NPDES MS4 Phase I Permit No. MN0061018
Annual Report for 2019 Activities

City of Minneapolis and the Minneapolis Park & Recreation Board

Co-Permittees

June 30, 2020

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SIGNATURE PAGE

Minneapolis
City of Lakes

NPDES MS4 Phase I Permit
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June 30, 2020

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

Elizabeth Stout

Date 6/30/2020 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
LSWMP	Local Surface Water Management Plan
MCES	Metropolitan Council Environmental Services
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 and 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

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BACKGROUND

This report provides documentation and analysis of the Minneapolis Stormwater Management Program (SWMP) activities conducted during 2019. 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 2019 Annual Report and will be submitted to the MPCA by June 30, 2020.

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 Minnesota Pollution Control Agency (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 is included with this report.

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.

MINIMAL CONTROL MEASURE ONE: PUBLIC EDUCATION

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 MPRB. Other activities are coordinated with and carried out by watershed management organizations, Hennepin County, and other entities.

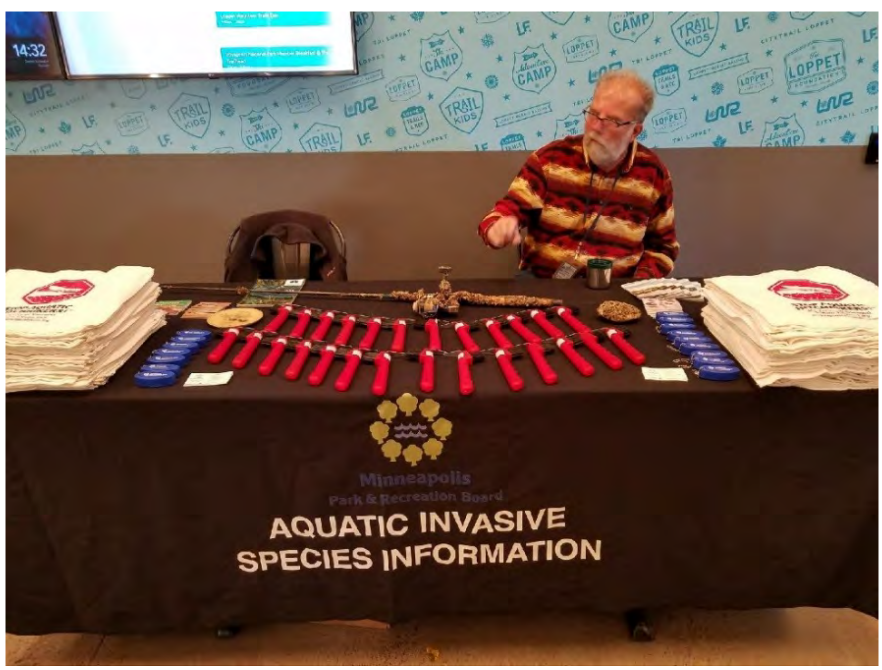
PREVIOUS YEAR ACTIVITIES

In 2019, MPRB staff provided water quality education programs throughout the City. Environmental Management naturalist staff participated in 96 Minneapolis community festivals, neighborhood events, as well as concerts and movies (see map and sites below). Hands-on water quality educational displays focused on neighborhood watersheds and how human activities impact local water bodies. Education staff utilized portable mini-golf, bean bag toss, an aerial photo floor graphic of the City and its watersheds, and other hands learning activities. In addition, 890 families and Nature Explorer Campers (ages 6-12) experienced water quality education while canoeing the lakes of Minneapolis.

Map and list of water quality education sites in 2019

At the Lakes

The MPRB continued its extensive Aquatic Invasive Species (AIS) Inspection 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 boats entering and leaving the lakes are inspected for AIS. In addition to providing boat inspections, staff are an information source for the park visitors. Staff directly interacted with 17,788 park visitors in 2019. Adjacent to the AIS booths are sandwich boards with action steps people can take to be good water stewards. The message boards 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.



Do Not Feed the Ducks

Our yellow duck ambassadors continued their focus on persuading park patrons to not feed the ducks. An oversized buoy in the shape of a rubber duck floated along the Lake Harriet shoreline that abuts Bread & Pickle (see photos), and a parade of more than 200 table-toppers with the ‘do not feed the ducks’ messaging were installed on the fishing rail at Powderhorn Lake (English and Spanish), and on picnic tables at Bread & Pickle and Sand Castle (Lake Nokomis).

Minnehaha Park

A moveable water quality education exhibit was deployed at Minnehaha Park near the pavilion that houses the popular restaurant, Sea Salt. 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 the cubes.

Canines for Clean Water

More than 160,000 dogs reside in the City of Minneapolis, generating an estimated 65,000 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 and empowering people to take action and make a difference!

In 2019 the Canines for Clean Water campaign continued to focus on Public Service Announcements (PSAs) shown at the Riverview Theatre, located near the Mississippi River and Lakes Nokomis and Hiawatha, and at the MPRB recreation centers. The PSAs focused on getting pet owners to pick up after their dogs, and encouraging all property owners to rake responsibly, expand their composting, and stop or reduce their use of salt or chlorides. New for this year, the PSAs had a simple message of “Green Lands, Blue Waters” to emphasize the connection of land use to water quality and showcased simple actions residents can take to keep our waters clean. For winter, the images featured winter scenes of the Mississippi River, Lake Nokomis, and dogs frolicking in the snow. The message here was to Protect the River, Protect the Lakes, Protect the Paws: Shovel, Don't Salt. The word chloride was not used in the PSA because more people understood ice melt as salt. Detailed information about chlorides, their impacts, and best practices for distribution can be found on the Minneapolis Park & Recreation Board website: www.minneapolisparks.org/dogs

Earth Day Watershed Clean-up

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 (see complete list below).

The 2019 Minneapolis Earth Day Clean-Up Event was held at 43 sites throughout the City of Minneapolis. It is a collaborative effort between the MPRB and City of Minneapolis Public Works - Solid Waste and Recycling Division.

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.

In addition, the Earth Day event had free family activities at four main sites: Lake Harriet, Lake Nokomis, Boom Island, and Creekview Park that featured bird feeder building along with naturalist activities. This single-day event removed nearly 9,000 pounds of litter from our city, that might otherwise have ended up in our waterways. The waived hauling fee along with the generous donation of 2,600 pairs of cotton gloves and 3,900 plastic bags from Minneapolis Solid Waste and Recycling made this clean-up a success!

2019 Earth Day Clean Up Sites

SITE	ADDRESS
29th Ave and Midtown Greenway	29th Ave and Midtown Greenway
Bassett's Creek	SE corner of Penn Ave N and 1 ½ Ave N
Bde Maka Ska East	Corner of W Lake St & E Calhoun Pkwy
Beltrami Park	1111 Summer St NE
Bluff Street Park	1 20th Ave S
Boom Island	724 Sibley St NE
Bryant Square Park	3101 Bryant Ave S
Cedar Lake	Cedar Lake Pkwy & 25th St W
Columbia	Columbia Pkwy & 35th Ave NE (playground parking lot)
Creekview	5001 Humboldt Ave N
East River Pkwy	E River Pkwy & Franklin Ave
Elliot Park	1000 E 14th St.
Father Henn Bluff	100 6th Ave SE
Folwell Park	1615 N Dowling Ave
Heritage Park/Sumner Field	10th Ave N and Van White Memorial Pkwy
James I. Rice Park	10th Ave N and Van White Memorial Pkwy
Kenny/Grass Lake	1328 58th St W

Kenwood	2101 Franklin Ave W
Lake Harriet	4135 Lake Harriet Pkwy, band shell parking lot
Lake Hiawatha	2701 E 44th St
Lake of the Isles East	W 27th St and E Lake of the Isles Pkwy
Longfellow Park	3435 36th Ave S
Loring	1382 Willow St
Lynnhurst	1345 W Minnehaha Pkwy
Mill Ruins	102 Portland Ave S
Merwyn Triangle Park	E Franklin Ave & 26th Ave S
Minnehaha Creek	W Minnehaha Pkwy and W Minnehaha Parkway
Minnehaha Falls	4801 S Minnehaha Drive
ML King	4055 Nicollet Ave S
Mueller Park	2509 Colfax Ave S
Nokomis	2401 Minnehaha Pkwy E
Pearl	414 Diamond Lake Rd E
Powderhorn	3400 15th Ave S
Sibley	1900 E 40th St
Steven's Square Park	1801 Stevens Ave
Theodore Wirth	The trailhead - Theodore Wirth Pkwy
Triangle Park	10th St between 4th and 5th Ave between the in-bound and out-bound access ramps to 35W

W River Pkwy & 24th	W River Pkwy & 24th St
W River Pkwy & 36th	W River Pkwy & 36th St
W River Pkwy & 44th	W River Pkwy & 44th St
Waite Park	1810 34th Ave NE (near playground off Garfield)
Webber Park	400 Dupont Ave N
Whittier	425 W 26th St

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, and within the watershed of the Mississippi Watershed Management Organization. Typical workdays included visiting such park sites as; B. F. Nelson, East Phillips, Stone Arch Bridge, Minneapolis Sculpture Gardens, Lake Nokomis Naturescape, Parade Ice Stadium, and North Mississippi Regional Park, to conduct invasive species removal, weed wrenching, planting, watering, and mulching.

As part of weekly career exposure days, the crews visited the Minneapolis Waste Water Treatment facility, trained to become Pollinator Ambassadors for the University of Minnesota's Bee Lab, completed 21 hours of training to receive Blue Thumb Certifications from MetroBlooms for their work and study of BMPs, continued their work as citizen scientists with the MPCA to gather soil samples for a fertilizer use study, and for the Minnesota Dragonfly Society to evaluate habitat and water quality at North Mississippi Regional Park.

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 Minneapolis Public Works through their contract with Landbridge Ecological, which manages vegetation at public storm water BMPs throughout the city. Landbridge and the Green Team's work in 2019 focused on weed and invasive species management at Logan Pond, Folwell Park, Heritage Park, Hiawatha Golf Course, Irving Triangle, and the rain gardens at Oliver Ave North.

Frog & Toad Surveys

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. MN 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 of whether stormwater ponds, constructed to intercept and treat runoff, can also function as a refuge for amphibians has been raised. In addition, complaints about the absence of formerly abundant frog and toad calling from Hiawatha Golf Course and the surrounding area have been reported. To evaluate the basis for this information, preliminary frog and toad listening surveys were conducted at Lake Hiawatha golf course in 2016-17, and then formalized in 2018-19. 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:

1) Determine if amphibians are living in or near stormwater ponds.
2) Use the Minnesota Frog and Toad Calling Survey protocols adapted for 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.
5) Incorporate citizen science and water resource education into monitoring activities.
6) Strengthen resident's understanding of the connection between water resource and amphibian health.

Minnesota Frog & Toad Calling Survey Findings

Specific information on stormwater pond sites and numbers of surveys conducted per year can be requested from the MPRB.

Overall few species were found in or near any of the stormwater ponds. American toads were the most ubiquitous. The single most diverse site—relatively speaking since only three species were documented over two years—was in north Minneapolis at 52nd and Upton. Green frogs, the only aquatic species found in any pond, were present and abundant with a chorus of 2. Interestingly, green frogs have not been heard in similar surveys conducted in Theodore Wirth Park (2015-19).

Toads were consistently found at Hiawatha Golf Course and in 2019, at least five adults were seen swimming at the surface in ponds 1 and 2. Pond 5 is located just north of Minnehaha Creek near the outlet and areas with comparatively more shrubs and trees. Tree frogs heard calling were from a distance and not from the pond itself. In addition, sprinkler irrigation at night on the golf course keeps the grass green and creates a humid microhabitat.

Two sites were found to have limited amphibian activity:

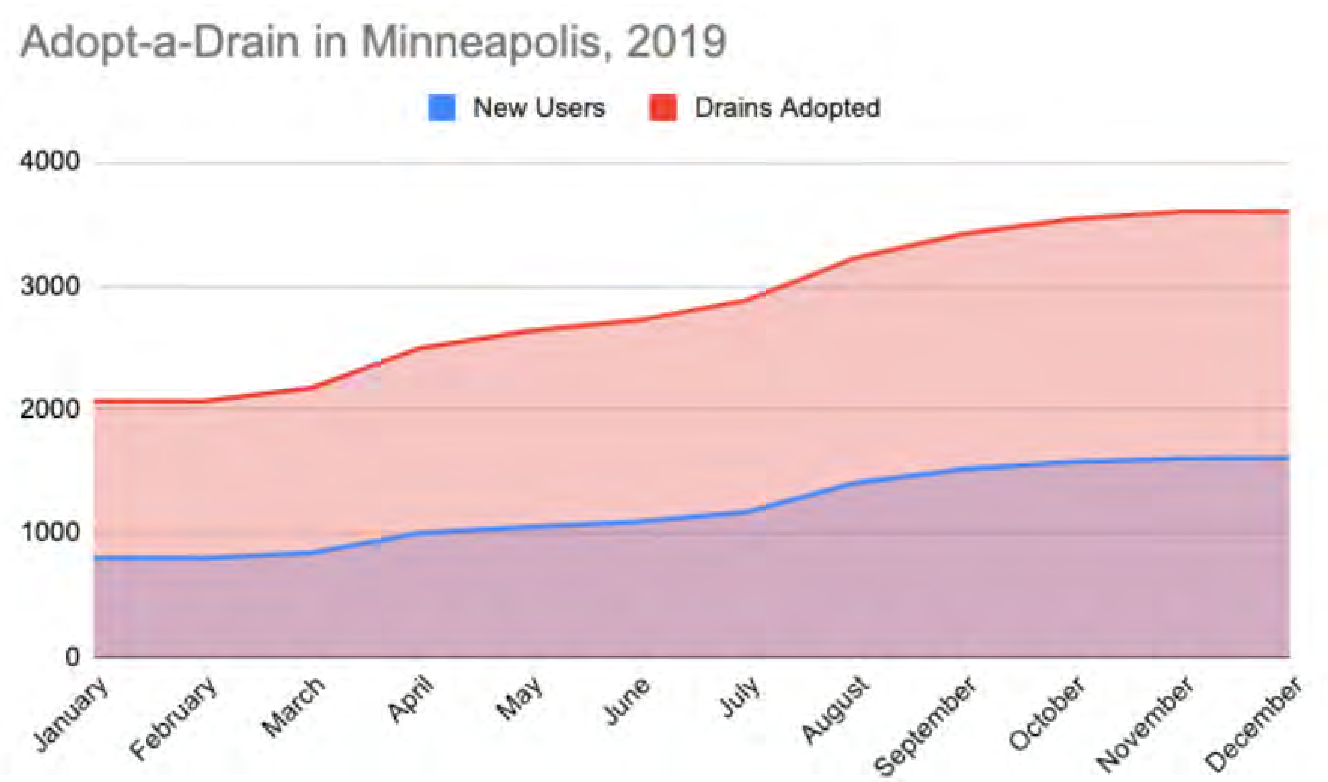
- Chicago & 37th S: Operating fountain, lot of lighting and traffic noise; a single toad chorus of 1 in 2018.
- Columbia Golf Course: Toad chorus of 1 was heard once, in 2019.

It was also observed that some riparian areas around stormwater ponds are being incrementally reduced through mowing. This is notable at the Heritage Park sites, Chicago and 37th S, and Hiawatha and Columbia golf courses. The ponds near Lake Nokomis and Bde Maka Ska are expanding due to high water, and the wet meadow areas (usually managed as turf) are a few degrees warmer; these sites are preferred breeding sites for toads.

Adopt-a-Drain Program

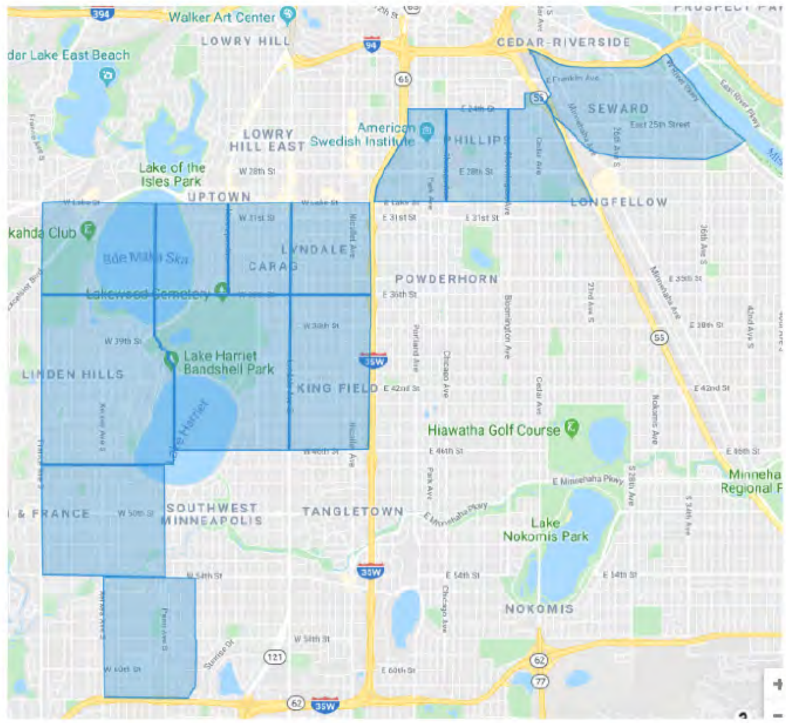
Since 2016, the Minneapolis Adopt-a-Drain program has empowered Minneapolis residents to take responsibility for storm drains and gutters in their neighborhoods by adopting and keeping them clean. In March 2019, the arrival of a metro-wide website (www.adopt-a-drain.org) was launched to serve all cities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

- Minneapolis led all cities in the Twin Cities with 1,630 total program participants (820 joined in 2019)
- 3,620 total storm drains adopted (1,561 were added in 2019)
- 535 participants in Minneapolis reported cleanings
- Collected 28,083 pounds of debris
- Over 530 volunteer hours logged
- 25 pounds of Total Phosphorus (TP) being removed from the waters of Minneapolis (the amount of TP removed is most certainly higher, as only 32.8% of participants reported cleanings)

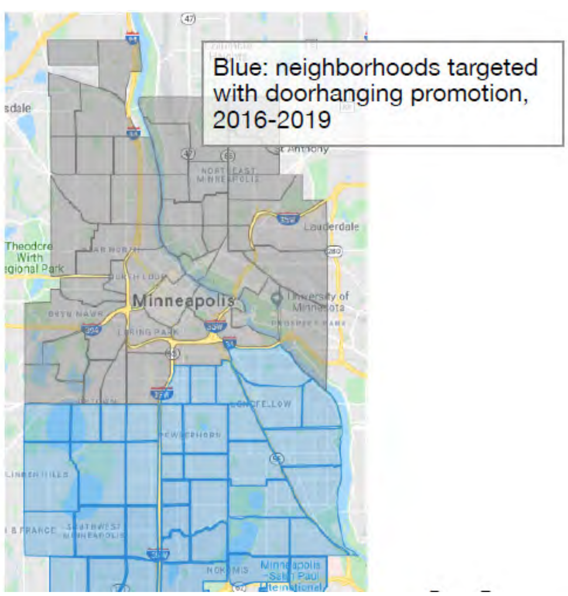


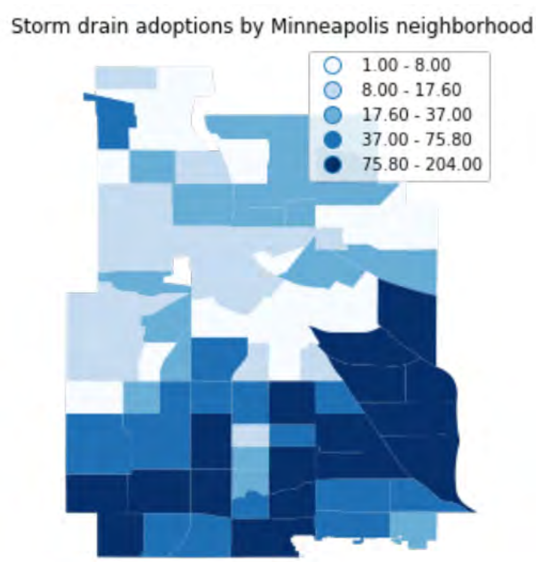
Adopt-a-Drain Door Hanging
Working in conjunction with Hamline University, 14,250 educational door hangers were distributed in 2019 to residential homes in 14 different neighborhoods in Minneapolis:

Neighborhood	Homes
East Harriet	750
Armatage	1,900
Fulton	2,400
Linden Hills	2,400
Lyndale	750
CARAG	700
ECCO	500
West Calhoun	50
Seward	1,800
Midtown Philips	1,200
East Philips	800
Philips West	1,000
Total	14,250



Door hanging continues to be a strong tool to get people to join the Adopt-a-Drain Program. Adoption rates in door hangered neighborhoods are consistently higher than non-door hangered neighborhoods:





617 welcome packets were distributed to new adopters that included a waterbody specific yard signs and stake, storm drain decals and adhesive application, welcome card with safety tips, application and cleaning instructions, and a customized Minneapolis welcome letter.

