis to change its Storm Water Management Program so that it includes treatment and additional best management practices for reducing trash, plastic, and other pollutants from the 43rd Street pipe. I want this improved program to be developed, implemented, and enforced by the City and Park Board. Additionally, I ask that trash and plastic be added to the SWMP as pollutants of concern.

We only have one Earth to share, and on our one Earth, there is only one Lake Hiawatha. I think that the City, and everyone in it, should treat the Lake like a cherished friend. We don't cover our friends in trash or feed them plastic! We don't let our friends drink antifreeze or motor oil! We can do better by Lake Hiawatha, and we should do better. The Lake is a treasure for the citizens of Minneapolis, and for the people of the world, to cherish. We shouldn't treat it like a dump.

As an additional note, we should recognize that a beautiful and trashless Lake Hiawatha can attract tourists and sightseers, bringing more revenue and positive publicity to our city. It would be wonderful if birdwatchers came to Minneapolis to see the birds that live by the lake and that eat some of the other creatures that live in it, wouldn't it? Or if people stopped by in the evenings to hear frogs singing? We can't have beautiful sights like that if storm water brings plastic into the lake! At this moment, the City of Minneapolis is uniquely well-positioned to bring us all closer to this idealized vision of the Lake Hiawatha environment. I want the City to take action, right now, by changing the SWMP to reduce trash, plastic, and other pollutants at Lake Hiawatha.

Thank you for your time and attention,
Julia Smith

From: Lauren Kinsey
To: Council Comment
Cc: katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; Johnson, Andrew; mckim.krista@epa.gov
Subject: [EXTERNAL] Please Classify Plastic & Other Trash as Pollutant of Concern
Date: Wednesday, June 8, 2022 6:43:37 AM

Since 2015, volunteers have removed over 10,000 pounds of trash from Lake Hiawatha. Plastic trash breaks down into smaller pieces and chemical components that are harmful to the web of life and to human beings. In laboratory tests, microplastics have been shown to cause damage to human cells, including both allergic reactions and cell death.

I live near Lake Hiawatha and I care about this issue because I feel it is my responsibility as a citizen of Minneapolis to be engaged with the democratic process and to advocate for a stewardship approach to the natural resources we hold in common. Therefore, I am asking you to classify plastic and other trash as a pollutant of concern.

Thank you,
Lauren Kinsey
Minneapolis Voter

From: paklucas
To: Council Comment
Cc: katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; mckim.krista@epa.gov; Johnson, Andrew
Subject: [EXTERNAL] Lake Hiawatha
Date: Wednesday, June 8, 2022 2:30:04 PM

To the City Council of Minneapolis:

I have gone to Lake Hiawatha Beach for 40 years. My children grew up going there at least weekly in the summer. Lake Hiawatha was one of the first experiences my four children had with swimming in a lake. It was a great beach for all of us. My three older kids eventually became lifeguards there. Now it grieves me that I cannot take my grandsons swimming there or let my dog drink the water. I don't want to see this great neighborhood resource that defines life in So Minneapolis for many of us go to waste. It is astounding how much garbage I see when I walk through the path by the lake. This was not so obvious when my kids were growing up.

I am asking that the SWMP include both treatment and management plans for reducing trash and street pollutants from the 43rd Street runoff pipe into the lake and they need to include trash and plastics as pollutants. The City Board and Park Board should be responsible to implement and enforce these standards.

Please save our lake.

Patricia Klucas
4026 27th Ave S
Minneapolis, MN 55406
612 229-6471

Know justice, know peace. (adapted from Pope Paul VI)

From: Sarah Santiago
To: Council Comment
Cc: katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; Johnson, Andrew; mckim.krista@epa.gov; bthompson@minneapolisparks.org; Catherine L.”; Becky Alper; Forney, Meg A.; bmenz@minneapolisparks.org; Musich, Steffanie D.; tolsen@minneapolisparks.org; eshaffer@minneapolisparks.org; asmith@minneapolisparks.org
Subject: [EXTERNAL] Hiawatha Master Plan Support and SWMP Recommendations
Date: Wednesday, June 8, 2022 12:36:31 PM

Hello,

I am an East Phillips resident writing to you regarding Lake Hiawatha, I support the Hiawatha Master Plan. I urge you to include treatment and additional best management practices for reducing trash, plastic, and other pollutants from the 43rd Street pipe, to be developed, implemented, and enforced by the City and Park Board (both manage the program). I also ask that trash and plastic be added to the SWMP as a pollutant of concern.

Thank you for your attention to this important matter.

Sarah Santiago
2649 Longfellow Avenue

From:	Joshua Houdek
To:	Johnson, Andrew; Koski, Emily; Payne, Elliott; Wonsley Worlobah, Robin; Vetaw, LaTrisha M; Chughtai, Aisha; Council Comment; Menshek, Peggy Y
Cc:	susan palchick; Pilger, Debra; katrina.kessler@state.mn.us; mat.hollinshead@northstar.sierraclub.org; bmenz@minneapolisparks.org; Thompson, Becka R.; Alper, Becky L.; Shaffer, Elizabeth A.; Musich, Steffanie D.; cabene@minneapolisparks.org; Forney, Meg A.; Olsen, Thomas J.; asmith@minneapolisparks.org
Subject:	[EXTERNAL] Stormwater Management Program Comments from Sierra Club
Date:	Wednesday, June 8, 2022 10:35:22 AM
Attachments:	Sierra Club Comments on Mpls-MPRB Stormwater Management Program (1).pdf

Chair Johnson and Public Works & Infrastructure Committee Members,

This letter (also attached as a pdf) is in response to the request for comments on the City of Minneapolis/Minneapolis Park and Recreation Board's Stormwater Management Program (SWMP), as required under the MS4 NPDES/SDS Permit No. MN0061018, which must be approved by the Minneapolis City Council after public review and comment.

Founded in 1968, the Sierra Club North Star Chapter is a non-profit environmental organization representing over 80,000 members and supporters across Minnesota, tens of thousands of which live, work, and play in Minneapolis. The Sierra Club works to safeguard the health of our communities, protect wildlife, and preserve our remaining wild places through grassroots activism, public education, lobbying, and litigation. As a leading grassroots voice working to preserve and protect Minnesota's environment, we empower volunteer leaders to act through environmental advocacy, community organizing, and outdoor exploration. We participate in the administrative process to encourage environmental health and sustainability, long term wildlife and habitat protection, and biodiversity goals.

Sierra Club comments on the SWMP:

1. Lake Hiawatha receives stormwater discharge directly via the 43rd Street pipe that is contaminated with trash and many other pollutants such as oil, soil, gas, fertilizer, pesticides, pet waste, automotive fluids, grass clippings, leaves, de-icers, road salt, and other hazardous materials. Friends of Lake Hiawatha volunteers have removed over 10,000 pounds of trash from Lake Hiawatha in the past eight years. We acknowledge that the City of Minneapolis has attempted structural Best Management Practices (BMPs) along with community outreach such as Adopt a Stormdrain and other BMPs, but these efforts have not stopped the continual presence of trash, plastics and other pollutants from entering Lake Hiawatha.

2. Trash is not listed in the pollutants of concern contained in Table A.4 of the SWMP. The SWMP states that the list of pollutants is not intended to be exhaustive on page 13 of the SWMP. The City and MPRB then acknowledge the possibility of other pollutants that may need control and treatment.

3. Water Quality standards are used to provide guidance and limitations for water bodies throughout the US and each state including Minnesota develop their own standards specifically for the types of waters and conditions in each state. Minnesota

Water Quality Standards are found in the regulations and contain a nuisance standard, 050.0210 Subpart 2. Nuisance conditions prohibited, which states:

No sewage, industrial waste, or other wastes shall be discharged from either point or nonpoint sources into any waters of the state so as to cause any nuisance conditions, such as the presence of significant amounts of floating solids, scum, visible oil film, excessive suspended solids, material discoloration, obnoxious odors, gas ebullition, deleterious sludge deposits, undesirable slimes or fungus growths, aquatic habitat degradation, excessive growths of aquatic plants, or other offensive or harmful effects

This standard does not directly include trash but the impacts of trash and other pollutants, especially floating solids, are directly discharged to the Lake, reaching the beaches and shoreline. The discharge of stormwater via the 43rd Street pipe to the lake generates nuisance conditions as defined by this standard which require treatment.

4. The US Environmental Protection Agency developed guidance for MS4 permits and SWMPs specifically related to trash management entitled Trash Stormwater Permit Compendium that provides approaches and Best Management Practices for managing trash in stormwater from across the country. This guidance indicates support for stormwater permits to cover the cleanup, management, and enforcement of trash related to stormwater. We recommend the use of enforceable trash provisions to require measurable trash discharge reductions. This approach could significantly reduce the amount of trash reaching streams, rivers, lakes and wetlands, and the SWMP should be modified to include the mitigation and prevention of trash contamination to lakes and rivers via stormwater. This has been done in a number of places in the country: Los Angeles, Baltimore, San Francisco, New York, and Honolulu.

5. In addition to Minnesota Water Quality Standards, Hennepin County Ordinance No. 25 Public Health Nuisance. Section 2.01 G and H. Prohibitions. provides:

The *creation or maintenance of a public health nuisance is prohibited. The following are hereby expressly declared to be public health nuisances without limitation by reason of such enumeration.*

…G. Accumulation of decaying animal or vegetable matter, animal or human feces, trash, rubbish, garbage, rotting lumber, packing material, scrap metal, tires or any

other substances in which flies, mosquitoes, other disease carrying insects, rodents or other vermin can harbor; this definition does not include compost bins or compost sites which are being managed in accordance with acceptable standards.

H. Accumulations of rubbish or junk as to become dangerous or injurious to the health and safety of any individual or to the public.

The trash, plastics and other refuse nearly continuously found in Lake Hiawatha is a public health nuisance in Hennepin County based on community observation and action, particularly the Friends of Lake Hiawatha. This public health nuisance found in Minneapolis, a part of Hennepin County, should be abated and considered in the SWMP.

The Sierra Club has previously commented on the SWMP and we continue to recommend that the stormwater directly discharged via the 43rd Street pipe requires treatment to prevent discharge of trash and other pollutants directly to the Lake. The SWMP uses BMPs such as education, public participation, erosion control measures, spill prevention and response, but based on the trash and continued direct discharge from the 43rd street pipe, these BMPs do not prevent all these pollutants from entering the stormwater and eventually the Lake. This has been demonstrated by the 10,000 pounds of trash and wastes removed by the Friends of Lake Hiawatha weekly cleanups for over eight years.

The time has come and the need is clear for increased local regulation and management of the water resources of Minneapolis from the impact of trash in our stormwater. The SWMP must be amended accordingly and the City Council must insist this is addressed in the SWMP.

Sincerely,

Matthews Hollinshead, Conservation Chair
Sierra Club North Star Chapter

Cc:
Director of Environmental Management Deb Pilger, MPRB
President and Commissioners, MPRB
Commissioner Katrina Kessler, MPCA
Public Health Director Susan Palchick, Hennepin County

Joshua Houdek
Senior Program Manager, Land Use and Transportation
Sierra Club North Star Chapter
2300 Myrtle Ave, Suite 260, Saint Paul, MN 55114
Main: 612-659-9124 Direct: 612-259-2447
sierraclub.org/mn

SIERRA CLUB
NORTH STAR CHAPTER

2327 East Franklin Avenue
Minneapolis, MN 55406
612-659-9124
sierraclub.org/mn

June 8, 2022

City of Minneapolis
Public Works and Infrastructure Committee
350 S Fifth St, Room 304
Minneapolis, MN 55415

Dear Public Works and Infrastructure Committee Members:

This letter is in response to the request for comments on the City of Minneapolis/Minneapolis Park and Recreation Board's Stormwater Management Program (SWMP), as required under the MS4 NPDES/SDS Permit No. MN0061018, which must be approved by the Minneapolis City Council after public review and comment.

Founded in 1968, the Sierra Club North Star Chapter is a non-profit environmental organization representing over 80,000 members and supporters across Minnesota, tens of thousands of which live, work, and play in Minneapolis. The Sierra Club works to safeguard the health of our communities, protect wildlife, and preserve our remaining wild places through grassroots activism, public education, lobbying, and litigation. As a leading grassroots voice working to preserve and protect Minnesota's environment, we empower volunteer leaders to act through environmental advocacy, community organizing, and outdoor exploration. We participate in the administrative process to encourage environmental health and sustainability, long term wildlife and habitat protection, and biodiversity goals.

Sierra Club comments on the SWMP:

1. Lake Hiawatha receives stormwater discharge directly via the 43rd Street pipe that is contaminated with trash and many other pollutants such as oil, soil, gas, fertilizer, pesticides, pet waste, automotive fluids, grass clippings, leaves, de-icers, road salt, and other hazardous materials. Friends of Lake Hiawatha volunteers have removed over 10,000 pounds of trash from Lake Hiawatha in the past eight years. We acknowledge that the City of Minneapolis has attempted structural Best Management Practices (BMPs) along with community outreach such as Adopt a Stormdrain and other BMPs, but these efforts have not stopped the continual presence of trash, plastics and other pollutants from entering Lake Hiawatha.

2. Trash is not listed in the pollutants of concern contained in Table A.4 of the SWMP. The SWMP states that the list of pollutants is not intended to be exhaustive on page 13 of the

SWMP. The City and MPRB then acknowledge the possibility of other pollutants that may need control and treatment.

3. Water Quality standards are used to provide guidance and limitations for water bodies throughout the US and each state including Minnesota develop their own standards specifically for the types of waters and conditions in each state. Minnesota Water Quality Standards are found in the regulations and contain a nuisance standard, 050.0210 Subpart 2. Nuisance conditions prohibited, which states:

   No sewage, industrial waste, or other wastes shall be discharged from either point or nonpoint sources into any waters of the state so as to cause any nuisance conditions, such as the presence of significant amounts of floating solids, scum, visible oil film, excessive suspended solids, material discoloration, obnoxious odors, gas ebullition, deleterious sludge deposits, undesirable slimes or fungus growths, aquatic habitat degradation, excessive growths of aquatic plants, or other offensive or harmful effects

   This standard does not directly include trash but the impacts of trash and other pollutants, especially floating solids, are directly discharged to the Lake, reaching the beaches and shoreline. The discharge of stormwater via the 43rd Street pipe to the lake generates nuisance conditions as defined by this standard which require treatment.

4. The US Environmental Protection Agency developed guidance for MS4 permits and SWMPs specifically related to trash management entitled Trash Stormwater Permit Compendium that provides approaches and Best Management Practices for managing trash in stormwater from across the country. This guidance indicates support for stormwater permits to cover the cleanup, management, and enforcement of trash related to stormwater. We recommend the use of enforceable trash provisions to require measurable trash discharge reductions. This approach could significantly reduce the amount of trash reaching streams, rivers, lakes and wetlands, and the SWMP should be modified to include the mitigation and prevention of trash contamination to lakes and rivers via stormwater. This has been done in a number of places in the country: Los Angeles, Baltimore, San Francisco, New York, and Honolulu.

5. In addition to Minnesota Water Quality Standards, Hennepin County Ordinance No. 25 Public Health Nuisance. Section 2.01 G and H. Prohibitions. provides:

   The *creation or maintenance of a public health nuisance is prohibited. The following are hereby expressly declared to be public health nuisances without limitation by reason of such enumeration.*

   …G. Accumulation of decaying animal or vegetable matter, animal or human feces, trash, rubbish, garbage, rotting lumber, packing material, scrap metal, tires or any other substances in which flies, mosquitoes, other disease carrying insects, rodents or other

vermin can harbor; this definition does not include compost bins or compost sites which are being managed in accordance with acceptable standards.

H. Accumulations of rubbish or junk as to become dangerous or injurious to the health and safety of any individual or to the public.

The trash, plastics and other refuse nearly continuously found in Lake Hiawatha is a public health nuisance in Hennepin County based on community observation and action, particularly the Friends of Lake Hiawatha. This public health nuisance found in Minneapolis, a part of Hennepin County, should be abated and considered in the SWMP.

The Sierra Club has previously commented on the SWMP and we continue to recommend that the stormwater directly discharged via the 43rd Street pipe requires treatment to prevent discharge of trash and other pollutants directly to the Lake. The SWMP uses BMPs such as education, public participation, erosion control measures, spill prevention and response, but based on the trash and continued direct discharge from the 43rd street pipe, these BMPs do not prevent all these pollutants from entering the stormwater and eventually the Lake. This has been demonstrated by the 10,000 pounds of trash and wastes removed by the Friends of Lake Hiawatha weekly cleanups for over eight years.

The time has come and the need is clear for increased local regulation and management of the water resources of Minneapolis from the impact of trash in our stormwater. The SWMP must be amended accordingly and the City Council must insist this is addressed in the SWMP.

Sincerely,

Matthews Hollinshead, Conservation Chair
Sierra Club North Star Chapter

Cc:
Director of Environmental Management Deb Pilger, MPRB
President and Commissioners, MPRB
Commissioner Katrina Kessler, MPCA
Public Health Director Susan Palchick, Hennepin County

From:	Matt Ryan
To:	Council Comment
Cc:	katrina.kessler@state.mn.us; ryan.anderson@state.mn.us; Johnson, Andrew; mckim.krista@epa.gov
Subject:	[EXTERNAL] Minneapolis Stormwater Management Program comments for City Council Public Hearing on the 6/9/2022
Date:	Thursday, June 9, 2022 10:39:32 AM

My name is Matt Ryan. I live at 3817 22nd Ave S in Minneapolis. My family and I, including my six-year-old son, regularly visit Lake Hiawatha. We walk, bike, and play near it, we canoe and kayak on it, and we cross-country ski on and alongside it.

We are saddened by the visibly awful water quality at our neighborhood lake. We are scared that we cannot feel safe when we see considerable trash — including syringes — in the lake and covering its shores, and that we often see algae blooms on its surface.

Out of wanting to help this terrible situation, we have recently started to participate in the trash pick-up events organized by Friends of Lake Hiawatha and have learned that an eye-popping 10,000 pounds of trash have been collected so far in those efforts. We have also seen with our own eyes that with every single rainstorm another deluge of trash (and presumably non-visible contaminants) are washed into the lake. Without a structural solution, the efforts of a handful of volunteers is fundamentally Sisyphean. It will never make more than a tiny dent in the firehose of pollution flowing directly from our streets to our lake.

We see the direct, unfiltered discharge of 923 acres of stormwater from highly urban land via the 43rd street pipe into the lake and are frustrated knowing that almost all the direct discharges into the other major lakes in Minneapolis have had structural treatment installed for many years. We have seen the dramatic water quality improvements that have resulted from these physical remediation structures and we are puzzled why our neighborhood lake does not have a concrete, actionable plan for similar efforts.

I am writing to make it clear that the addition of litter as a recognized pollutant at the lake is a good step forward. It is clearly causing nuisance conditions at the lake. But it is not enough. We need to see concrete commitments to structural mitigation, and we need a solution that will address not just litter but the host of other contaminants the stormwater flowing into the lake picks up as it runs across land, streets, pavement, parking lots, sidewalks, and yards picking up pollutants such as oil, dirt, fertilizer, microplastics, fertilizer, and pesticides.

I am writing to ask that the assessment, installation and maintenance of structural best management practices within the storm sewer system and at the 43rd street pipe discharge be included in the SMWP, be completed as soon as possible, and be designed with the goal of maximum removal of solid waste and other pollutants. It is very important to me that the plan include an enforceable schedule of one year. We are tired of the lack of action to resolve this and we believe that firm deadlines need to be set in order for meaningful progress to be made.

Thank you,
Matt Ryan

Appendix D

Minneapolis
City of Lakes

Minneapolis
City of Lakes

2021 Lake Hiawatha Litter Report

August 27, 2021

Contents

Appendices

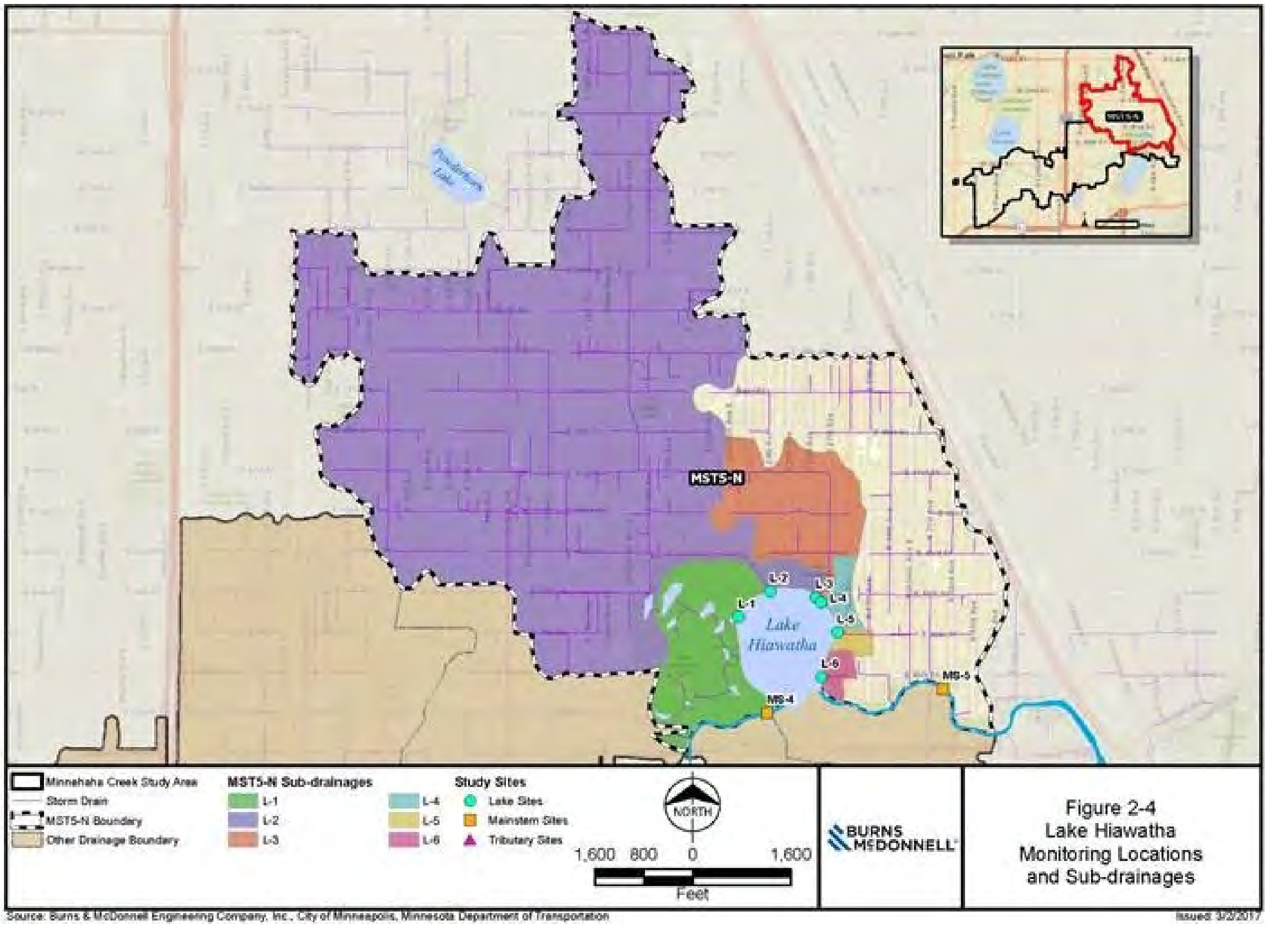
Introduction

Minnehaha Creek flows from Lake Minnetonka at the outlet of Grays Bay eastward for 22 miles to the Mississippi River. Lake Hiawatha is in-line to the creek and receives stormwater runoff from parts of Minneapolis and parts of cities and road authorities upstream, including Plymouth, Wayzata, Minnetonka, St. Louis Park, Hopkins, Edina, Hennepin County and Mn Dept. of Transportation, that drain to Minnehaha Creek. Lake Hiawatha is directly impacted by the 7.5 million acres and 340,000 people that are upstream and drain to Minnehaha Creek and ultimately into the lake.

Besides the creek, there are also storm sewer pipes that carry stormwater that discharges to Lake Hiawatha at six locations. Stormwater runoff is the water that runs off of roofs, driveways, and streets and is piped through the storm sewer network to the lake. As the rainwater flows to the lake it picks up pollutants along the way. These pollutants might be trash and litter, leaves and grass clippings, pet waste, leaks and residue from vehicles, grease, or metals.

The City and the Minneapolis Park and Recreation Board (MPRB), as NPDES MS4 co-permittees, have a number of practices and programs that help address and mitigate pollutants from stormwater runoff from the neighborhoods. These include three holding pond projects, one at Bloomington and 42nd which was constructed in 1989, one at Sibley Field Park which was constructed in 2000, and one at 37th and Columbus which was constructed in 2003. There are also a series of stormwater ponds in the Hiawatha golf course and a rain garden in the corner north of the golf course.

The lake has also been monitored for water quality by the Minneapolis Park and Recreation Board since 1992. In general the water quality in Lake Hiawatha has been very stable. The water level in the lake is also monitored by the MPRB. The levels are mostly influenced by the flow in Minnehaha Creek and management of the Grays Bay Dam at Lake Minnetonka. Lake levels can fluctuate up to five feet.



Ordinances and Policies

Ordinances

The City of Minneapolis and the Minneapolis Park and Recreation Board have comprehensive ordinances around the disposal of litter in the city and within parks. These ordinances are in several sections of city code, including Housing, Health and Sanitation, Licenses and Business Regulations, Streets and Sidewalks, and the Zoning Code. A comprehensive list of City and MPRB Ordinances with links can be found in Appendix A.

Policies

The City of Minneapolis' 2040 Comprehensive plan addresses waste and litter under its goal of a clean environment. The City's Waste Reduction policy is to maintain and expand opportunities to reduce waste and properly dispose of waste to meet the City's zero-waste goals. The City has established action steps to meet the City's zero-waste goals that include:

- Educate residents, businesses, and institutions on the benefits of reducing waste, recycling, and composting.
- Discourage and put a stop to illegal dumping.
- Leverage partnerships with Hennepin County and other organizations to combine resources, expand existing programs and develop new programs.

- Support priorities defined in the MPCA Solid Waste Management Policy Plan and Hennepin County Solid Waste Management Master Plan.
- Encourage retailers and manufacturers to reduce and eliminate packaging.
- Explore additional ways to disincentivize or prohibit disposable packaging, containers, and single-use carryout bags.

The MPRB's Ecological System Plan addresses how environmental impacts from the city can be addressed throughout the park system in order to better protect water, air, land, and life in the parks. There are several recommendations that address waste and litter. These include:

- Develop a Clean Sweep Plan, which explores additional street and path sweeping technology, timing, and schedule, chloride management strategies, and potential of new equipment.
- Continue to work with community partners and agencies, including but not limited to watershed districts, the City of Minneapolis, the MPCA, and neighboring cities to better address and manage the collective impacts of polluted stormwater runoff.
- Complete a trash impact study that identifies estimated volumes, sources, and solution to meet specific targets and timeframes.
- Further promote the City's adopt-a-catch-basin program.
- Install additional maintenance control devices, such as SAFL Baffle and SAFL Snout, at key stormwater outfalls in coordination with partners.
- Expand public education regarding proper waste reduction and impacts on water bodies.