Additionally, 195 Minneapolis residents signed up the adopt storm drains at the Eco-Experience building at the Minnesota State Fair

The Minneapolis Adopt-a-Drain 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:

This brochure was revised in 2019 to include a QR code to allow program access from a smartphone.

In 2019, 812 waterbody specific Adopt-A-Drain yard signs were distributed to adopters in Minneapolis to provide a secondary touchpoint away from the storm drain, in the adopter's yard, to help raise awareness about the program.

Storm Drain Stenciling Program

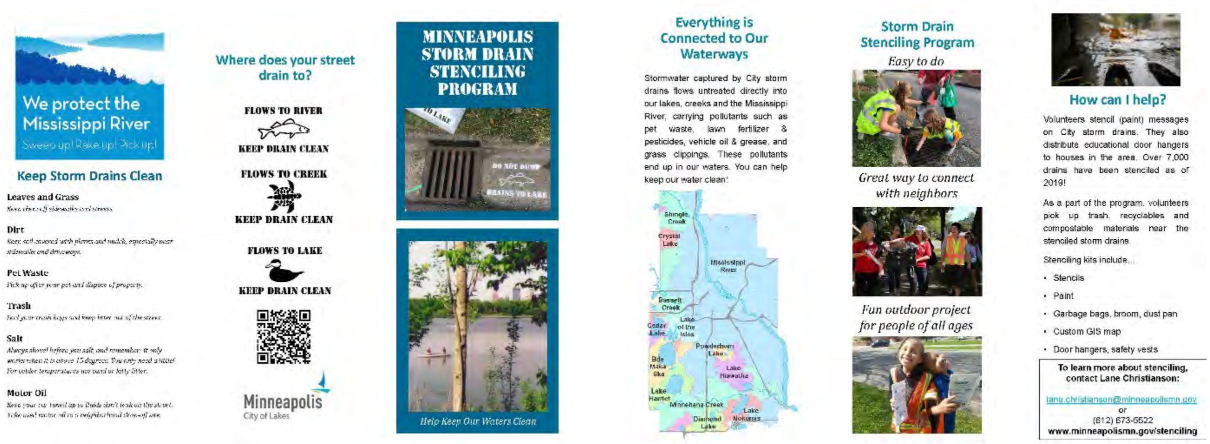
Storm drain stenciling not only educates volunteers who paint environmentally friendly messages like "FLOWS TO RIVER/LAKE/CREEK – KEEP DRAIN CLEAN" on the storm drains, but also engages residents and people passing by. It is a great team-building exercise that helps people learn actions they can do to 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 2019 Storm Drain Stenciling Program had robust involvement from volunteers, including:

- 500+ volunteers participating
- 1,110 storm drains stenciled
- 1,500+ doorhangers hung on residential homes
- 84 bags of trash and debris collected
- 2,500 pounds of trash, leaves, and debris removed from storm drain system
- Over 3 pounds of phosphorus removed from lakes, creeks, and the Mississippi River

Gas stations, Fortune 500 companies, City of Minneapolis departments, small businesses, public schools, charter schools, churches, Girl Scout troops, Boy Scout troops, neighborhood organizations, green teams, block clubs, and individual residents – all organized stenciling activities in 2019. Staff from the Friends of the Mississippi River also helped to coordinate stenciling events in the Mississippi River Gorge area in Minneapolis.

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:



This brochure was revised in 2019 to include a QR code to allow program access from a smartphone.

Metro Blooms Training and Engagement Programs

In 2019, 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.

2019 Resilient Yard Workshops

- 14 workshops
- 573 Minneapolis residents participated
- 57 Minneapolis residents received on site consultations
- 71 onsite rain garden consultations
- 168 residents installed neighborhood-based raingardens

The Neighborhood of Raingarden projects was promoted through workshops where participants were encouraged to attend and learn more about raingardens and resilient landscapes.

Creating Your Resilient Yard
6 of these workshops focused on the creation of water-friendly sustainable landscapes.

Year-end survey results

- 23% of respondents had installed a raingarden due to workshop
- 5% were currently working on installing a rain garden
- 31% plan to install a rain garden in the future
- 10% already had a raingarden prior to attending workshop

Turf Alternatives:
4 of these workshops focused on turf alternatives that minimize irrigation and maximize pollinator habitat.

Year-end survey results

- 32% installed turf alternatives
- 5% currently working on turf alternative installations
- 45% plan to install turf alternatives in the future

Healthy Soils:
2 of these workshops focused on the process of creating healthy soils to nurture native plants, raingardens, and trees in your landscape.

Year-end survey results
100% kept soil covered, reduced chemical disturbances, and kept living roots in the soil on at least 60% of their yard after attending a healthy soils workshop.

Lawns to Legumes Resident Workshop
One workshop shared information about the Minnesota Lawns to Legumes program, and how residents can utilize funding to install raingardens and native plantings.

Boulevard Bioswale Program

The goal of this program is to convert traditional, mounded boulevards into boulevard bioswales on blocks with ash trees in North Minneapolis. The removal of many boulevard ash trees presented a unique opportunity to install boulevard bioswales where mounded boulevards existed. These are boulevards that are lowered and planted with native or well-adapted plants to capture stormwater, provide food for pollinators, and beautify neighborhoods.

North Minneapolis was targeted due to its status as an Environmental Justice (EJ) community, a community that has been historically excluded from environmental protection projects and the shaping of environmental policies, despite high exposure to environmental harm. EJ communities like North Minneapolis are often composed of low-income or/and predominantly residents of color. Metro Blooms worked with North Minneapolis community leaders to recruit residents to participate from the following neighborhoods:

- Harrison Neighborhood Association
- Jordan Area Community Council
- Hawthorne Neighborhood Council

Each program participant received a complimentary one-on-one site consultation with a Metro Blooms landscape professional to design the plant palette best suited for their boulevard.

Four boulevard bioswale block parties recruited over a dozen participants who learned about the benefits of a boulevard bioswale. A total of 34 residents participating in the boulevard program.

Year-end results

- 43 boulevard bioswale consultations
- 37 boulevard bioswales were installed, covering over 6,000 sq. ft.
- Included residential, commercial, and institutional properties
- 111 residents participated
- Plantings were projected to capture 300,000 gallons of water, 250 pounds of sediment, and 1 pound of phosphorus annually
- 10 different species of flowers were established through these plantings to provide food for pollinators

Pollinator Plantings

Minneapolis Public Works hosted a “Plants for Pollinators Neighborhood Event” at the Bancroft Stormwater Pond at E 42nd St and Bloomington Ave. S. on October 19th, 2019.

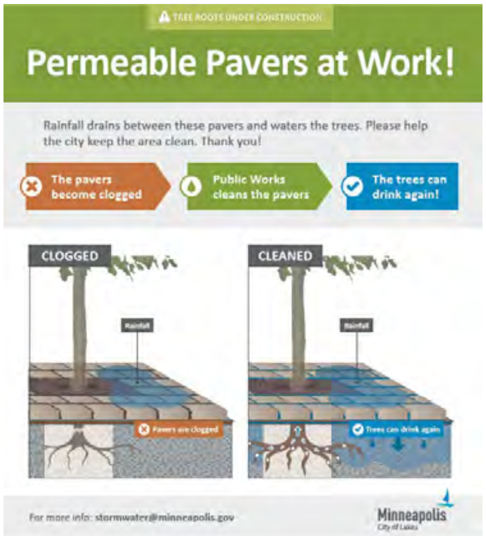
Joining local and national efforts to help dwindling populations of butterflies, bees and other pollinators, events like this help increase pollinator habitats and reinforcing goals and objectives to help manage stormwater infrastructure.

On a cold and rainy morning, over 20 people attended and learned about pollinators. A large turf area was converted to a pollinator sanctuary by planting over 2,000 plants to help restore pollinator habitats. Attendees also learned about the history of our stormwater ponds, the benefits of pollinators, and how we are working to provide more pollinator habitat at pond sites. There was a table that contained information on rain gardens, pollinators and stormwater as well as seeds harvested by Metro Blooms. Children participated with their parents using kid sized trowels and special gardening gloves.

The event demonstrates a strong level of interest in pollinators and our stormwater ponds. It was a great platform to showcase what Public Works is doing to engage the neighborhood to take ownership in the ponds, as well as helping to manage them.

Permeable Paver Maintenance

In 2019, the pervious pavers along 2nd and Marquette Avenues required maintenance to restore their effectiveness. This maintenance project provided an educational outreach opportunity for city staff. Staff distributed notice of construction letters to property owners with construction details, and information on how these permeable pavers support boulevard trees and assist in stormwater management. Informational flyers were also available. Following the maintenance project interpretive signs were installed at several paver locations. These interpretive signs inform people how pavers work and why restoration of them maintains their functionality.



Interpretive Signage Program

Stormwater BMPs are designed to blend into the community, to be enjoyed as parks, gardens, and neighborhood ponds. The residents and businesses that benefit from these BMPs are often unaware of the role that these facilities play in managing water quality and assisting with neighborhood flood control. Traditional educational signage can be technical, containing large amounts of text, appealing to only a small fraction of the community. To reach a more broad and diverse audience, a new approach was taken using locally designed artwork and online tools to create an engaging and visually compelling interactive story about these BMPs.

Together, the City and the consulting firm HDR developed engaging site-specific artwork for 26 public BMPs, as well as a companion website to supplement and link the signs together. These tools facilitate resident engagement with individual sites and their functionality, but also allows for an exploration of how each site connects with each other and works to protects our creeks, lakes, and the Mississippi River.

18 signs are scheduled to be installed in 2020 on 11 stormwater ponds sites. An interactive website will be available later in 2020. Phase two includes 20 additional signs being installed at 15 pond sites in 2021.

Staff Training

City Snow and Ice Management

City maintenance supervisors and equipment operators are trained in appropriate winter maintenance techniques. 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 – Transportation, Maintenance, & Repair division shift staff attended the annual review of procedures and best practices. The review covers the recognition and response to hazardous materials or situations. The Division Director is a trainer for the American Public Works Association Snow Fighters coursework.

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

MPRB Snow and Ice Management Training

The MPRB has 35 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 2019 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 2019 SCWMC education activities report can be found in Appendix A2.

MINIMAL CONTROL MEASURE TWO: PUBLIC PARTICIPATION

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 will be at the Policy and Government Oversight (POGO) Committee meeting on June 18, 2020 at 1:30 p.m. Due to the Covid19 pandemic all council meetings are being held electronically however the public is still offered an opportunity to comment at the meeting and to submit comments in written form. 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 **A3**. 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.

MINIMAL CONTROL MEASURE 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

Minneapolis Public Works staff conducting a field dry weather flow screening

Dry Weather Flow Screening

The City has implemented a storm drain outfall inspection program that includes inspections for flows during dry weather as an approach to identification of Illicit Discharge Detection and Elimination sources. If dry weather flows are detected during an inspection, then a grab sample is collected for analysis to determine if pollutants are present. City Public Works and Department of Health Environmental Services work together to discover the source and ultimately to eliminate the illicit flows. Due to heavy rains and high water through the summer there were limited opportunities to conduct dry weather flow screenings in 2019. The goal of this program is complete the screenings and outfall inspections once per permit cycle.

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.

Illicit Discharge Detection and Elimination Screening Program

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. These combined efforts result in an annual screening of at least 20% of the City drainage areas and outfall structures.

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, employee training on spill response procedures, and identification of the required spill response contractor. Minneapolis Fire Inspection Services participates in most of the inspections, reviewing spill response strategies. In addition, site plan inspections also look at drainage patterns from the site to the nearest storm sewer inlet or water body and the watershed destination and outlet location. The City public works staff have so far completed initial inspections of near 80 of its own facilities and has developed a Stormwater Pollution Prevention Plan (SWPPP) for each site.

PREVIOUS YEAR ACTIVITIES

Spill Response

City of Minneapolis Fire Inspection Services responded to 41 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 1 spill incident on the Mississippi River where a containment boom was deployed. Minneapolis Fire Inspection Services, Minneapolis Public Works (Surface Water & Sewers Division) and MPCA participated in these efforts.

Outfall Inspection

16 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, MPCA and Mississippi Watershed Management Organization.

SPILL RESPONSE/CONTAINMENT BOOM DEPLOYMENT TRAINING

Mississippi River Spill Drill/Training Exercise

Minneapolis Fire, Minneapolis Regulatory Services, and the MPCA conducted a Spill Response Training/Exercise on the Mississippi River on August 27th, 2019. Spill response strategies and Standard Operating Procedures (SOPs) were discussed and storm sewer outfall map reading was reviewed.

The training scenario was a 5,000-gallon diesel spill from a tanker truck, on the street and into the storm sewer system, to the outfall on the Mississippi River.

The goals for the training were:
- Responder and public safety
- Discussion of evacuation versus shelter in place
- Air and sewer monitoring
- Flushing of the storm sewer system
- River safety procedures
- Spill boom deployment

Waterworks Drill/Training

Spill Response/Boom deployment trainings at the Minneapolis Waterworks facility did not happen in 2019 due to high water conditions on scheduled dates of trainings. Future trainings will take place as conditions allow.

Facility Inspection Program - SWPPP

As per Fire Inspection Manager, 11 facilities were inspected in 2019. 302 facilities are self-reporting, which are reviewed, filed, and maintained by Fire Inspection Services. 302 hazardous material facilities are inclusive to the City's Fire Commercial (FCOM) building permit. Hazmat registrations and inspections are based on FCOM cyclical rotations.

343 Emergency Response plans for TIER II Hazardous Materials Facilities were reviewed. Reviews include hazardous materials storage and spill response plans.

MINIMAL CONTROL MEASURE FOUR: CONSTRUCTION RELATED EROSION AND 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). This ordinance is scheduled to be updated in 2020.

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.

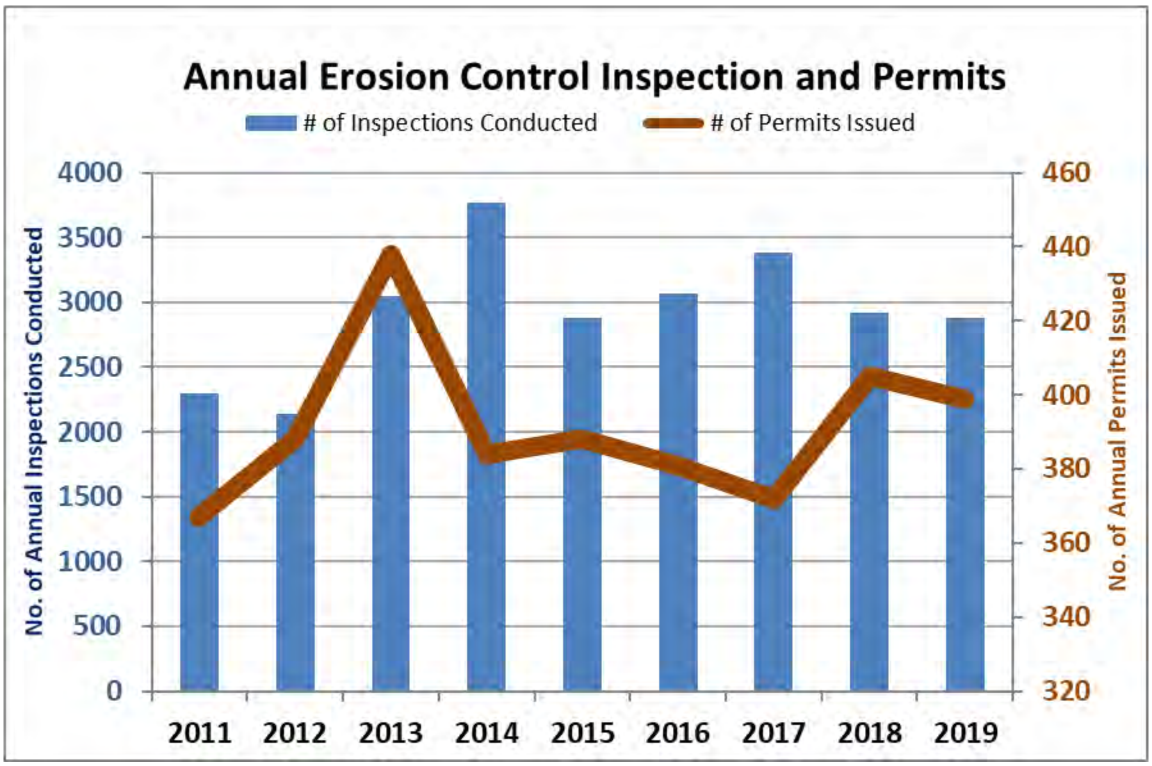
Enforcement

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, ranging from 367 in 2011 to 438 in 2013. While the number of permits issued by the City has been consistent, the number of inspections increased. Minneapolis employs four environmental inspectors that address sediment and erosion control enforcement and the City has hired four additional seasonal technicians to help increase inspection frequency during the busy summer months.

Year	Permits Issued	Cases	Inspections	Enforcement Actions	Citations
2010			1943	194	33
2011	367		2300	142	32
2012	388		2144	147	34
2013	438		3048	353	113
2014	384	433	3769	237	77
2015	388	1832	2880	250	77
2016	381	674	3071	259	51
2017	372	674	3379	349	109



MINIMAL CONTROL MEASURE FIVE: POST-CONSTRUCTION STORMWATER MANAGEMENT FOR PUBLIC AND PRIVATE PROJECTS

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.

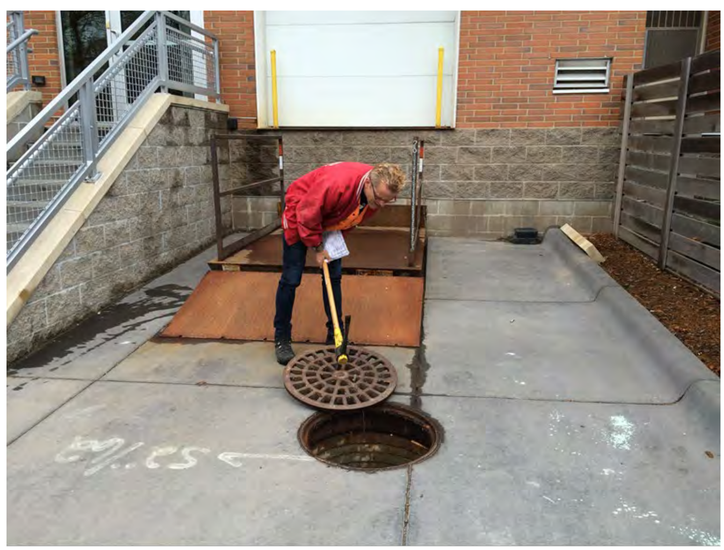
Targeted pollutants include:

- 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.