The MPRB has established a Master Plan that governs Nokomis-Hiawatha Regional Park. Natural resources goals to improve the natural setting and quality of the park are part of this Master Plan and one of the goals is to explore solutions to reduce trash in Lake Hiawatha via Minnehaha Creek.

Studies

Litter Scans and Benchmarking

The City of Minneapolis Public Works – Solid Waste & Recycling Division (SW&R) is working to measure the amount of litter throughout the City in a consistent and consumable way. They have developed a benchmarking scan that will be used to establish baseline data. Each annual litter scan will be used to measure changes in the amount of litter and identify focus areas for Clean City programming. The litter scan measures the visual presence of litter in predefined segments within each neighborhood community on a scale of 1 to 4.

The benchmark scan was held in 2017. Annual litter scans were held in 2018 and 2019. The 2020 and 2021 annual scans were cancelled due to the pandemic. Additional information on this program can be found in Appendix B.

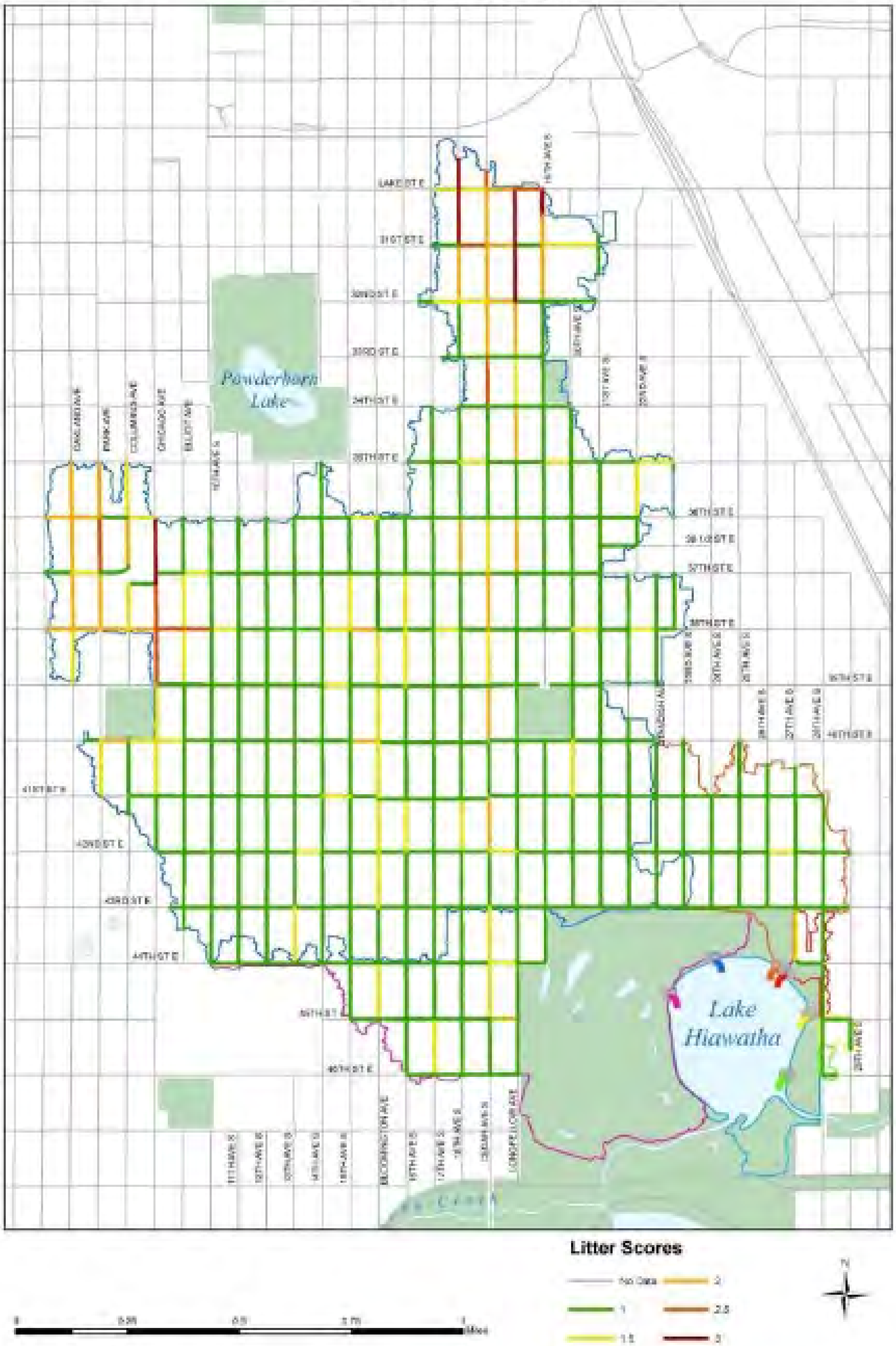
Urban Scholar - 2019 and 2020 Lake Hiawatha Trash Survey

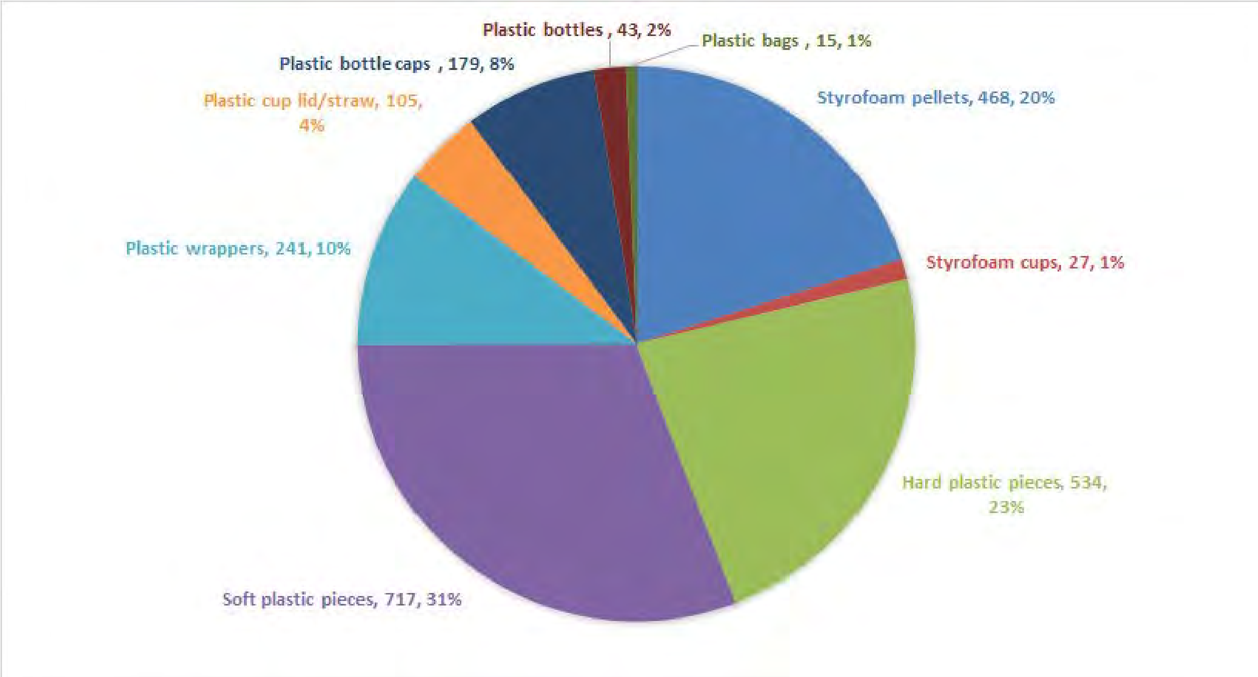
In 2019 the Public Works – Surface Water & Sewer Division (SWS) sponsored an Urban Scholar to implement a study on the trash in Lake Hiawatha. This exploratory study was an effort to quantify the amount of trash into Lake Hiawatha and identify potential sources. The study was specifically focused on developing a methodology to identify the amount, types of trash, and potential sources to Lake Hiawatha. The full study can be found in Appendix C.

The overall objective of the Study was to provide the City with information on the types and sources of trash to Lake Hiawatha and to use the information gathered from the study to provide recommendations on how to manage trash within the lake and to prevent trash and litter from entering the storm sewer system.

In order to analyze Lake Hiawatha's watershed contribution of trash into the lake, a detailed litter scan was done across the entire watershed. The litter scan was adapted from City of Minneapolis Solid Waste & Recycling Division, which does an annual litter survey using the "Keep America Beautiful" national program. Detailed information on the methodology used and scoring metrics can be found in Appendix C.

Lake Hiawatha Litter Scores





Breakdown of Plastic Trash Items – Lake Hiawatha shoreline, for all Sites and Dates

Based on results of the 2019 litter scan, there appears to be a correlation between higher population density and higher amounts of litter observed and this is not surprising as more heavily populated areas will likely produce more litter. When compared with bus routes and stops, there are more bus stops where there are higher amounts of litter. This could be due to people not being able to throw their trash in a trash can and throwing it on the street instead.

Recommendations, as a result of the 2019 Hiawatha Trash Study, included the following:

- Create awareness and outreach content for the public on plastic pollution
- Make a distinction on size requirement for plastics category during future work because there are a lot of small plastic particles in the lake
- Have random 100 ft transects all over the lake that will cover the whole circumference of the lake
- Collect data during dry and wet weather conditions
- Use a boat for more accessibility and visibility when conducting the trash surveys
- Educate businesses on plastic pollution and how to reduce it on their businesses.

Due to COVID-19 restrictions, the Hiawatha Trash study was reduced in 2020 from the 2019 recommendations. The most significant addition to the program was that staff conducted a plastics assessment where 1 meter by 1 meter trash sites were chosen for the plastics assessment to help understand the role of microplastics in the trash problem.

The results show that there are mainly hard plastic pieces, followed by soft plastic pieces at Lake Hiawatha Beach. There were a few items that were in the meso size category (5-25 mm), but most of the plastic pieces were in the micro category. In total, there were 26 pieces in the micro category and all the microplastics that were found are secondary microplastics. This means that all the plastic pieces at Lake Hiawatha have been broken down from larger plastic products.

Pilot Projects

Floating Trash Collection Curtain

In 2016 SWS staff initiated a pilot project to look at the effectiveness of an end-of-pipe BMP for trash collection and removal. Details on this pilot proposal can be found in Appendix D.

Staff deployed a floating curtain in Lake Hiawatha just downstream of the stormwater outfall on the north side of the lake on MPRB property. It was a pilot project partnership between the City and MPRB designed to inform future decisions about structural changes to the area storm system and to raise awareness about trash. The City installed two signs in the vicinity of the floating structure. The signs had the City's stormwater website on them in case people wanted more information.

The floating trash curtain was installed on August 8th and removed on September 10th. In that time period the curtain had to be reinstalled twice due to heavy rains dislodging the curtain anchors. There were only three bags of trash collected by this pilot during the month-long installation.

City crews spent approximately 19 hours installing and maintaining the curtain. The pilot yielded some measurable debris captured within the curtain but the crew in that area had to balance the removal of trash with other competing priorities like repairing sanitary cave-ins and unplugging catch basins. The general foreman provided information on debris that is removed from catch basins and manholes and estimated that City crews could remove between three to four tons of trash in 19 hours, far more than what was removed by the floating trash curtain installed in the lake. It was determined that with limited crews and hours in the day the most efficient use of City resources related to trash and water quality must be a top priority.

Proprietary System Analysis

It was suggested that a proprietary system such as FreshCreek Technologies be evaluated as an option for Lake Hiawatha trash removal. City staff researched the installation of a pipe netting TrashTrap system that FreshCreek Technologies recommends for retrofit projects.

The watershed entering Lake Hiawatha through the north outfall is approximately 1,100 acres. The conduit at this location is a 5 foot by 5.75-foot box culvert. According to the most up-to-date modeling of this area, the 100-year peak flow rate is 348 cfs through the pipe with a corresponding peak velocity of 12 feet per second. The city's flood modeling anticipates that the peak flow rates would be similar for some lesser rainfall events and that this is a reasonable number to use for design purposes.

The TrashTrap systems are designed to handle flow velocities up to 5 feet per second while the peak velocity at this inlet is 12 feet per second. According to the manufacturer, a rule of thumb ratio for estimating floatable trash content in wet weather flows is two cubic feet of floatables per million gallons of stormwater and one cubic foot of trash typically weights 25 to 30 lbs. Based on the peak flows for this inlet there could be up to 40 cubic feet of trash in one day during peak flows. Standard nets contain approximately 25 cubic feet of captured floatables and trash. Based on these assumptions, staff could be required to replace this net up to twice a day at peak flows. In addition, as this outfall is located in the golf course and there is no access road currently available, the construction of an access road would be required to perform ongoing maintenance.

It was determined that a simple retrofit of a TrashTrap system isn't possible in this location. In order to make this technology work, at a minimum the city would need to 1) install energy dissipaters in the conduit above the location of the TrashTrap to slow the in-pipe velocity to a maximum of 5 feet per second, 2) evaluate a more extensive multiple-net system to reduce the required maintenance to at least monthly, and 3) install an access road to this inlet. In addition, the city would need to make sure that a vehicle or crane with adequate lifting capabilities is accessible to the site to safely perform necessary maintenance.

Trash Screens

In February 2018 SWS staff retrofitted three manholes upstream of Lake Hiawatha with trash screens as part of ongoing pilot efforts to improve the water quality in the lake. The trash screens were fabricated by City staff and designed to capture floatable trash and debris that could wash through the city's storm sewer system. City crews were able to access and maintain the manholes by vactoring out all of the debris and trash before it enters Lake Hiawatha. Crews tracked debris removed to assess the success of the pilot project and inform future water quality improvement efforts. Additional information on this pilot project can be found in Appendix E.

Education and Engagement

Clean City Programs

The City of Minneapolis Solid Waste & Recycling Division (SW&R) of Public Works has offered Clean City Opportunities for approximately 25 years. The intent of these programs is clean up, reduce, or prevent litter. These programs successfully balance volunteer efforts with City support and have new participation each year. These programs include:

- Earth Day Cleanup partnership with MPRB
- Adopt-An-Ash Receptacle
- Adopt-A-Litter container or Recycling Container
- Adopt-A-Block
- Adopt-A-Street or Highway

For more information on these programs see Appendix F.

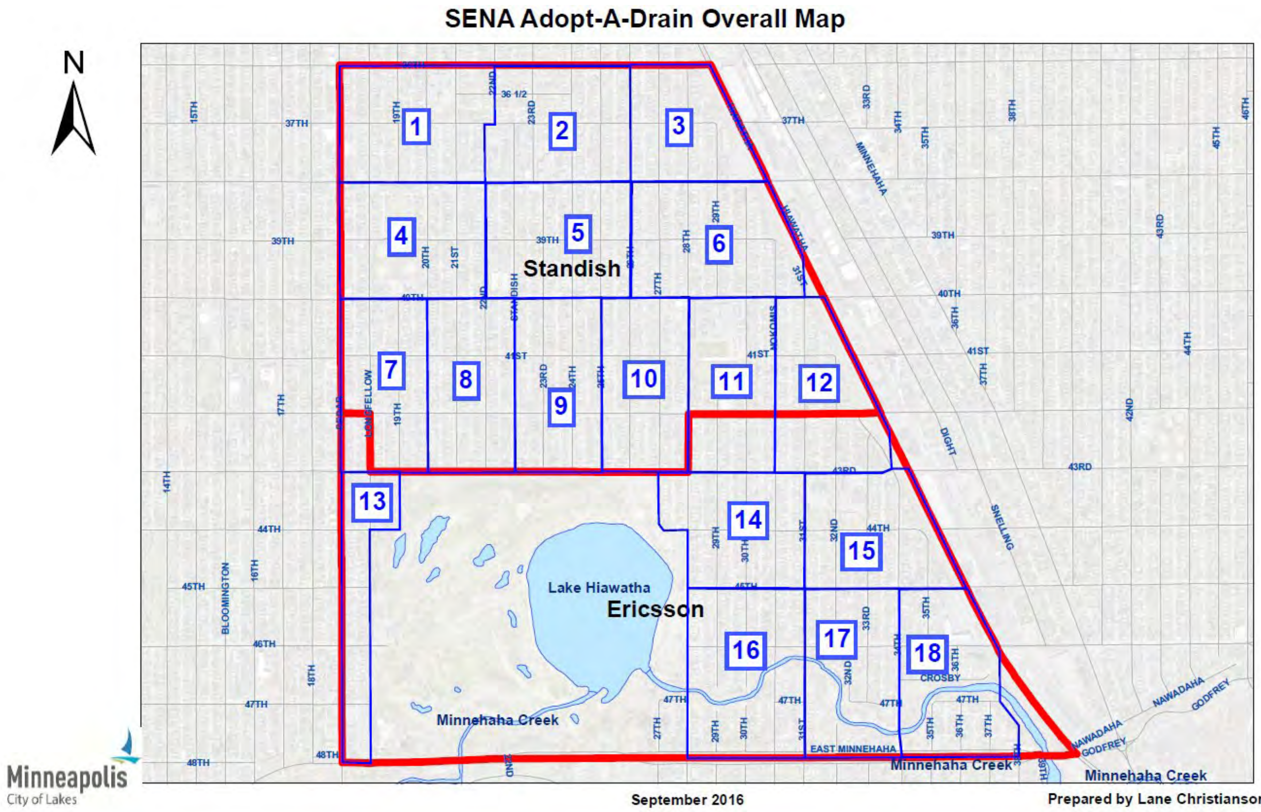
Litter Solutions Process

In 2017, the SW&R began a process of identifying new ways to reduce litter throughout the City. This process was informally named Litter Solutions. Information on this program can be found in Appendix F and in a City Council Presentation.

Adopt a Drain: Pilot Project with the Standish-Ericsson Neighborhood:

In 2016 the Standish-Ericsson Neighborhood Association (SENA) approached the City and the Minnehaha Creek Watershed District (MCWD) about possible water quality projects that could be implemented in that neighborhood. SENA had a grant from Hennepin County and was looking for ideas on where to make the most environmental impact with that funding.

SENA, MCWD, and the City decided to implement an Adopt-a-Drain pilot program in the SENA area to try to remove trash and other debris from catch basins and entering Lake Hiawatha.



In the pilot year every single home within the Lake Hiawatha watershed area (~4,500 homes) within SENA were doorhangered by student workers from Hamline University and volunteers. In addition, Master Water Stewards were engaged to go door-to-door in the with a goal of talking to about 1,000 people at homes on randomly assigned blocks. Master Water Stewards had iPads with them so people could sign up for the Adopt-a-Drain program on the spot. The Master Water Stewards gathered data on the added efficacy of going door-to-door as compared to just doorhangering homes.

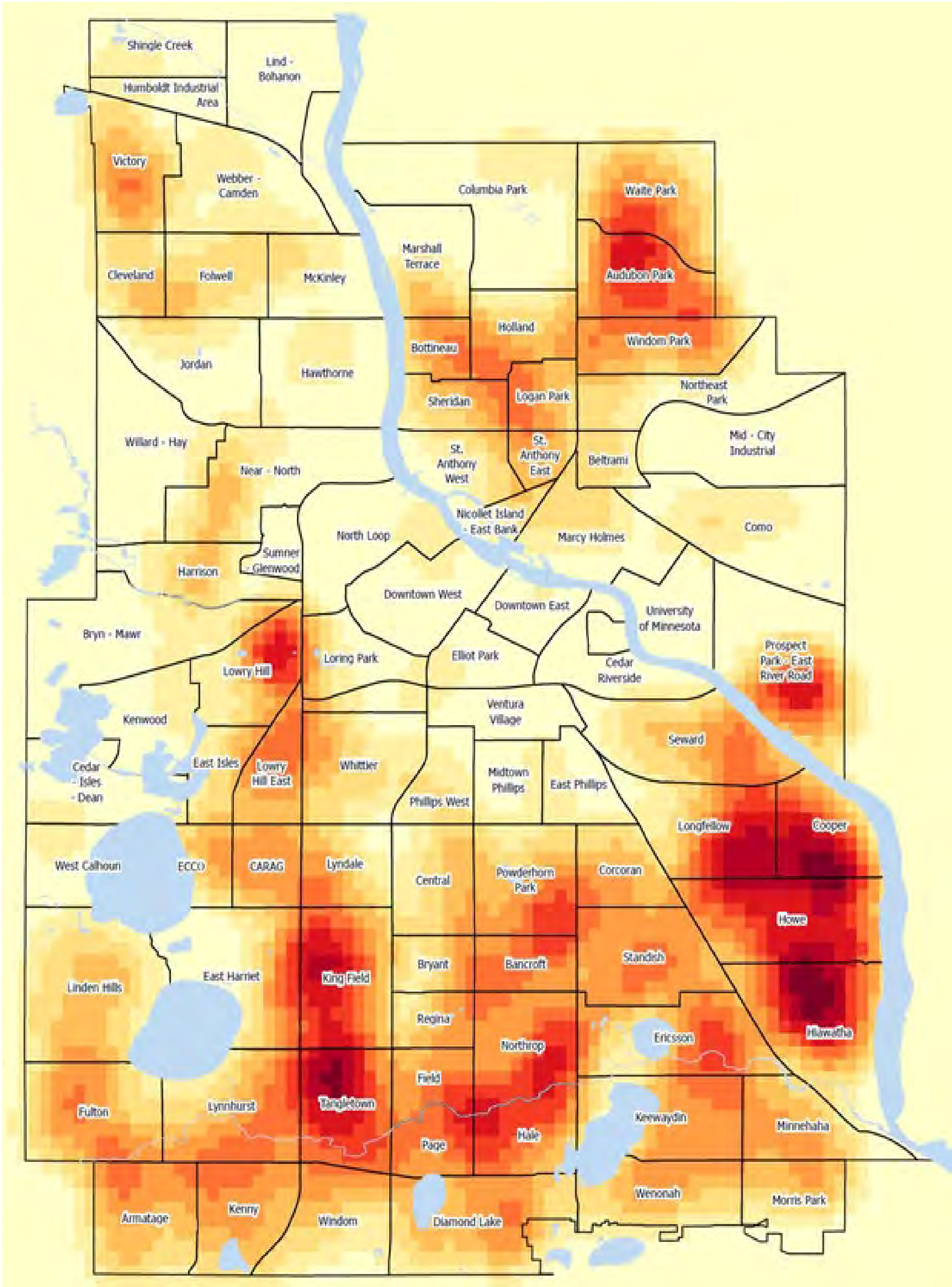
In the first year, 153 people signed up to adopt storm drains in Minneapolis. Over 300 storm drains were adopted and over 2,380 pounds of trash and debris was reported to be removed from storm drains in the first year. The pilot program that was concentrated in the Standish-Ericsson Neighborhoods included 70 people signing up, adopting 120 storm drains.

In 2017 the Adopt-a-Drain program continued with doorhangering all of the homes within the Lake Hiawatha watershed. This included an additional 5,800 homes within the Bancroft, Bryant, Central, Corcoran, East Phillips, Northrop, and Powderhorn neighborhoods.

Adopt-a-Drain Program – Ongoing Work

Since 2016, the Minneapolis Adopt-a-Drain program has empowered Minneapolis residents to take responsibility for storm drains and gutters in their neighborhoods by adopting and keeping them clean. In March 2019, the arrival of a metro-wide website (www.adopt-a-drain.org) was launched to serve all cities in the Twin Cities 7 county area.

Despite the COVID-19 pandemic, the Minneapolis Program posted significant numbers in 2020. Minneapolis led all cities in the Twin Cities with 2,194 total program participants and 4,851 total storm drains adopted. 962 participants in Minneapolis reported cleanings in 2020 and collected 54,712 pounds of trash and debris with an estimated 65 pounds of Total Phosphorus removed from the waters of Minneapolis. The Lake Hiawatha watershed has a total of 134 program participants who adopted 312 storm drains. In 2020, 46 Adopt-a-Drain participants in the watershed reported cleanings, spending 66 hours to collect 2,667 lbs. of trash and debris.



Density of adopted storm drains in Minneapolis

Storm Drain Stenciling Program

Storm drain stenciling not only educates volunteers who paint environmentally friendly messages like “FLOWS TO RIVER/LAKE/CREEK – KEEP DRAIN CLEAN” on the storm drains, but also engages residents and people passing by. It is a great team-building exercise that helps people learn actions they can do to improve the quality of the lakes, creeks, and the Mississippi River in Minneapolis. The program provides stencils in English, as well as Spanish and Somali languages for certain neighborhoods.

The Stenciling Program supplied brochures to all 47 Minneapolis Park & Recreation Centers, all Minneapolis Park & Recreation lake kiosks, Hennepin County libraries, neighborhood organizational offices, environmental fairs, and National Night Out events:

Minneapolis Storm Drain Stenciling 2012 - 2021

Lake Hiawatha Watershed

Minneapolis
City of Lakes

August 2021

MPRB Education and Engagement

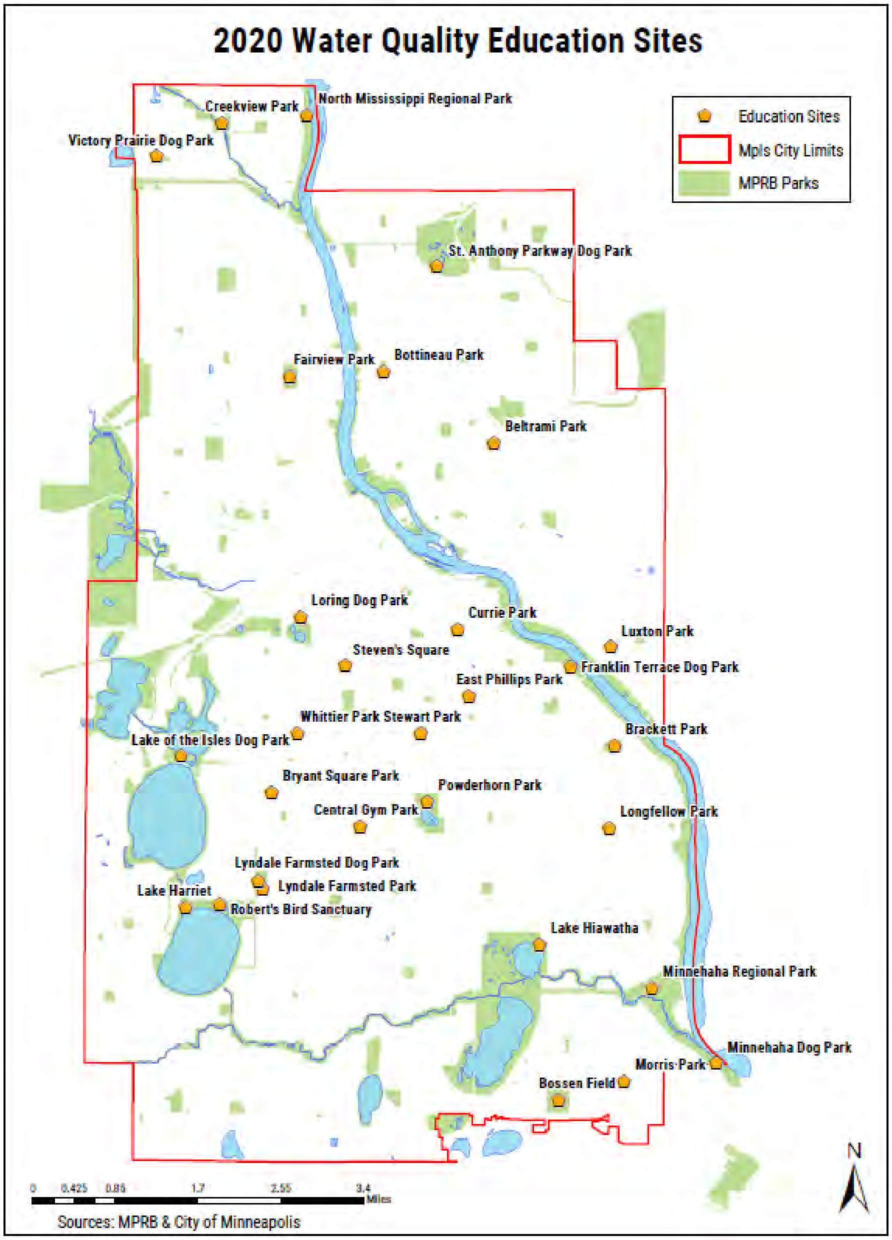
The Earth Day Watershed Clean-up was initiated in 1995 to draw attention to the water quality improvement needs of Minneapolis' lakes, and the effects that individual actions have on urban water quality. The goals of the Earth Day Clean-Up event are to prevent trash and debris from entering Minneapolis water bodies, and to provide a volunteer experience and environmental education to Minneapolis residents and park users. This annual event occurs in Minneapolis parks and neighborhood areas that are part of the watersheds of Minneapolis water bodies, including the Chain of Lakes, Lake Nokomis, Lake Hiawatha, Powderhorn Lake, Diamond Lake, Shingle Creek, Minnehaha Creek, Bassett Creek, and the Mississippi River.

The 2019 Earth Day event had 1,897 volunteers that collected an impressive 7,760 pounds of trash, and 1,200 pounds of metal. Hands-on learning activities were also provided throughout the day and focused on water quality, recycling, composting, and organic gardening and lawn care. 2020's Earth Day Clean events were canceled due to Covid restrictions, but residents were encouraged to clean up litter and debris in their neighborhoods.

Earth Day Events: MPRB-wide

Year	Number of Sites	Number of Volunteers	Volunteer Hours	Trash (lbs)	Recyclables (lbs)	Metals (lbs)	Total (lbs)
2011	40	1,500					15,000
2012	40	1,500					>10,000
2013*	NA	NA	NA	NA	NA	NA	NA
2014		>1,700		6,700	1,100	250	8,050
2015	38	1,850	4,625	8,480	620	1,460	10,560
2016	36	1,437	3,592.5				10,380
2017	38	1,809	4,522.5				7,700
2018	34	501	1,252.5				4,720
2019	43	1,897	4,742.5	7,760		1,200	8,960
2020*	NA	>600	1,500	NA	NA	NA	NA

***Limited information: 2013 Earth Day Clean-up was cancelled due to snow. 2020 had limited information due to a "Do-it-yourself" Clean-up to prevent the spread of COVID-19.**



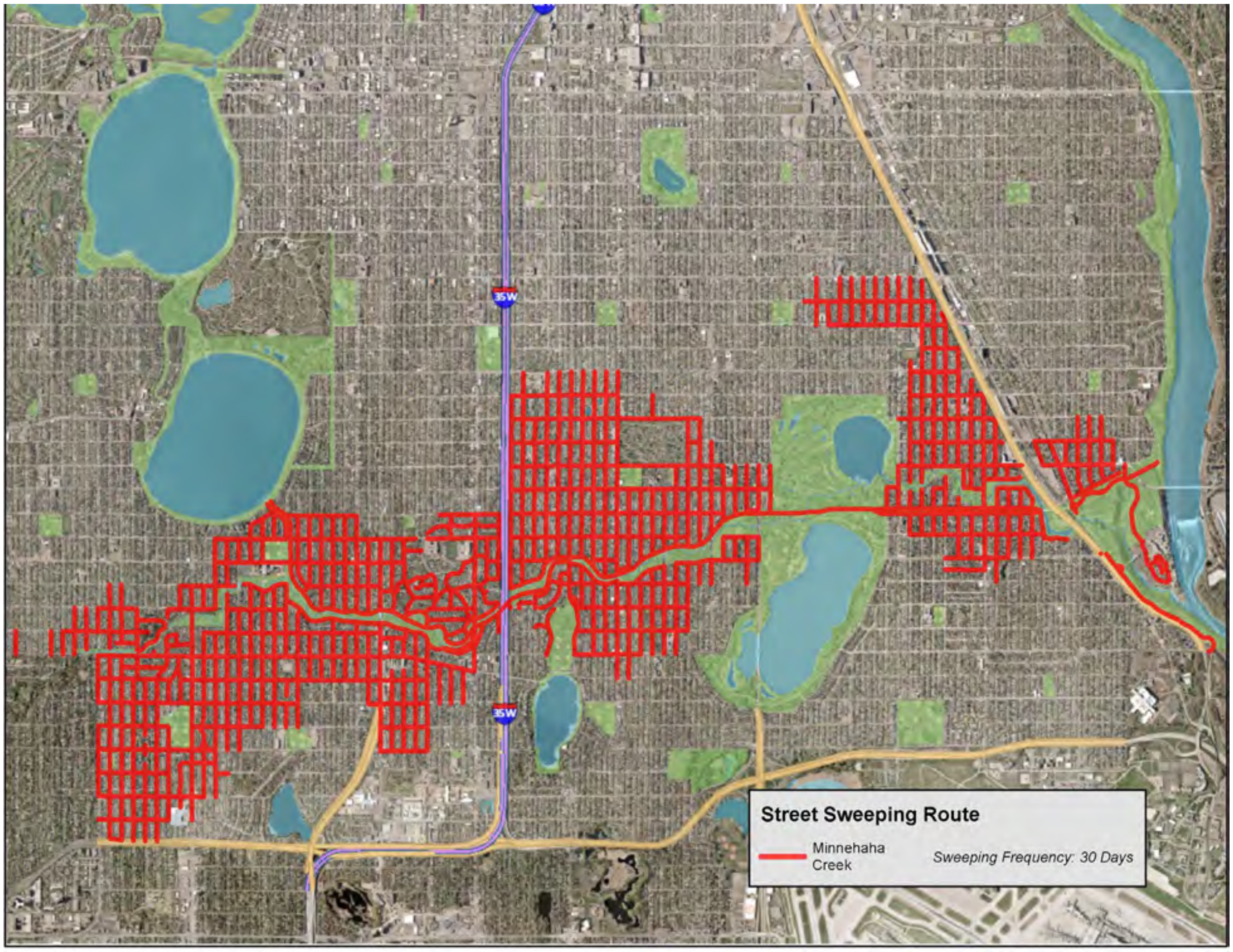
Additional information on the City and MPRB educational efforts and programs can be found in the [Annual NPDES MS4 Report] on the City's website.

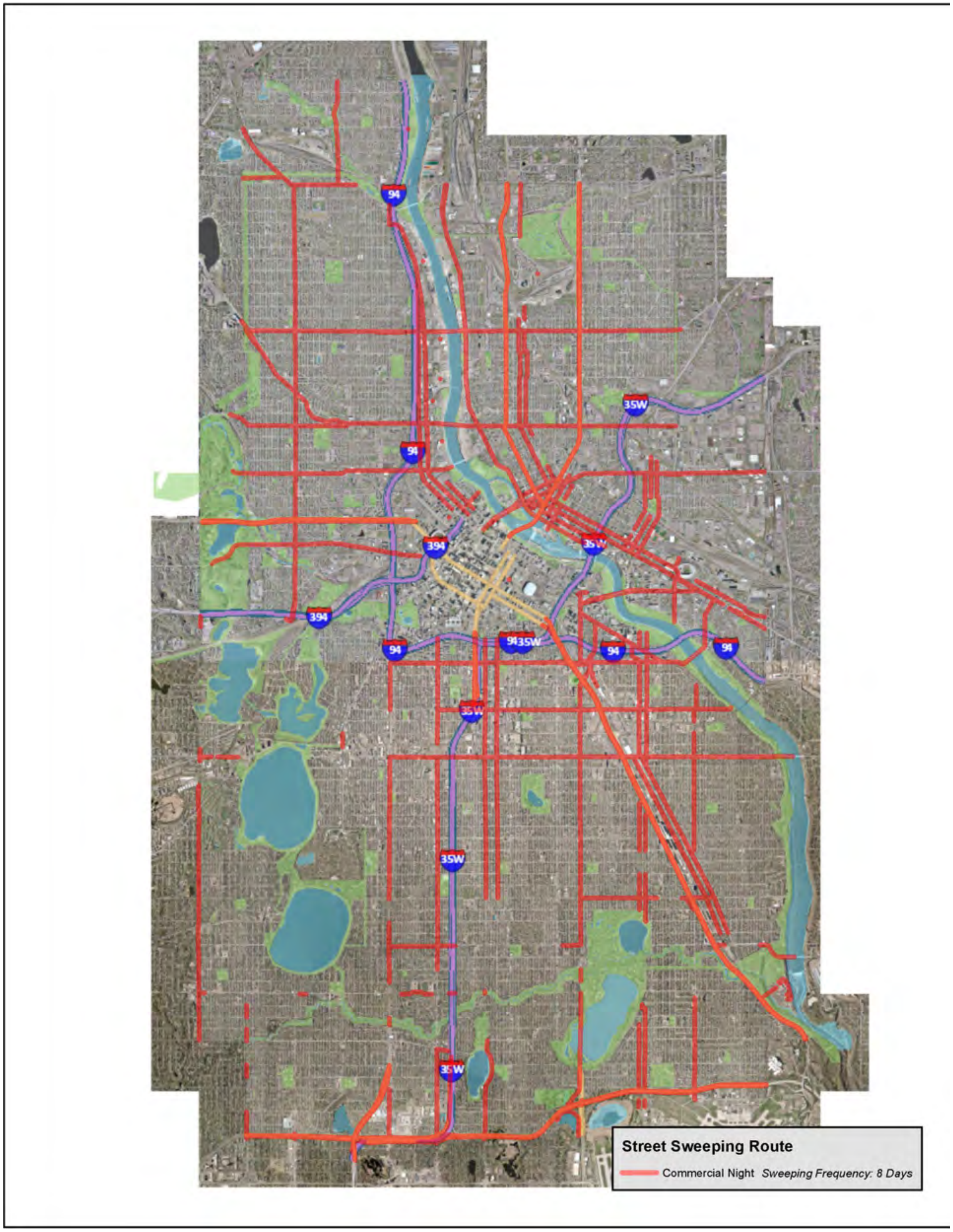
Good Housekeeping

Street Sweeping

The City of Minneapolis employs several street sweeping approaches. Some are citywide, and some vary by area or land use. Curb-to-curb sweeping operations occur citywide twice a year in the spring and fall. At those ties, all city streets are swept systematically (alleys are also included in the spring), and temporary parking bans are enforced to aid with sweeping operations and to ensure that curb-to-curb sweeping is accomplished. Operational routines and special methods are employed to address seasonal conditions, and to optimize cleaning.

During the summer, between the spring and fall sweep events, sweepers are assigned to maintenance districts for periodic area sweeping. Main commercial routes are swept on an eight-day frequency. In the Lake Hiawatha watershed these include Lake Street, East 42nd Street, Cedar Avenue, and South 28th Avenue. In addition, the streets within the Minnehaha Creek watershed are swept on a 30-day frequency.




94
94
35W
394
394
94
9435W
94
94
35W
35W
35W
Street Sweeping Route
Commercial Night Sweeping Frequency: 8 Days

Trash Removal Programs

Minneapolis

Litter containers are placed throughout the City to manage litter at transition points as directed by City Council action. The council action requires a litter container at each intersection within the Downtown Core, at each bus shelter throughout the City, and at each intersection within Commercial Corridors.

Because businesses, individual residents, block clubs, or other organizations may have individual concerns about litter in their neighborhoods the City offers an Adopt-a-Litter container program where the organization can adopt a container for a period of two years. An adopted litter container is an effective means of preventing much of the litter from being tossed to the ground in the first place.

A map of all litter, ash, and recycling containers in the City can be found in Appendix G.

MPRB

MPRB has a trash collection program in the parks. In the Lake Hiawatha watershed there are both Regional and Neighborhood parks. Trash collection differs in these two types of parks.

Regional Park Trash Removal:

In the Regional park areas, MPRB uses Toter trash cans that are serviced by MPRB staff using a Load and Pack vehicle year-round. There is daily service by this vehicle. The vehicle alternates days picking up trash or recycling. While the fishing dock is out at Lake Hiawatha, MPRB places a barrel receptacle next to the dock that is emptied separately from the Toter cans. Beyond receptacles, park keepers go through the area and pick litter daily. Maps on regional trash routes, and litter and recycling containers maintained by the MPRB in the Lake Hiawatha and Minnehaha Creek watersheds can be found in Appendix G

Neighborhood Park Trash Removal:

The neighborhood portion of Lake Hiawatha park, like all neighborhood parks, use the rolling garbage and recycling cans that are serviced by the City of Minneapolis and are distributed throughout the parks. Park Keepers are expected to pick litter in the park daily and to move the cans to the designated pickup points weekly for servicing via the City of Minneapolis trash program.

Volunteer Park Trash Removal Program

The Environmental Management Volunteer coordinator facilitates groups who want to pick up trash in the parks. Supplies are provided, and MPRB staff remove bagged trash that is collected by volunteers. The number and scale of these events varies by year depending on the interest of the groups.

Volunteers that have stewardship agreements that include trash removal are listed below along with the location of where work is done.

Volunteers	Location
Bob Sorg	Sheridan Memorial
Bracket Children's Forest	
CIDNA	South Beach
Father Hennepin Bluff	Father Hennepin Bluff Park
Friends of Diamond Lake	Diamond Lake Park
Friends of Lake Hiawatha	Lake Hiawatha Park
Friends of the Mississippi River	Multiple sites

Jim Nicholas	Lake Harriet
Life Source	Ole to Broadway
Mississippi Park Connections	Multiple sites
North Loop Neighborhood	James Rice Park
West Bank Parks	Bluff Street Area

The following table shows the number of volunteers and volunteer hours dedicated to trash removal between 2015 and 2020.

Year	Number of Volunteers	Volunteer Hours
2015	324	464
2016	406	1,240
2017	340	674
2018	97	343
2019	410	770
2020	62	737

MPRB also hosts an annual Earth Day event that is centered on trash pickup across all parks. There are typically 30-40 park host sites for Earth Day, and it is not uncommon for volunteers to remove over 10,000 lbs of trash during the event.

Friends of Lake Hiawatha – citizen led trash removal

Sean Connaughty and Friends of Lake Hiawatha (FoLH) organize and perform extensive lake clean-ups at Lake Hiawatha and completed trash surveys in 2015 and 2018. During the surveys, the amount of trash removed from the park is not only weighed, but individual pieces of trash are also separated into categories, counted, and even sorted by brand names.

In 2015, 103 bags of trash were removed from Lake Hiawatha by FoLH, the total weighing over 2,000 pounds (https://docs.google.com/document/d/1PLvBQlo8o_3KkFwq9GMIGEUEITk1abUcknECwQiIZ84/edit).

In 2018, a crew of 40 volunteers removed 226 pounds of trash in three hours with FoLH (http://www.vortexnavigationcompany.com/trashsurvey.html).

Monitoring

LAURI Index

In 2004, the MPRB worked with Barr Engineering Company with funding from Minneapolis Public Works to develop a rating index for lakes. The index was designed to give recreational users a source of information about conditions affecting their use of city lakes.

The LAURI has five indices:

- Public Health (E. coli measured at public swimming beaches)
- Water Quality (water clarity/Secchi depth)
- Habitat Quality (aquatic plant and fish diversity)
- Recreational Access (availability and ease of public access)

- Aesthetic Considerations (color of the water, odor of the water, and garbage/debris)

Data for the LAURI analysis is collected during each lake monitoring session and once a month during beach monitoring trips (13-18 times per year). Presence of trash is noted as part of the aesthetic consideration portion of the LAURI when trash levels are either at more than 3 pieces of fixed or more than three 3 pieces of floating trash at the site of evaluation.

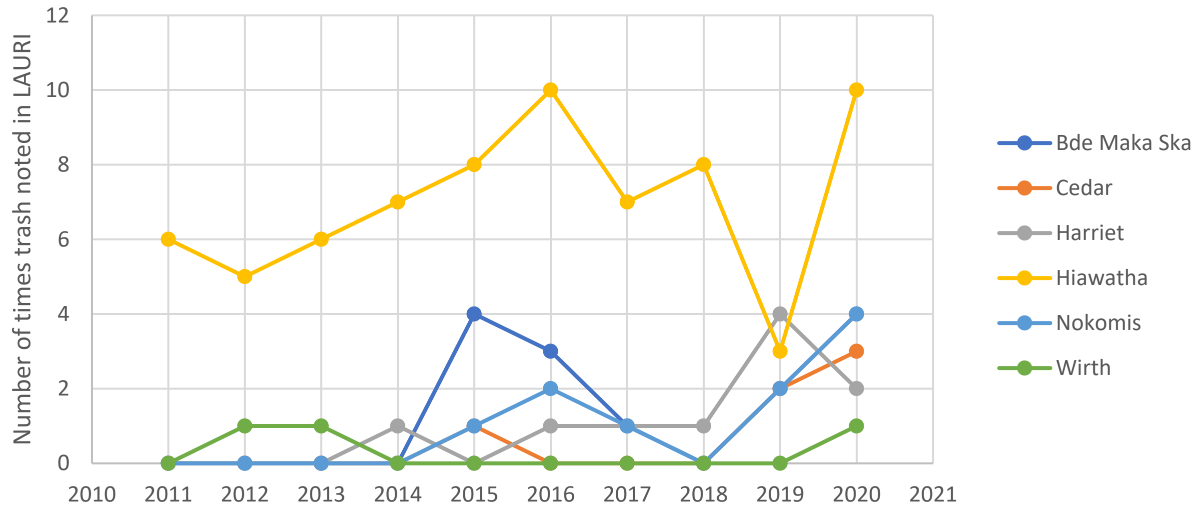
Scoring for the aesthetic portion of LAURI pertaining to trash:

Debris	Score
None	10
Natural	9
Foam	8
Piles of milfoil (>3)	7
Fixed trash (>3)	4
Floating trash (>3)	3
Dead fish (>5)	2
Green scum	2
Oil film	1
Sewage solids	0

For the purposes of this document, MPRB graphed the number of times staff recorded a 3 (Trash floating >3) or 4 (Trash fixed >3), combining the beach and lake data for each lake for each year.

The graph shown below includes the lakes with swimming beaches since trash has the potential to be a recreational as well as aesthetic nuisance for the public.

Number of times trash was noted during the LAURI survey over the past 10-years at lakes with beaches.



In all but one year, trash was noted at Lake Hiawatha more often than the other lakes with beaches. In 2019, the score for Hiawatha was low, which would seem to indicate less trash was present, however, the lower score is likely a limitation of the scoring system since trash must be seen to be counted. 2019 was the wettest year on record and had very high lake levels. Since the shoreline of Hiawatha was submerged, fixed trash was underwater and therefore fewer instances were logged. It is assumed that the trash was still present, but it was not visible to be scored.

Next Steps

The City and the MPRB will continue to implement existing litter programs including public education, litter scans, street sweeping, and Clean Cities programming. Field monitoring utilizing the LAURI index will continue in all lakes under the MPRB purview. As budget and program availability allows, the City of Minneapolis will continue the litter monitoring and shoreline assessment at Lake Hiawatha through the Urban Scholar program.

Prior to the 2022 NPDES MS4 Annual Report submittal to the MPCA the City and the MPRB will assess the Stormwater Management Program and determine if changes need to be made to address litter.

Appendix A – City of Minneapolis and Minneapolis Park & Recreation Board Litter and Waste Control Ordinances

Appendix A

City of Minneapolis and Minneapolis Park & Recreation Board Litter Ordinances

Title 11 Health and sanitation, Chapter 225 Garbage and refuse. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT11HESA_CH225GARE

Title 12 Housing, Chapter 244.370 Rubbish chutes and bins. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT12HO_CH244MACO_ARTIVEQFA_244.370RUCHBI

Title 12 Housing, Chapter 244.700 Disposal of solid waste. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT12HO_CH244MACO_ARTVIIMAOC_244.700DISOWA

Title 13 Licenses and Business Regulations, Chapter 295.70 Prevention of litter, noise; compliance with consumer protection. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT13LIBURE_CH295MOFOST_295.70PRLINOCOCOPR

Title 13 Licenses and Business Regulations, Chapter 317.100 Refuse. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT13LIBURE_CH317MOVEREGA_317.100RE

Title 13 Licenses and Business Regulations, Chapter 287.80 Prohibited on streets, sidewalks, public grounds, refuse, trash or debris. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT13LIBURE_CH287FIST_287.80PRSTSIPUGRRETRDE

Title 13 Licenses and Business Regulations, Chapter 319.260 Maintenance standards. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT13LIBURE_CH319OPAIMOVEPALO_319.260MAST

Title 14 Liquor and Beer, Chapter 360.95 Litter and refuse control. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT14LIBE_CH360INGE_360.95LIRECO

Title 17 Streets and Sidewalks, Chapter 427.30 Obstructions, encroachments and littering generally. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=MICOOR_TIT17STSI_CH427INGE_ARTIGE_427.30OBENLIGE

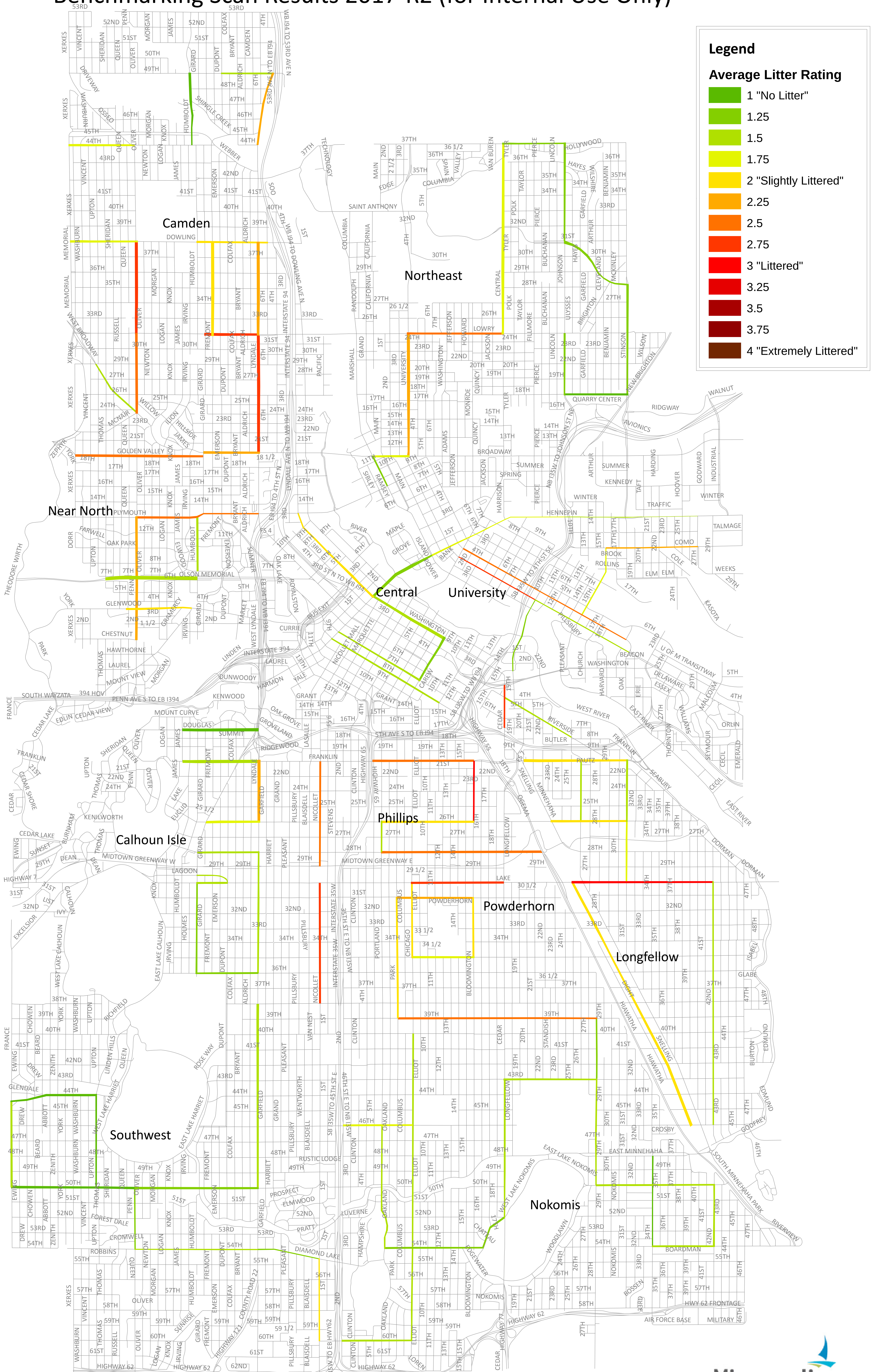
Title 20 Zoning Code Chapter 535.670 Direct discharge of waste. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=MICOOR_TIT20ZOCO_CH535REGEAP_ARTIXGEPEST_535.670DIDIWA

Title 20 Zoning Code Chapter 535.680 Water Pollution. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=MICOOR_TIT20ZOCO_CH535REGEAP_ARTIXGEPEST_535.680WAPO

Park and Recreation Board Code of Ordinances: Chapter 2, PB2-5 Littering. https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=PAREBOCOOR_CH2GEREGOCO_.2-5LI