Inspecting Private Stormwater BMPs

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 2019, City staff updated Chapter 54 to be in compliance with the current NPDES MS4 permit and watershed management organization requirements. This process involved input from:

- Internal and external city partners and stakeholders
- a comprehensive citizen and technical advisory committee (including representatives from the four watershed management organizations in Minneapolis)
- Local developers
- Civil site designers
- Landscape architects
- Property managers
- Non-profit organizations

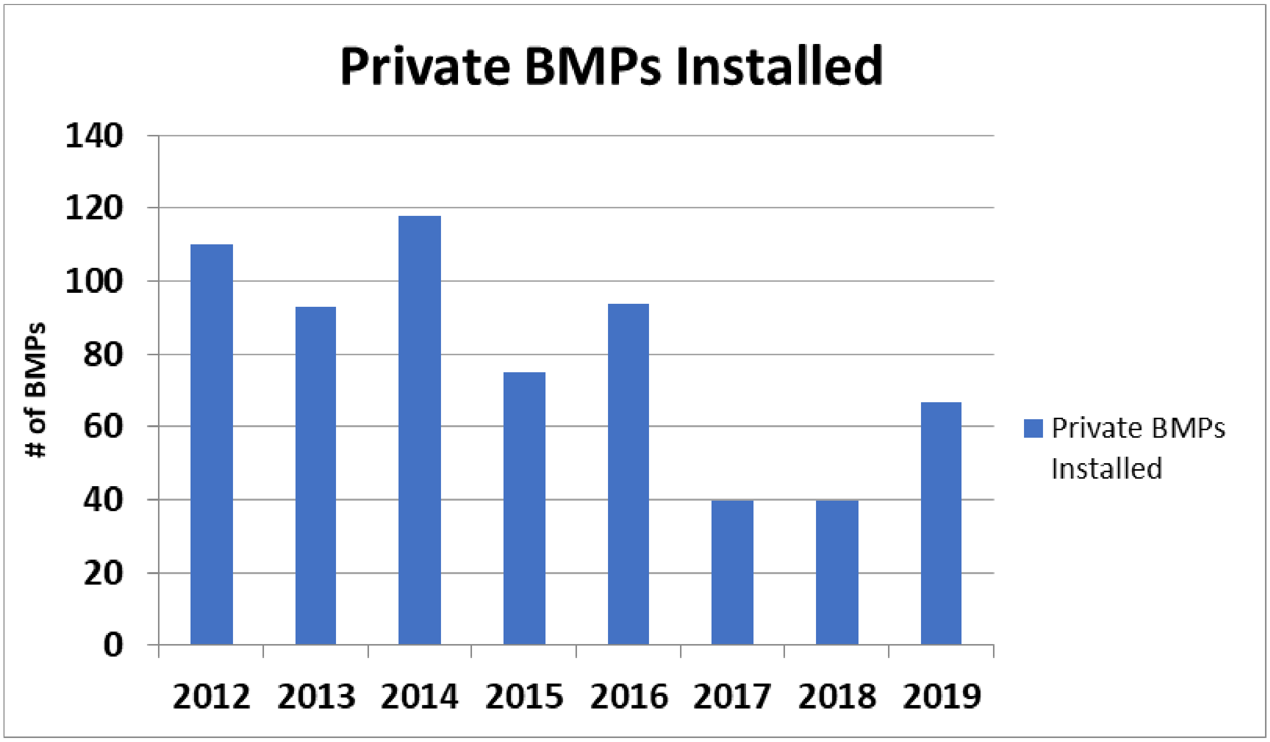
The Chapter 54 ordinance sets standards according to the specific receiving water body or type of water body. These standards include, but are not limited to:

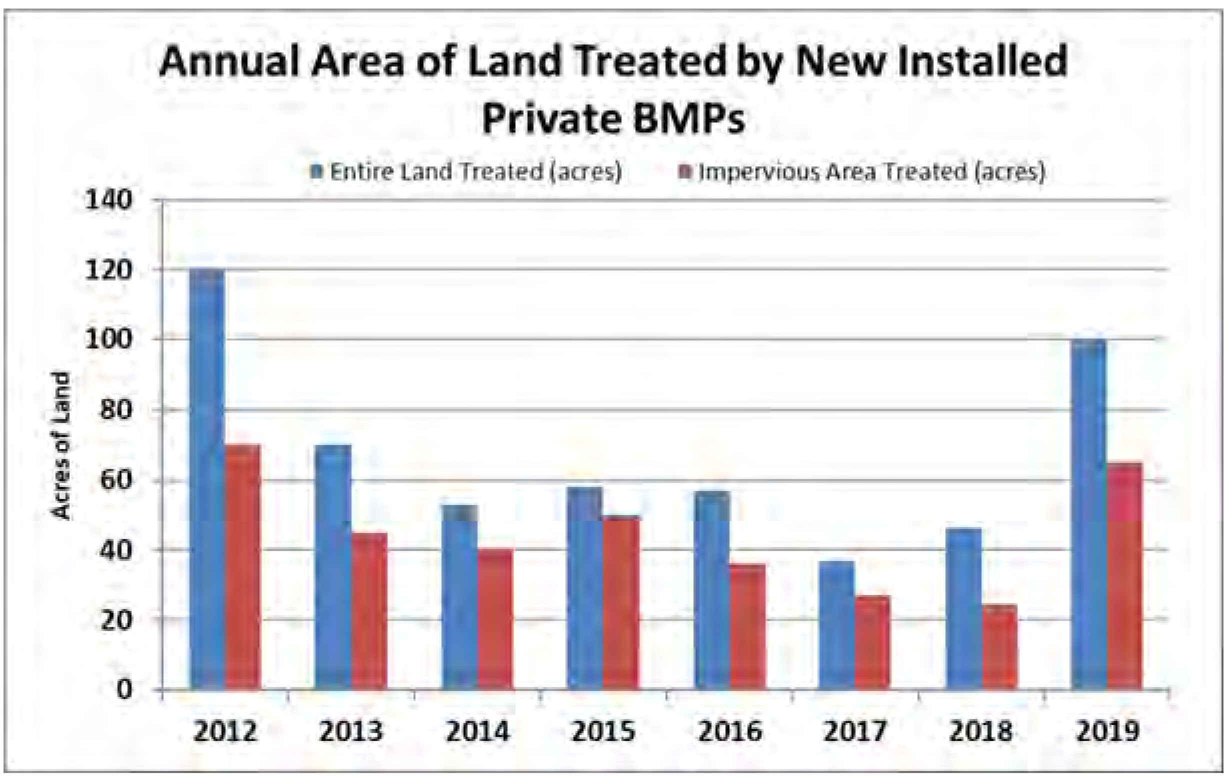
- Controlled rate of runoff to all receiving water bodies
- Reductions of TSS for discharges for all receiving water bodies
- Reductions in nutrients for stormwater that discharges to lakes and wetlands
- Maximizing infiltration by minimizing the amount of impervious surface
- Employing natural drainage and vegetation

This ordinance is anticipated to go to the City Council for adoption in late 2020.

PREVIOUS YEAR ACTIVITIES

During 2019, Minneapolis Public Works took part in the preliminary review of 299 projects approving 142 including 33 projects requiring stormwater management, with 67 BMPs constructed. These BMPs will provide rate control and water quality for approximately 100 acres of land, including 65 acres of impervious area.


Private BMPs Installed
# of BMPs
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
Private BMPs Installed


Annual Area of Land Treated by New Installed Private BMPs
Entire Land Treated (acres)
Impervious Area Treated (acres)
Acres of Land
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019

MINIMAL CONTROL MEASURE 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

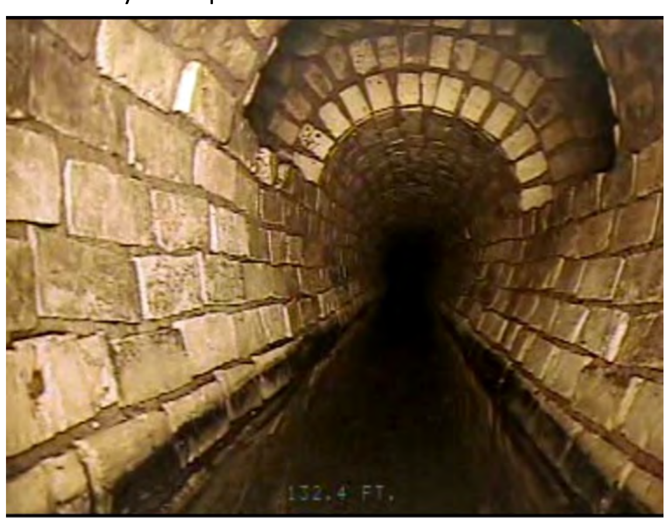
The objective of this NPDES stormwater management program is to minimize the discharge of pollutants through the proper operational management and maintenance of the City's storm drain system, streets, alleys, and municipal property. The City of Minneapolis contributes stormwater runoff to various receiving 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.



Brick Egg-type Sewer

The City has introduced Maximo™ as part of an asset management program to compile assets, track work orders, and assist in work scheduling and purchasing.

The City's goals in implementing an asset management program include identifying 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.

An appropriate staffing level is a key component for achieving the City's overall management goals. The current staffing level of the PW-SWS Operations section is approximately 113 full-time employees, up from 75 in 2013. This increase is anticipated to bring about a more proactive approach, including pollution prevention that the City is striving for. 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:

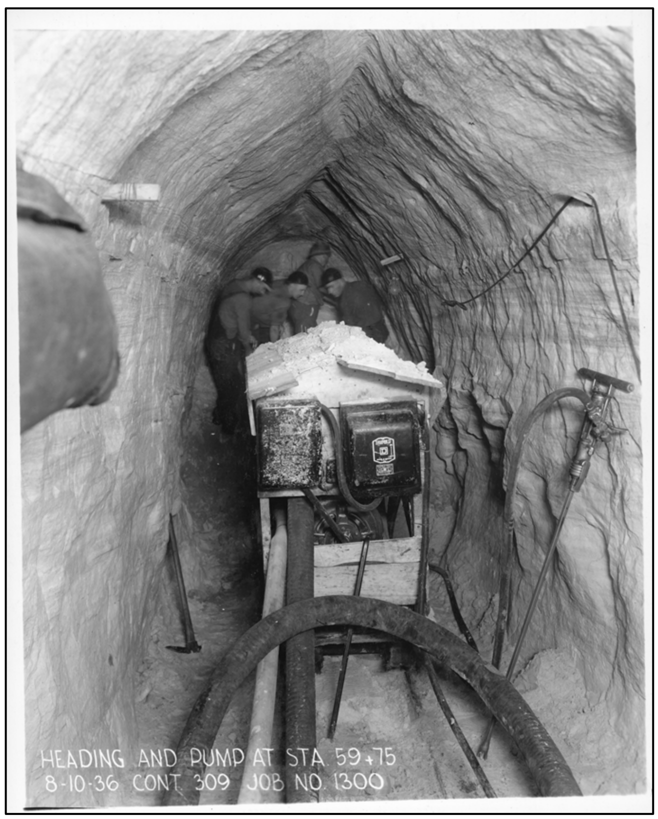
Crews	Staff/crew	Type	Tasks
4	2	Route Truck	Daily pipeline system inspections, complaint response, and resolution to minor system operational problems
5	2	Jet Truck	"As-requested" cleaning of storm system components, routine cleaning of sanitary system pipes, and "as-requested" cleaning of pump/lift stations. Hydro jet-wash technique.
1	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.
1	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.
6	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

2019 Storm Drain Infrastructure cleaning and repair information data:

- Completed repairs on 52 catch basins
- Cleaned 4.9 miles of storm drain utilizing hydro-jet washing
- Televised and condition assessed 1 miles of storm drain-pipe
- Continued repairs of 1,100 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



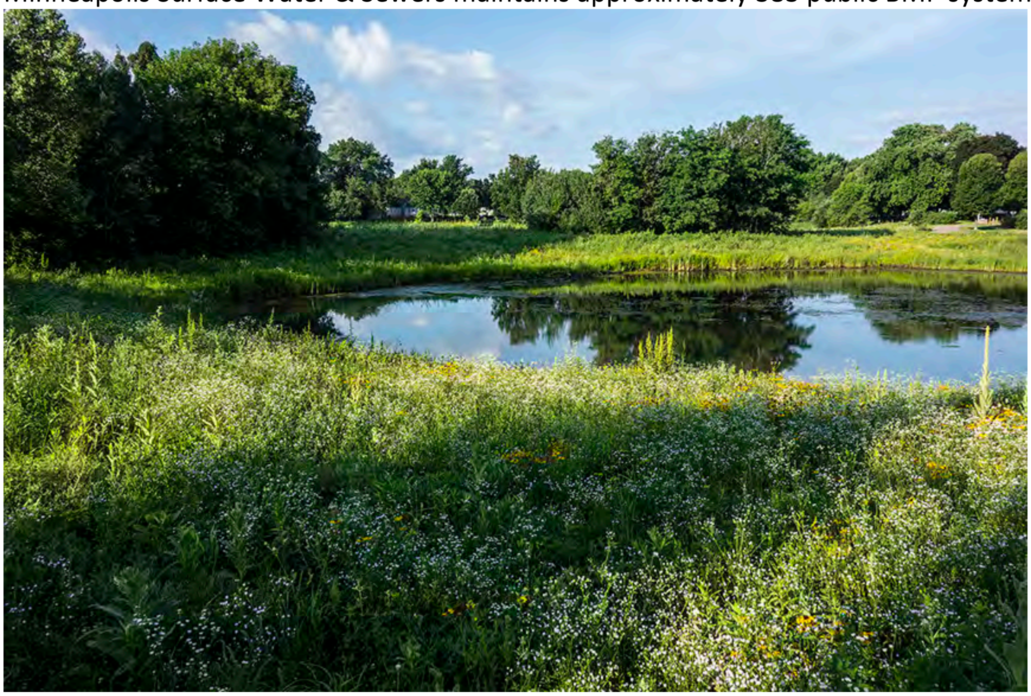
WATER RESOURCE FACILITIES OPERATIONAL MANAGEMENT AND MAINTENANCE

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 383 public BMP systems.



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.

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

Vegetated Swale at 25th Ave. SE

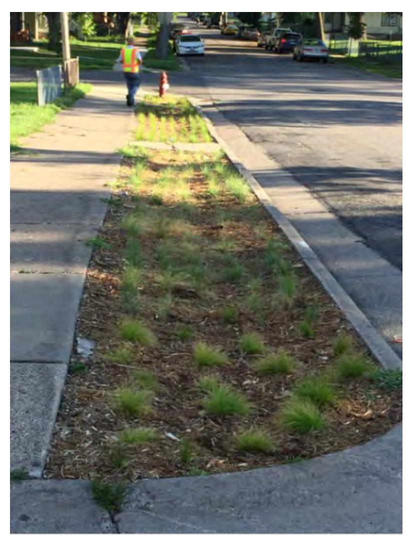
Pre-treatment Practices

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 Outfalls
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

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 2019, Minneapolis Public Works crews removed accumulated sediment and debris from grit chambers, and approximately 150 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
- BOD5
- COD
- Phosphorus
- Chlorides

PROGRAM OVERVIEW

Pollutant control is most commonly 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. Site specific plans have been developed for each facility which include site maps, operations specific Best Management Practices, and inspection and reporting requirements. 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. Plan development is being prioritized by facilities with the highest pollutant potential.

These facility plans are being used to facilitate regular site inspections that will document 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.

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
- BOD5
- 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 2019-2020 winter season was a normal year starting with snow fall in November and ending in April with several freeze-thaw cycles which required more granular material usage along with November snowfalls that did not melt off completely and formed ice in the alleys and side streets. There were 24 notable events with 51.5 inches for the season, as compared to an average of 48 inches. The most snowfall was observed in November. There were four declared snow emergencies, compared to the annual average of four, and there were 153 days of temperatures at or below freezing by late of April. There were two notable freezing rain events in 2019-2020. 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:

- 9,400 tons of salt applied to roadways
- 8,247 tons of sand applied to roadways
- 15,232 tons of materials reclaimed during spring and summer street sweeping operations
- 6,338 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

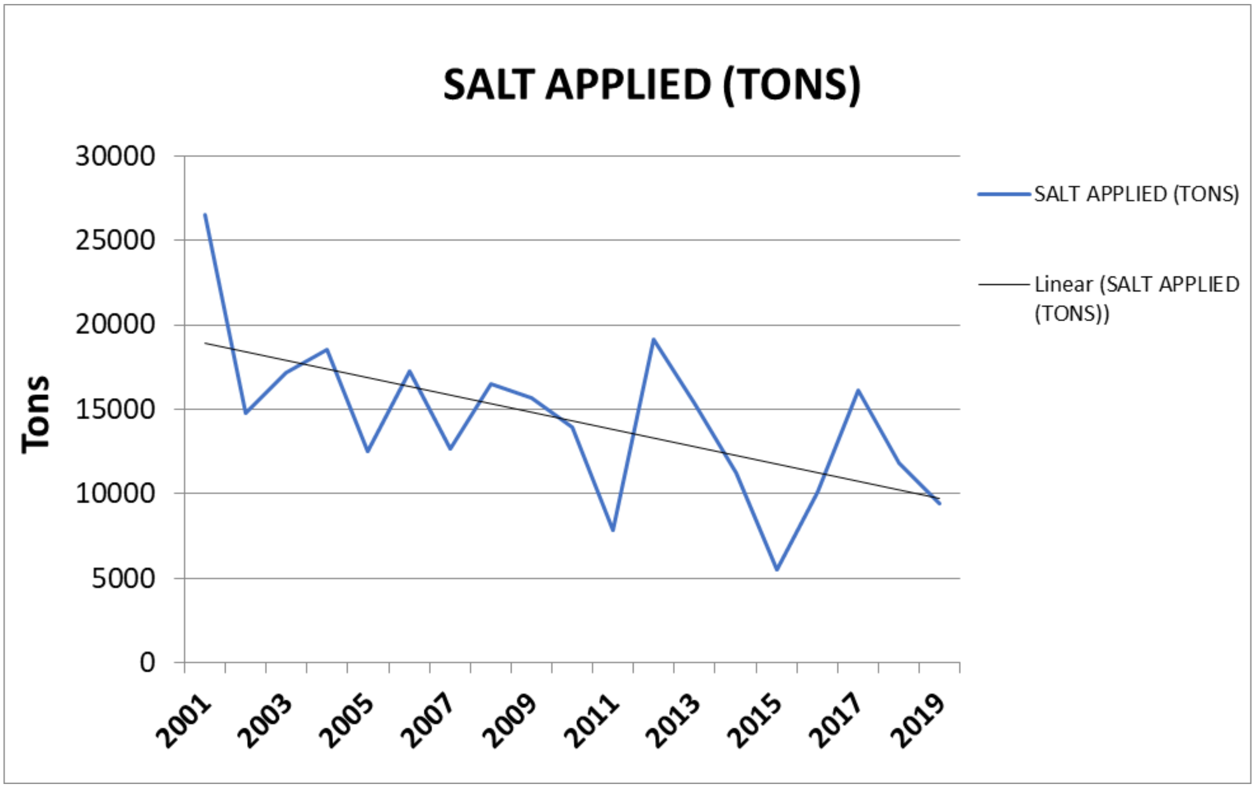


Figure 6-2

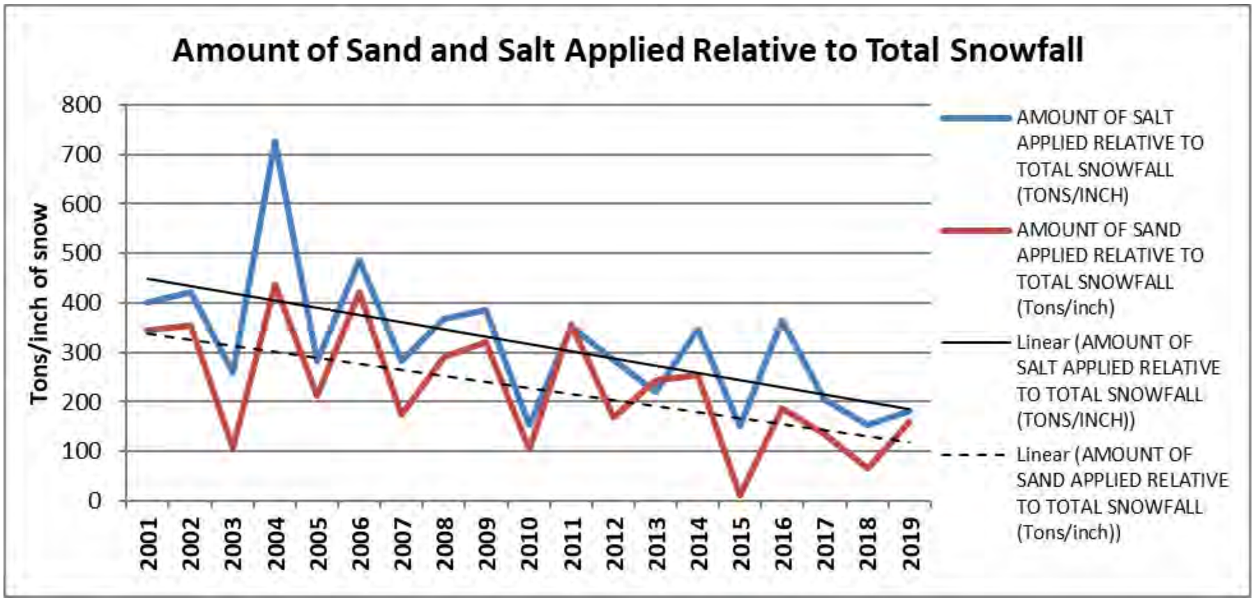
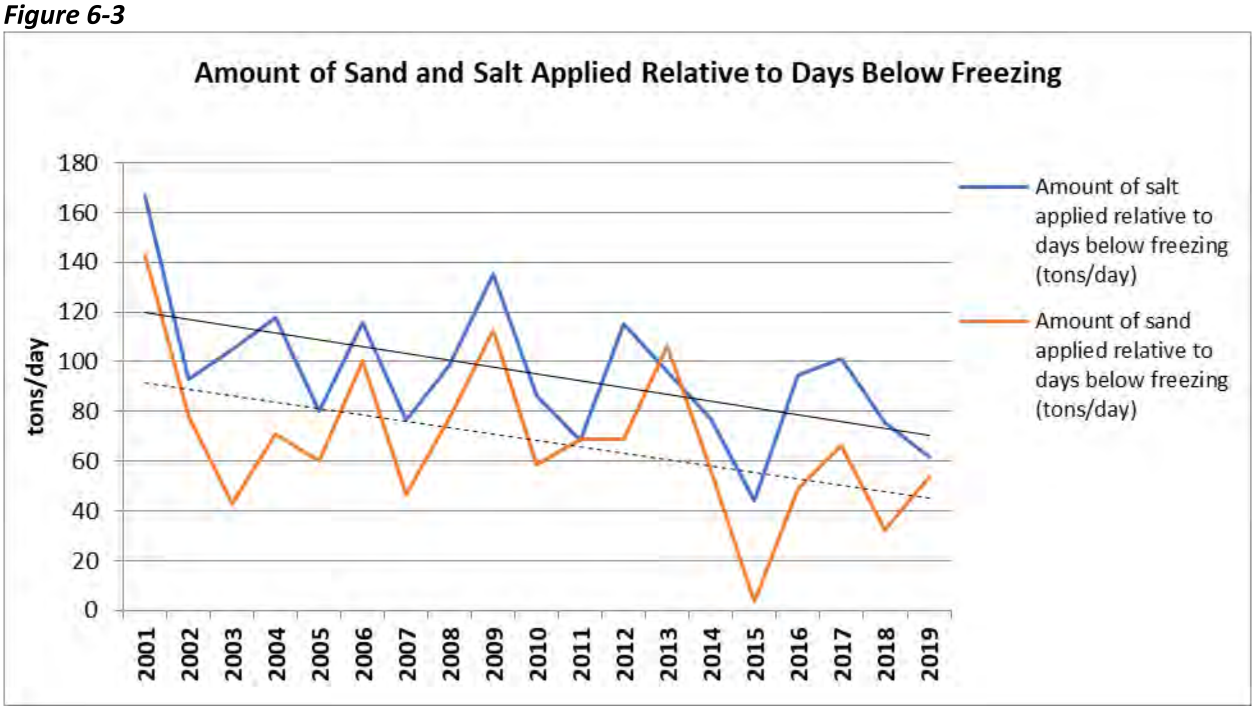


Figure 6-3



<u>Performance Measures</u>

- Amount of materials recovered as a percentage of materials applied: 122%
- Amount of salt and sand applied relative to total snowfall: 343 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.