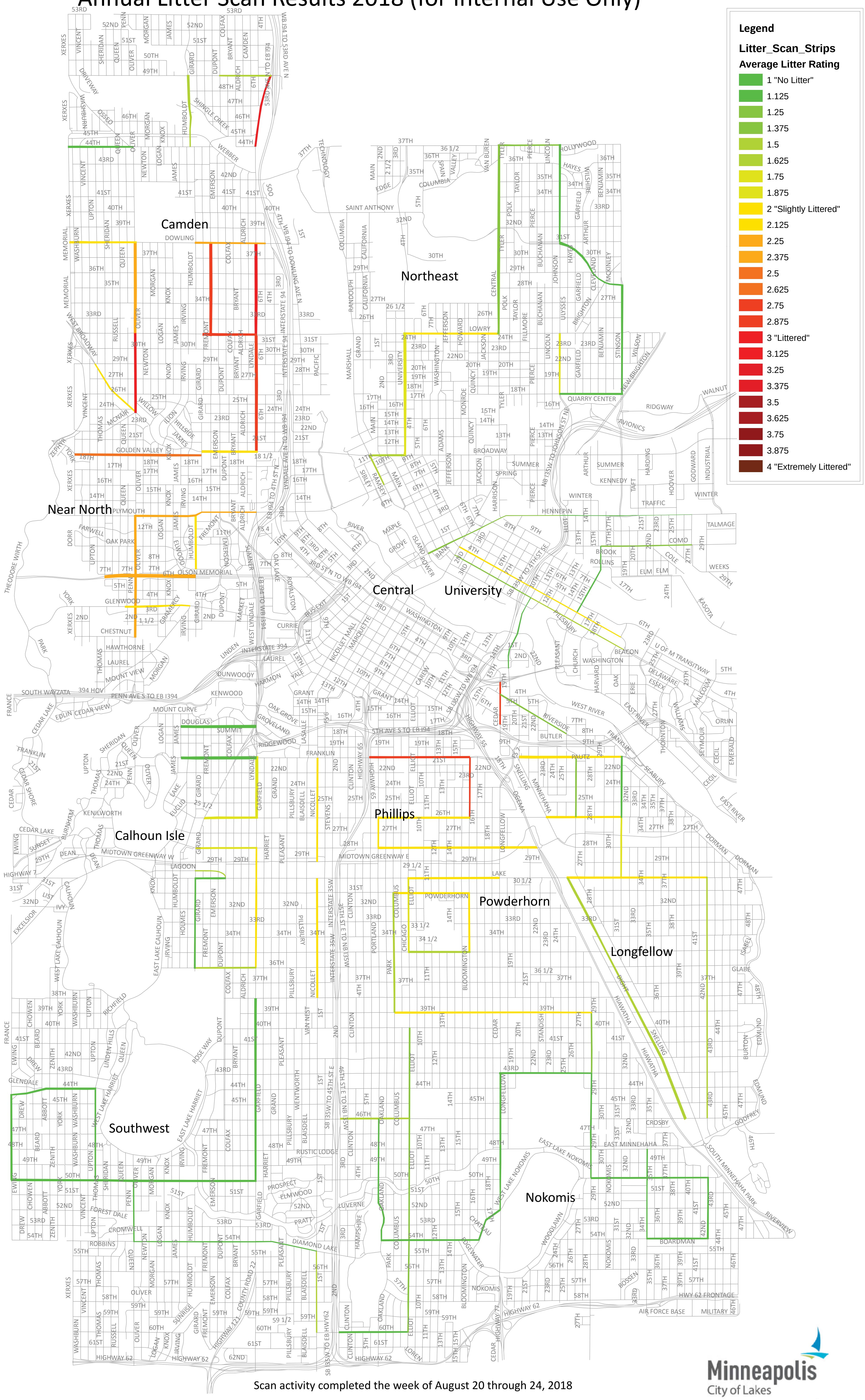
Appendix B – 2017 to 2019 Litter Scan and Benchmarking Maps

Benchmarking Scan Results 2017-R2 (for Internal Use Only)



Scan activity completed the week of June 5 through 9, 2017

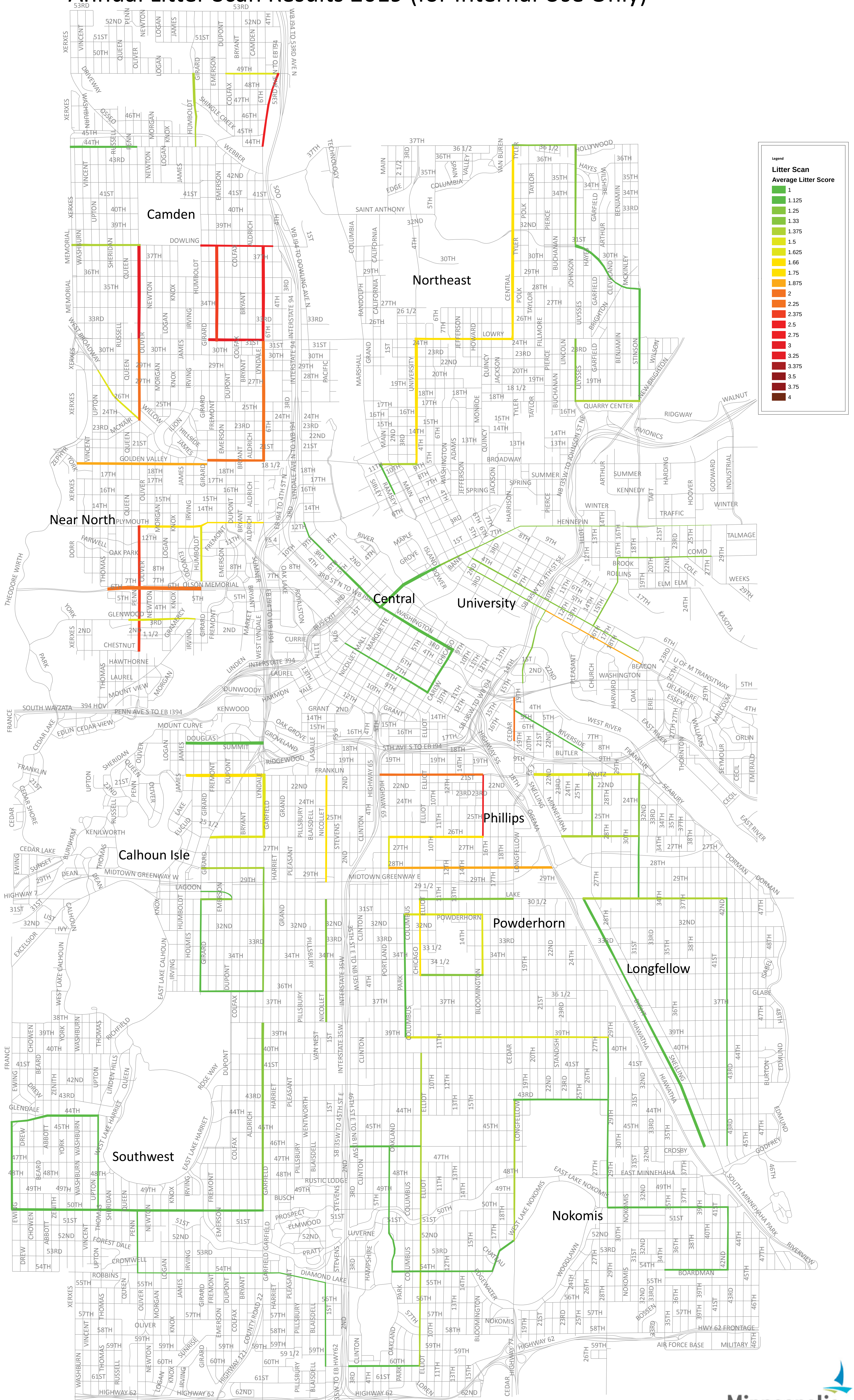
Annual Litter Scan Results 2018 (for Internal Use Only)



Minneapolis City of Lakes

Scan activity completed the week of August 20 through 24, 2018

Annual Litter Scan Results 2019 (for Internal Use Only)



Scan activity completed the week of August 19 through 23, 2019

Minneapolis
City of Lakes

Appendix C – City of Minneapolis Urban Scholar: Lake Hiawatha Trash Study Report

Lake Hiawatha Trash Study Report

Prepared for:

City of Minneapolis, Surface Water and Sewer

Prepared by:

Laura Garcia Pimentel

Date Submitted:

August 13, 2019

Supervisor:

Nico Cantarero

TABLE OF CONTENTS

LIST OF TABLES

PAGE NO.

LIST OF FIGURES

1.0 INTRODUCTION

Lake Hiawatha is a lake located in South Minneapolis, MN, USA. It is the only lake in Minneapolis that is directly connected to Minnehaha Creek. Minneapolis Park and Recreation Board purchased the lake in 1922 and the name changed from Rice Lake to Lake Hiawatha. The Minneapolis Park and Recreation Board transformed all of the previous wetland into a lake surrounded by a park (Friends of Lake Hiawatha). Lake Hiawatha receives inflow from the south (from Minnehaha Creek) and from other stormwater outfalls around the lake (Figure 1).

Currently, Lake Hiawatha and the park have a fishing dock, wading pool, tennis courts, and softball diamonds. The park is used for many recreational activities as there is a recreation center that hosts activities and there is also a municipal golf course that borders the lake. Many people use the bike and walking paths that start at Lake Hiawatha and veer into Lake Nokomis. Lake Hiawatha is a very important water body in Minneapolis because it is one of the few lakes through which Minnehaha Creek flows, and the last one before it reaches Minnehaha Falls and then the Mississippi River (Friends of Lake Hiawatha).

Friends of Lake Hiawatha is an extraordinary volunteer group that does lake clean ups annually. This volunteer group is the only cleaning effort that is done in the lake. In an effort to quantify the amount of trash into Lake Hiawatha and identify potential sources, the City has initiated this exploratory Study. The Study is specifically focused on developing a methodology to identify the amount, types of trash, and potential sources to Lake Hiawatha.

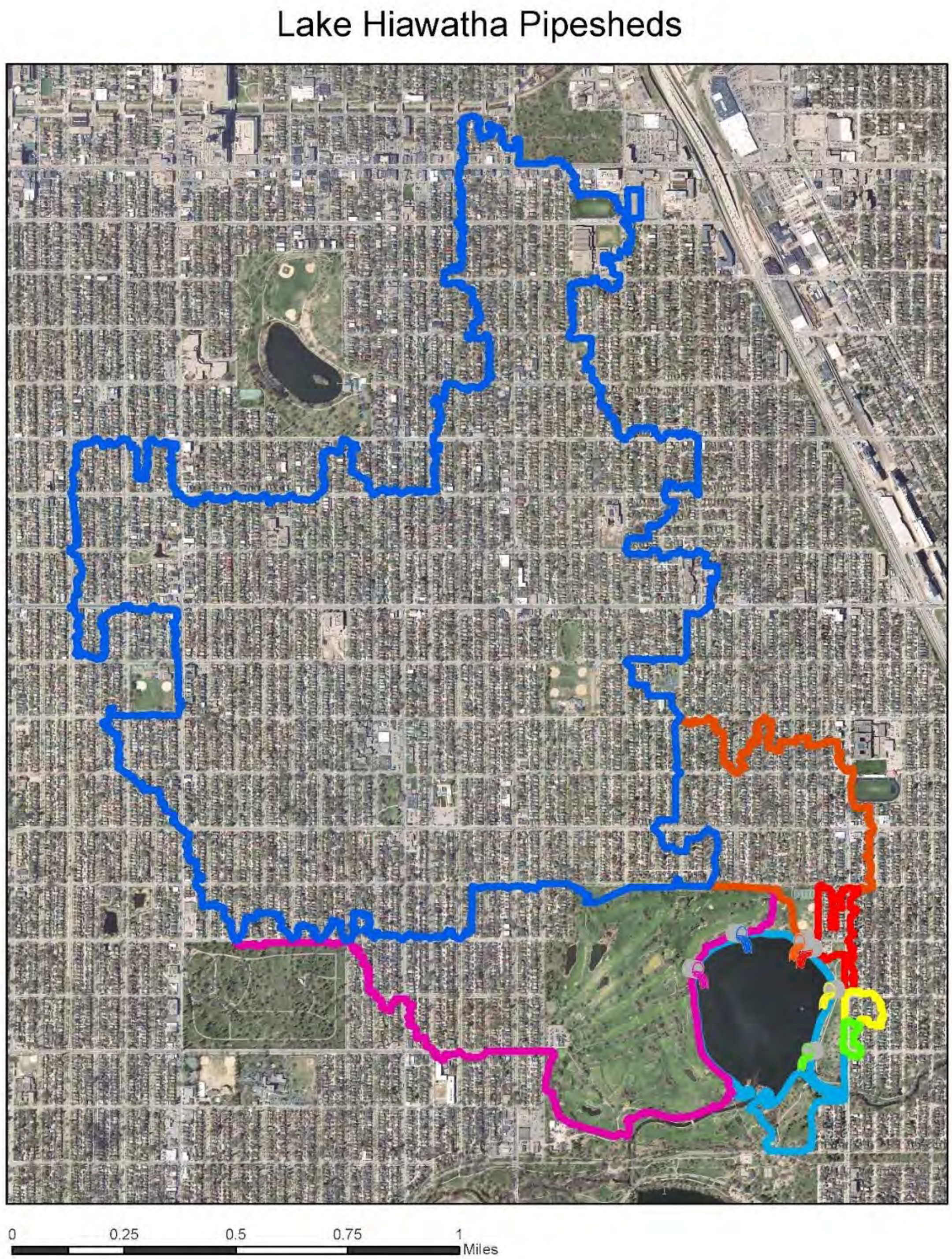


Figure 1. Lake Hiawatha Pipesheds

1.1 Study Objectives

The overall objective of the Study is to provide the City with information on the types and sources of trash to Lake Hiawatha and to use the information gathered from the Study to provide recommendations on how to continue this project in the future. Based on a review of existing data, the study design was designed to meet the following objectives:

1. Develop a methodology to
    a. Collect quantitative and qualitative data on the amount and type of trash in Lake Hiawatha
    b. Identify monitoring locations along the lake and within the watershed
2. Conduct field inspections
    a. Develop an inspection form to assess the amount and type of trash
    b. Create a mobile inspection form to support field inspections
    c. Perform periodic field inspections to collect data
    d. Perform watershed assessments to look for potential sources
3. Work with stakeholders to
    a. Coordinate with other City staff
    b. Work with neighborhood and other volunteer groups
    c. Create public education/outreach content for the project

1.2 Description of Study Area

Lake Hiawatha is a 54 acres urban lake that is located in the Southern part of Minneapolis, just North of Lake Nokomis. Minnehaha creek feeds into the lake on the Southwestern side and exits the lake on the Southeastern side. The lake's watershed drains 1.95 square miles of highly developed land consisting of residential and commercial uses. The study area for this project consists of 9 transects, 100 feet in length, placed around the shoreline of the lake. Over 70 percent of the land use in the study area consists of urban neighborhoods as summarized in Table 1 and shown on Figure 2. With the high degree of development within Lake Hiawatha's watershed, the natural hydrology of the area has been altered. With this, a greater percentage of impervious area covers the watershed that drains into the lake, allowing for increased stormwater volumes to enter the lake. This process discharges street litter into the lake through its outfalls and from Minnehaha Creek.

Table 1: Major Land Use Types within the Study Area

Land Use Type	Percent of Study Area
Urban Neighborhood	73.4
Parks and Open Space	20.2
Commercial	2.6
Public and Institutional	2.5
Mixed Use	1.3

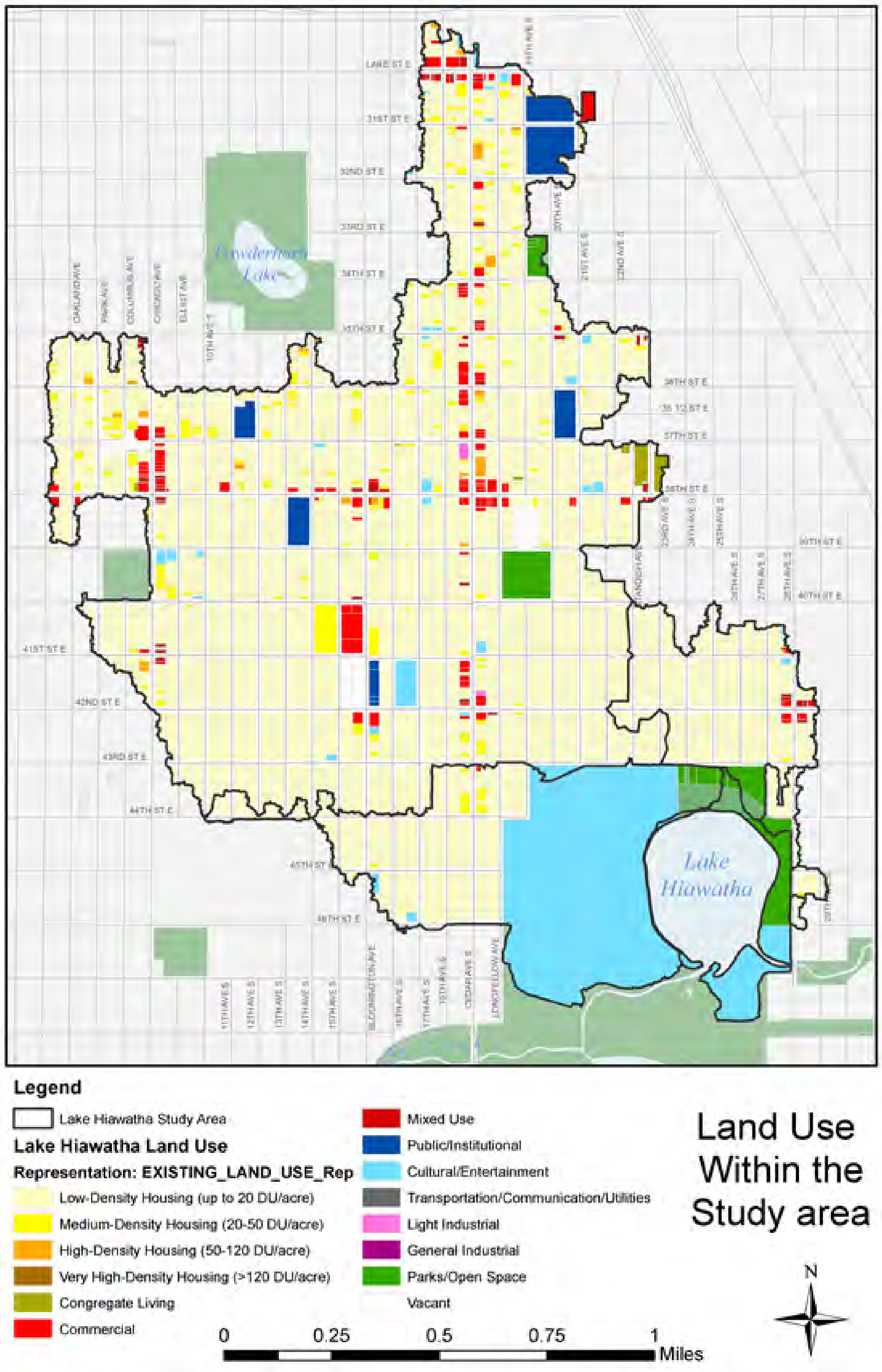


Figure 2. Land Use Within the Study Area

2.0 MATERIALS AND METHODS

2.1 Choosing the Sites

In order to start identifying the types and sources of trash to Lake Hiawatha, City staff started by choosing trash sites. GIS maps were used to figure out where the outfalls in the lake are and which watershed they belong to. Then, staff went out to the lake and walked along the shoreline of the lake. Nine trash survey points were originally chosen that served as a baseline for establishing 100 ft transects. The trash survey points were chosen by visually evaluating the level of trash as well as accessibility.

Once the trash survey points were established, there was another lake site visit in order to establish 100 ft survey transects. These transects needed to be established because the survey from the Surface Water Ambient Monitoring Program (SWAMP) requires 100 ft lake transects. When establishing the 100 ft transects, staff went back to the trash survey points as this is a good place to start. Spots that were accessible and had good visibility were chosen for the transects. A Measure Master was then used to measure 100 ft from starting to ending point. Where possible, the starting and ending points of the transects were easily identified landmarks such as a tree or a high voltage station. Starting and ending points of each transect were documented using a global positioning system (Trimble GNSS R1), so that future assessments can be made at the same location. Spray paint and string were also used to mark the starting and ending points of the transect. In total, nine 100 ft transects were established to survey the amount and type of trash (Figure 3). Three of the nine sites were surveyed only once due to high levels of vegetation and the sites being inaccessible without a boat, while other sites were surveyed three to four times this summer to analyze the amount and type of trash during dry weather conditions.

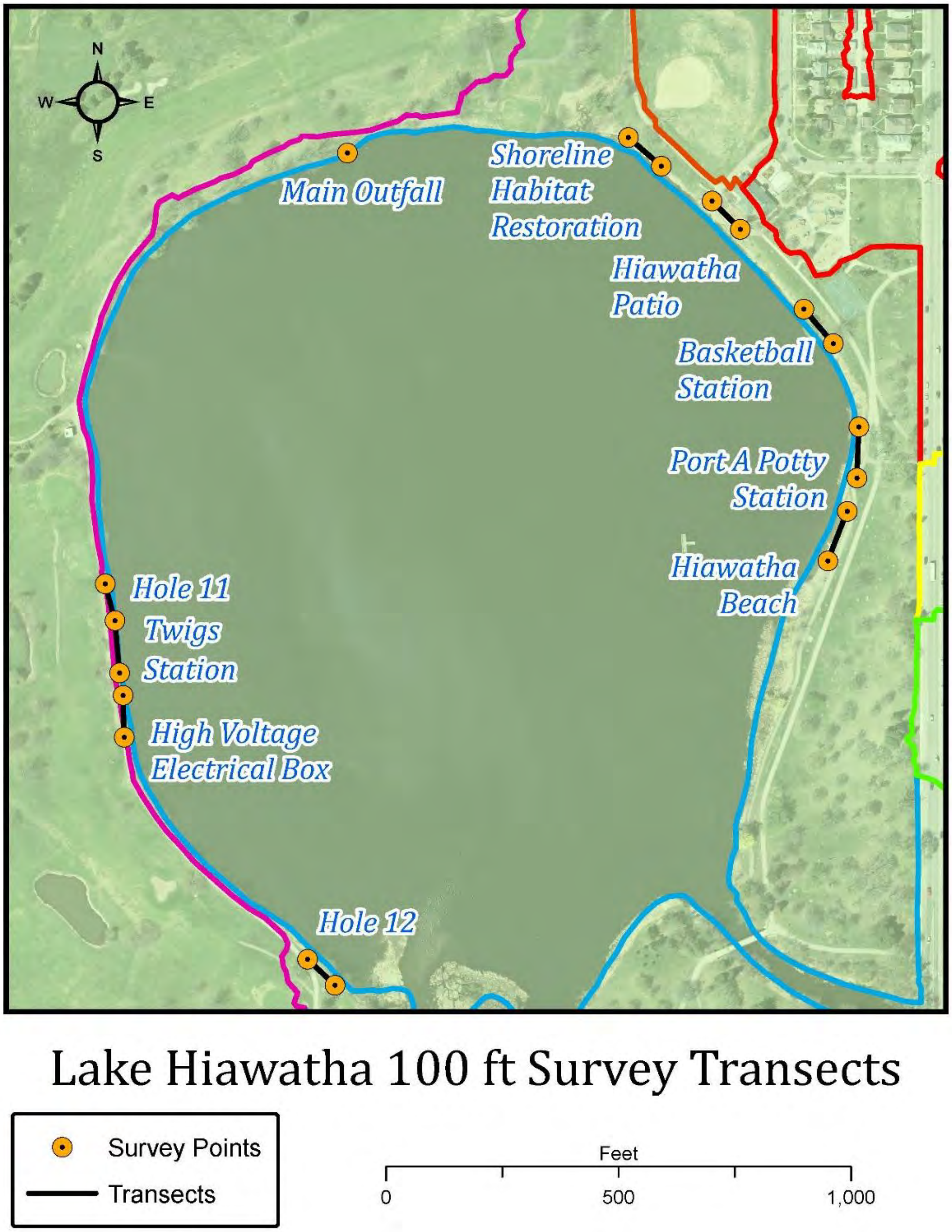


Figure 3. Lake Hiawatha 100 ft Survey Transects

2.2 Station Description Survey

The first step after the survey transects have been established is to do a station description survey. This survey was taken from the Surface Water Ambient Monitoring Program (SWAMP) in the San Francisco Bay Region of California. This survey is used once a transect has been established and it helps identify the type of station, starting and ending coordinates, starting and ending description of site, site length, vegetation, and identifying features of the different stations (Appendix A). This survey was filled only once and it was after transects had been established. This information allows for revisiting of sites later in the summer and later in the year.

2.3 Rapid Trash Assessment (RTA)

The next step after filling out the station description survey is to do the Rapid Trash Assessment (RTA). The trash assessment protocol used was taken from the Surface Water Ambient Monitoring Program (SWAMP) in the San Francisco Bay Region of California (Appendix B). This trash assessment protocol involves tallying all the trash items found within the defined boundaries of a site ("A Rapid Trash Assessment Method Applied to Waters of the San Francisco Bay Region: Trash Measurement in Streams"). For the purposes of our study, trash wasn't picked up due to lack of materials, time restraints, and for the safety of the employees. The process of the Rapid Trash Assessment (RTA) allows for the assessment of temporal changes in impairment, usage patterns, and trash deposition rates under wet and dry weather conditions ("A Rapid Trash Assessment Method Applied to Waters of the San Francisco Bay Region: Trash Measurement in Streams").

The RTA inspection form was created in Survey123. Survey123 is a survey web app for the ArcGIS platform and it is a simple way to create, share, and analyze surveys. A minimum of two people are required to conduct the RTA. Usually, there are three or four people when doing the RTA and tasks are divided according to the number of team members. A three-member team has one designated note-taker and two trash assessors and a four-member team has two designated note-takers and two trash assessors. The two trash assessors start at opposite ends of the transect and visually assess the amount and type of trash there is in the shore of the lake and ten feet into the lake. They count the number of trash items and put them into the appropriate categories. The note taker(s) use an iPad to put the information into the Survey 123 app. The RTA has various categories of trash that include: plastic, metal, large items, biohazard, toxic, construction debris, biodegradable, miscellaneous, glass, and fabric/cloth.

2.4 Site Condition Survey

After filing out the Rapid Trash Assessment survey, the next step is to do the site condition survey. The site condition survey was also taken from the Surface Water Ambient Monitoring Program (SWAMP) in the San Francisco Bay Region of California (Appendix B). The site condition survey was put into the Survey 123 app and is completed after the RTA survey. Usually there are three or four people when doing the site condition survey and the team members agree on a scoring for five different categories.

The revised version from the Surface Water Ambient Monitoring Program (SWAMP) includes five condition categories that capture the scope of issues associated with trash in water bodies. The scoring scale was modified from the original version because not all sites being surveyed have perfect visibility. The first two parameters, which are level of trash and actual number of trash items found, focus on qualitative and quantitative levels of trash. The next parameters, threat to aquatic life and threat to human health, are an estimation of threat to water quality in Lake Hiawatha. The last parameter, illegal dumping, helps identify whether there was dumping at a site or accumulation. The form provides a range of numbers within a given category, which allows a range of conditions encountered in the lake from optimal to poor. Scores range from 0-20 with 0 being the worst condition and 20 being the best condition for a given category. Once team members agree and assign the scores for the five categories, the final scores are summed up. Each site was assessed one to five times during this summer period. The scoring categories ("A Rapid Trash Assessment Method Applied to Waters of the San Francisco Bay Region: Trash Measurement in Streams") include:

1. *Level of Trash*. This assessment parameter is intended to reflect a qualitative "first impression" of the site, after observing the entire length of the transect. Sites scoring in the "poor" range are those where trash is one of the first things noticeable about the water body. No trash should be obviously visible at sites that score in the "optimal" range.
2. *Actual Number of Trash Items Found*. Based on the tally of trash along the 100-foot lake reach a score is given within the appropriate condition category based on the number of tallied items. Where more than 50 items have been tallied, assign the following scores: 5: 51-100 items; 4: 101-150 items; 3: 151-200 items; 2: 201-250 items; 1: 251-300 items; 0: over 300 items. Use similar guidelines to assign scores in other condition categories. Sometimes items are broken into many pieces. Fragments with higher threat to aquatic life such as plastics should be individually counted, while paper and broken glass, with lower threat and/or mobility, should be counted based on the parent item(s). Broken glass that is scattered, with no recognizable original shape, should be counted individually. The

judgment of whether to count all fragments or just one item also depends on the potential exposure to downstream fish and wildlife. Concrete is trash when it is dumped, but not when it is placed. Consider tallying only those items that would be removed in a restoration or cleanup effort.

3. *Threat to Aquatic Life*. If trash items are persistent in the environment, buoyant (floatable), and relatively small, they can be transported long distances and be mistaken by wildlife as food items. Larger items can cause entanglement. Some discarded debris may contain toxic substances. All of these factors are considered in the narrative descriptions in this assessment parameter.
4. *Threat to Human Health.* This category is concerned with items that are dangerous to people who wade or swim in the water, and with pollutants that could accumulate in fish in the downstream environment. The worst conditions have the potential for presence of dangerous bacteria or viruses, such as with medical waste, diapers, and human or pet waste.
5. *Illegal Dumping and Littering.* This assessment category relates to direct placement of trash items at a site, with "poor" conditions assigned to sites that appear to be dumping or littering locations based on adjacent land use practices or site accessibility.

2.5 Litter Scan

In order to analyze lake Hiawatha's watershed contribution of trash into the lake, a litter scan was done across the entire watershed. The litter scan was adapted from City of Minneapolis Solid Waste & Recycling Department, which does an annual litter survey using the "Keep America

Beautiful" national program (Appendix C). A litter scan consists of one driver, one navigator, and two scanners. The driver follows the predetermined route for the day and maintains a speed of approximately 15 mph. The navigator announces when an area for scanning is entered and exited. Scanners, one on the driver side and one on the passenger side, visually rate the amount of litter on a scale of 1-4. With 1 being no litter, 2 being slightly littered, 3 being littered, and 4 being extremely littered. All streets in the watershed were rated on an individual block level. Values given by each scanner were averaged together to give the rating for each street.

3.0 RESULTS

The 24 site visits conducted by the City of Minneapolis Surface Water and Sewer staff over the summer confirmed that high levels of trash, especially plastics are present throughout Lake Hiawatha. The most prominent type of trash that is present in Lake Hiawatha is plastics, 91.51% of the total trash items is composed of plastics (Figure 4). Miscellaneous items (4.20%), biohazard (including bird waste) (2.12%), and biodegradable items (1.45%) were the next most commonly found items. Toxic items (0.08%) were not commonly found as only 2 lighters were found in total. Metal items (0.63%) were also not commonly found as only 16 metal items were found. The breakdown for the trash category of plastics indicates that soft plastic pieces (31%) were most commonly found in Lake Hiawatha followed by hard plastic pieces (23%), and then styrofoam pellets (20%) (Figure 5). These results indicate that small pieces of plastic are the most common type of pollution into Lake Hiawatha.

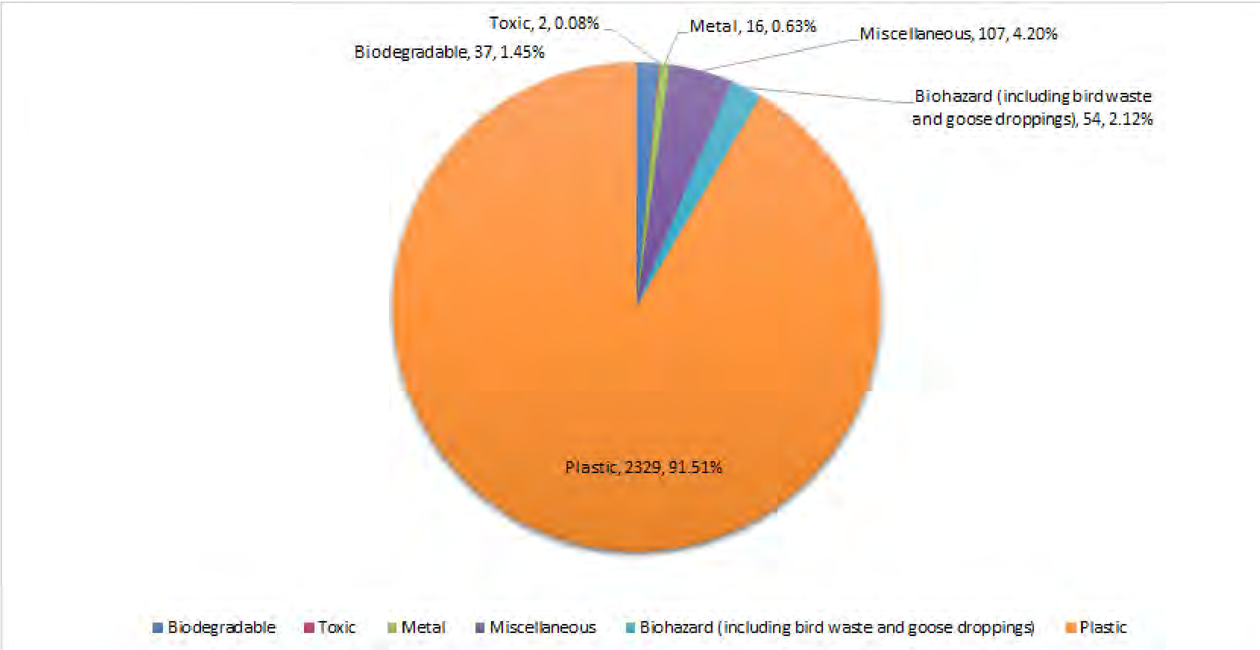


Figure 4. Total Trash Items, by Category, for all Sites and Dates

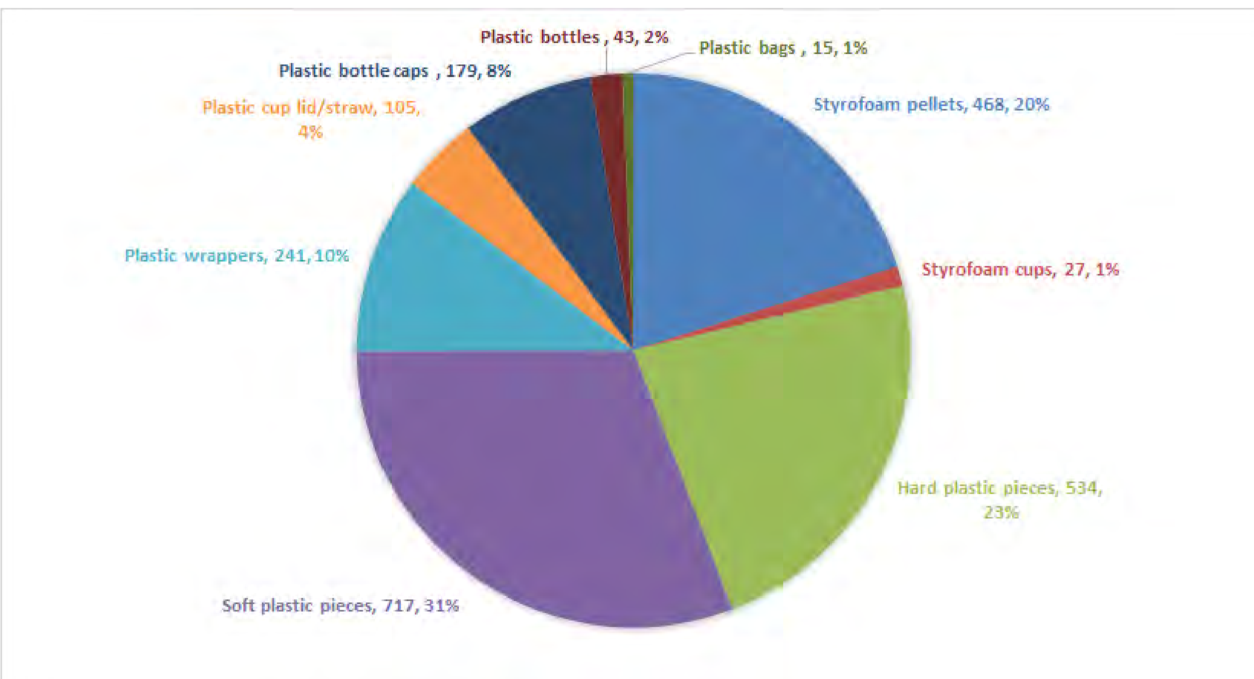


Figure 5. Breakdown of Plastic Trash Items, for all Sites and Dates

When looking at the total number of trash items, by category and date, for all sites there is a trend of increasing number of trash items (Figure 6). Comparing the first site visit that was done on July 11, 2019 to the last site visit that was done on August 8, 2019 there is a slight increase on the total number of trash items. For the plastic category, there was an increase of 275.61% of plastic items between the first site visit on July 11 and the last site visit on August 8. For the biohazard category, there was an increase of 33.33% of biohazard items between the site visit done on July 19 and August 8. For the miscellaneous category, there was an increase of 31.58% of miscellaneous items between the site visit on July 11 and August 8. For the metal category, there was an increase of 50% of metal items between the site visit on July 19 and August 8. For the toxic category, there were only two toxic items found in total. For the biodegradable category, there was an increase of 600% of biodegradable items between the site visit on July 19 and August 8. This data indicates that the plastic and biodegradable trash categories had the highest increase of trash items.

When looking at trash items, by site and date, for all trash categories there is a trend of increasing number of trash items for the Hiawatha Patio site (Figure 7). For all the other sites there is no clear trend of increasing number of trash items, however there is some increase of trash items and some decrease of trash items.

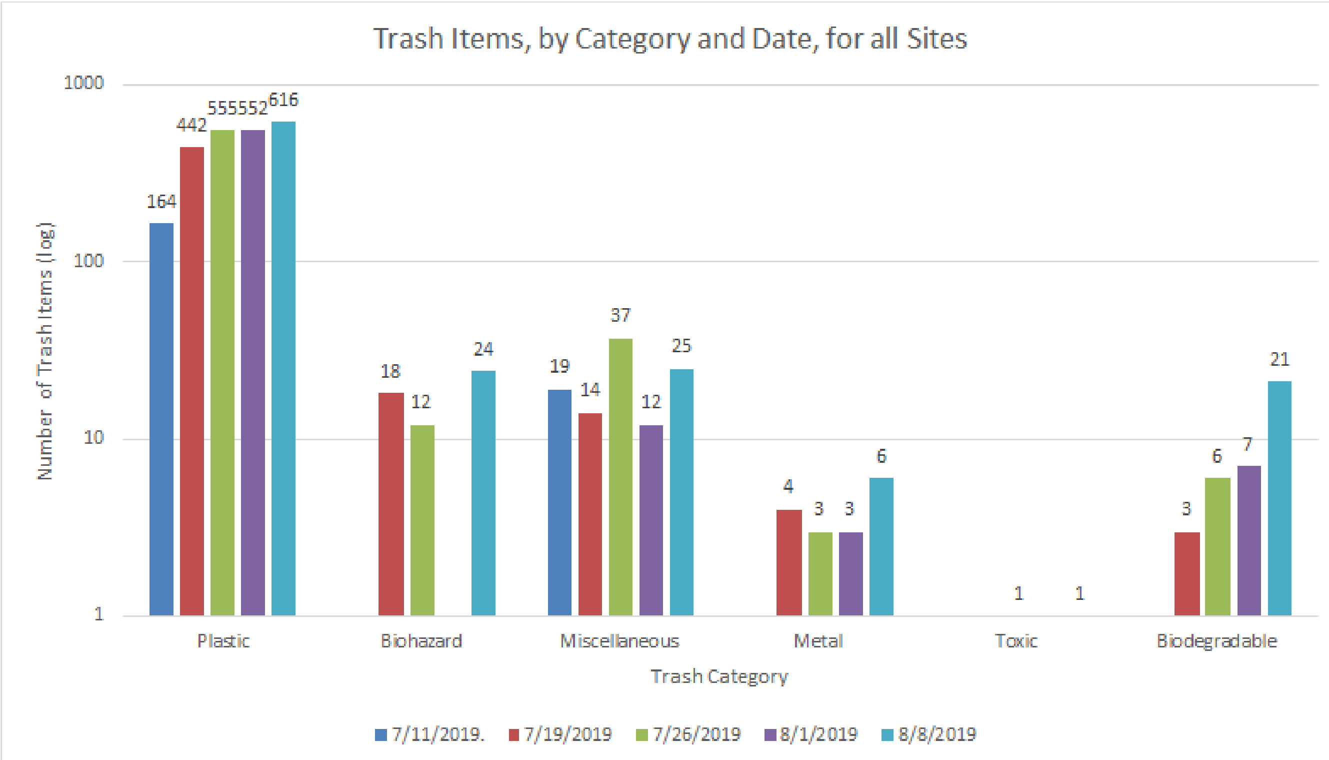


Figure 6. Trash Items, by Category and Date, for all Sites

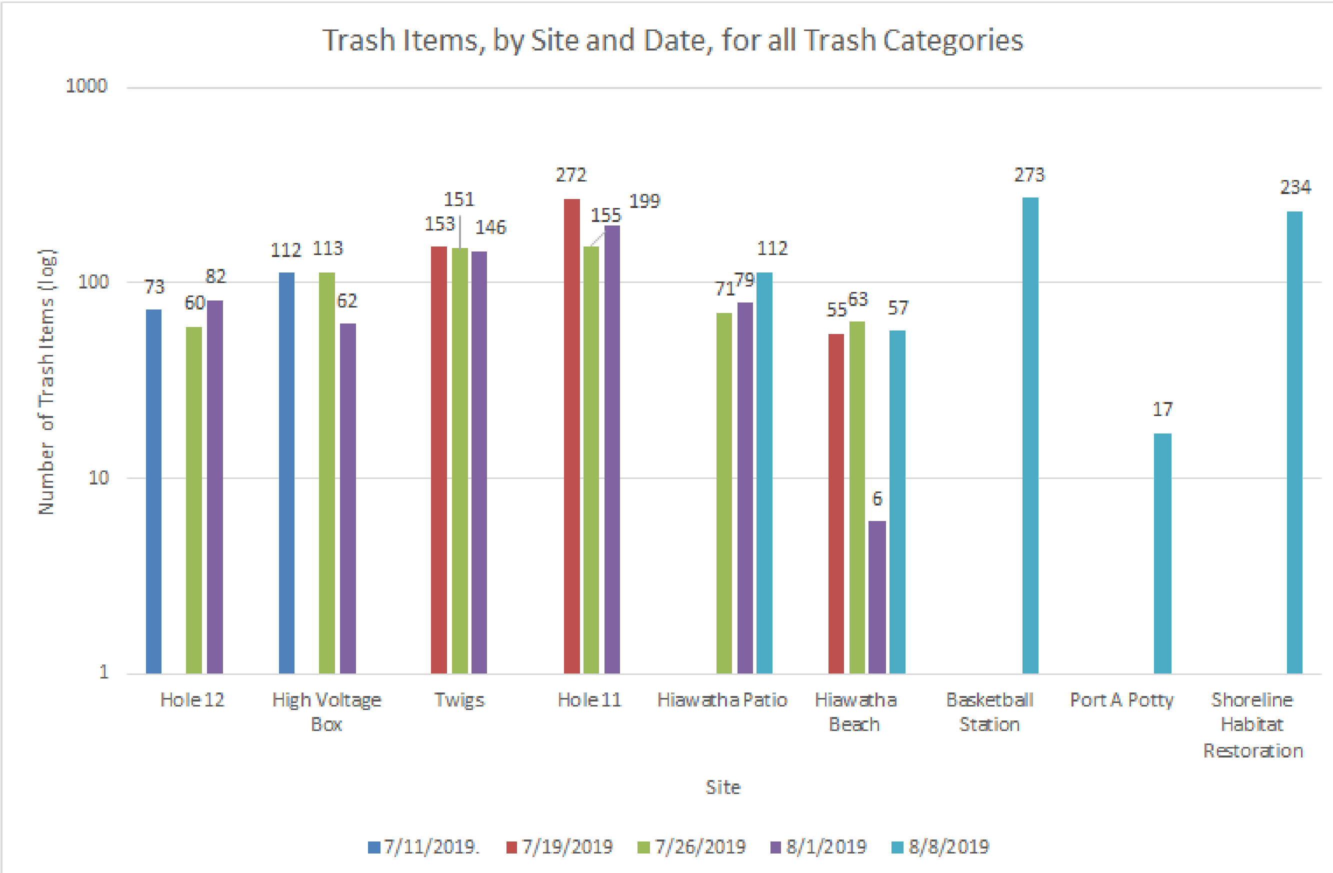


Figure 7. Trash Items, by Site and Date, for all Trash Categories

When looking at the average condition category scores, by site, for all dates the parameters that have the highest scores are threat to human health and illegal dumping (Figure 8). All sites had scores of 20, which is optimal, for illegal dumping. The next parameter with the highest scores was threat to human health. All sites had scores of 20 except the Twigs Station and Hiawatha Beach. The Twigs station had a tampon inserter which made the site's average condition score lower. The Hiawatha Beach site had a lower score because there was pet waste and goose droppings. This is evidence of bacteria or virus hazards to humans which made the sites have a lower condition score. The condition scores for level of trash on first glance varied from 6-19. No sites had scores in the poor category. Trash was not distracting to the eye on first glance. Creek bank, emergent, and littoral zones did not contain substantial levels of litter and debris on first glance. However, when rating the actual number of trash items found, the scores were a lot lower and varied from 2-19. Some sites had over 200 trash items while others had less than 50 pieces. There were sites that had a lot of trash pieces such as the Basketball Station and this was due to having a lot of small plastic pieces that were trapped and/or accumulated in the vegetation. Other sites such as the Port A Potty didn't have many actual number of trash items found and this was due to having a lot of vegetation such as very long cattails. The whole Port A Potty site wasn't accessible due to the very high cattails so some trash could've been missed. The scores for threat to aquatic life correlated to the actual number of trash items found as most of the trash items were plastic. Plastic corresponds to items that are a threat to aquatic life. The trash items that are a threat to aquatic life are hard or soft plastics, styrofoam, balloons, cigarette butts. Presence of settleable, degradable, and non-toxic debris such as glass or metal are also threats to aquatic life. Overall, the illegal dumping and threat to human health had the most optimal scores while actual number of trash items found and threat to aquatic life had the lowest scores.

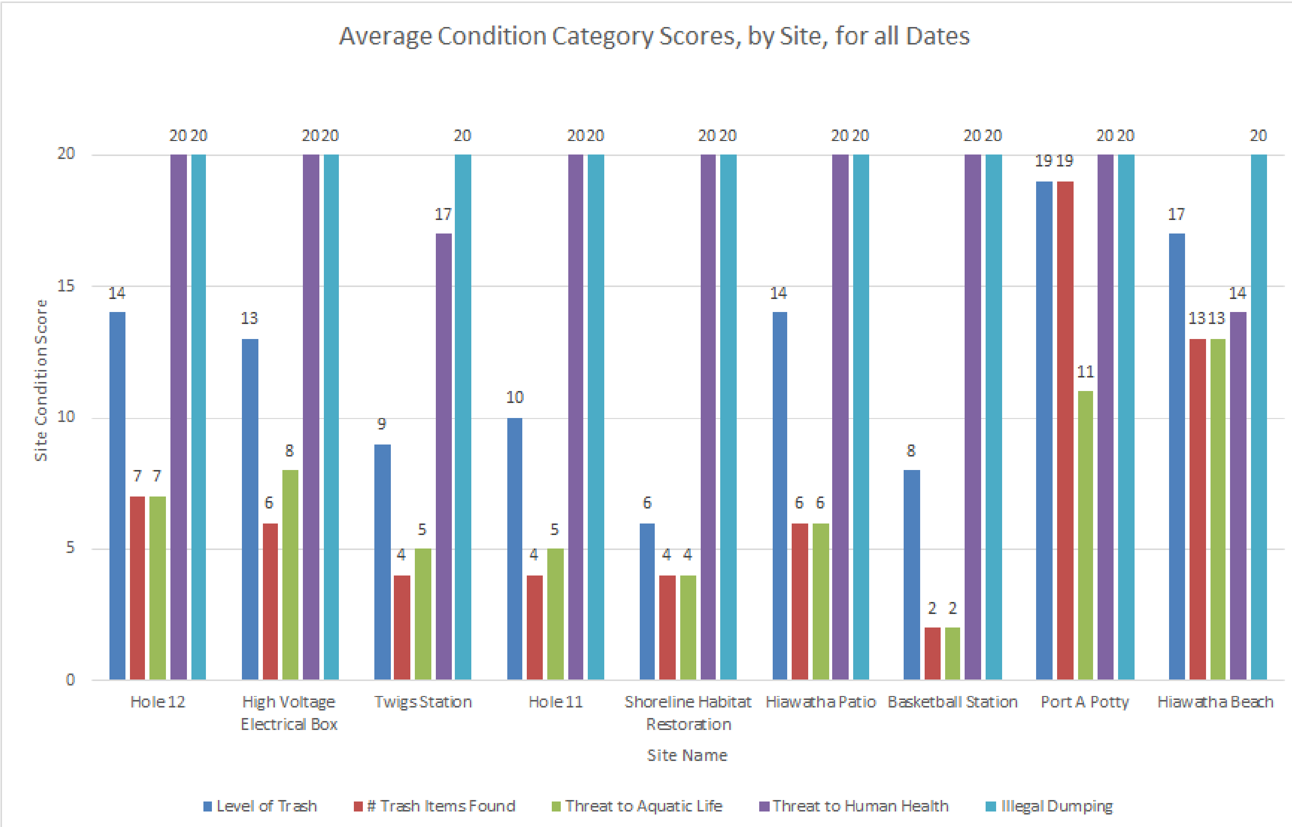


Figure 8. Average Condition Scores, by Site, for all Dates

When looking at the site condition scores for hole 12, by date and category the scores appear to stay the same (Figure 9). For threat to human health and illegal dumping the scores were of 20, which is optimal. For level of trash, the scores varied from 13-15 and for actual number of trash items found the scores varied from 5-8. On the other hand, when looking at the site condition scores fro Hiawatha Beach, by date and category the scores varied on different dates. For level of trash, the scores varied from 15-19. For actual number of trash items found, the scores varied from 7-18. For threat to aquatic life the scores were 15 except on July 26, which had a score of 8. For threat to human health, the scores varied from 10-20. The only score that remained the same across all dates was for illegal dumping, which had a score of 20.

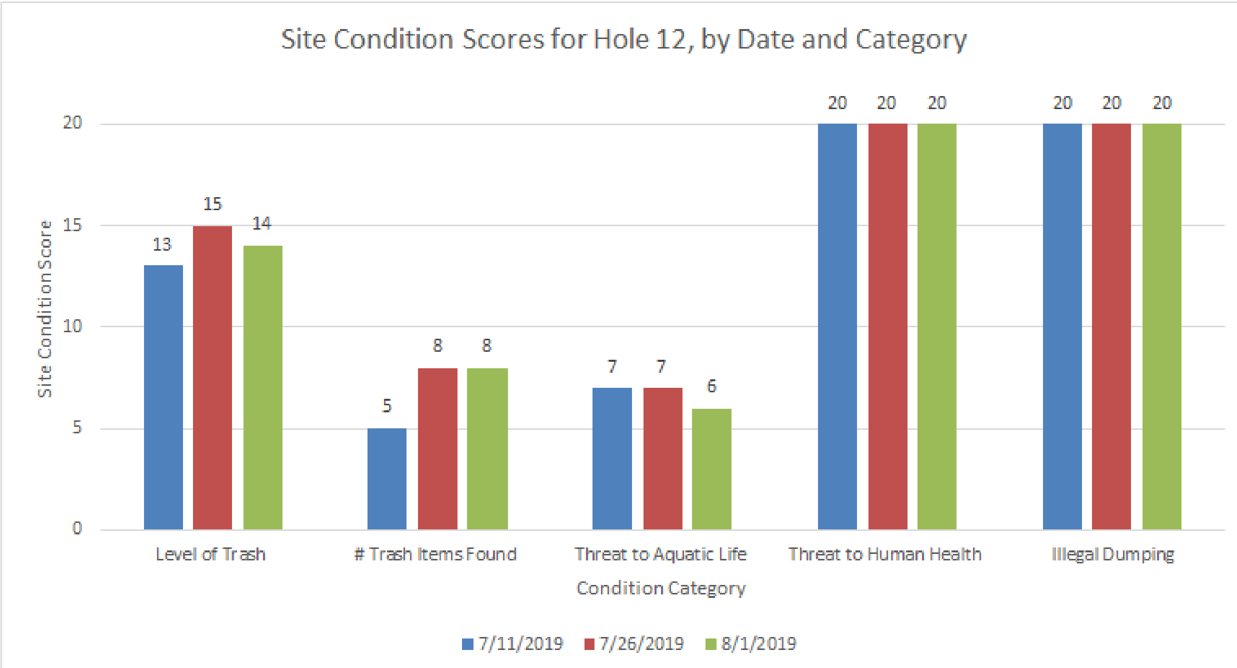


Figure 9. Site Condition Scores for Hole 12, by Date and Category

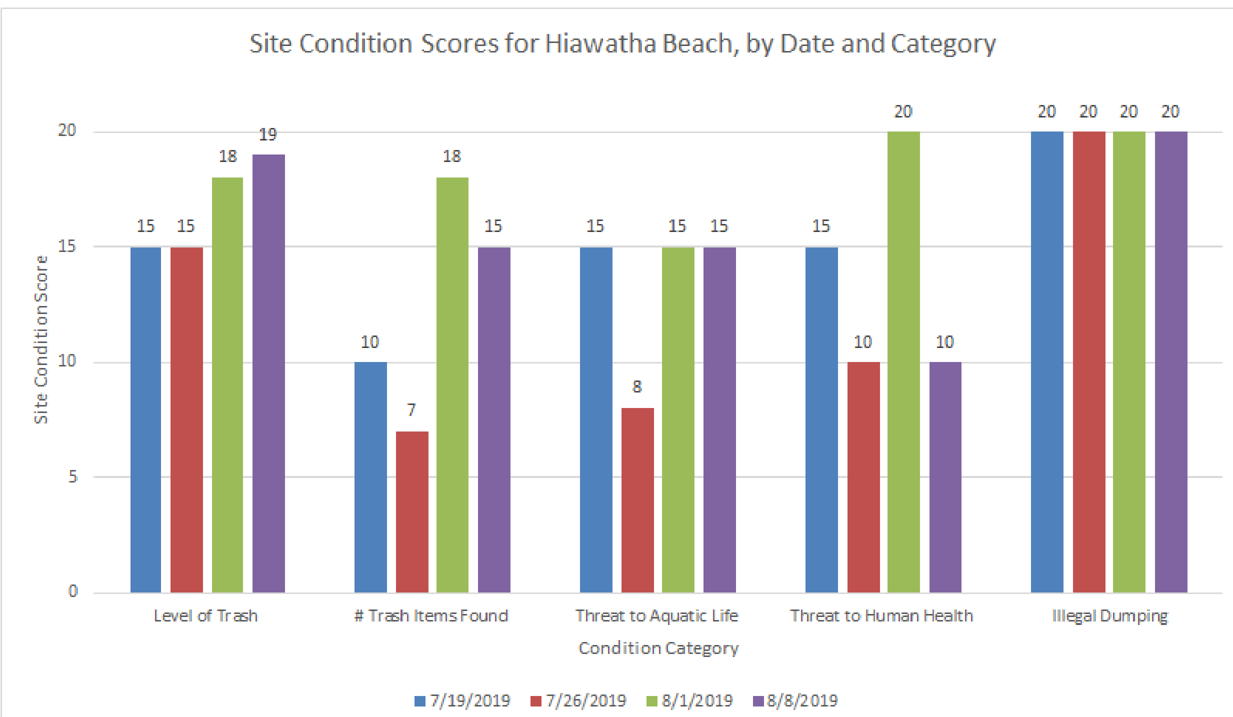


Figure 10. Site Condition Scores for Hiawatha Beach, by Date and Category

When looking at site condition scores for Hiawatha Center compared with a boat the scores were lower with a boat except for threat to human health and illegal dumping, which remained at 20 (Figure 11). The boat allowed more visibility of trash therefore the scores were lower when conducting surveys on a boat. An exploratory survey was conducted on the Hiawatha Center site to compare the amount of trash when using a boat and it shows that more trash was found when using a boat (Figure 12). When using a boat, 139 plastic trash items were found compared to 110 without a boat. With a boat, 3 miscellaneous trash items were found compared to 1 without a boat. With a boat, 3 biodegradable trash items were found compared to 1 without a boat.