Targeted pollutants include:

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

PROGRAM OVERVIEW – MINNEAPOLIS PARK & RECREATION BOARD PROPERTIES

Integrated Pest Management (IPM) Policy and Procedures

The Minneapolis Park and Recreation Board's (MPRB) Integrated Pest Management policy for golf courses and general park areas is included in the MPRB's General Operating Procedures. Specific areas where IPM is intensely used are the major display gardens at Lyndale Park, Loring Park, Minneapolis Sculpture Garden, Minnehaha Falls Park, premiere athletic fields and golf courses. Gardener, golf and maintenance staff have adopted IPM techniques and use them as 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 regular maintenance practice. Landscape pesticide products may be used during park renovations, to maintain premier athletic complexes, to control invasive species, or to ensure plant health with 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

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. 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.

In its General Operating Procedures, the MPRB has established that no chemical application will be used to control aquatic weeds.

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, Division of Ecological and Water Resources. The Environmental Stewardship Division coordinates the Eurasian watermilfoil control program.

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. An important component of this program is the implementation of Integrated Pest Management (IPM) procedures. IPM Procedures reduce chemical and fertilizer use, which in turn helps to protect water quality and provide for healthier habitats for wildlife.

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:

Environmental Planning

- Outreach and Education
- Water Conservation
- Water Quality 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 Hiawatha and Fort Snelling have current Audubon Certification. The MPRB is currently in the process of obtaining certification for Hiawatha Golf Course.


Rain Garden at Riverside and 8th St. S

PREVIOUS YEAR ACTIVITIES

Currently 208 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.

Zero phosphorus turf fertilizers were specified for purchasing bids beginning with the 2002 fertilizer bid. This was done in response to the 2002 City and State regulation changes regarding phosphorus turf fertilizers. A wide range of zero phosphorous fertilizers are available to park maintenance and golf course foremen if fertilizer is needed.

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 A.

MINIMAL CONTROL MEASURE SEVEN: STORMWATER DISCHARGE 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
- Chlorides
- 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 stormwater conditions. For example, Escherichia coli (E. coli) monitoring per the MPCA's inland lakes standard is 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 19, 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. 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.

PREVIOUS YEARS ACTIVITIES

Lake Monitoring

In 2019, 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.

All the lakes in Minneapolis fall into either the mesotrophic or eutrophic category. Bde Maka Ska, Harriet, and Wirth are mesotrophic with moderately clear water and some algae. Brownie, Cedar, Isles, Hiawatha, Loring, and Nokomis are eutrophic with higher amounts of algae. Powderhorn and Spring are hypereutrophic with high nutrient concentrations and the potential for severe algal blooms. Trends in lake water quality can be seen by using the annual average TSI since the early 1990s.

Table 7-1. Water quality trends in Minneapolis lakes from 1991-**2019**.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
Bde Maka Ska	Brownie Lake	
Wirth Lake	Cedar Lake	
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Lake Nokomis	
	Loring Pond	
	Powderhorn Lake	
	Spring Lake	

NPDES Land Use Sites Monitoring

In 2019, snowmelt stormwater runoff and fat, oil, and grease monitoring was carried out at four sites representative of multi-family residential, recreational/parkland, commercial/high-rise, and commercial/industrial land uses. Site 6 (22nd/Aldrich, residential), Site 7 (14th/Park, mixed use), Site 8a (Pershing Park, parkland), and Site 9 (61st/Lyndale, commercial) were monitored for snowmelt stormwater runoff quantity and quality. Two snowmelt grabs were collected at each site.

Over two years, Fat-Oil-Grease (FOG) samples were collected at 8 sites in Minneapolis. Out of the 36 samples collected, 15 had detectable FOG. Two of the 36 samples were over the 15 mg/L threshold. Both samples were of snowmelt and were collected within one day of each other at the 61st and Lyndale site in 2019. This site has an industrial land use type. It was also inaccessible for sampling during the majority of 2019 due to construction.

Best Management Practice (BMP Monitoring)

The 2019 BMP sites monitored were the Winter Infiltration Basin (Ulysses St. NE & Johnson St. NE), 24th & Elm Infiltration Basin, two Powderhorn Lake Inlets (SE inlet, N inlet), and the Minneapolis Sculpture Garden rainwater reuse cistern. These sites were monitored to gather information on how each system functioned and the efficacy of the intended treatment. The Minneapolis NPDES monitoring allows the City to characterize its stormwater for pollutants and judge how effective the BMP's installed are at removing the pollutants. Detailed monitoring methods and results are listed in Appendix A.

COORDINATION 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

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

The MCWD receives revenue through direct taxation against properties within its jurisdiction. 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

In 2011, the MWMO adopted its Third Generation Watershed Management Plan. The City and MPRB participated in its planning committees. The MWMO is starting data collection for their next generation management plan. The City and the MPRB will be active participants in the newest plan development process. 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.

Coordination with the Shingle Creek Watershed Management Commission

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.

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 the watershed organizations 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 three of the seven “lagoons” created within the creek in Theodore Wirth Park between Golden Valley Road and Trunk Highway 55. The City of Minneapolis and the Minneapolis Park and Recreation Board are cooperating with BCWMC on the study. The feasibility study will be completed in 2020. Construction date will depend on acceptance of the feasibility study by BCWMC and alignment with other capital plans.

- 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.

- 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 are planned on the MPRB’s Colombia Golf Course, MPRB Parkland, and integrated with City of Minneapolis street projects. Preferred project has been chosen, and construction is expected to commence in 2021.

- Collaboration between MPRB, MCWD, and Minneapolis continued via the master planning process for the Minnehaha Regional Trail corridor along Minnehaha Creek. If preliminary 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 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.

- Erosion and sediment control permit inspections are coordinated with the MCWD.

- The MPRB works with the DNR and surrounding suburbs on projects like the Lake Nokomis Carp management study and other state regulatory programs.

- 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

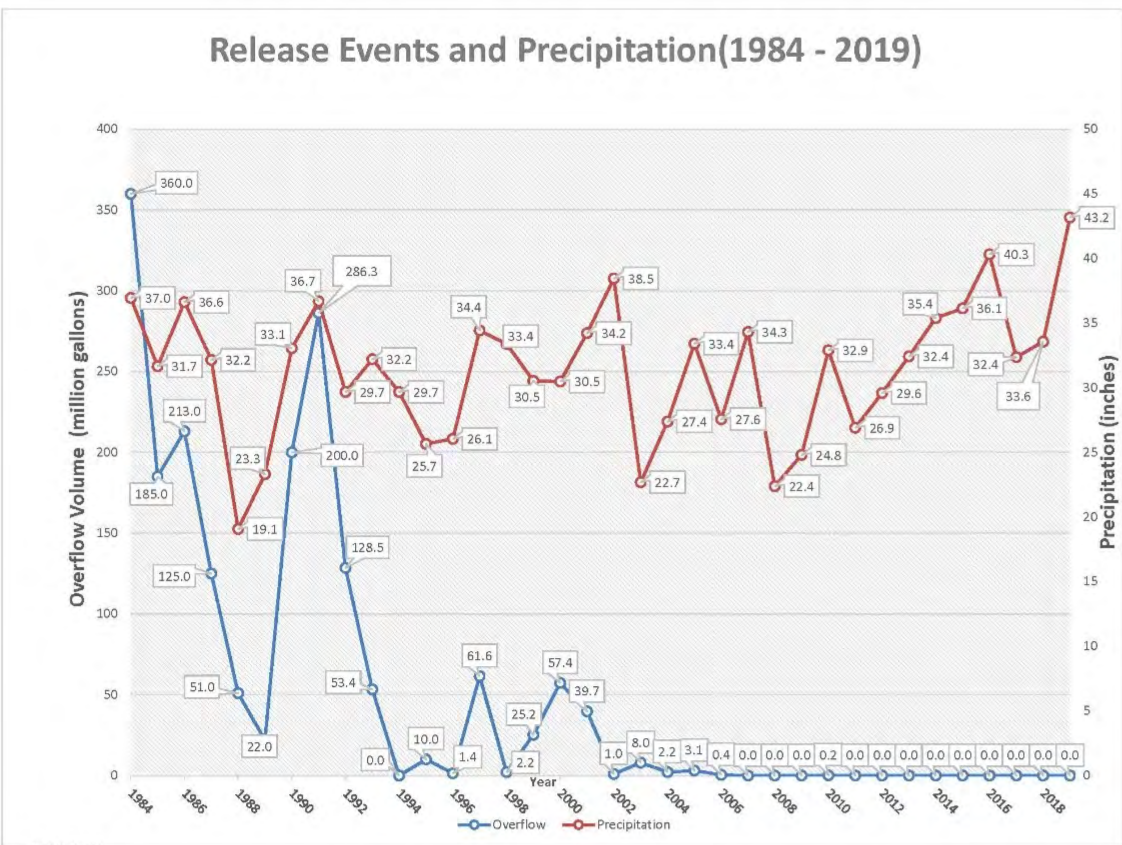
PROGRAM OBJECTIVE

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 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 Metropolitan Council 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 1984-2019.



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.

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.

2019 Flood Mitigation Capital Projects

As part of the Mid-City Industrial street reconstruction project, an infiltration (dry) pond was constructed adjacent to New Brighton Blvd. This location in Minneapolis had a history of street and property flooding based on complaints received from area businesses. The primary reasons for the flooding were surcharging of the storm drain network due to lack of capacity in the pipes and large areas of impervious surface flowing into the storm drain system without attenuation.

The street reconstruction provided the opportunity to replace the affected systems with larger pipes. However, the storm tunnel that receives discharge from the project area is not able to handle the resulting increase in flows. Therefore, a regional storage basin was required to offset the increase in flows. In addition to providing flood mitigation, the pond will also provide water quality treatment by allowing for the infiltration of stormwater into the underlying soils.

The pond provides the following water quality treatment for 31.05 acres, of which 24.28 acres is impervious.

Performance and Water Quality Benefits

- MIDS volume reduction
  - 53% (30.4 acre-feet infiltrated)
- MIDS total phosphorus removal
  - 53% (24.8 pounds removed)
- MIDS total suspended solids removal
  - 53% (4,510 pounds removed)

Cooperation with Metropolitan Council

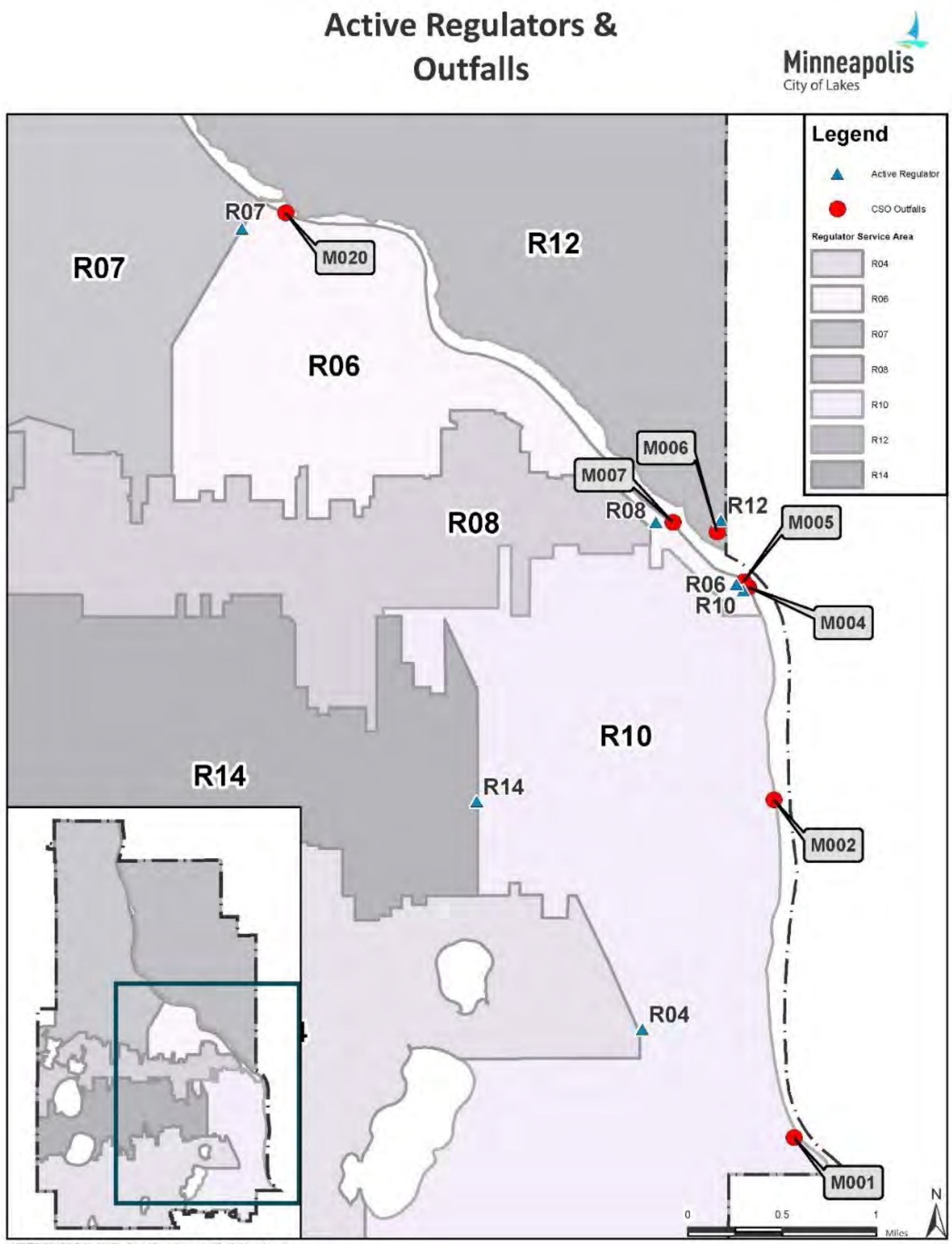
The sanitary sewer system from Minneapolis discharges to the Metropolitan Wastewater Plant, which is owned by the Metropolitan Council. Release events from the sanitary or combined sewer system can occur during periods of hydraulic overload caused by extraordinary rainfall or snowmelt events. Release 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.

Metropolitan Council 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



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, 785 miles of sewer smoke testing (96% 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, 198 storm drain separations projects have been identified for the Combined Sewer Overflow Program. Of the identified projects, 151 were completed, separating 620 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, 7,295 of 7,585 rainleader violations have been resolved.

PREVIOUS YEAR ACTIVITIES AND ONGOING COORDINATION EFFORT

Release Events from the Sanitary or Combined Sewer System

Metropolitan Council continues to monitor overflow duration and volume at each of the regulators. In 2019**,** there were zero reported releases to the Mississippi River from the monitored regulators.

Studies, Investigations and Monitoring Activities

In 2019**,** 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: 56 sanitary sewers and 5 rain gages were monitored in 2019. Sewer metering data was reviewed for rainfall dependent inflow and infiltration.

- Smoke Testing: 77 miles of sewers were tested in 2019.

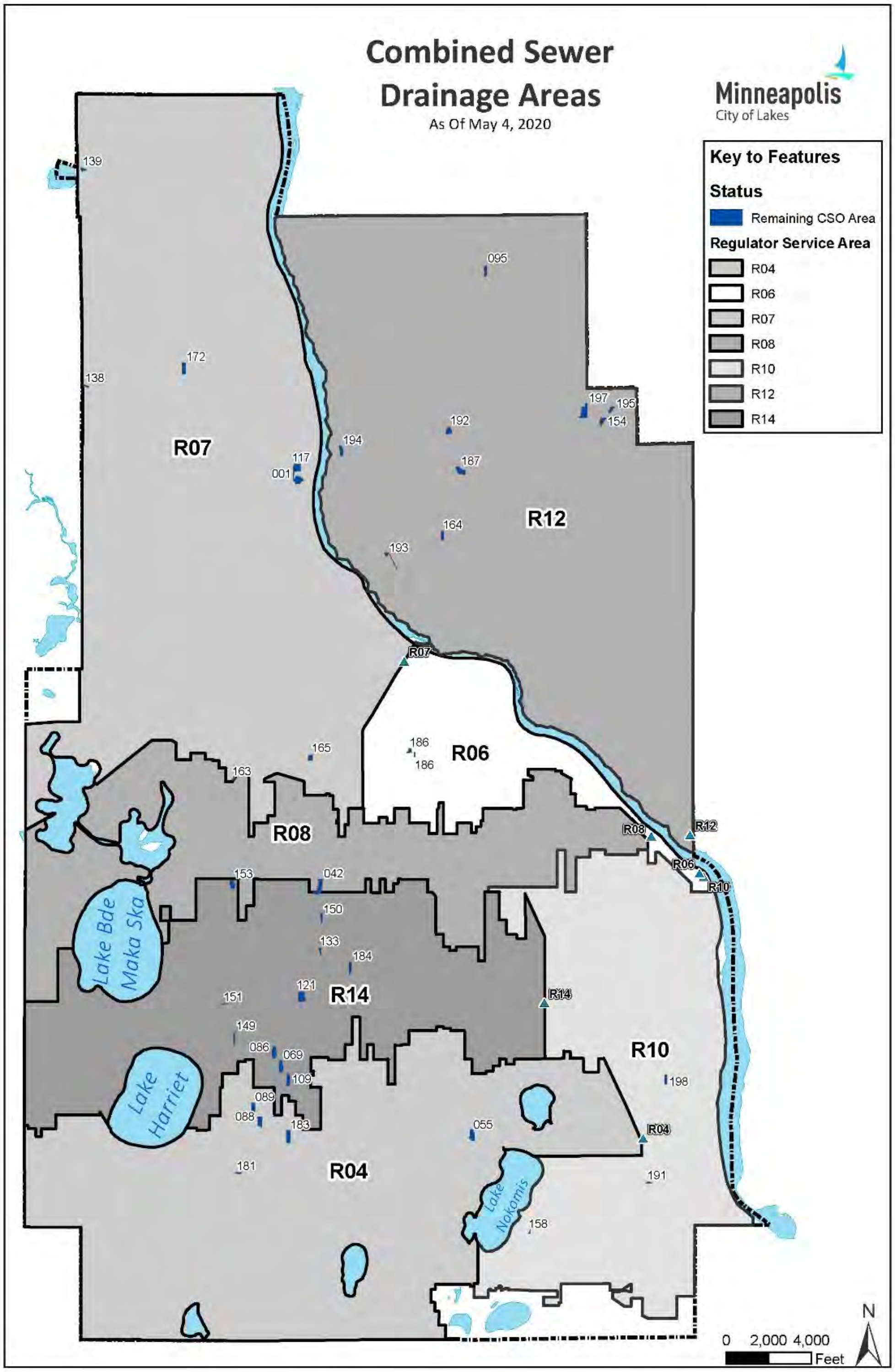
- Suspected Cross Connection Investigations: 3 investigations were completed in 2019. These include suspected connections identified from record drawings, GIS work and routine maintenance of the sewer system.

- Manhole Condition Assessments: Panoramic inspections and Level 2 NASSCO condition assessments were completed on 9,955 manholes in 2019, for a total for 25,436 since 2016.

- Sewer Condition assessments: Televising and NASSCO condition assessments were completed on 13.2 miles of sanitary sewer.

Identified Inflow to the Sanitary Sewer System

An inventory of the drainage areas and sewersheds of the remaining 36 combined sewer areas is provided in the following map and table.



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CSO AREA ID	SEWER SHED	AREA [acres]	LOCATION
1	R07	2.77	22nd Ave N & 2nd St N
42	R14	3.69	Stevens Ave & Lake St E
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
150	R14	0.93	Stevens Ave & 32nd St E
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

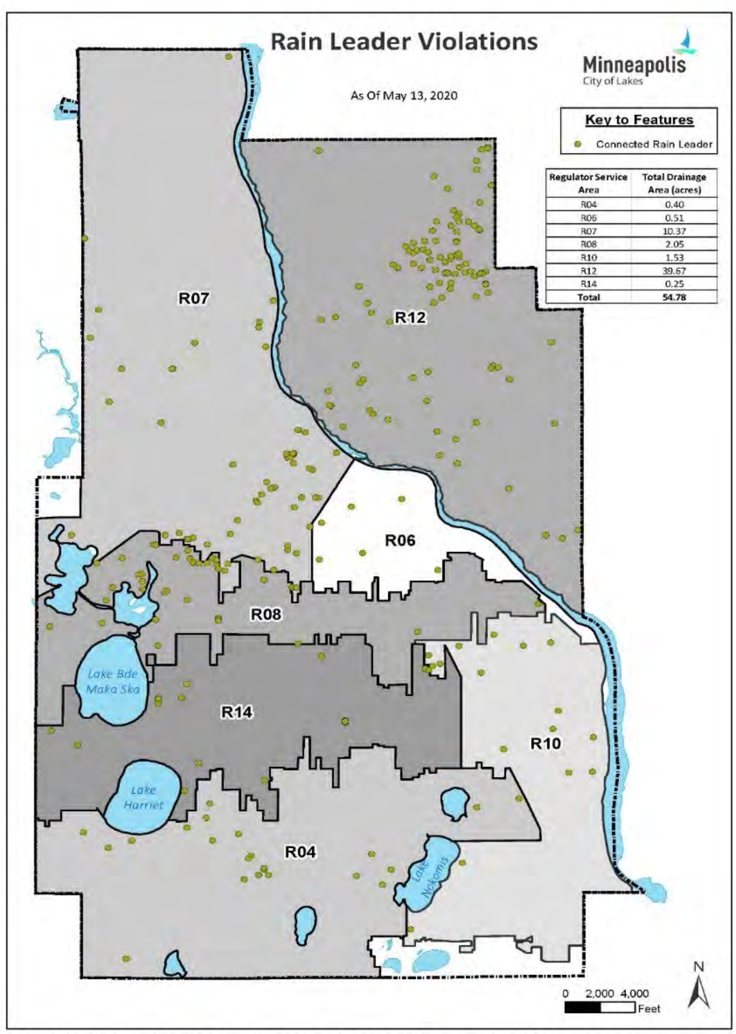
Combined Sewer Overflow / I & I Reduction Projects

Five storm drain separation projects were completed in 2019, eliminating 3.74 acres of direct drainage.

PROJECT NAME	PROJECT LOCATION	DRAINAGE AREA [acres]
CSO 176	10th Ave N & 5th St N	0.58
CSO 177	10th Ave N & 8th Ave N	0.84
CSO 188	8th St S & Park Ave	0.73
CSO 189	8th St S & Park Ave	0.81
CSO 196	27th Ave NE & University Ave NE	0.78
	Total:	**3.74**

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 2019, 55 rainleaders were disconnected.



Regulator Service Area	Total Drainage Area (acres)
R04	0.40
R06	0.51
R07	10.37
R08	2.05
R10	1.53
R12	39.67
R14	0.25
Total	**54.78**

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	10.39	0.18
2	R14	3,973.96	21.01	.53
4	R10	4,239.58	3.75	.09
5	R06	1,459.49	1.65	.11
6	R12	8,322.38	56.74	.68
7	R08	3,019.47	2.28	.008
20	R07	8,571.93	21.22	.25
	Total:	**35,467.85**	**117.06**	**.33**

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 2019, 6.96 miles of sanitary sewer were lined.

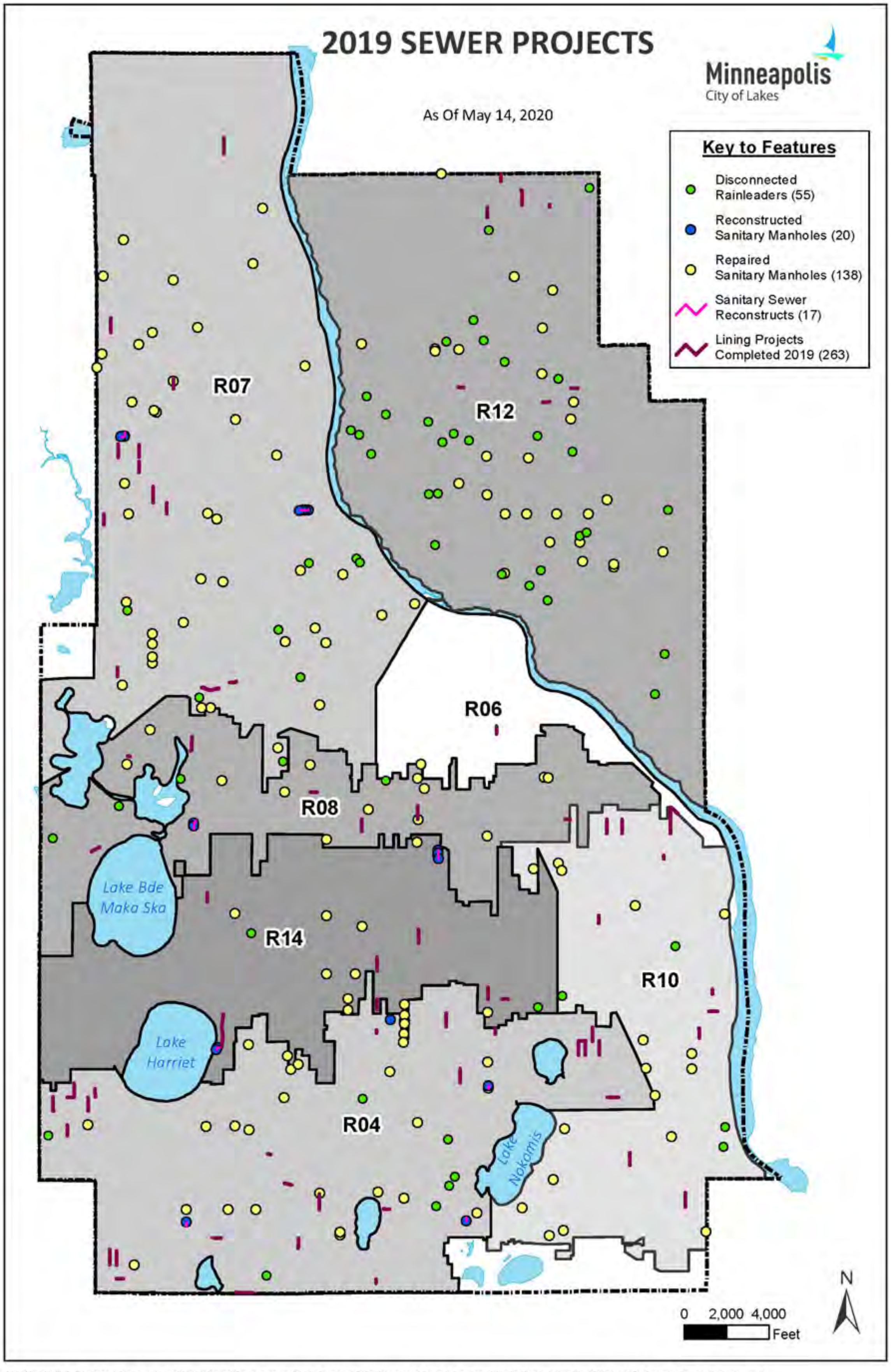
- Sewer Reconstruction: Full replacement of a sewer through an open excavation or tunneling for mainline is utilized when that sewer can no longer be rehabilitated. In 2019, 17 sewer construction projects were completed, replacing 2,310 feet of sewer and 22 manholes.

- Manhole Repairs: Includes a range of repairs from mortar work, to partial or full reconstruction of manholes. In 2019, 138 repairs to sanitary manholes were completed.

Annual Expenditures for Program Activities Summary

Sanitary Rehab Projects – Repair and Replacement	$14,688,556
CIPP Lining Projects	$3,045,484
Sewer Separation Projects *	$518,827
Rainleader Disconnect Work	$618,600
Sanitary Manhole Inspections	$364,000
Flow Metering	$527,454
Smoke Testing	$446,189
Other I & I Studies	$141,575
Total	**$20,350,685**

*Two sewer separation projects were funded out of a paving project were not tracked here


2019 SEWER PROJECTS
Minneapolis
City of Lakes
As Of May 14, 2020
Key to Features
Disconnected Rainleaders (55)
Reconstructed Sanitary Manholes (20)
Repaired Sanitary Manholes (138)
Sanitary Sewer Reconstructs (17)
Lining Projects Completed 2019 (263)
R07
R12
R06
R08
R14
R10
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Lake Bde Maka Ska
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0 2,000 4,000
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Collaboration with External Partners

Metropolitan Council 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 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 the following:

- 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 Metropolitan Council to construct additional capacity.

APPENDIX A

APPENDIX B

Appendix A

Minneapolis
City of Lakes

Bassett Creek Watershed Management Commission

March 4, 2020

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

RE: 2019 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 2019 this assessment was $35,805. Further, watershed commissioners representing Minneapolis and Minneapolis city staff participate in, guide, and help implement the programs of the BWCMC, including its public education program. In 2019, approximately 7% 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.

In 2019, the BCWMC performed or participated in the following education and outreach activities:

BCWMC Website - The BCWMC maintained its new user-friendly website in 2019 and maintained the information including latest news, contact list, meeting calendar, meeting materials, watershed plan, data, and projects. In 2019, there were approximately 4,978 unique users and 7,687 sessions.

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. In 2019, 103 classes totaling 2,681 students participated in Lesson 1 and 58 classes with 1,516 students also participated in Lesson 2. In all, 1,266 students in the Bassett Creek Watershed participated in these lessons in 2019.

Also in 2019 WMWA updated its "10 Things" brochure in cooperation with Hennepin County. This publication is used at tabling events and is offered at city brochure racks. It succinctly lists 10 actions average residents can take to improve waters in their community.

WMWA also participated in the Plymouth Kids Fest in August and interacted with hundreds of children and their parents about water quality and stormwater runoff.

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 displays an exhibit at the State Fair to educate the public about watersheds and its Adopt-a-Drain program. In 2019, the Clean Water Minnesota Media Campaign provided its members with monthly, 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 used these stories in social media and its website homepage. Find more information at www.cleanwatermn.org.

Participation in Community Events and Meetings – The BCWMC used its new educational display materials (including watershed map, banners, and bean bag toss game) and participated in the Golden Valley Arts and Music Festival (September 14th), the Golden Valley Sustainability Fair (September 20th), the annual meeting of Association of Medicine Lake Area Citizens, and at a restoration event at Westwood Nature Center. BCWMC volunteers talked with event participants, provided education on water resources, and gave away educational items like dog waste disposal bag dispensers, watershed maps, cups showing the amount of deicer needed for a certain space, native seeds, and written educational materials.

Bassett Creek Watershed 50th Anniversary Tour and Celebration – On June 27th, the BCWMC held a 50th anniversary event with a tour of watershed projects and an evening reception featuring keynote speaker Mark Seeley. Long time Commission Engineer, Len Kremer, gave a presentation on the history of the organization and its involvement in the large flood control project. Approximately 74 people attended the tour and/or celebration event including some city council members, residents, and multiple partners. A commemorative booklet was also produced that includes BCWMC history, accomplishments, priorities, and future goals.

Chloride Education – The BCWMC focused much effort on addressing over salting in 2019 including working with other partners in the Metro area who are concerned about over salting. BCWMC created information cards for residents to hand out at businesses that are applying too much salt. Approximately about 3,000 cards were handed out educating about smart salting practices. A companion website (saltsmart.info) was also created for residents and property managers to find more information about salt best management practices.

BCWMC produced a video on dressing right for winter weather that had a Facebook reach of 12,000 with over 7,000 views. 6,400 of those views were unique (not repeat) views.

On September 24th the BCWMC hosted a free "Smart Salting for Property Managers" certification training course. Approximately 15 people attended the course.

Four BCWMC guest column articles related to over salting were publishing in the Sun Post in 2019 (see below).

Partnership with Metro Blooms for Harrison Neighborhood Project – Since 2016, the BCWMC has partnered with and supported the Metro Blooms' Harrison Neighborhood Project. The project aims to engage residents, and commercial businesses, train youth, and install water quality practices in Minneapolis' Near North neighborhood. The BCWMC collaborates on grant-funded projects and offers its own financial support. Since 2016, these programs have resulted in engagement with and bioswale installations on 37 residential properties; participation by neighborhood residents at 4 community block parties; engagement with 11 commercial property owners about possible BMP installations; and training of 15 local sustainable landcare stewards.

Aquatic Invasive Species (AIS) Education – In 2019, the BCWMC received a Hennepin County AIS Prevention Grant to assist with AIS education and early detection. Lake-specific AIS identification and education cards were developed for 6 priority lakes in the watershed including Parkers, Lost, Northwood, Sweeney, Twin, and Medicine Lakes. These cards are intended for in-person dissemination among lake homeowners (neighbor to neighbor). The cards include photos and descriptions of key AIS that may enter the lake (or those that are already in the lake in the case of Medicine). The cards also include important information on a lake homeowner's personal responsibility in AIS prevention. As an example, the Medicine Lake card can be found here.

The BCWMC also facilitated an AIS Early Detection Training course at the Plymouth Library on July 23rd. Approximately 24 people attended the training from the BCWMC and surrounding watersheds.

Volunteer Monitoring Programs – The BCWMC entered agreements with the Metropolitan Council and Hennepin County to participate in the Citizen Assisted Monitoring Program (CAMP) and the River Watch Program, respectively. In 2019, volunteers collected data from 9 locations on lakes in the watershed. Through River Watch, students from the Nawayee Center School in Minneapolis collected data on Bassett Creek at Morgan Ave. Find the 2019 River Watch Report here.

Commissioner Training Sponsorship – The BCWMC reimbursed Commissioners for registration costs to attend the Minnesota Association of Watershed Districts Conference and Annual Meeting.

Creek Crossing Signs – In 2019, city partners installed creek signs at 6 locations including 3 in Plymouth and 3 in Golden Valley, bringing the total creek signs watershed-wide to 7 crossings.

Educational Guest Columns in Local Papers – Each month, the BCWMC education consultant, on the Commission's behalf, submitted an article related to water resources to the Sun Post local newspaper. The following articles were published in the online newspaper. Some of these appeared in printed versions as well.

January 2019: The Impact of Road Salt on Wildlife and Soil
March 2019: How to Stop the Cycle of Over Salting
May 2019: Celebrating 50 Years – The Formation of the BCMWC
July 2019: Who Takes Care of Our Lakes and Streams
August 2019: Please Don't Feed the Algae
September 2019: Smart Salting Training Course for Property Managers
December 2019: Smart Salting Education Program

Social Media – The BCWMC continued with weekly posts on its Facebook page. The BCWMC made 89 Facebook posts reaching 57,882 people and had 5,155 engagements. The page currently has 323 followers, which is a 32% increase from the previous year.

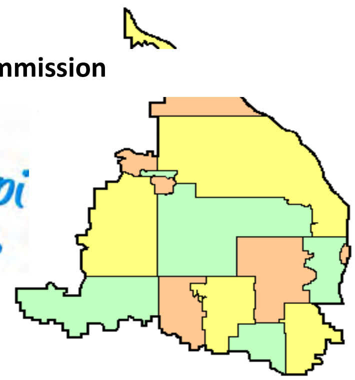
Financial Sponsorship for Organizations – The BCWMC financially sponsored the Children's Water Festival.

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



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Tel: 763.553.1144 • Fax: 763.553.9326
Email: judie@jass.biz • Website: www.shinglecreek.org

National Pollutant Discharge Elimination System (NPDES) Phase Education and Public Outreach Program 2019 Annual Report II

The Shingle Creek and West Mississippi Watershed Management Commissions conducted education and public outreach activities in 2019 in fulfillment of their Third Generation Watershed Management Plan Watershed Education and Public Outreach Program goals.

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 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, and 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. 2019 was the sixth year of the program. Two persons 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.

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. 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.

Table 1. Watershed PREP Program participation growth.

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
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

Table 2. 2019 schools and students participating in Lesson 1: What is a Watershed?

Date	School	School District	City	Watershed	Classes	Students
2/28	Hassan	Elk River	Rogers	Elm	4	119
2/21	Lakeview Elementary	Robbinsdale	Robbinsdale	Shingle	3	62
3/25	Plymouth Creek	Wayzata	Plymouth	Bassett	4	110
3/27	Sunset Hill	Wayzata	Plymouth	Bassett	4	116
4/4	Neill Elementary	Robbinsdale	Crystal	Bassett	3	68
4/12	Gleason Lake	Wayzata	Plymouth	Minnehaha	4	92
4/30	Meadow Ridge Elementary	Wayzata	Plymouth	Elm	4	116
5/1	Meadow Ridge Elementary	Wayzata	Plymouth	Elm	2	58
5/3	Oakwood	Wayzata	Plymouth	Minnehaha	3	84
5/13&15	Kimberly Lane	Wayzata	Plymouth	Bassett	6	145
5/14	Zachary Lane Elementary	Robbinsdale	Plymouth	Bassett	4	96
4/30	Northport Elementary	Robbinsdale	Brooklyn Ctr	Shingle	2	45
5/14	Forest Elementary	Robbinsdale	Crystal	Shingle	3	83
5/21&22	Rush Creek	Osseo	Maple Grove	Elm	5	127
9/25	Noble Elementary	Robbinsdale	Golden Valley	Bassett	2	52
10/1	Rice Lake	Osseo	Maple Grove	Elm	3	73
10/3	Rice Lake	Osseo	Maple Grove	Elm	2	47
10/4	Rice Lake	Osseo	Maple Grove	Elm	2	46
10/9-10	Elm Creek Elementary	Osseo	Maple Grove	Elm	4	93
10/16/19	Monroe Elementary	Anoka-Henn	Brooklyn Park	W. Miss	4	112
10/23	FAIR Pilgrim Lane Magnet	Robbinsdale	Crystal	Shingle	1	24
10/24	SEA Magnet	Robbinsdale	Golden Valley	Bassett	3	84
10/30	Rogers	Elk River	Rogers	Elm	4	116
10/31	Palmer Lake	Osseo	Brooklyn Park	Shingle	3	70
11/4-5	Weaver Lake	Osseo	Maple Grove	Elm	4	118
11/11	Good Shepherd	Parochial	St. Louis Park	Bassett	2	33
11/15	Meadowbrook	Hopkins	Golden Valley	Bassett	2	55
11/19-20	Dayton	Anoka-Henn	Dayton	Elm	3	85
11/21-22	Oxbow Creek	Anoka-Henn	Champlin	W. Miss	7	191
11/25-26	Basswood	Osseo	Maple Grove	Elm	6	161
				Total	**103**	**2,681**

Table 3. 2019 schools and students participating in Lesson 2: The Incredible Journey

Date	School	School District		Watershed	Classes	Students
227	Hassan	Elk River	Rogers	Elm	4	118
2/6	Lakeview Elementary	Robbinsdale	Robbinsdale	Shingle	3	61
4/3	Neill Elementary	Robbinsdale	Crystal	Bassett	3	68
4/23&24	Rush Creek	Osseo	Maple Grove	Elm	5	127
29-Apr	Northport Elementary	Robbinsdale	Brooklyn Ctr	Shingle	2	46
5/7	Forest Elementary	Robbinsdale	Crystal	Shingle	3	84
9/30	Rice Lake	Osseo	Maple Grove	Elm	3	71
10/3	Rice Lake	Osseo	Maple Grove	Elm	2	47
10/7-8	Elm Creek	Osseo	Maple Grove	Elm	4	92
10/14-15	Basswood	Osseo	Maple Grove	Elm	6	175
10/22	Rogers	Elk River	Rogers	Elm	4	118
10/23	FAIR Pilgrim Lane Magnet	Robbinsdale	Crystal	Shingle	1	24
10/29	Palmer Lake	Osseo	Brooklyn Park	Shingle	3	68
11/6-7	Oxbow Creek	Anoka-Henn	Champlin	W. Miss	7	194
11/8	Meadowbrook	Hopkins	Golden Valley	Bassett	3	83
11/12	Meadowbrook	Hopkins	Golden Valley	Bassett	2	56
11/18-19	Dayton	Anoka-Henn	Dayton	Elm	3	84
				Total	**58**	**1,516**

Community Education and Outreach. The PREP educators provided outreach at three community and school events. Because of the nature of these events, it is difficult to keep a tally of the number of contacts made and citizens engaged. Events are detailed in Table 4.

Table 4. 2019 Watershed PREP community education and outreach participation

Date	Event	Location	Watershed	# of Attendees
4/27	Arbor Day Event	Maple Grove	EC/SC	62 children "planted" trees in the watershed
8/1	Plymouth Kids Fest	Plymouth	BC/EC/SC	4,000
11/12	Filmed Meadowbrook Program for video promotion			

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.

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
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.