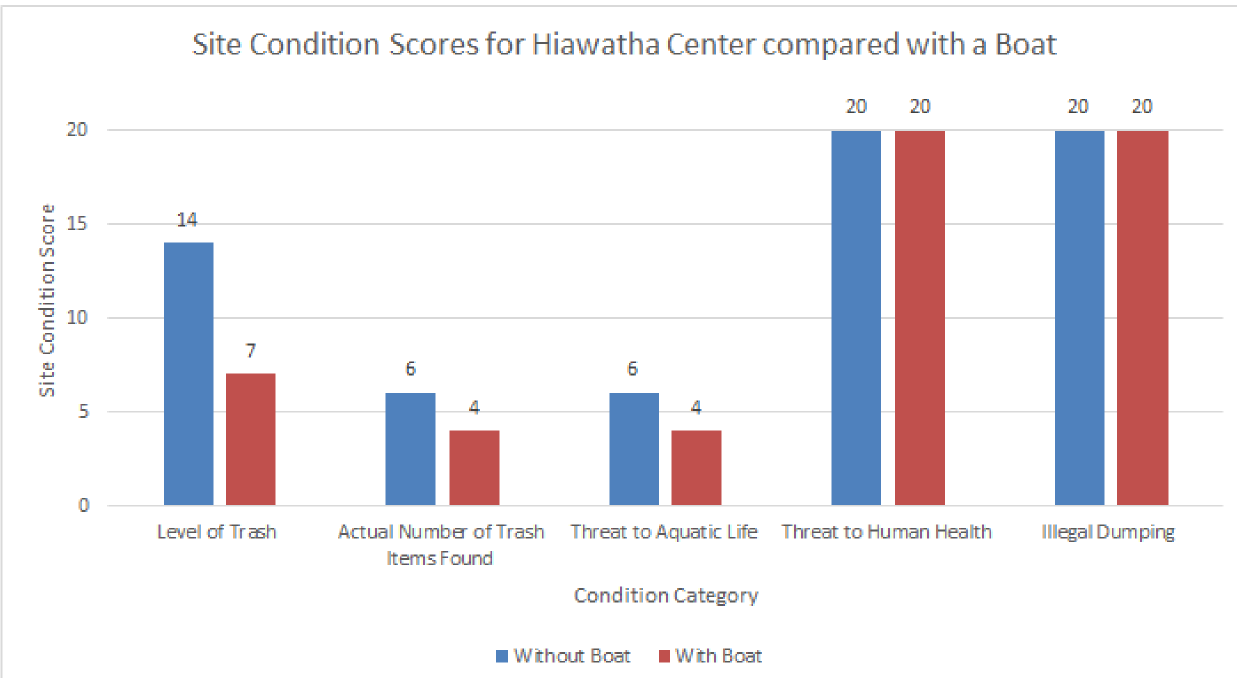


Figure 11. Site Condition Scores for Hiawatha Center compared with a Boat

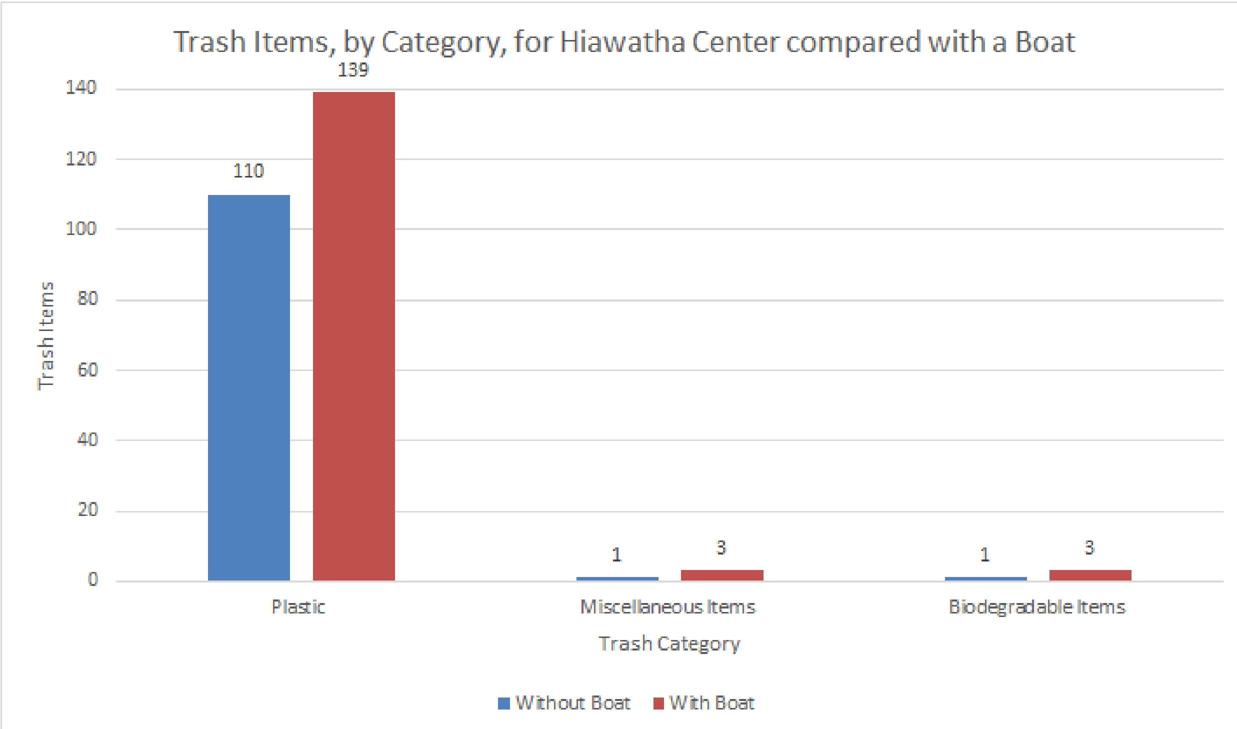


Figure 12. Trash Items, by Category, for Hiawatha Center compared with a Boat

The litter scan survey produced data for 518 blocks, which were then compiled into a layer in ArcMap, symbolized by score. Looking at the layer by itself, two patterns are readily apparent. There are two small areas, one in the north and the other in the northwest, that have high amounts of litter block by block (Figure 13). These are the areas near Lake and Cedar, and Chicago and 38th. There are also certain streets outside of these clusters, such as Bloomington and Cedar, that tend to consistently have higher amounts of litter. Most blocks in the watershed have practically no litter. These blocks are overwhelmingly single family residential blocks. When compared with block census data, there appears to be a correlation between higher population density and higher amounts of litter. This is not surprising as more heavily populated areas will likely produce more litter (Figure 14). When compared with bus routes and stops, there are more bus stops where there are higher amounts of litter. This could be due to people not being able to throw their trash in a trash can and throwing it on the street instead (Figure 15).

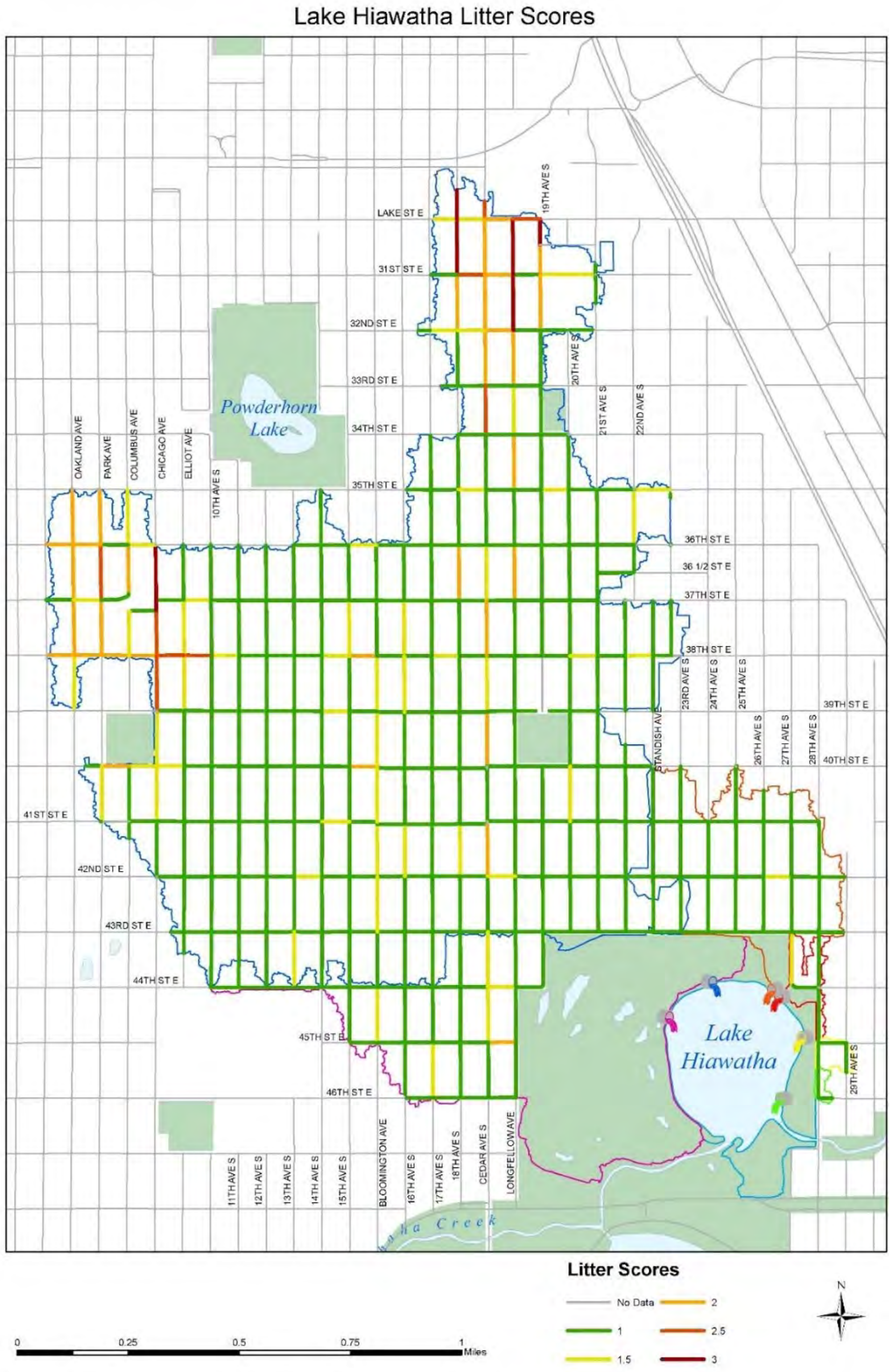


Figure 13. Lake Hiawatha Litter Scores

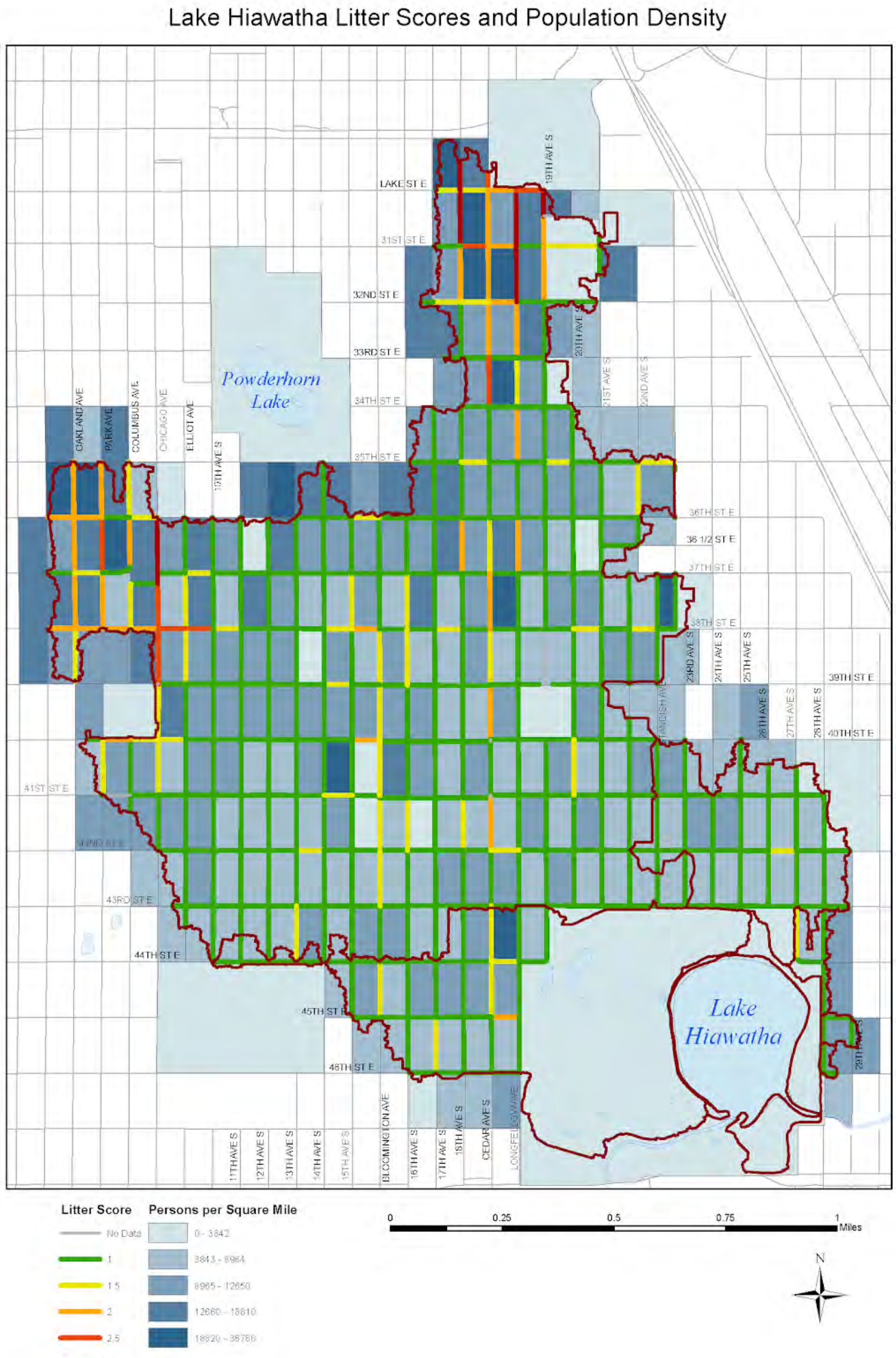


Figure 14. Lake Hiawatha Litter Scores and Population Density

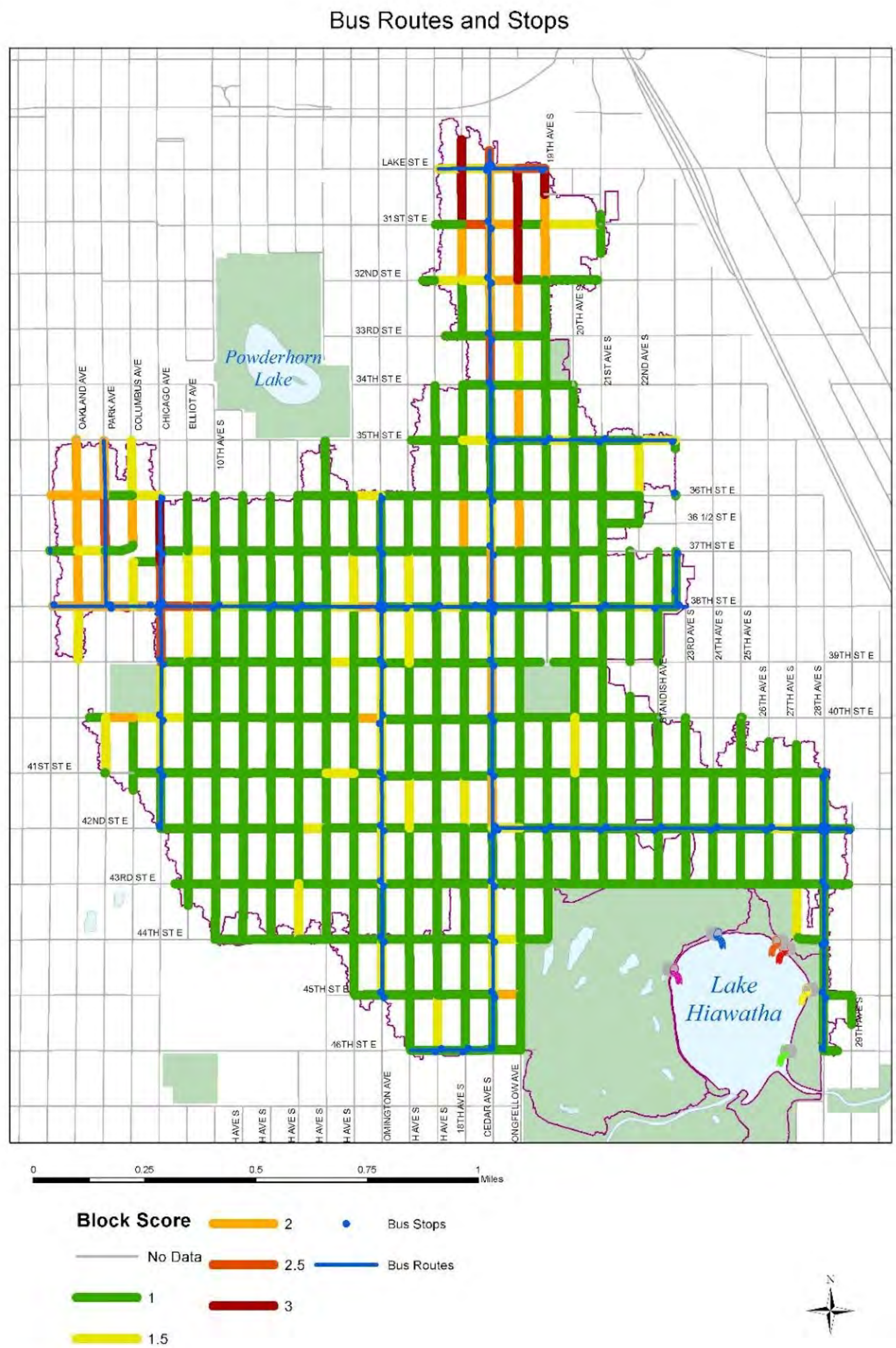


Figure 15. Lake Hiawatha Litter Scores and Bus Routes & Stops

4.0 DISCUSSION

Plastic pollution is an issue for Lake Hiawatha. Plastic pollution is the accumulation of plastic objects and particles, which is prominent in Lake Hiawatha. This is an issue because it affects wildlife, wildlife habitat, and humans. The chemical structure of most plastics makes them resistant to degradation and as a result they are a threat to aquatic life and humans (Le Guern).

One main threat to aquatic organisms is entanglement. Entanglement has been responsible for the deaths of many organisms including fish, seals, turtles, and birds ("Plastic Debris in the World's Oceans") The report known as *Plastic Debris in the World's Oceans* estimates that at least 267 different animal species have suffered from

entanglement and ingestion of plastic debris. This can be a problem for Lake Hiawatha because many aquatic organisms make the lake their habitat and there is potential for entanglement and ingestion of plastic particles. Another problem with the high amount of plastics in Lake Hiawatha is that they are in small sizes, so there is more potential for ingestion. These small pieces of plastic are also harder to pick up when doing lake cleanups because of the size so it's more likely that they will stay in the lake. The plastic particles that stay in the lake will affect the aquatic organisms' habitat especially when searching for food. When searching for food these organisms can acquire toxic chemicals from the plastic particles. Plastic pollution also affects birds because plastics can be mistaken for food and toxic chemicals can be ingested. Lake Hiawatha is not a very populated lake for swimming and other recreational activities. This is sometimes due to the high levels of *E. coli*, however the high amounts of trash in the lake would also make it a threat to humans. This can interfere with enjoyment of the natural environment and there could be bacteria or virus hazards in the trash items. Even though there wasn't a lot of biohazardous items (2.12%) throughout all of our site visits the plastic pollution can still be a threat to humans therefore it is important to address this problem.

The plastic and biodegradable trash categories had the highest increase of trash items. This could be due to accumulation of trash and trash getting trapped in vegetation. If trash gets trapped in vegetation, it is easier to accumulate thus increasing the amount of trash found. For the other categories there were increases and decreases of trash for different dates and this could be due to trash not getting accumulated or trapped in the vegetation (Figure 6).

When looking at trash items, by site and date, for all trash categories there is no clear trend of increasing number of trash items, but there is some increase of trash items and some decrease of trash items. This can be due to Sean Connaughty, from Friends of Lake Hiawatha, doing weekly cleanups every Saturday. He does cleanups every Saturday so when there was a decrease in the number of trash items at different sites it could be due to having had a trash cleanup the Saturday before. Another reason why there was a decrease in the number of trash items at the other sites could be because trash items weren't getting caught in vegetation and they could've gone to other parts of the lake with its flow.

Lake Hiawatha has no evidence of illegal dumping as there were no large items such as furniture, appliances, shopping carts, bags of garbage, or yard waste. There was also no evidence of easy vehicular access for in-and-out dumping of materials to avoid landfill costs. The exploratory survey on the Hiawatha Center site shows that more trash was visible with a boat because more trash items were found. A boat should be used when conducting further surveys because it allows for more visibility and accessibility.

5.0 CONCLUSION AND RECOMMENDATIONS

Levels of trash in Lake Hiawatha are very high and lots of plastics are present throughout Lake Hiawatha. The most prominent type of trash that is present in Lake Hiawatha is plastics, 91.51% of the total trash items is composed of plastics. Miscellaneous items (4.20%), biohazard (including bird waste) (2.12%), and biodegradable items (1.45%) were the next most commonly found items. The breakdown for the trash category of plastics indicates that soft plastic pieces (31%) were most commonly found in Lake Hiawatha followed by hard plastic pieces (23%), and then styrofoam pellets (20%). Plastic pollution is an issue for Lake Hiawatha because it affects wildlife, wildlife habitat, and humans. The chemical structure of most plastics makes them resistant to degradation and as a result they are a threat to aquatic life and humans. The exploratory survey conducted on the Hiawatha Center site to compare the amount of trash when using a boat shows that more trash was found when using a boat. There appears to be a correlation between higher population density and higher amounts of litter and this is not surprising as more heavily populated areas will likely produce more litter. When compared with bus routes and stops, there are more bus stops where there are higher amounts of litter. This could be due to people not being able to throw their trash in a trash can and throwing it on the street instead.

In summary, the City of Minneapolis Surface Water and Sewer staff recommends the following for this study:

- Put trash screens where litter scan showed the streets to be the most littered
- Create awareness and outreach content for the public on plastic pollution
- Make a distinction on size requirement for plastics category because there are a lot of small plastic particles in the lake
- Have random 100 ft transects all over the lake that will cover the whole circumference of the lake
- Collect data during dry and wet weather conditions
- Use a boat for more accessibility and visibility when conducting the trash surveys
- Educate businesses on plastic pollution and how to reduce it on their businesses

REFERENCES

A Rapid Trash Assessment Method Applied to Waters of the San Francisco Bay Region: Trash Measurement in Streams. Surface Water Ambient Monitoring Program and California Water Boards, *A Rapid Trash Assessment Method Applied to Waters of the San Francisco Bay Region: Trash Measurement in Streams* , https://www.waterboards.ca.gov/sanfranciscobay/docs/swampthrashreport.pdf.

"Lake Hiawatha History." *Friends of Lake Hiawatha*, http://friendsoflakehiawatha.org/history/.

Le Guern, Claire. "When The Mermaids Cry: The Great Plastic Tide." *Plastic Pollution*, http://plastic-pollution.org/.

Plastic Debris in the World's Oceans. Greenpeace International , 2006, *Plastic Debris in the World's Oceans*, https://www.greenpeace.org/austria/Global/austria/dokumente/Studien/meere_Plastic_Debris_Study_2006.pdf.