Press Releases and Newspaper Articles
The Commissions received news media coverage of some of its projects in 2019:

- After the Shingle Creek Commission announced receipt of a federal grant, local cable access CCX Media did a story on the Crystal Lake Management Plan.
- MPR News did a story on lake alum treatments that featured the Bass Lake project in the Shingle Creek watershed.
- The Commissions distributed a press release announcing the receipt of an award from the Environmental Initiative for the Biochar enhanced Filters project. The project and award were featured in *Municipal Sewer and Water Magazine*, a national trade journal. It was also featured on the blog of the Biochar Project, a nonprofit in Australia.

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 2019 the site received over 3,105 visitors and over 9,900 pageviews. Most of the pageviews are to the meetings and project review pages, but there was significant traffic to the page dedicated to the biochar filters project (366 pageviews) and Twin Lake carp management page (305 pageviews).

Social Media. The Commission established a Facebook page in 2016. During 2019 there were 147 followers, 4,481 reaches and 7,492 impressions. A reach is logged when a timeline post is seen by an individual viewer, while impressions are the number of times a post was seen. Viewers were "engaged" 714 times. An engagement is a click to open a post, view a photo or video, make a comment, or click on a reaction emoji. Commission posts were "liked" 304 times, "shared" 53 times, 104 photos were opened and 14 comments were made.

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. The 2019 website activity is shown on the last page of this report.

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 project includes the additional benefit of creating habitat for pollinators. An agreement between Metro Blooms and the Shingle Creek Commission, as fiscal agent, to move the stormwater runoff.

Phase One of the project began with creation of a name, tag line and logo. 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 included a roll out of the Pledge campaign on the Metro Blooms and WMWA websites where citizens can enter the square footage of their new plantings, creation of a *Pledge to Plant* banner for events, and a social media campaign that began in 2016. The campaign was promoted at the State Fair and other 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 but the median pledge covers 250 square feet. Most of the Pledges come 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 and at events Educators attended in 2019. Pledges were not tallied in 2019.

Pledge campaign materials will be included in the 2020 Metro Bloom workshop handouts.

<u>Rain Garden Workshops</u>

The Commissions partnered with WMWA to sponsor three Rain Garden workshops through Metro Blooms in 2019. 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. In 2019 Metro Blooms offered Creating Resilient Yard workshops providing an overview of Minnesota's changing weather patterns and ways to mitigate the impact in your own yard. The presenters offered recommendations for individual properties and options for establishing mowable, native alternatives to "grass" turf, raingarden basics, and other resilient yard practices. Attendees also received one-on-one design assistance from landscape professionals and Master Gardeners. The locations and number of participants are shown in Table 5.

Table 5. 2019 Rain garden workshop locations and participation.

Location	Date	No. Participants

Champlin – Champlin City Hall	April 4	16
Crystal partnering w/Golden Valley, New Hope, Robbinsdale–Crystal Community Ctr	May 9	38
Plymouth – St Barnabas Church	May 2	37

Shingle Creek Cleanup

The 18th Annual Great Shingle Creek Cleanup was held the week of April 21-27, 2019. Each city sponsored its own cleanup, which could be a special event or simply a request that the existing Adopt-a-Park volunteers schedule their spring cleanup during that week.

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. Only one lake, Meadow Lake in New Hope, was monitored by volunteers in 2019.

Streams. Routine stream macroinvertebrate monitoring in both watersheds is conducted by volunteers through Hennepin County's River Watch 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 River Watch protocols to collect physical, chemical, and biological data to help determine the health of streams in the watershed. Two sites on Shingle Creek were monitored in 2019 – the long-term (24 years) site next to Park Center High School in Brooklyn Park, monitored by students from Park Center High School; and a site at Webber Park Falls in Minneapolis, monitored by students from Avail Academy in Fridley.

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 macroinvertebrates and vegetation. In 2019, BP-5 Brookdale Park in Brooklyn Park and CR-1 Wetland 639W in Crystal were monitored in the Shingle Creek watershed. The sites in the West Mississippi watershed were the BP-1 Environmental Preserve wetlands and BP-7 Zane Sports Park, both in Brooklyn Park.

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:

WMWA

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 the Freshwater Society, Hennepin County Environment and Energy, and Three Rivers Park District. The Mississippi WMO also participates but is not a formal member. 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 is also available on the WMWA website.

Other Partnerships

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;
- BlueThumb, 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.

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>

- 2018 Annual Water Quality Monitoring report findings
- Biochar- and Iron-Enhanced Sand Filter Project update and final report
- Twin Lake Carp Management Project update
- 2019 Lake and Stream Monitoring update
- SRP Reduction Project update and results
- FEMA Flood Modeling update
- FEMA Flood Modeling amendment
- Becker Park updates
- Bass and Pomerleau Alum Treatment preliminary results
- Connections II introduction
- River Park project introduction

<u>Guest Speakers</u>

Representatives from Metro Blooms presented Phase II of their proposed 5-year stormwater retrofit project for the Autumn Ridge Apartments in Brooklyn Park. The residents were seeking a second Shingle Creek Partnership Cost Share Grant to help fund the project. Representatives from Metro Blooms returned later in the year to present the progress achieved in Phase II.

<u>Other</u>

- The Commission made contributions to fund the annual Road Salt Symposium presented by Fortin Consulting and the Water Summit sponsored by the Freshwater Society.
- Shingle Creek Commission made application for an Environmental Initiative Award in the category, Environmental Innovation, that recognizes "a partnership working on the next environmental breakthrough." The application was for the Biochar- and Iron-Enhanced Sand Filter project. The Commission received an Honorable Mention.
- Consideration of an Enhanced Street Sweeper as a capital project on the CIP.

Evaluation:

No specific evaluation of this programming has been completed

Minneapolis
City of Lakes

Public Works Department
Surface Water & Sewers Division
309 2nd Ave S - Room 300
Minneapolis, MN 55401
www.minneapolismn.gov

No comments were received on the SWMP or 2019 Annual Report.

CITY OF MINNEAPOLIS

Public Works - Street Maintenance Division

Standard Operating Procedure for Vehicle Related Spills (VRS)

May 13, 2020

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)
     Rick Jorgensen: 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 WATER BODY
(within Minneapolis City Limits)

Surface Water	Area (acres)	Impervious %	Population 2010	Single Family / Duplex %	Multi Family %	Inst. %	Comm. %	Ind. %	R.O.W. %	Golf Course %	Park, Rec., or Preserve %	Rail %	Airport %	Open Water %
Bassett Creek	1,621.2	40.6%	15,766	43.1%	1.2%	3.5%	2.1%	3.9%	24.2%	0.0%	20.4%	1.6%	0.0%	0.0%
Bde Maka Ska	1,250.2	45.3%	14,482	34.9%	8.7%	1.7%	5.9%	0.1%	20.6%	4.7%	15.6%	0.0%	0.0%	0.0%
Birch Pond	38.8	10.3%	4	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	99.9%	0.0%	0.0%	0.0%
Brownie Lake	93.9	40.3%	321	30.9%	0.0%	0.0%	28.6%	0.0%	18.6%	0.0%	18.2%	3.1%	0.0%	0.6%
Cedar Lake	287.8	31.5%	1,853	38.0%	1.1%	2.2%	0.4%	0.0%	18.6%	0.1%	37.8%	0.7%	0.0%	1.3%
Crystal Lake	420.9	41.7%	5,728	62.0%	1.7%	2.6%	0.7%	0.0%	30.3%	0.0%	2.7%	0.0%	0.0%	0.0%
Diamond Lake	663.7	47.8%	6,291	45.6%	4.0%	2.2%	3.6%	7.9%	27.8%	0.0%	8.9%	0.0%	0.0%	0.0%
Grass Lake	324.7	43.3%	2,707	59.0%	0.1%	3.2%	2.3%	0.0%	29.9%	0.0%	4.9%	0.0%	0.0%	0.6%
Hart Lake	3.3	51.2%	21	24.8%	0.0%	0.0%	19.2%	0.0%	52.7%	0.0%	0.0%	3.3%	0.0%	0.0%
Lake Harriet	1,120.5	38.6%	9,867	46.6%	1.8%	2.8%	1.5%	0.0%	20.2%	0.0%	26.1%	0.0%	0.0%	1.1%
Lake Hiawatha	1,243.4	42.9%	16,515	49.8%	2.9%	2.9%	2.0%	0.0%	26.9%	10.4%	5.1%	0.0%	0.0%	0.0%
Lake Nokomis	695.8	35.1%	5,776	47.7%	0.1%	2.1%	0.4%	0.0%	22.9%	0.0%	26.6%	0.0%	0.0%	0.2%
Lake of the Isles	769.8	44.5%	11,516	42.6%	10.0%	2.3%	3.2%	0.3%	23.8%	0.0%	17.5%	0.0%	0.0%	0.3%
Legion Lake	2.1	43.0%	23	60.5%	0.0%	0.0%	0.0%	0.0%	39.5%	0.0%	0.0%	0.0%	0.0%	0.0%
Loring Pond	27.2	16.2%	36	0.0%	3.1%	3.5%	0.1%	0.0%	1.3%	0.0%	91.5%	0.0%	0.0%	0.5%
Minnehaha Creek	3,347.4	38.6%	32,559	53.0%	0.8%	3.2%	1.5%	0.2%	24.2%	0.7%	15.9%	0.0%	0.0%	0.0%
Mississippi River	20,313.0	57.7%	237,734	29.2%	6.0%	6.5%	6.1%	12.0%	28.8%	1.5%	7.8%	2.5%	0.1%	0.1%
Mother Lake	30.5	45.4%	112	25.3%	0.0%	1.5%	0.1%	0.0%	63.9%	0.0%	0.0%	0.0%	9.2%	0.0%
Powderhorn Lake	322.7	43.5%	6,483	44.3%	5.7%	3.7%	1.6%	0.0%	27.1%	0.0%	17.5%	0.0%	0.0%	0.1%
Richfield Lake	57.6	65.0%	356	27.2%	3.4%	1.0%	27.7%	0.1%	40.6%	0.0%	0.0%	0.0%	0.0%	0.0%
Ryan Lake	60.6	42.3%	506	50.3%	0.0%	0.0%	0.0%	10.0%	28.3%	0.0%	2.2%	8.8%	0.0%	0.5%
Shingle Creek	1,457.7	44.7%	11,571	40.5%	1.2%	2.3%	1.1%	8.8%	19.9%	1.2%	22.2%	3.8%	0.0%	0.3%
Silver Lake	25.0	41.2%	206	66.1%	3.4%	0.0%	2.2%	0.0%	28.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Spring Lake	50.0	32.6%	208	40.2%	0.3%	6.4%	0.0%	0.0%	15.7%	0.0%	37.1%	0.0%	0.0%	0.2%
Taft Lake	138.9	45.1%	1,228	57.6%	0.0%	0.0%	0.0%	0.0%	42.1%	0.0%	0.2%	0.0%	0.0%	0.0%
Wirth Lake	40.6	6.1%	25	0.2%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	99.6%	0.0%	0.0%	0.0%
Grand Total	**34,407.3**	**50.9%**	**381,894**	**36.2%**	**4.6%**	**4.9%**	**4.5%**	**7.8%**	**26.7%**	**1.6%**	**11.7%**	**1.7%**	**0.0%**	**0.2%**

Stormwater Retrofit Plan

Introduction/background

The City of Minneapolis developed this retrofit plan to address stormwater quality from existing development. While new development and redevelopment are required to manage stormwater on-site, older developments may have been constructed before stormwater management was required or modern criteria were established. Retrofitting existing unmanaged or inadequately managed stormwater runoff will help the City improve water quality in lakes, creeks, wetlands, and the Mississippi River.

Retrofits include new installations or upgrades to existing Best Management Practices (BMPs) in developed areas where there is a lack of adequate stormwater treatment. Stormwater retrofit goals may include, among other things, the correction of prior design or performance deficiencies, flood mitigation, disconnecting impervious areas, improving recharge and infiltration performance, addressing pollutants of concern, demonstrating new technologies and supporting stream restoration activities.

This retrofit plan is required under the City's 2018 NPDES MS4 permit, which states in Part III.C.6.i:

i. Retrofit plan

(1) Develop a retrofit plan to evaluate the ability to implement structural stormwater BMPs in areas of the Permittee's jurisdiction that currently do not have stormwater runoff treatment or where existing structural stormwater BMPs could be enhanced to improve pollutant removal capability. The Permittee must submit the retrofit plan to the Agency for review and approval within 24 months of receiving permit coverage. Once approved by the Agency, the retrofit plan will become an enforceable part of the SWMP.

(2) At a minimum, the retrofit plan must include a discussion of the following:

(a) Retrofits on lands the Permittee owns, including public parcels of land or public right-of-way areas for implementation of structural stormwater BMPs.

(b) Developing strategies to encourage privately owned parcels to install stormwater retrofits to reduce and/or treat stormwater runoff from privately owned impervious surfaces.

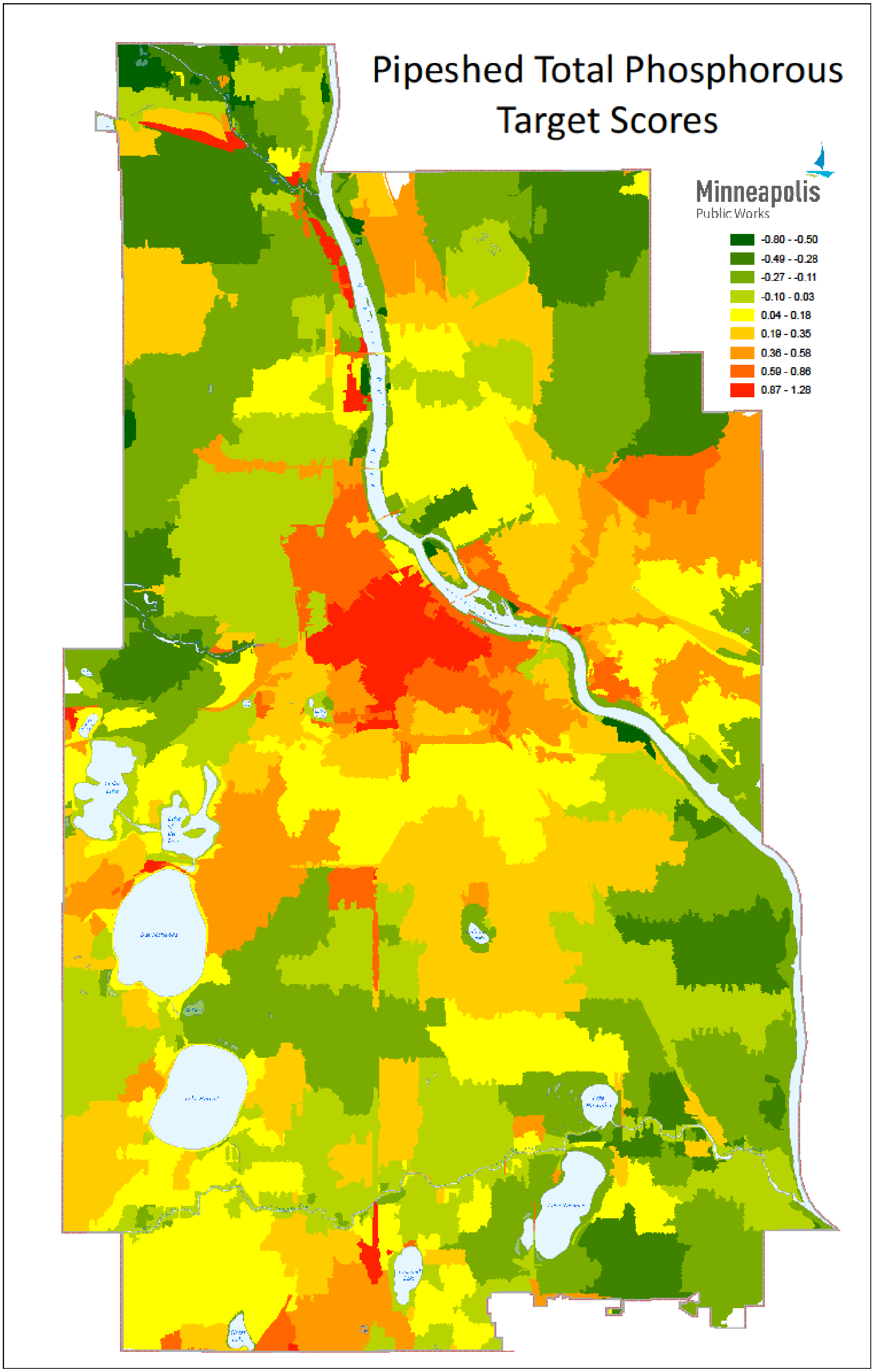
The City has developed several tools and programs to identify and implement retrofit projects, including completion of the water quality model, ongoing city-wide flood modeling, development of a prioritization tool, and use of the tool to add water quality and water resource protection to infrastructure projects.

Water Quality Model

The City developed a GIS based water quality model that estimates TP and TSS loads from pipesheds. The model uses impervious area through land use and water quality BMPs to determine loads for each pipeshed. The City continually updates the data in the model to more accurately assess loads and treatment, including adding new or modified structural BMPs and performing quality control review on existing BMPs and the pipe network. The results of the water quality model are used for stormwater quantity, quality, and comprehensive planning.

The TP loads are compared to the allowed concentrations in the receiving waterbody to determine the pipeshed phosphorus target score. This metric is the parameter from the water quality model used in the comprehensive stormwater prioritization. This metric is used as one of the factors to develop the water quality prioritization tool.

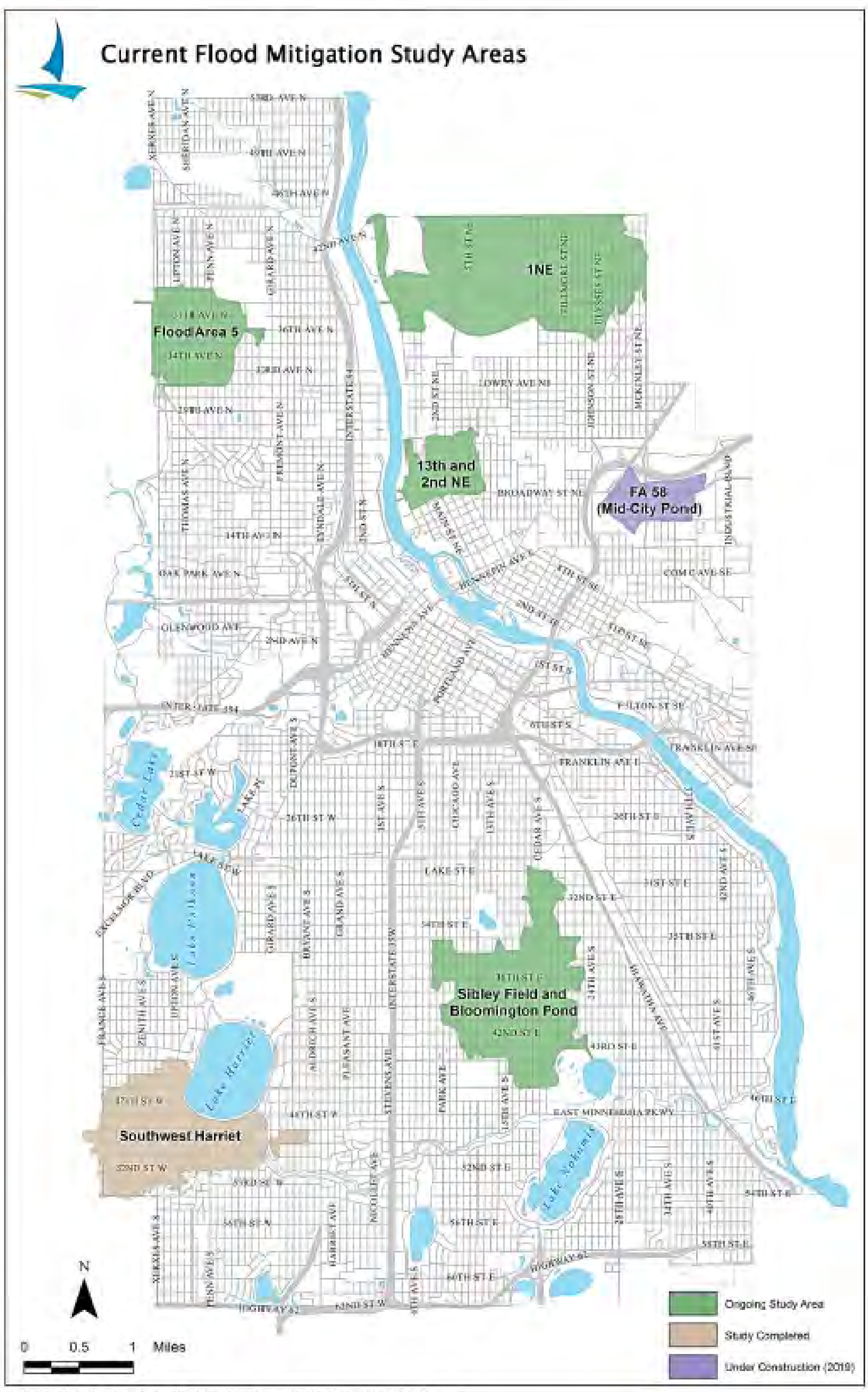
Figure 1: The factor calculated as the TP load compared to the receiving waterbody allowed concentration



Flood Modeling

Hydrologic and hydraulic modeling has been completed for most of the City. The modeling identifies structures at risk of flooding in various design storms and can be used to model specific storms. The number of structures that flood is used to identify specific areas and pipesheds where flood risks are the greatest. The City uses this information to prioritize comprehensive stormwater assessment studies, and to inform flood mitigation needs for other City infrastructure projects. The comprehensive stormwater studies consider water quality and green infrastructure solutions as part of the study recommendations. The City recently completed studies for the areas shown on the following map.

Figure 2: Flood Study Areas – Studies in progress or completed

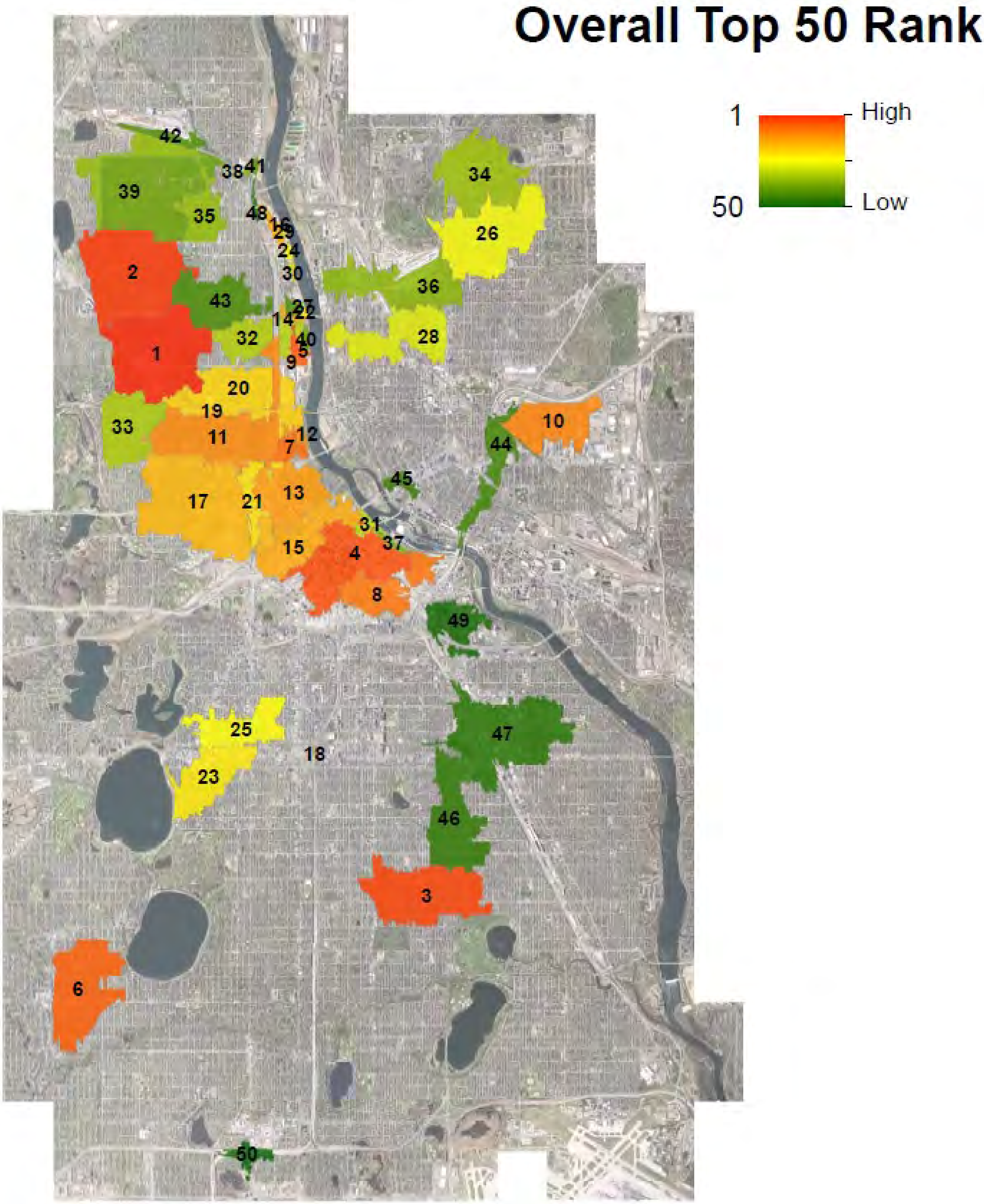


Comprehensive Stormwater Studies

Comprehensive stormwater studies are being conducted throughout the City to find locations where projects can provide multiple benefits related to flood reduction, water quality, and infrastructure condition. Studies areas are prioritized based on flood modeling, water quality modeling, asset management, planned road construction, and Racially Concentrated Areas of Poverty (RCAP). The next comprehensive stormwater study area encompasses five adjacent pipesheds in north Minneapolis. Water quality improvements will be recommended as a part of these studies.

The areas where comprehensive stormwater studies are conducted will not be studied separately as part of the water quality pipeshed studies described later in this retrofit plan. Recommendations from the comprehensive stormwater studies may be included in the water quality CIP selection and funding decisions described later in this retrofit plan. Stormwater facilities constructed from results of the comprehensive stormwater studies will be incorporated into the water quality model.

Figure 3: 50 Highest ranked Comprehensive Stormwater Study pipesheds



Stormwater Infrastructure Condition Assessments and Asset Management

The City is in the process of assessing the condition of stormwater pipes and conveyance structures. This assessment involves inspection using CCTV. The City has completed the majority of stormwater manholes, and much of the accessible sections of pipe. The asset management program uses risk-based approach by quantifying the Likelihood of Failure (LOF) and Consequence of Failure (COF) for each asset. Risk (ROF) is calculated by multiplying LOF and COF to rank each element. Elements of the system scored with the highest COF and ROF are evaluated for increased assessment and design needs. The highest LOF and ROF scores are also used to determine repairs and upgrades where other city infrastructure projects are planned.

Prioritization Tool

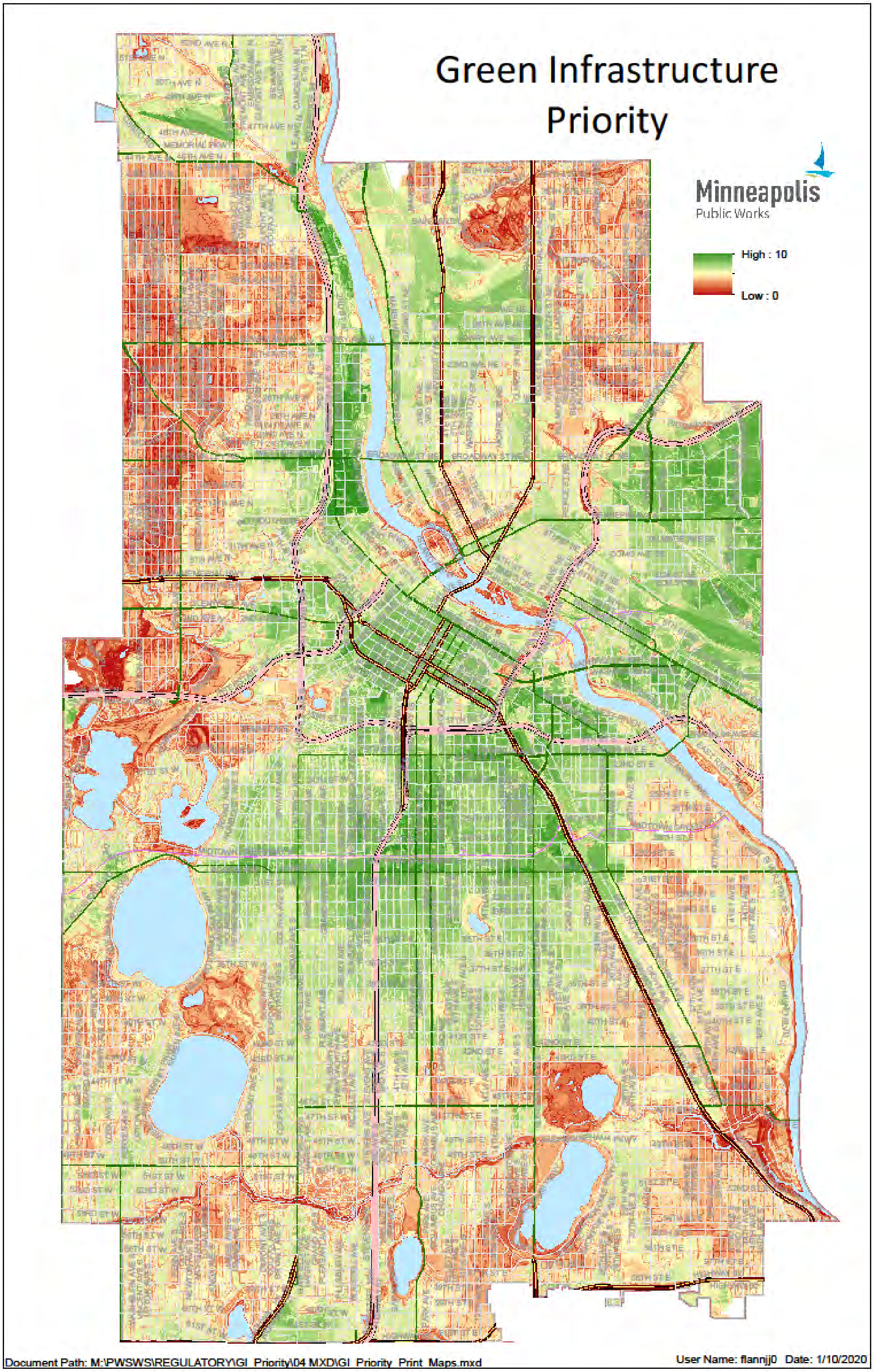
The City created the prioritization tool to identify areas of the city where green infrastructure improvements and water quality studies should be funded. The intent of the tool is to determine which areas of the city provide a more cost-effective opportunity relative to other parts of the city. The tool is a planning level tool, not intended to replace design.

Use

The prioritization tool is being used for short, medium, and long-term assessment of funding for water quality projects. The tool is being used to:

- Short: Assess other infrastructure projects to add water quality improvements
- Medium: Select water quality study areas
- Long: Rank potential projects for CIP planning

Figure 4: Green Infrastructure Prioritization Map



SHORT-TERM

The most common short-term use of the tool is on street improvement projects. The extent of the street reconstruction is compared to the tool to determine the priority. Where the priority is high (green), the City adds water quality improvements with a goal of one-inch of runoff over the impervious portion of the drainage area and the minimum treatment is 0.55-inches of runoff over the impervious portion of the reconstructed ROW area. Where the priority is medium (yellow), the goal is to provide stormwater management for 0.55-inches over impervious areas, and the minimum treatment is to provide vegetated stormwater management practices. The medium areas help to gain experience meeting future requirements that may be implemented with changes to the City's stormwater ordinance. Where the priority is low (red), impervious conversion to pervious and native plantings is the goal, and strategic opportunities for stormwater management are considered, but not using an established goal. Due to the nature of long, linear street projects, each project may have some portions in a spectrum of priorities, and the goals along the corridor as grouped to reflect the differences in priority.

MEDIUM-TERM

The City conducts pipeshed or area studies to identify stormwater solutions. These studies have largely been focused on flooding issues where water quality improvements are considered. The prioritization tool is used to identify pipesheds or areas to conduct studies where the focus is water quality. The first round of pipeshed studies for water quality retrofit is being conducted on pipesheds draining to impaired waterbodies on 'typical' representations of the city. More specific portions of the city, such as downtown and heavy industrial areas, will be included in future rounds of pipeshed studies. These areas are still considered for other evaluations, including studies on vegetation success and salt application, but will be studied for retrofit opportunities once the process has been better defined. The initial pipeshed studies will be used to determine methods to expand citywide analysis and data needs and to streamline future TMDL responses.

LONG-TERM

The tool will be used to identify capital improvement projects and to inform other city infrastructure projects were combined efforts can realize cost savings. As the City identifies projects, the prioritization tool can be used to rank the projects and assign to future years according to available funding. CIP planning is conducted annually, so as project priorities shift, the tool can continue to feed into the selected projects.

Parameters

The tool utilizes factors that determine the impact of water quality improvements and the suitability of the area to construct water quality improvements. These factors are weighted and combined to create the prioritization tool, which is a map that shows the high priority areas in green and the low priority areas in red. The combined factors are intended to reflect the most cost-effective parts of the city to retrofit existing development.

As new and updated sources of data become available, the tool will be updated to reflect the changes. The tool is intended to change as the city changes and will be used both at the individual project level, and at the long-range capital improvement planning level. The factors used to create the current version of the tool are described as follows. The combined suitability and impact equally influence the prioritization. The individual factors are weighted within their group.

SUITABILITY

The suitability group of factors reflect conditions that allow for structural BMPs, specifically infiltration practices. The factors rely mostly on soil conditions and consist of:

Factor	Source	Weight
Estimated soil infiltration rate	US Web Soil Survey; MNGS Hennepin County Geologic Atlas	30%
Depth to bedrock	MNGS Hennepin County Geologic Atlas	10%
Depth to groundwater	MN DNR	10%
Karst prone areas	MN DNR	15%

Slope	MN DNR LiDAR	25%
Wellhead protection areas	MN Department of Health	10%

Additional data that the City will incorporate as it becomes available include:

- Soil mapping and infiltration potential – while soil information is included, it is largely classified as urban soil. The City has other sources of soil information that are not in a format that can easily be added to this prioritization. The City also supports efforts to better define and map urban soils data.
- Hotspot sources
- Soil or groundwater contamination

IMPACT

The impact group of factors reflect the need and benefit of providing water quality and green infrastructure improvements. These factors are largely based on data from the water quality model and include the City's metric to consider environmental equity for culturally and economically disadvantaged populations.

Factor	Source	Weight
Sub-watershed TP load	Minneapolis Water Quality Model	20%
Pipeshed TP target score	Minneapolis Water Quality Model and Lake Hiawatha TMDL	30%
BMP drainage area TP treatment	Minneapolis Water Quality Model	20%
Distance to parks	City of Minneapolis and MPRB	10%
Racially concentrated areas of poverty	US Census 2010	20%

Additional data that the City will incorporate as it becomes available include:

- Available land – this includes parcels owned by government agencies that may be under-utilized.
- Land use – the model currently accounts for land use types.
- Future development – portions of the city are subject to more development by private entities, that may fall under the City's stormwater ordinance, so provide stormwater improvements. The City's 2040 plan is expected to increase impervious and density, so areas where more up-zoning is expected to occur may require more city intervention
- Climate change – the City continues to experience record stormwater and temperature impacts due to climate change. These impacts do not follow the developed predictions used
- TMDLs – as TMDLs are implemented, the TP target score will be adjusted and a determination made to decide whether a TMDL weighting factor should be added to the prioritization tool.

Citywide stormwater quality retrofit plan

The City uses the prioritization tool to select water quality retrofit opportunities. The opportunities come from studies to identify stand-alone projects, and from coordination with other city infrastructure projects. The stand-alone projects and coordinated infrastructure projects will be assessed annually as part of the stormwater capital project plan.

1. Project opportunity identification
    a. Existing stormwater facility modifications
    b. Available space identification
    c. Pipeshed studies
    d. TMDL requirements
2. Annual project selection
    a. Infrastructure coordination assessment
    b. CIP selection based on funding and priority

Existing stormwater facility modifications

The City operates several stormwater facilities throughout the City. Some of the facilities were constructed to provide stormwater quantity control and could be modified to provide water quality treatment. Modifying existing stormwater facilities can provide a cost-effective water quality treatment option with limited disruption to the surrounding development. The following table summarizes the City's inventory of existing stormwater facilities. This does not include facilities that are in design or construction in 2020.

Facility type	Number of facilities
Grit chamber	159
Wet pond	18
Surge basin	3
Detention basin	6

The City has started evaluating the stormwater modification potential through a survey of 18 of the City's facilities. The City is also in the process of designing modification of another facility to provide water quality treatment.

- Stormwater facility modification potential study – 18 facilities
- Stormwater facility modification design – 1 facility with approximately 20 acres of drainage area
- Grit chamber evaluation – evaluate downstream conditions for existing stormwater facilities and opportunities to create new stormwater facilities.

Available space investigations

One of the most challenging aspects of retrofitting developed urban areas is finding space to construct stormwater management facilities. In Minneapolis, this is further complicated with the significant flooding issues experienced from climate change, topography, and the condition of the conveyance system. The City does own and manage land in the city. Additionally, the MPRB has extensive tracts of land throughout the city. The main types of available land for retrofit opportunities consist of:

- Right of way (ROW)
- MRRB land
- City-owned parcels

Redevelopment projects provide further opportunities to improve water quality, and these are managed by the City through the City's stormwater ordinance.

Private parcels still make up the majority of the City. The City encourages voluntary retrofit and water quality treatment on private parcels through the stormwater utility credit program. This program accepts applications to reduce the stormwater utility fee on a property through installation of stormwater management devices.

The City does not have a formal program for public private partnerships or regional treatment planning; however, both of these options may be considered through proposals and as identified in pipeshed studies.

ROW analysis

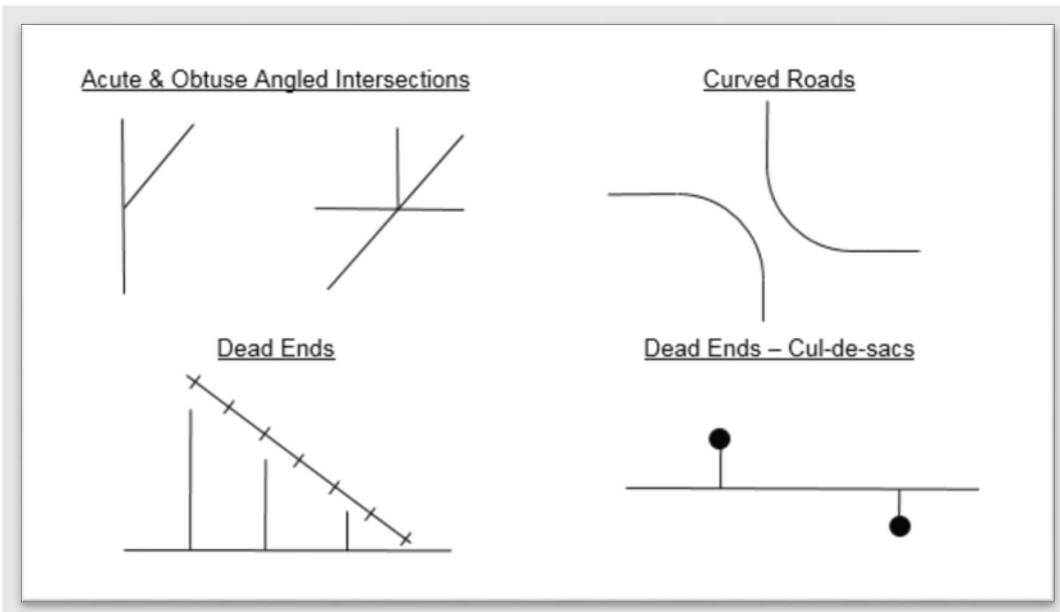
The City manages the right of way (ROW), which consists of about a quarter of the City's land. The ROW is mostly impervious and required to function for transportation purposes. The main pervious portion of the ROW consists of slighted raised or crowned turf grass or trees under grates.

EXCESS IMPERVIOUS

Past development of the ROW resulted in larger than necessary impervious surfaces. Modern designs often result in road diets or a reduction in the width of impervious and vehicle travel areas. Additionally, the ROW typically collects runoff from adjacent areas, so receives and conveys most of the City's stormwater. The combination of stormwater collection and impervious reduction results in the opportunity to provide green infrastructure through small distributed facilities that mimic natural hydrology. Where impervious conversion to stormwater management or habitat enhancements occur in conjunction with planned infrastructure, cost savings through multiple program goals can be achieved.

The City conducted an GIS assessment of the City's right of way to identify excess impervious areas. The areas are mapped and ranked. Road projects and other infrastructure projects can be compared to these opportunity areas. The areas are also included in the pipeshed studies to quickly identify available spaces for potential stormwater treatment. The searches conducted consist of[1]:

- *Acute & Obtuse Angled Intersections:* Intersections that meet at angles that are not 90 degrees (see diagram below). Such intersections often have unused impervious space that can be converted into a BMP or at least removed and turned into green space.
- *Dead Ends:* Streets and alleys that dead end may be ideal candidates for BMPs or impervious surface removal. Dead end streets also include former intersections that have been closed and turned into 90-degree curves (see diagram).
- *Wide Roads:* Minor streets with curb to curb widths that are larger than necessary may be candidates for impervious surface removal.
- *Medians:* Streets throughout the city with medians have space that could be converted into a BMP or have impervious surface removed.
- *Unpaved Alleys:* The City has a program to pave alleys that are not. This program may also be expanded to address alleys in poor condition with stormwater improvement needs.
- *Alleys with VCP and poor condition:* The City surveys the condition of roads and alleys. The condition of alleys was compared to alleys with VCP (vitrified clay pipe), which is being replaced.