APPENDIX A

STATION DESCRIPTION SURVEY FORM

Station Description Survey

1. Name of station:
2. Color of sub watershed:
3. By outfall or no outfall nearby:
4. Type of station (stream, lake or land use):
5. Start coordinates:
6. Start description:
7. End coordinates:
8. End description:
9. Length:

Vegetation, roots, obstructions:

10. Transect:
11. Transect dimensions:
12. Transect identifying features:

Scale for vegetation description (use numbers when describing the vegetation)

1. None- pavement, sidewalk, or gravel
2. Slight- a few roots and bushes
3. Moderate- sparsely populated cattails/ banks have overstory of trees and understory that is easily walked through
4. Dense- thick, understory or waist high weed buffer/ dense cattail that would trap most trash
5. Impenetrable- impenetrable amount of cattails/ understory with vines and weeds that would eliminate any possibility of trash reaching a stream

APPENDIX B

RAPID TRASH ASSESSMENT PROTOCOL

Rapid Trash Assessment Worksheet

Surface Water Ambient Monitoring Program, San Francisco Bay Regional Water Quality Control Board

1. Location ID:
2. Monitoring group, staff:
3. Date/time:

Trash Assessment Parameter	Optimal	Sub optimal	Marginal	Poor
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1. Level of Trash	On first glance, no trash visible. After close inspection for litter and debris, little or no trash is evident (< 10 pieces).	On first glance, little or no trash visible. After close inspection small levels of trash (10-20 pieces) evident.	Trash is evident in low to medium levels (21-50 pieces) on first glance. Emergent, littoral zones, and creek bank contain litter and debris. Trash material includes: scattered cans, bottles, food wrappers, bottle caps.	Trash distracts the eye on first glance. Creek bank, emergent, and littoral zones contain substantial levels of litter and debris (>50 pieces). Trash material includes: many cans, bottles, bottle caps, food wrappers, clothing, and miscellaneous items.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Actual number of Trash Items Found	0 to 10 trash items found based on a trash assessment of a 100-foot lake reach	11 to 20 trash items found based on a trash assessment of a 100-foot lake reach	21 to 50 trash items found based on a trash assessment of a 100-foot lake reach	Over 50 trash items found based on a trash assessment of a 100-foot lake reach
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Threat to Aquatic Life	Trash, if any, is mostly paper or wood products or other biodegradable materials.	Little or no (<10 pieces) transportable, persistent, buoyant litter such as: hard or	Medium prevalence (10-50 pieces) of transportable, persistent, buoyant litter	Large amount (>50 pieces) of transportable, persistent, buoyant litter such as: hard or

	Note: A large amount of rapidly biodegradable material like food waste creates high oxygen demand, and should not be scored as optimal.	soft plastics, Styrofoam, balloons, cigarette butts. Presence of settleable, degradable, and non-toxic debris such as glass or metal.	such as: hard or soft plastics, Styrofoam, balloons, cigarette butts Larger deposits (< 50 pieces) of settleable debris such as glass or metal. Any evidence of clumps of deposited yard waste or leaf litter.	soft plastics, balloons, Styrofoam, cigarette butts; toxic items such as batteries, lighters, or spray cans; large clumps of yard waste or dumped leaf litter; or large amount (>50 pieces) of settleable glass or metal.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Threat to Human Health	Trash contains no evidence of bacteria or virus hazards such as medical waste, diapers, pet or human waste. No evidence of toxic substances such as chemical containers or batteries. No ponded water for mosquito production. No evidence of puncture and laceration hazards such as broken glass or metal debris.	No bacteria, virus hazards or sources of toxic substances. Small presence (<10 pieces) of puncture and laceration hazards such as broken glass and metal debris. No presence of ponded water in trash items such as tires or containers that could facilitate mosquito production.	Presence of any one of the following: hypodermic needles or other medical waste; used diaper, pet waste, or human feces; any toxic substance such as chemical containers, batteries, or fluorescent light bulbs (mercury). Medium prevalence (10-50 pieces) of puncture hazards.	Presence of more than one of the items described in the marginal condition category, or high prevalence of any one item (e.g. greater than 50 puncture or laceration hazards).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Illegal Dumping	No evidence of illegal dumping. No bags of trash, no yard waste, no household items placed at site to avoid proper	Some evidence of illegal dumping. Limited vehicular access reduces the amount of potential dumping, or	Presence of one of the following: furniture, appliances, shopping carts, bags of garbage or yard waste,	Evidence of chronic dumping, with more than one of the following items: furniture, appliances,

	disposal, no shopping carts.	material dumped is diffuse paper-based debris.	coupled with vehicular access that facilitates in-and-out dumping of materials to avoid landfill costs.	shopping carts, bags of garbage, or yard waste. Easy vehicular access for in-and-out dumping of materials to avoid landfill costs.

Rapid Trash Assessment Worksheet

Surface Water Ambient Monitoring Program, San Francisco Bay Regional Water Quality Control Board

TRASH ITEM TALLY (Tally with (•) if found above high water line, and (|) if below)

PLASTIC # Above___ # Below___	**METAL** # Above___ # Below___
Plastic Bags	Aluminum Foil
Plastic Bottles	Aluminum or Steel Cans
Plastic Bottle Caps	Bottle Caps
Plastic Cup Lid/Straw	Metal Pipe Segments
Plastic Pipe Segments	Auto Parts (specify below)
Plastic Six-Pack Rings	Wire (barb, chicken wire etc.)
Plastic Wrapper	Metal Object
Soft Plastic Pieces	**LARGE (specify below)** # Above___ # Below___
Hard Plastic Pieces	Appliances
Styrofoam cups pieces	Furniture
Styrofoam Pellets	Garbage Bags of Trash
Fishing Line	Tires
Tarp	Shopping Carts
Other (write-in)	Other (write-in)
BIOHAZARD # Above___ # Below___	**TOXIC** # Above___ # Below___
Human Waste/Diapers	Chemical Containers
Pet Waste	Oil/Surfactant on Water
Syringes or Pipettes	Spray Paint Cans
Dead Animals	Lighters
Other (write-in)	Small Batteries
CONSTRUCTION DEBRIS#Above___ #Below___	Vehicle Batteries
Concrete (not placed)	Other (write-in)
Rebar	**BIODEGRADABLE** # Above___ # Below___
Bricks	Paper
Wood Debris	Cardboard
Other (write-in)	Food Waste
MISCELLANEOUS # Above___ # Below___	Yard Waste (incl. trees)
Synthetic Rubber	Leaf Litter Piles
Foam Rubber	Other (write-in)
Balloons	**GLASS** # Above___ # Below___
Ceramic pots/shards	Glass bottles
Hose Pieces	Glass pieces
Cigarette Butts	**FABRIC AND CLOTH** # Above___ # Below___
Golf Balls	Synthetic Fabric
Tennis Balls	Natural Fabric (cotton, wool)
Other (write-in)	Other (write-in)
Total pieces Above: **Below:**	**Grand total:**
Tally all trash in above rows; make notes below as needed to facilitate scoring.	
Littered:	
Dumped:	
Downstream Accumulation:	

SPECIFIC DESCRIPTION OF ITEMS FOUND:______________________________________

____

APPENDIX C

LITTER SCAN PROTOCOL

Minneapolis

Solid Waste & Recycling- Litter Scoring Sheet

Date: ____________ Scorer Name: __________________ Neighborhood: ____________________

#1 No Litter	#2 Slightly Littered	#3 Littered	#4 Extremely Littered

Sub Area #	Score (1,2,3,4)	Notable Conditions (Seating) ☐ Driver side ☐ Passenger side
1	Check box ☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots
2	☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots
3	☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots
4	☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots
5	☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots
6	☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots
7	☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots
8	☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots
9	☐1 ☐2 ☐3 ☐4	☐ Graffiti ☐ Overflowing Dumpster/Garbage Ct/Litter Container ☐ Tires ☐ Overgrown Vegetation ☐ Large Items ☐ Vacant Lots

Appendix: Lake Hiawatha Trash Study Summer 2020

Prepared by Laura Garcia Pimentel

Study Area

Due to COVID-19 restrictions, City staff was only able to visit two transects this summer. The two transects that were visited this summer were Lake Hiawatha Beach and Shoreline Habitat Restoration (Figure 1). Site visits were conducted on July 28, 2020 and July 29, 2020. In addition to visiting those two transects, staff conducted a plastics assessment where 1 m by 1 m trash sites were chosen for the plastics assessment (Figure 2).

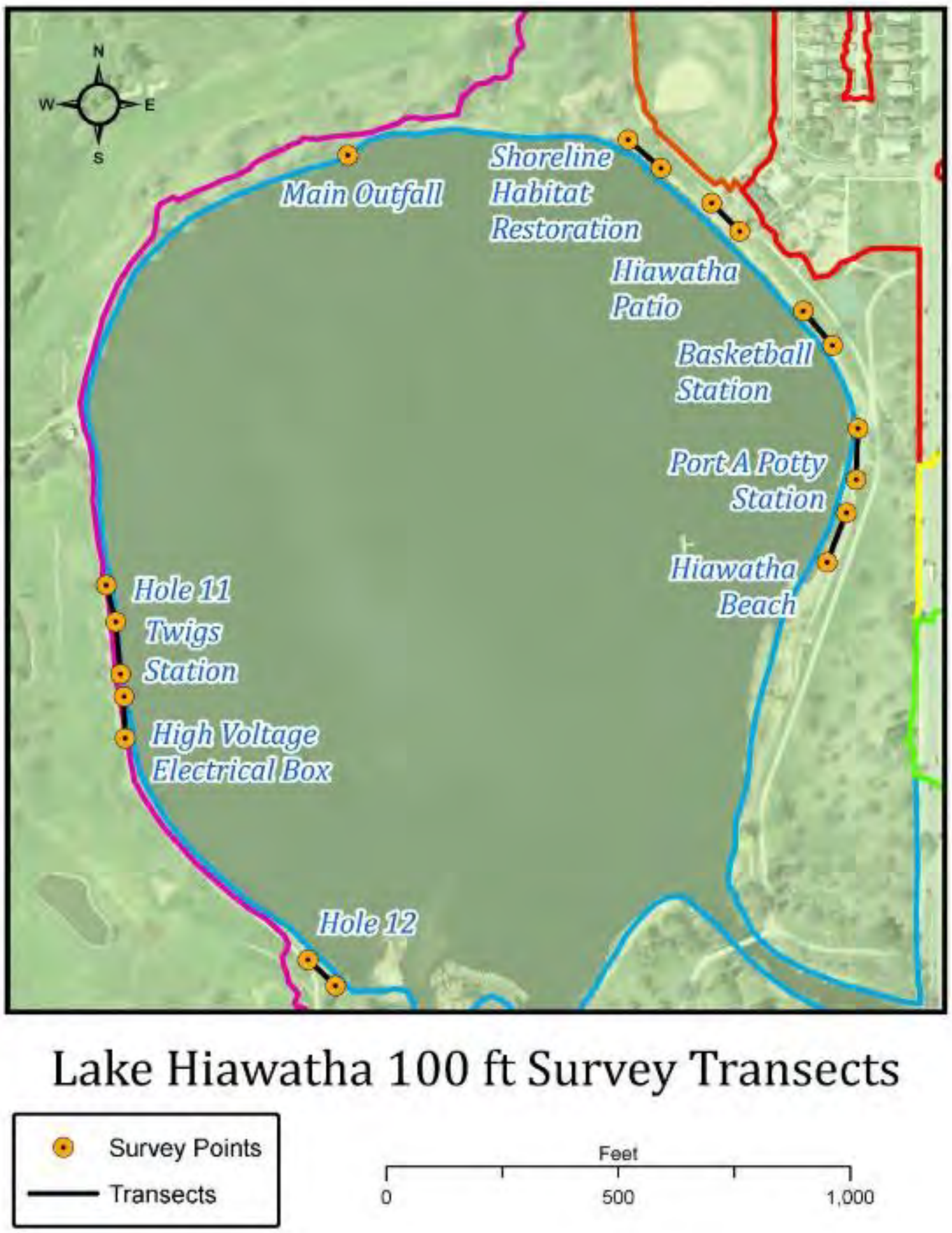


Figure 1. Lake Hiawatha 100 ft Survey Transects

Figure 2. Plastics Assessment Trash Sites

Results

The two site visits conducted by the City of Minneapolis Surface Water and Sewers staff over the summer of 2020 confirmed that high levels of trash, especially plastics are present throughout Lake Hiawatha. The most prominent type of trash that is present in Lake Hiawatha is plastics, 63% of the total trash items is composed of plastics (Figure 1). Miscellaneous items (36%) and biohazard items (including bird waste) (1%) were the next most commonly found items. There was no biodegradable, toxic, or metal items found this year. This could be due to only being able to visit two sites which were the Lake Hiawatha Beach site and the Shoreline Habitat Restoration site. The breakdown for the trash category of plastics indicates that hard plastic pieces (43%) were most commonly found in Lake Hiawatha followed by soft plastic pieces (33%), and then plastic wrappers (8%) (Figure 2). These results indicate that small pieces of plastic are still the most common type of pollution into Lake Hiawatha.

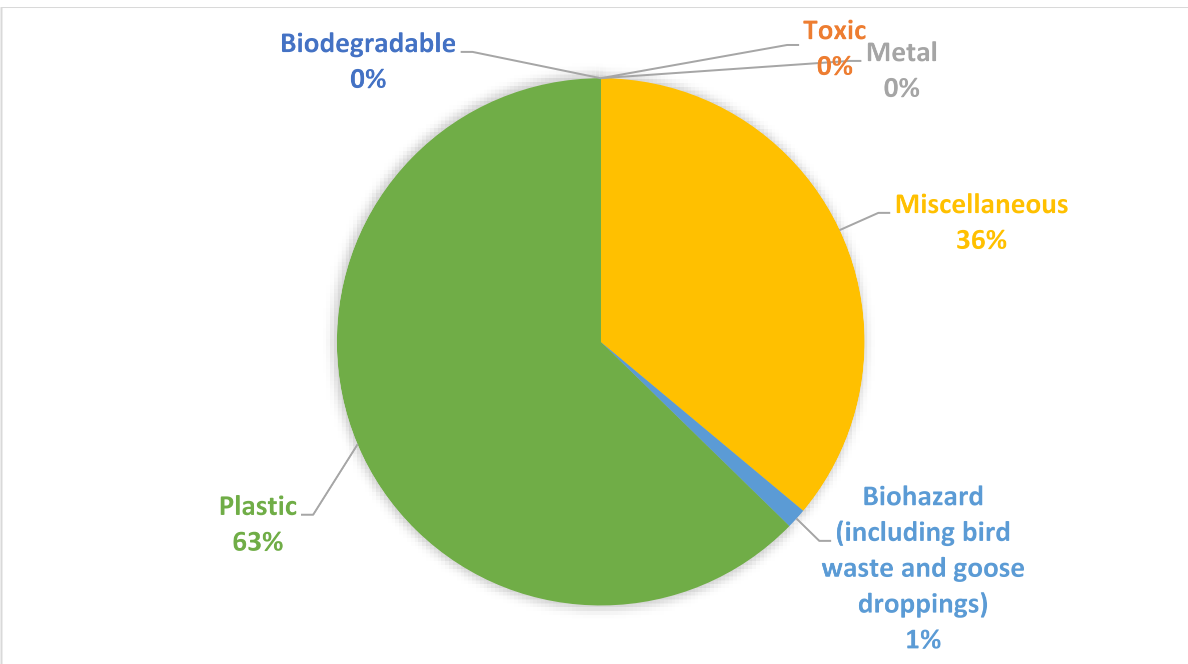


Figure 1. Total Trash Items, by Category, for all Sites and Dates

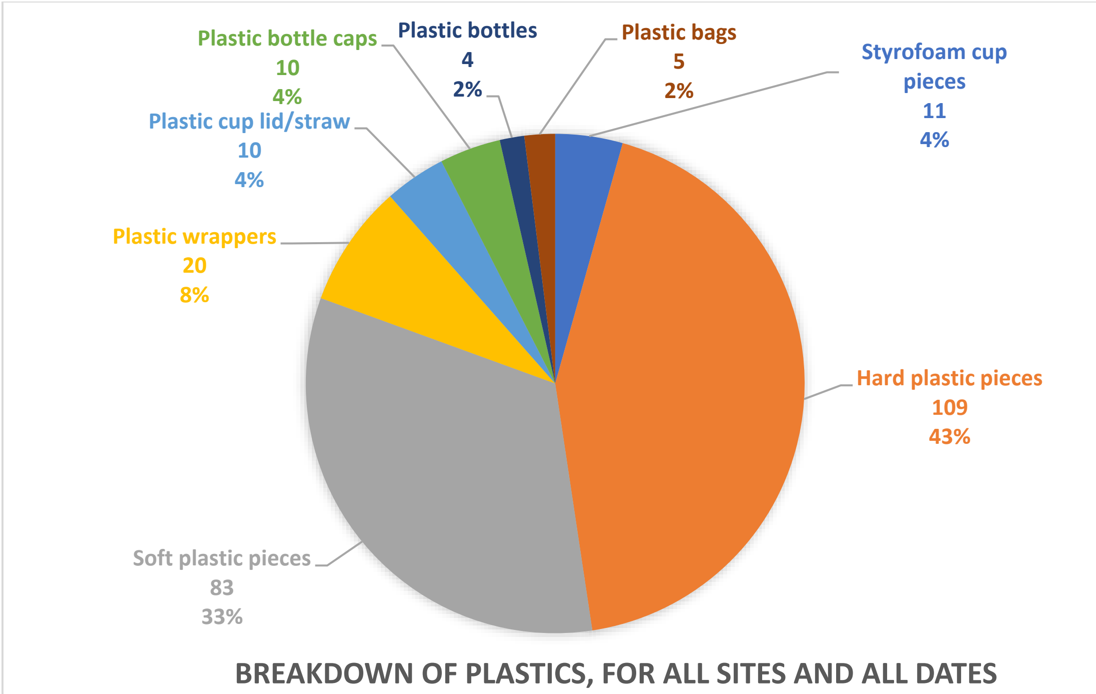


Figure 2. Breakdown of Plastics, for all sites and all dates

When looking at the total number of trash items, by category and date, for all sites there was an increase in the number of plastic items (Figure 3). Comparing the first site visit that was done on July 28, 2020 to the last site visit that was done on July 29, 2020 there is a slight increase on the total number of plastic trash items. On July 28, there was 97 plastic items and on July 29 there was 155 plastic items. For the miscellaneous items, there was a decrease in the number of items found. On July 28 there was 100 miscellaneous items found while on July 29 there was 45 miscellaneous items.

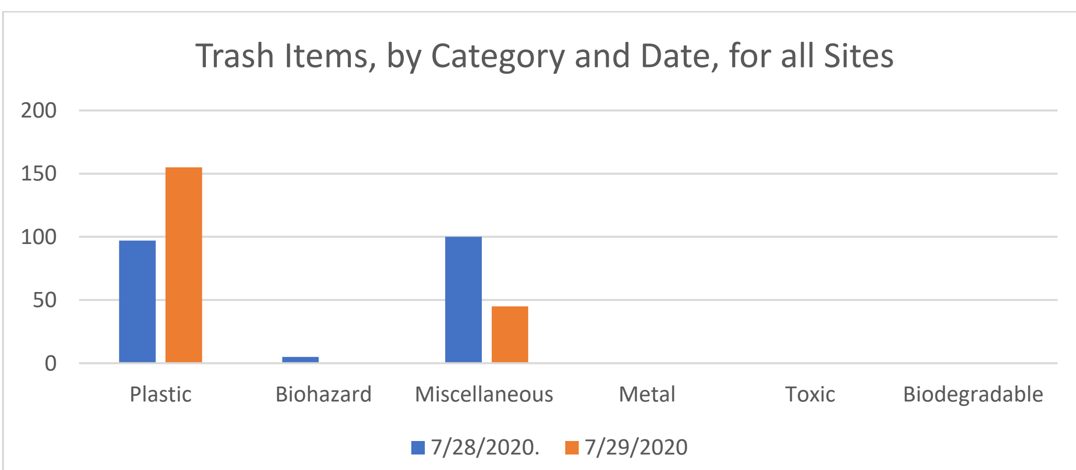


Figure 3. Trash Items, by Category and Date, for all Sites

When looking at the average condition category scores, by site, for all dates the parameters that scored the worst are actual number of trash items found, threat to aquatic life, and level of trash (Figure 4). All sites had scores of 20, which is optimal, for illegal dumping. The next parameter with the highest scores was threat to human health. Lake Hiawatha Beach and Shoreline Habitat Restoration didn't score perfectly on the parameter of threat to human health because there was pet waste at both sites. This is evidence of bacteria or virus hazards to humans which made the sites have a lower condition score. The condition scores for level of trash was 6 for both sites (Lake Hiawatha Beach and Shoreline Habitat Restoration). Trash was evident in low to medium levels (21-50 pieces) on first glance. Emergent, littoral zones, and creek bank contained litter and debris. Trash material included: scattered cans, bottles, food wrappers, and bottle caps. When rating the actual number of trash items found, the scores were 5 for both sites. This is because over 50 trash items were found based on a trash assessment of a 100-foot lake transect. The scores for threat to aquatic life correlated to the actual number of trash items found as most of the trash items were plastic. Plastic corresponds to items that are a threat to aquatic life. The trash items that are a threat to aquatic life are hard or soft plastics, Styrofoam, balloons, cigarette butts. Presence of settleable, degradable, and non-toxic debris such as glass or metal are also a threat to aquatic life. Overall, the illegal dumping and threat to human health parameters had the most optimal scores while the actual number of trash items found and threat to aquatic life had the lowest scores. Overall, the total trash items for Lake Hiawatha Beach was 202 trash items and 200 for the Shoreline Habitat Restoration transect (Figure 5).

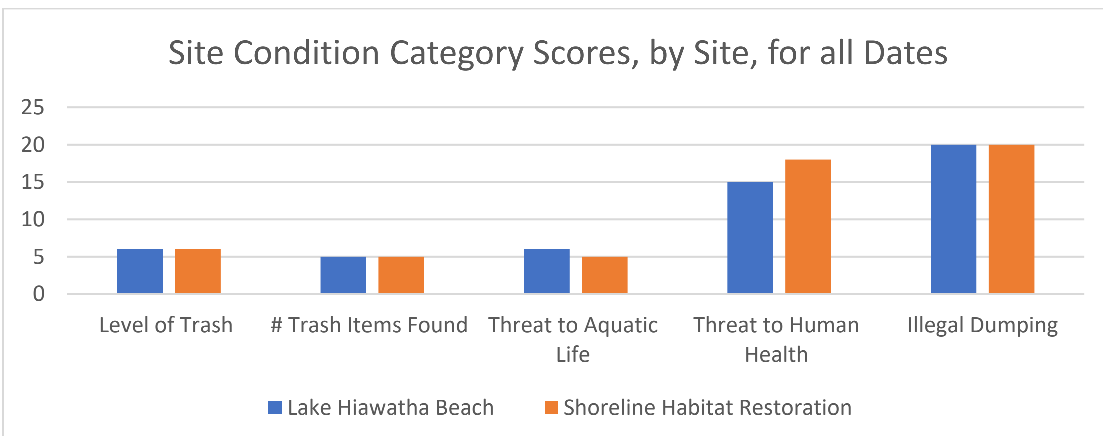


Figure 4. Site Condition Category Scores, by Site, for all Dates

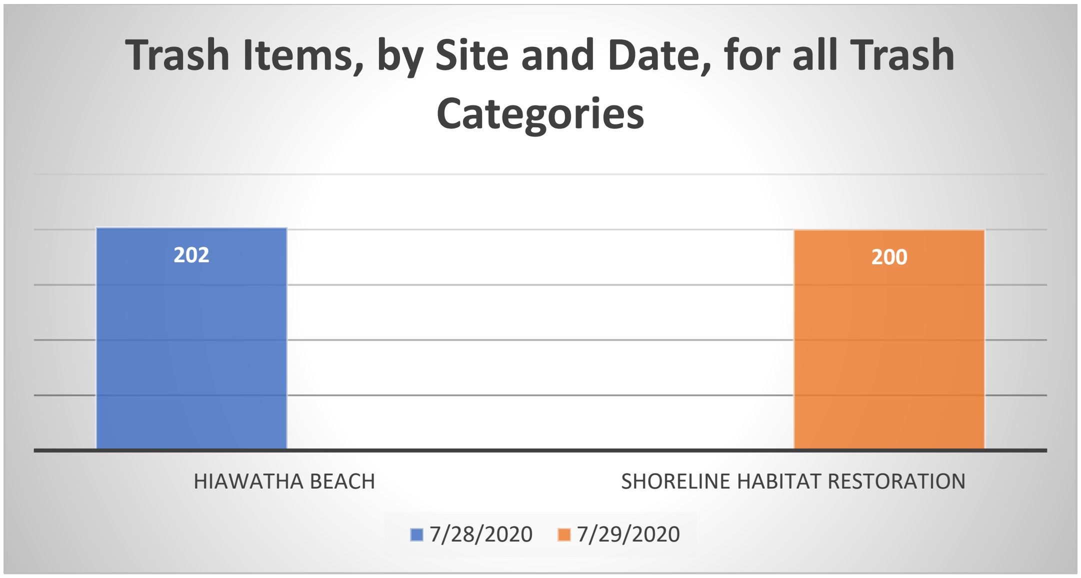


Figure 5. Total Trash Items, by Site and Date, for all Trash Categories

City staff conducted a plastics assessment at the Lake Hiawatha beach transect. Staff chose two sites within the transects that were representative of the larger area. The first site was at the beginning of the transect and the second site was at the end of the transects. These two sites were 1 m by 1 m and were measured using a Measure Master. The plastics assessment helps to categorize plastic pieces according to size (micro, meso, macro, and mega). It allows to record if the microplastics found are primary microplastics (intentionally manufactured small particles) or secondary microplastics (breakdown of larger plastic products). Lastly, it helps categorize plastic pieces according to their morphological descriptors (fragment, foam, film, line, pellet).

The results show that there are mainly hard plastic pieces, followed by soft plastic pieces at Lake Hiawatha Beach (Figure 6). There were a few items that were in the meso size category (5-25 mm), but most of the plastic pieces were in the micro category. In total, there were 26 pieces in the micro category and all the microplastics that were found are secondary microplastics. This means that all the plastic pieces at Lake Hiawatha have been broken down from larger plastic products.

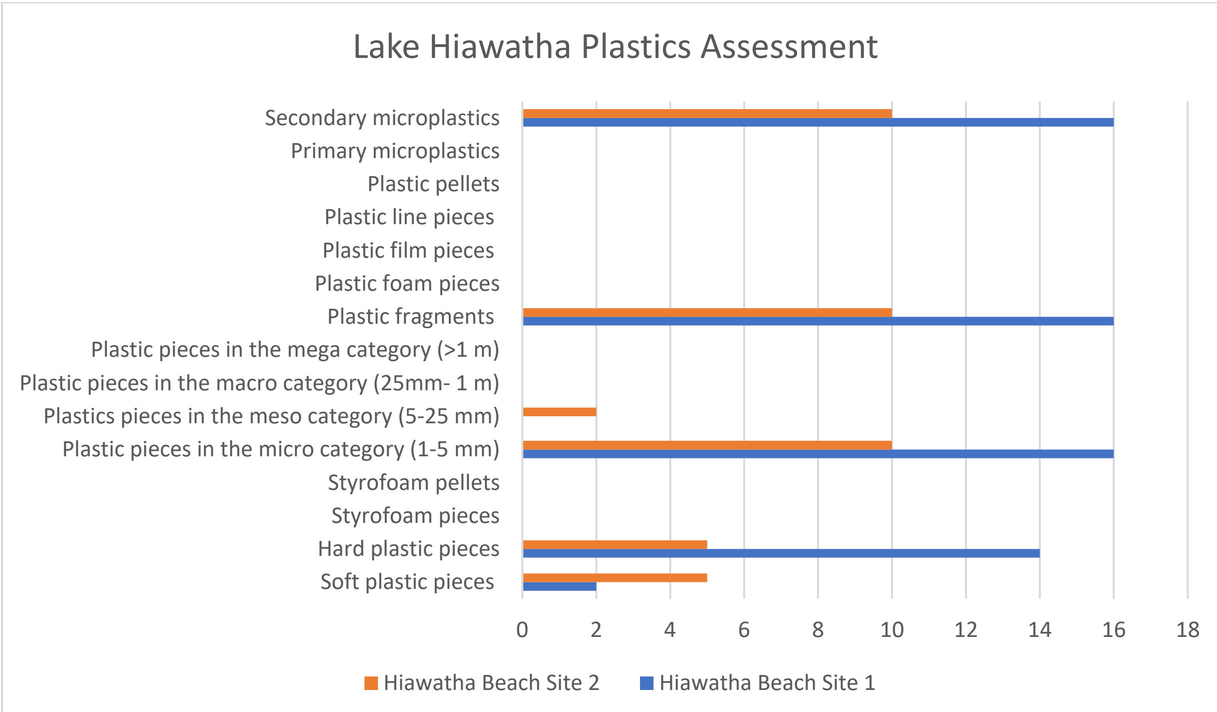


Figure 6. Lake Hiawatha Plastics Assessment

Recommendations

Levels of trash in Lake Hiawatha are very high again and lots of plastics are present throughout Lake Hiawatha. Plastic pollution is an issue for Lake Hiawatha because it affects wildlife, wildlife habitat, and humans. The chemical structure of most plastics makes them resistant to degradation and as a result they are a threat to aquatic life and humans. The recommendations from last summer's report should be considered when continuing this Study in the future.

Pictures Appendix:

Figure 1. Lake Hiawatha Beach Site 1 for Plastics Assessment

Figure 2. Lake Hiawatha Beach Site 2 for Plastics Assessment

Figure 3. Lake Hiawatha Beach 100 foot Transect

Figure 4. Lake Hiawatha Beach 100 foot Transect

Figure 5. Shoreline Habitat Restoration 100 foot Transect

Figure 6. Shoreline Habitat Restoration 100 foot Transect

Minneapolis
City of Lakes

Appendix D – Lake Hiawatha Stormwater Outlet Pilot Project

Appendix D

Lake Hiawatha Stormwater Outlet Pilot Project

Background: The stormwater outfall at the north part of Lake Hiawatha drains 1.4 square miles of the City. Like other traditional drainage systems, trash in often carried by the stormwater runoff and deposited into the receiving water. The MPRB and the City of Minneapolis are conducting a comprehensive planning process, with input from the community, to determine the long term use of the golf course land. The outcome of that process will results in changes to the stormwater system in the vicinity of the golf course including the configuration and size of the pipes and the use of specific treatment technologies to reduce flooding and impacts to water quality. In advance of the outcome Minneapolis City Council Member Andrew Council has requested that the City work with MPRB to design and implement a pilot to collect floating trash at the north stormwater outfall.

Pilot proposal: In coordination with MPRB, the City could deploy a floating curtain in the lake near the stormwater outlet for the extent of the pilot project, which is recommended to last no longer than eight weeks. Depending on availability of supplies the project could start August 1, 2016.

During the pilot project, the City would coordinate with MPRB to access the outlet from the golf course and would use nets with extendable handles to remove trash caught by the curtain.

City crews would visit the site to remove trash approximately once a week during the eight week pilot project. However priority would be given to other critical sanitary and sewer work such as responding to system backups, localized flooding, and ongoing cleaning and inspection of the 1400 miles of sewer pipes and associated infrastructure.

Crews should make the following observations during each site visit:

- Amount of trash collected (e.g., number of trash bags of materials collected)
- Dominant trash types (bottles, plastic bags, etc.)
- Trash in the vicinity, or visible in lake, not caught by the curtain
- Flow coming from the outlet (slow, moderate, fast)
- Recent precipitation events
- Condition of the curtain

To assure the safety of City and MPRB crews as well as residents it is important that others not interfere with curtain or attempt to collect trash caught by the curtain. Having only City crews remove accumulated material will also help evaluate the effectiveness of the pilot project.

It is recommended that signs are posted on the shore near the outfall within the golf course and along the shore of the lake not in the golf course. The signs should say something to the extent, "*Please do not disturb the floating curtain and trash in this area. This is a pilot project between the City of Minneapolis and MPRB. The purpose of the project is to understand the extent of floatable trash* *entering Lake Hiawatha from the storm sewer. The results of the pilot will inform future work to improve the City's stormwater system. If you are concerned about trash please be vigilant about picking up your own trash and encourage others to do the same*."

<u>Pilot measures:</u> To inform future investment of public dollars in City infrastructure the following elements will be tracked as part of the pilot; cost of materials and equipment, hours and cost for fabrication, deployment, repair, and retrieving the curtain, hours/cost for removing and disposing of trash collected, general characterization of trash collected, weather or other interference with project, lessons learned about fabrication, deployment, repairs needed, and removing trash, in case the practice is of interest in the future.

Appendix E – Mitigating Trash Upstream of Lake Hiawatha – Manhole Pilot Project

Mitigating Trash Upstream of Lake Hiawatha - Manhole Pilot Project

In February 2018 Surface Water and Sewer Staff retrofitted three manholes upstream of Lake Hiawatha with trash screens as part of ongoing pilot efforts to improve the water quality in lake. The retrofitted manholes are located at 3825 16th Ave St, E 41st between 26th and 27th Ave S, and E 41 St @ Longfellow. The selection of the manholes was informed by a litter surveyed completed earlier in 2017 by staff from the Solid Waste and Recycling Division of Public Works. The three manholes are located in relative proximity to commercial and retail properties where higher volumes of litter have been observed. Consideration was also given to the configuration of the connected storm pipes to minimize the likelihood of street flooding if the pilot failed and caused an obstruction in the pipe.

The trash screens were fabricated by City staff and designed to capture floatable trash and debris that could wash through the city's storm sewer system. City crews are able to access and maintain the manholes by vactoring out all of the debris and trash before it enters Lake Hiawatha. Crews are tracking debris removed to assess the success of the pilot project and to inform future water quality improvement efforts.

Photos

Data Collection and Next Steps

Between the installation date and October 15, 2018 City crews visited each manhole 14 – 15 times for an average of 1 – 2 hours. During most of those visits the crews did not find any appreciable trash to remove. On several instances they did remove up to 0.125 cubic yards of material from each location. Given that the installation of the screens in those locations did not result in appreciable trash collection, crews are re-evaluating the location and design. As of January 2019 staff were still developing recommendations for modifying the design and alternate locations that may capture trash. Any changes in the design will be informed by hydraulic modeling of the system as it is important to select locations where a trash screen will not block flow and result in flooding.

Appendix F – Litter Solutions Process and Clean City Program Summary

SW&R Litter Solutions Process and Clean City Programs Summary

Litter Solutions

In 2017, SW&R began a process of identifying new ways to reduce litter throughout the City. This process was informally named Litter Solutions. The process resulted in a three-pronged approach, with a mechanism to measure results, expanding on our litter abatement and prevention efforts.

Litter Be Gone

The annual litter clean-up event "Litter Be Gone" provides an opportunity for all Minneapolis residents, business and property owners, visitors and other groups to come together and clean-up litter in the City. The intent of the program is to change behavior and reduce the amount of litter. Clean up activities take place in each of the 11 neighborhood communities. All event services are provided by a City selected contractor.

The first Litter Be Gone contract resulted in a citywide litter cleanup event for three consecutive years (2018-2020). The City was unsuccessful in extending the contract or in securing proposals from replacement contractors due to the pandemic.

Litter Be Gone Event Results

Financial Report	**2018**	**2019**	**2020**
Billable Expenses	$ 34,951.52	$ 33,087.45	$ 16,223.43
In-Kind or Cash Donations	$ 12,193.72	$ 45,201.15	$ 43,067.87
Total Event Value	$ 47,145.24	$ 78,288.60	$ 59,291.30
% In-Kind or Cash Donations	26%	58%	73%
Activity Report	**2018**	**2019**	**2020**
Events Registered	54	53	-
Events Reporting Results	54	37	102
Volunteers	1295	1733	715
Blocks Cleaned	642	530	956
Bags Collected	558	484	658
Average Report	**2018**	**2019**	**2020**
Average Bags of Litter per Block	0.87	0.91	0.69
Average Bags of Litter per Volunteer	0.43	0.28	0.92
Average Bags per Event Held	10.33	13.08	6.45
Average Blocks Cleaned per Event Held	11.89	14.32	9.37

Request for Litter Cleanup Supplies

The litter clean-up supply request is a Clean City program that will allow Minneapolis residents, business and property owners, visitors and other groups to order standard Clean City supplies for one-time litter clean-up events, or for reoccurring litter clean-up events that do not meet the commitment requirements of other programs such as Adopt-A-Block or Adopt-A-Street. People may request litter bags, gloves, litter grabbers through the program.

Request for Litter Cleanup Supplies was advertised on the City's website and through Utility Bill inserts in 2019, and 2021. It is promoted at least twice per year through Recycling Reminder emails and is also often included in Council Member email newsletters.

Request for Litter Clean Up Supplies Results

Volunteer Participation	2017	2018	2019	2020	2021 (YTD)
Request for Litter Clean Up Supplies	3	37	98	36	87

Clean City Classroom

Clean City Classroom is a curriculum designed for grades K-6 to teach students about proper disposal of materials including litter prevention, waste reduction, recycling, composting, and beautification in Minneapolis. The program is intended to reduce the amount of litter using education and properly dispose of waste generated. The program is modeled after the Waste In Place curriculum prepared by Keep America Beautiful.

Clean City Classroom educator training was provided to Minneapolis Public School educators in 2019, was cancelled in 2020, and was held virtually in 2021 to Minneapolis educators with a redefined focus on the City of Minneapolis.

Clean City Classroom Results

Educator Training	2019	2020	2021 (YTD)
Number of Educators Trained in Curriculum	19	-	11

Benchmarking and Annual Litter Scan

To measure the amount of litter through-out the City in a consistent and consumable way. The benchmark scan will be used as baseline data. Each annual litter scan will be used to measure changes in the amount of litter and identify focus areas for Clean City programming. The litter scan measures the visual presence of litter in predefined segments within each neighborhood community on a scale of 1 to 4.

The benchmark scan was held in 2017. Annual litter scans were held in 2018 and 2019. The 2020 and 2021 annual scans were cancelled due to the pandemic.

Benchmarking and Annual Litter Scan Results

See Attachment A.

Standard Clean City Opportunities

The City of Minneapolis, Solid Waste and Recycling Division (SW&R) has offered Clean City Opportunities for approximately 25 years. The intent of these programs is to clean up, reduce or prevent litter. These programs successfully balance volunteer efforts with City support and have new participation each year.

Earth Day Cleanup partnership with Minneapolis Park and Recreation Board

The City has partnered with the Minneapolis Park and Recreation Board on it's annual Earth Day Cleanups at Minneapolis Parks since 1995. Through the partnership, the City provides litter clean up supplies and litter disposal services to MPRB and MPRB helps promote and host volunteer clean up events at Parks around the City. In 2019, over 4,700 pounds of litter was collected through the Earth Day clean up event. In 2018, over 500 volunteers picked up more than 4,700 pounds of garbage.

Adopt-An-Ash Receptacle

Cigarette butts and other Cigarette waste has long been the most littered item across our nation. The Division of Solid Waste and Recycling offers an Adopt-Ash-Receptacle program to help reduce Cigarette waste from our City streets, sidewalks and boulevards. Any interested party can adopt an Ash Receptacle to be placed at an appropriate location for pedestrians to use. Ash receptables are serviced by the volunteer.

Adopt-An-Ash Receptacle Results

Volunteer Participation	2017	2018	2019	2020	2021 (YTD)
Number of New Ash Receptacles Placed	20	9	15	8	2

Total Placed	Count
Ash Receptacle	251

Adopt-A-Litter Container or Recycling Container

Businesses, individual residents, block clubs or other organizations can adopt a litter container/recycling container for a minimum of two years. These entities already know the locations where litter collects and have on-the-scene interest in minimizing litter and debris. An adopted litter container/recycling container is an effective means of preventing much of the litter from being tossed to the ground in the first place. Participants of this Program are not charged to have a litter container/recycling container placed and may service the container themselves or pay the city to service the container for them. City service option is not available for recycling containers.

In addition to the Adopt program, litter containers are placed throughout the City to manage litter at transition points as directed by Council Action. The CA requires a litter container at each intersection within the Downtown Core, and each bus shelter throughout the City, and at each intersection within Commercial Corridors.

Litter Container Results

Placements	2017	2018	2019	2020	2021 (YTD)
Number of New Litter Containers Placed	6	72	76	49	55
Total Number of City Serviced Litter Containers	670	Unavailable	Unavailable	Unavailable	727
Total Number of Adopter Serviced Containers	1408	Unavailable	Unavailable	Unavailable	2004

Adopt-A-Block

Individuals, businesses, block clubs or organizations are encouraged to adopt their block. It has been demonstrated many times over that when people are in a place that is well cared for, their behavior is more respectable toward other people and the neighborhood. Solid Waste will provide plastic bags and a pair of reusable gloves, as well as 'Do Not Litter' recognition signs. Adopters agree to collect litter, in addition to other tasks, at least four times per year.

Adopt-A-Block Results

Volunteer Participation	2017	2018	2019	2020	2021 (YTD)
Number of New Adopt-A-Block Participants	2	6	11	10	14

Adopt-A-Street/Highway

This program is provided through a joint agreement with the Solid Waste & Recycling and Traffic Divisions of the City of Minneapolis and Hennepin County Commissioners. Individuals, businesses, block clubs or organizations are encouraged, with highly visible *Adopt-A-Street* signs, to adopt a Minneapolis City street or County highway. Participation in this Program pledges that the adopter will maintain the street or highway for a 6-block stretch, both sides of the street. Solid Waste will provide adopters with plastic bags, safety vests and reusable gloves. The City will dispose of the trash bags at no charge to the adopter.

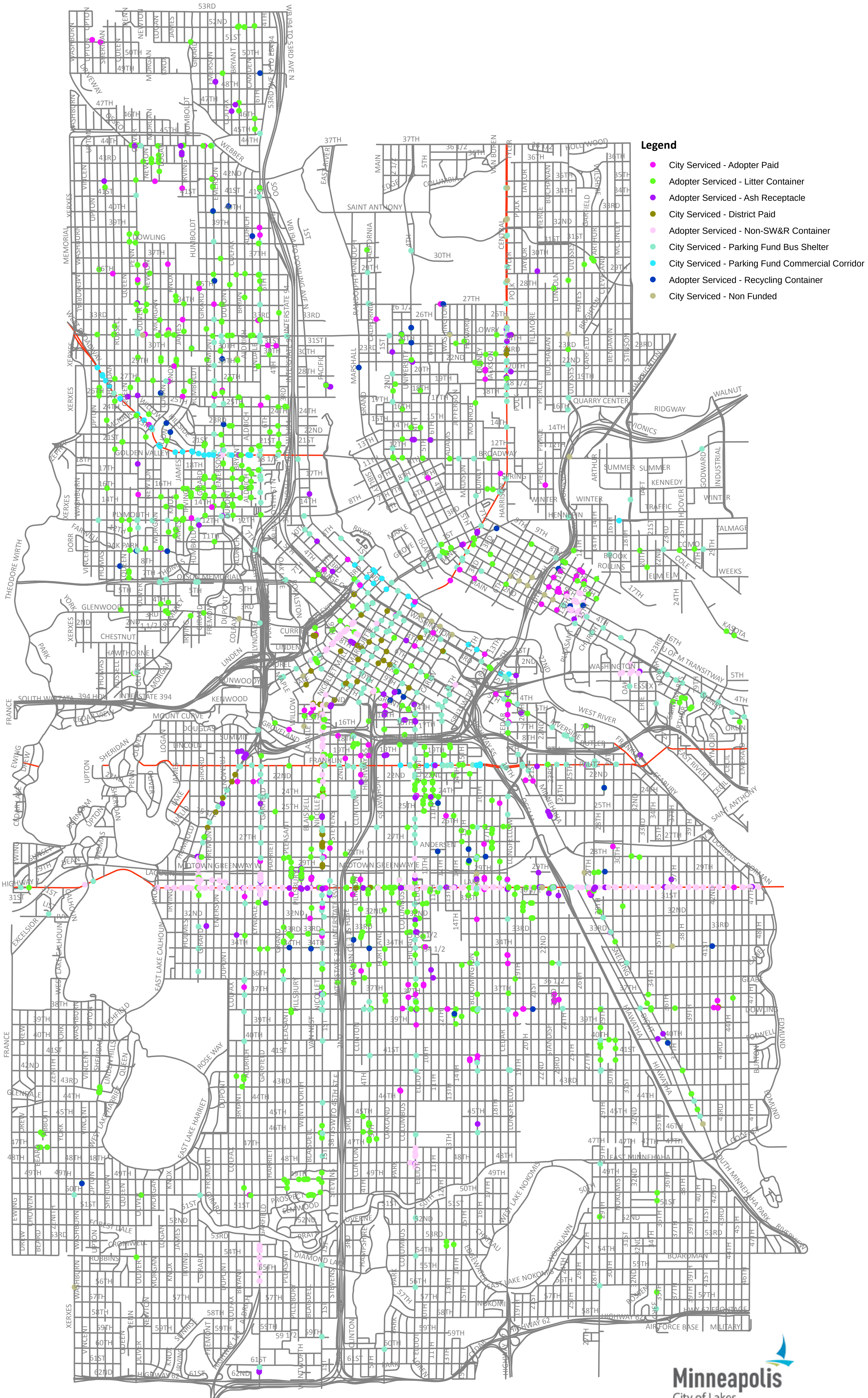
Adopt-A-Street/Highway Results

Volunteer Participation	2017	2018	2019	2020	2021 (YTD)
Number of New Adopt-A-Block Participants	3	5	7	3	2

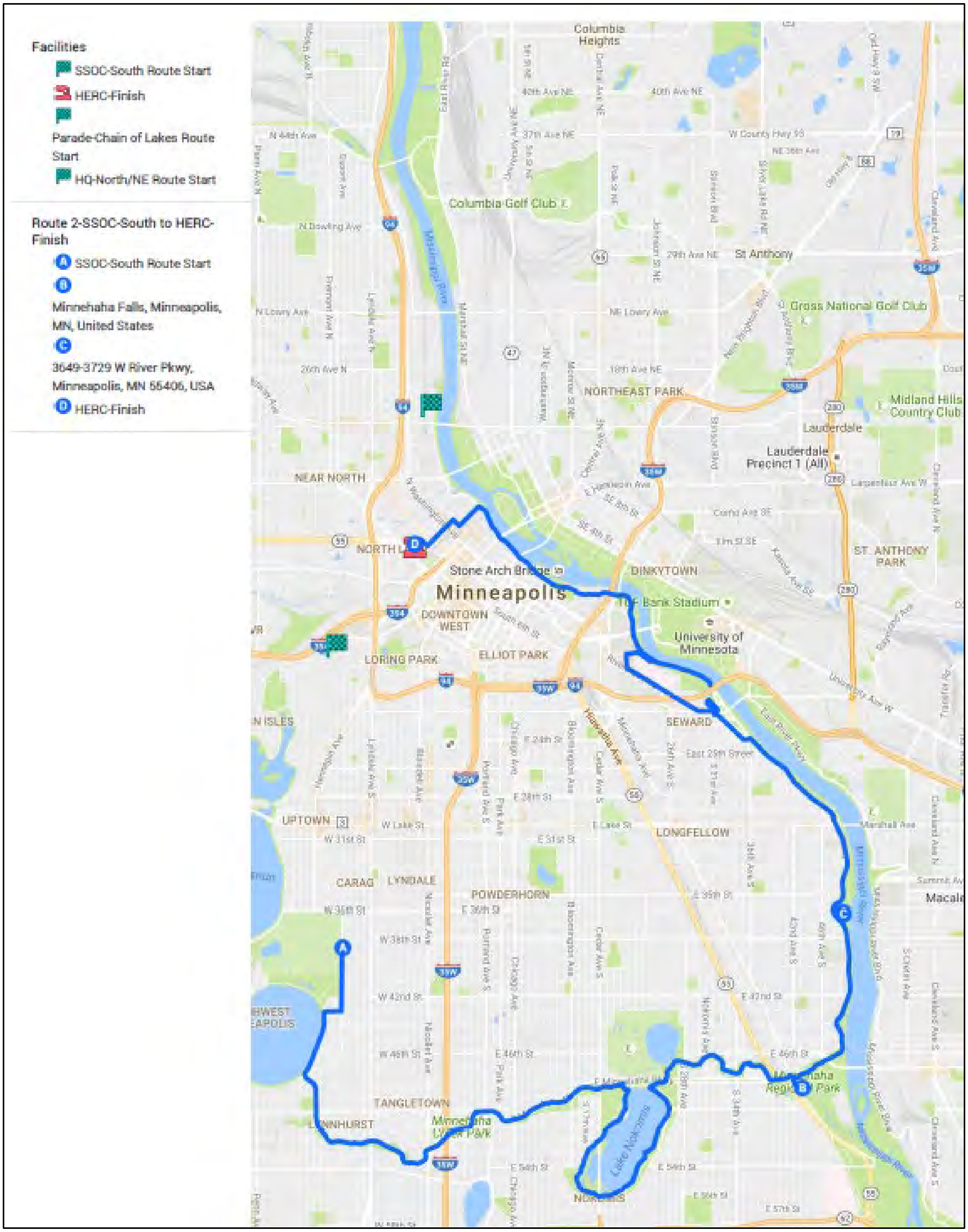
Minneapolis
City of Lakes

Appendix G – Litter Containers and Ash Receptacles Map

Litter Containers and Ash Receptacles

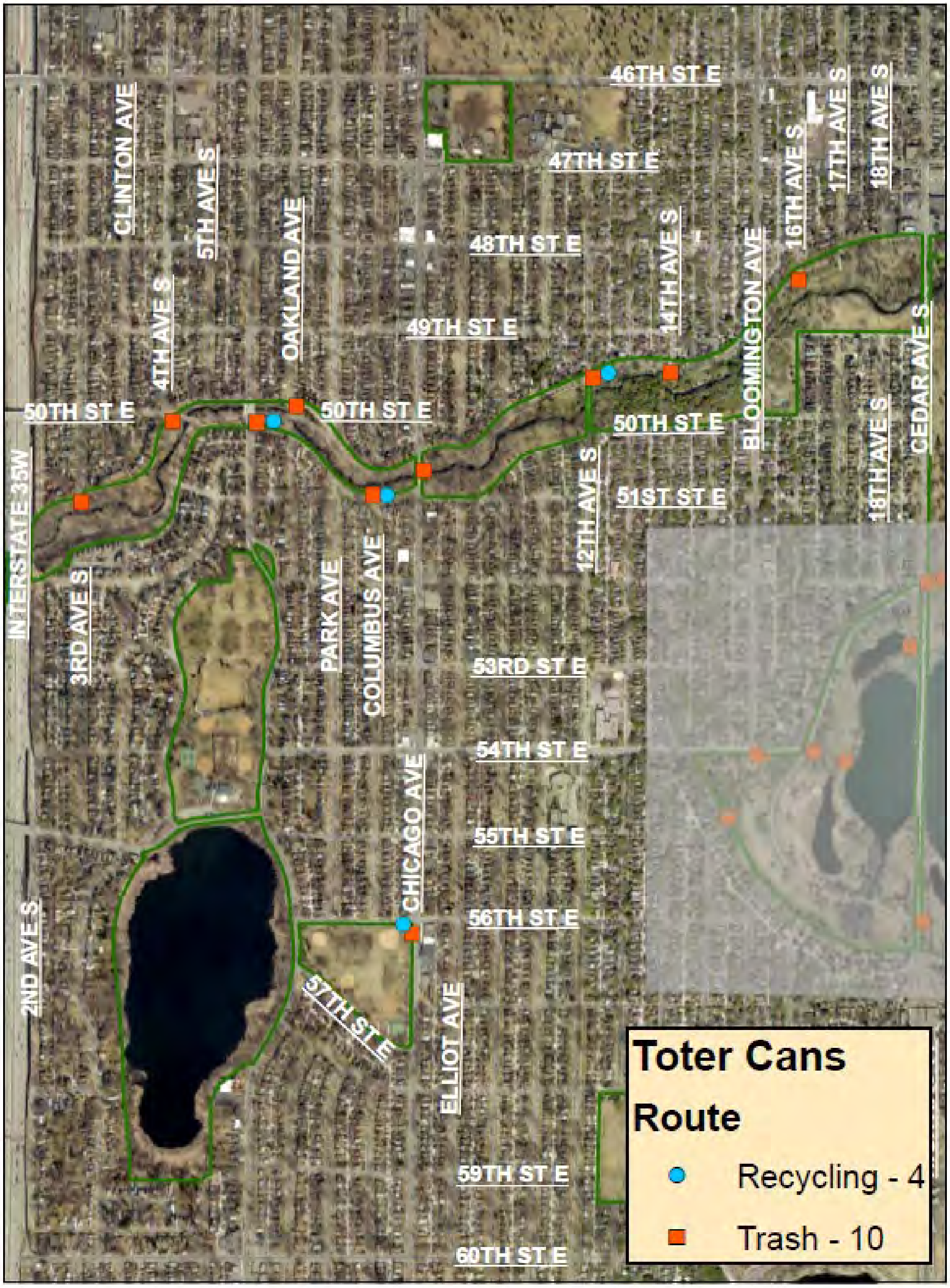


June 15, 2020



Example of An MPRB Load and Pack Route – Regional Trash Route 2 – South Parkways and River

Locations of Toter trash and recycling cans at Lake Hiawatha serviced by MPRB Load and Pack



Toter trash and recycling locations along Minnehaha Creek serviced by MPRB Load and Pack