The searches resulted in the quantities in the following table. The angled intersections and dead ends were manually evaluated to filter for errors in the geoprocessing.

Impervious opportunities	Results
Angled intersections	330 intersections
Dead ends	202 ends
Curved roads	60 points
Medians	12 miles
Wide roads	162 miles
Unpaved alleys	74 alleys
Alleys with VCP	10 alleys

[1] M:\PWSWS\REGULATORY\GI_Priority\BMP_Potential

BOULEVARD ENHANCEMENTS

The space between the sidewalk and the curb, or boulevard, provides opportunities for stormwater management and habitat enhancement. The boulevard's location next to the gutter and downgradient of the sidewalk and parcel development is conveniently located for collecting and treating stormwater. The ROW has competing demands, and the City has safety and aesthetic goals for the city that include reducing vehicle travel lanes and adding buffers between travel modes (cars, bikes, and pedestrians). While these areas provide opportunities for stormwater management, they also provide opportunities for impervious reduction and habitat improvement. The City is working on stormwater runoff reduction through two programs:

- Blooming boulevards: The City sponsors the blooming boulevards program, which funds outreach and conversion of typical planted areas between the sidewalk and curb (boulevard) to enhance the vegetation and lower the ground to allow water to drain across the planted area.
- Boulevard vegetation restoration standards: The City has started changing how the boulevards are planted. In 2015 the City passed a resolution[2] encouraging pollinator plantings throughout the city. The City is in the process of developing new boulevard restoration options through the Transportation Action Plan (TAP) design guidelines for road projects that would allow and standardize native and pollinator plants.

MPRB coordination

The Minneapolis Park and Recreation Board (MPRB) is a co-permittee with the City of Minneapolis on their shared NPDES MS4 Phase I permit. The MPRB and the City are jointly responsible for ensuring that the permit requirements are met.

The MPRB owns, operates, and manages the designated park land within the City. This includes regional parks, neighborhood parks, and "parklets" as well as parkways and trail corridors. The MPRB conducts park modifications through its master planning process and the MPRB maintains the city's street trees and is working on increasing the amount and diversity of the city's tree canopy. The MPRB is committed to improving environmental habitat through vegetation enhancements and stormwater management.

In 2019 the MPRB began drafting their Comprehensive Plan entitled "Parks for All". As part of the Plan development the MPRB has established numerous workgroups to delve into various topic areas such as Art, Culture, and History, Climate Resilience, Public Health, Gentrification, and Water Resources. Both the Climate Resilience and Water Resources work groups have begun incorporating ideas for integrating water quality and flood management practices into future park planning. There is a strong drive to ensure that as parks are redeveloped they meet multiple needs and incorporate stacked, layered benefits for the community. This plan is expected to be completed and adopted by the MPRB Board in early 2021 and the plan will guide how the City and the MPRB will collaborate on water quality and flood related projects within the parks, on parkways, and through shoreline and streambank stabilization projects.

City-owned parcel analysis

The City owns and operates parcels throughout the City. The parcels are either for city operations or parcels for redevelopment. The operations parcels include office and maintenance facilities as well as stormwater management facilities. These parcels are evaluated for stormwater management retrofit site analysis and pollution prevention. The parcels containing stormwater management facilities are evaluated for retrofit opportunities as previously described. The redevelopment parcels are owned by Community Planning and Economic Development (CPED) and consist mainly of single-family parcels. The number of CPED parcels varies and may have future development plans. The City-owned parcels have been identified and are considered during pipeshed studies.

Pipeshed studies

The City selects pipesheds to study for stormwater modifications within three categories. The pipesheds are selected based on the prioritization tools developed. The pipeshed studies for retrofit opportunities are being conducted through water quality focus; however, the City also considers water quality improvement opportunities through its comprehensive stormwater studies and through flood mitigation studies. The comprehensive stormwater studies prioritization uses the *Pipeshed TP Target Score* parameter described above.

[2] http://www.minneapolismn.gov/sustainability/policies/minneapolis-pollinator-resolution

- Water quality pipesheds
- Comprehensive stormwater studies
- Flood area studies

The water quality pipeshed studies will vary in the level of detail reviewed to identify potential opportunities. The schedule for pipeshed studies follows:

- Phase 1: Two pilot pipeshed studies to identify opportunities, develop the process, and identify different levels of studies. The pipesheds will be selected using the prioritization tool and to reflect more typical development conditions. The downtown and industrial areas of the city with high priority will be evaluated in later rounds to benefit from lessons learned.
- Phase 2: Pilot pipeshed study to coincide with impairment monitoring and assessment
- Phase 3: Select pipesheds to perform detailed analysis and initiate citywide data collection needs.
- Phase 4: Evaluate lower priority pipesheds using broader analysis. The broader analysis is initially expected to focus on available space results. Future broader analysis studies may focus on other factors, determined from lessons learned through more detailed pipeshed studies.
- Phase 5: Identify waterbodies for targeted pipeshed studies. The waterbodies will be selected based on impairments and TMDL requirements.

Phases 4 and 5 will be continuously conducted to address citywide retrofit needs.

TMDL requirements

The City's TMDLs include the following waterbodies and associated pollutants:

Waterbody name	Pollutant of concern	Type of WLA
Shingle Creek; Lower Shingle Creek Watershed	Nitrogenous biochemical oxygen demand	Categorical
Shingle Creek; Upper Shingle Creek Watershed	Nitrogenous biochemical oxygen demand	Categorical
Lake Nokomis	Phosphorus	Individual
Wirth Lake	Phosphorus	Categorical
Silver Lake	Phosphorus	Categorical
Crystal Lake	Phosphorus	Categorical
Ryan Lake	Phosphorus	Categorical
Shingle Creek	Chloride	Categorical
Lake Hiawatha	Phosphorus	Individual
Minnehaha Creek; Lake Minnetonka to Mississippi River	Escherichia coli	Categorical
Powderhorn	Chloride	Categorical
Silver	Chloride	Categorical
Minnehaha Creek	Chloride	Categorical
Spring	Chloride	Categorical
Diamond	Chloride	Categorical

Waterbody name	Pollutant of concern	Type of WLA
Bassett Creek	Chloride	Categorical
Wirth	Chloride	Categorical
Brownie	Chloride	Categorical
Loring (South Bay)	Chloride	Categorical
Bassett Creek Medicine Lake to Mississippi River	E. coli	Categorical
Shingle Creek Eagle Creek/Bass Creek to Mississippi River	E. coli	Categorical
Mississippi River	TSS	Categorical

The TMDLs that identify stormwater management facilities as part of the mitigation requirements consist of the Lake Nokomis and Lake Hiawatha TMDLs, which applies to the those two lakesheds and to the direct drainage areas to Minnehaha Creek, which drains to Lake Hiawatha. The City expects the pending Lake Pepin TMDL to govern the nutrient and sediment impairment needs and will adjust as further guidance is issued.

The specific projects identified to address these TMDLs can be found in the ***MS4 TMDL Assessment*** that was submitted to the MPCA in November 2018.

Private parcel retrofit

The City encourages retrofit of existing development through its stormwater fee reduction program. This program allows private entities to apply for a reduction in their stormwater utility fee through implementation of stormwater retrofit facilities.

The City's stormwater ordinance currently requires new and redevelopment to meet stormwater standards, including water quality treatment. The City is updating the stormwater ordinance to strengthen the stormwater requirements.

As opportunities are identified through pipeshed studies, the City will pursue retrofit and maintenance agreements on parcels with owners of the properties. The most common types of properties include:

- Other government properties:
    - Schools
    - Government offices and maintenance facilities
- Non-profit organizations: environmental groups, churches
- Industrial parcels: these often have large amounts of impervious that are used sporadically.

Stream and shoreline restoration

The City of Minneapolis is home to a 12-mile reach of the Mississippi River, three creeks, and 17 lakes, ponds, and wetlands. These waterbodies are impacted by urbanization in the city. With the increase in stormwater runoff rate and runoff volume that is a symptom of increased impervious surface these natural waterbodies can be degraded and subject to erosion. Repairing and restoring the shorelines and banks of these waterbodies have a measurable effect on water quality.

Bassett, Minnehaha, and Shingle Creeks flow through highly developed areas where there is limited space for a vegetated buffer between the creeks and the adjacent impervious surfaces. This environment increases the potential for streambank erosion and associated negative water quality impacts. All three of the watershed management organizations (WMOs) have identified stream restoration as a cost effective and simple best management practice for minimizing the amount of sediment, phosphorus, and e Coli that are transported downstream.

Much of the land directly adjacent to the creeks is owned and managed by the MPRB. In 2005, the MPRB conducted an Erosion Site Survey that identified numerous problem areas along Bassett Creek and Shingle Creek through Golden Valley, Robbinsdale, and Minneapolis. The problems include degraded vegetative diversity and invasive species, areas of active bank erosion, and deposition of sediments.

MPRB staff completed the inventory by walking the length of the creeks and identifying, locating, and documenting sites of significant bank erosion and sediment deposition, as well as the presence of obstructions, storm sewer outlet structures, and other utilities within the stream channel. Documentation included location of the site on aerial photographs, notes on the details of each site, and a digital photograph of each site. The inventory includes estimates of the extent of erosion measured as a percent of the entire bank. Each site was classified as minor (less than 25%), moderate (25 – 50%), or severe (more than 50%). Typically, the causes of erosion were related to the following:

- heavy foot traffic resulting in surface runoff across exposed slopes, steep slopes, or shaded slopes,
- storm sewer outfalls discharging above the normal water level of the creek,
- incising of the stream channel and cut bank formation due to elevated flow rates.

In response to this erosion survey, the Bassett Creek Watershed Management Commission (BCWMC), in partnership with the City of Minneapolis and the MPRB, has performed stream restoration projects along multiple reaches of the Main Stem of Bassett Creek. In addition, there is an upcoming project scheduled for a reach of Bassett Creek between Glenwood Avenue and the entrance of the new Bassett Creek Tunnel.

The goals of the stream stabilization project include:

- Stabilize eroding banks to improve water quality.
- Preserve natural beauty along the creeks and contribute to the natural habitat and species diversification by planting eroded areas with native vegetation.
- Prevent future channel erosion along the creeks and the resultant negative water quality impact of such erosion on downstream water bodies.

There are a variety of techniques that can be used to stabilize streambanks. These include:

- Riprap: Riprap (also called stone toe protection) is used to protect the toe of the stream bank. In-stream riprap typically consists of cobble-sized rock (six inches to 12 inches in diameter). The riprap is keyed into the streambed and extends up the bank to approximately the bankfull level elevation. The bankfull level is the elevation of the water in the channel during a 1.5-year return frequency runoff event. In some cases, this level may be below the top of the stream bank. Riprap is typically used in conjunction with planting of the upper banks to provide full bank protection. Riprap is especially effective in heavily shaded areas, where it is difficult to establish vegetation.
- Root Wads: Root wads are constructed from root balls with sections of their tree trunks attached. Removed trees will be salvaged for their use as root wads. The tree trunks are buried into the bottom of the stream bank, with the root wad end sticking out into the stream. Supporting footer logs and boulders are often used to stabilize the root wads.
- Biologs: Biologs are natural fiber rolls made from coir fiber that are laid along the toe of the stream bank slope to stabilize the toe of the stream bank. Biologs 10 – 22 inches in diameter are typically used. Because they are made of natural fiber, vegetation can grow on the biologs. When needed, grading of the stream bank slope above the biolog is used to create a more stable slope (2:1 to 3:1).

- J-Vanes: J-vanes (also called rock vanes) are constructed of boulders embedded into the creek bottom. The vanes are embedded in the stream bank and are oriented upstream to direct the flow away from that bank. J-vanes typically occupy no more than one-third of the channel width.
- Live Stakes: Live stakes are dormant stem cuttings, typically willow and dogwood species. They are collected and installed during the dormant season (late fall to early spring) and grow new roots and leaves, quickly and cheaply establishing woody vegetation on a stream bank. The willows and dogwoods grow into stands that provide long lasting bank protection.
- Live Fascines: Live fascines also use dormant willow and dogwood cuttings installed during the dormant season. In this case, the cuttings are bundled together and planted in a row parallel to the stream flow. They can be effective in reducing sheet erosion along a slope because a portion of the fascine extends above the ground surface.
- Site Grading: In many places, the eroding bank will be graded to a 3:1 slope. This provides a stable slope that will not naturally slough, and it provides a surface that is flat enough on which vegetation can be planted or seeded.

Many of these same techniques can be used to stabilize the riverbanks and lakeshores within the city. The Mississippi Watershed Management Organization (MWMO) has developed a guidance document to help restore the natural landscape of the Mississippi River Critical Area as it passes through an urbanized Minneapolis corridor. Traditional riverbank stabilization methods used have focused on hard armoring practices such as riprap and block, void of any vegetation when installed. The bioengineered practices laid out in the MWMO guide prioritizes restoration that will resolve near bank erosion issues and improve aquatic and terrestrial habitat within a corridor that has become so fragmented. That guidance document can be found here: https://www.mwmo.org/wp-content/uploads/2017/11/Part-II_Installation_Manual_20171117.pdf

The City of Minneapolis, the MPRB, and the Minnehaha Creek Watershed District are working collaboratively to address erosion issues along Minnehaha Creek. This collaborative effort is being guided by a Memorandum of Understanding between the three partners. That document can be found here: http://lims.minneapolismn.gov/File/2017-00430

Other analysis

As the City develops its stormwater CIP plan, additional analysis may be incorporated into the opportunity analyses. An example of another type of analysis to identify opportunities is using the water quality model to search for points in the model where the combination of high pollutant loads combined with shallow stormwater pipes exists.

Annual project selection

The City documents stormwater retrofit opportunities in a GIS based map that tracks the facilities through construction. After the facilities are built and accepted, they are transferred to the maintenance tracking database. The opportunities database includes facilities recommended through the analyses described in this document as well as facilities recommended by external partners, including community groups, other government agencies, and private developers. The City selects water quality improvement projects through two main channels, consisting of coordination with other infrastructure projects and analysis of documented stormwater opportunities.

a. Infrastructure coordination assessment – The Green Infrastructure Prioritization map is used by other infrastructure project managers to identify overlap with their projects. Further explanation of this process is in the *Prioritization Tool* section of this plan.
b. CIP selection based on funding and priority – The map will be used annually in conjunction with other datasets to inform CIP spending and select projects.

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

By Palmisano

Designating the utility rates for water, sewer, stormwater, solid waste, and recycling service effective with water meters read on and after January 1, 2019.

Resolved by The City Council of The City of Minneapolis:

Water Rate

Effective with utility billings for water meters read from and after January 1, 2019, the meter rates for water are hereby fixed and shall be collected as follows:

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

1. Three dollars and sixty-three cents ($3.63) per one hundred (100) cubic feet for customers not otherwise mentioned.

2. Three dollars and seventy-eight cents ($3.78) 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	$ 5.00
3/4-inch	7.50
1-inch	12.50
1 1/2-inch	25.00
2-inch	40.00
3-inch	80.00
4-inch	125.00
6-inch	250.00
8-inch	400.00
10-inch	575.00
12-inch	1,650.00

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:

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)

The sanitary sewer rates and stormwater service rate shall be applied to utility billings for water meters read from and after January 1, 2019.

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 four dollars and twenty-one cents ($4.21) 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	$ 5.80
3/4-inch	8.70
1-inch	14.50
1 1/2-inch	29.00
2-inch	46.40
3-inch	92.80
4-inch	145.00
6-inch	290.00
8-inch	464.00
10-inch	667.00
12-inch	1,914.00

3. The sanitary sewer rate applicable outside the City of Minneapolis for all sewage flow generated is four dollars and twenty-one cents ($4.21) 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-one dollars and six cents ($31.06) 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.

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 thirteen dollars and nine cents ($13.09). 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 (3) 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 sixteen dollars and thirty-six cents ($16.36).

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 at thirteen dollars and nine cents ($13.09).

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 nine dollars and eighty-two cents ($9.82).

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 $ 13.09 = Monthly Fee

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

Land Use	Coefficient Applied
Bar-Rest.-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 and Recycling Rate

Solid waste and recycling variable rate charges associated with water meter read dates from and after January 1, 2019, the charges shall be as follows:

1. The base unit charge shall be twenty-four dollars and fifty-three cents ($24.53) 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	$15.89
Medium	1.00 ESU	$12.71
Low	.75 ESU	$ 9.27

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 can not 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 City of Minneapolis Stormwater Fee website . If you need additional information, please contact (612) 673-2965.

Last updated Mar 3, 2015

2019 Grit Chamber Data

370 Yearly total - Yards Vac'd 461.40

Grit ID	Location	Number of Inspections	Route	Date Inspected	Inspector	Estimated Volume In Cu. Yds.	Floatables Y/N	Cleaning Required Y/N	Maintenance Crew Leader	Volume Of Sediment Removed	Date Cleaned	Maintenance Comments
1	UPTON AVE N & 53RD AVE N	1	N	6/14/19	LJ	0.0	Y	Y	LJ	2	6/14/19	
		2										
2	UPTON AVE N & 53RD AVE N	1	N	4/8/19	LJ	1.0	N	N	LJ	1	4/8/19	
		2										
3	SHERIDAN AVE N, N OF 52ND AVE N	1	N								4/9/19	
		2	N	4/26/20	LJ	3.0			LJ		4/26/19	
4	RUSSELL AVE N NORTH OF 52ND AVE N	1	N	4/1/19	LJ	1.0	N	Y	LJ	1	4/1/19	
		2										
5	PENN AVE N & 52ND AVE N	1	N	4/1/19	LJ	1.0	N	Y	LJ	1	4/1/19	
		2										
6	PENN AVE N & 52ND AVE N	1	N	4/8/19	LJ	1.0	N	N	LJ	1	4/8/19	
		2										
7	OLIVER AVE N & 52ND AVE N	1	N	4/3/19	LJ	1.0	N	Y	LJ	1	4/3/19	
		2										
8	NEWTON AVE N & SHINGLE CREEK	1	N	6/10/19	LJ	1.0	N	Y	LJ	2	6/10/19	
		2										
9	OLIVER AVE N & 51ST AVE N	1	N	4/3/19	LJ	1.0	N	N	LJ	1	4/3/19	
		2										
10	MORGAN AVE N & 51ST AVE N	1	N	4/1/19	LJ	1.0	N	Y	LJ	1	4/1/19	
		2										
11	KNOX AVE N & 51ST AVE N	1	N	9/4/19	LJ	4.0	Y	Y	LJ	3	9/4/19	
		2										
12	KNOX AVE N & 50TH AVE N	1	N	4/4/19	LJ	9.0	Y	Y	LJ	8	4/5/19	
		2										
13	IRVING AVE N & 50TH AVE N	1	N	4/3/19	LJ	1.0	N	N	LJ	1	4/3/19	
		2										
14	JAMES AVE N, NORTH OF 49TH AVE N	1	N	4/1/19	LJ	1.0	N	Y	LJ	1	4/1/19	
		2										
15	21ST AVE N & 1ST ST N	1	N	11/2/19	MA	12.0			MA	12	11/2/19	
		2										
16	XERXES AVE N & 14TH AVE N	1	N	11/18/19	ZL	16.0			ZL	16	11/18/19	
		2										
17	XERXES AVE N & GLENWOOD AVE	1	N	6/12/19	LJ	4.0	Y	Y	LJ	2	6/13/19	
		2										
18	MORGAN AVE N & CHESNUT AVE	1	N	6/21/19	LJ	4.0	Y	Y	LJ	4	6/21/19	
		2										

2019 Grit Chamber Data

19	GIRARD AVE NO & CURRIE AVE NO	1	N	12/9/19		25.0				25	12/9/19	
		2	N	11/18/19		25.0				25	11/18/19	
20	BRIDAL VEIL TUNNEL OUTLET	1	E	10/4/19	LJ	2.0	Y	N	LJ	1	10/4/19	
		2										
21	LAKE OF THE ISLES PKWY & LOGAN AVE	1	SW	7/25/19	JM	8.0			JM	8	7/25/19	
		2										
22	W 22ND ST & JAMES AVE S	1	SW	6/5/19	JM	5.0			JM	5	6/5/19	
		2										
23	YARD SUMPS, 26TH & HIAWATHA	1	S									No record found? Ours where?
		2										
24	DREW AVE S & W LAKE ST	1	SW							5.00	5/21/19	
		2										
25	EXCELSIOR BLVD & MARKET PL	1	SW						JM	12	6/13/19	
		2										
26	W LAKE ST & ALDRICH AVE S	1	SW		JM	2.0			JM	2	6/19/19	
		2										
27	W 32ND ST & BRYANT AVE S	1	SW						LS	6.00	11/29/19	
		2										
28	W 33RD ST & HOLMES AVE S	1	SW							6.00	7/17/19	
		2										
29	W 33RD ST & GIRARD AVE S	1	SW							11.00	7/30/19	
		2										
30	YORK AVE S & W LAKE CALHOUN PARKWAY	1	SW						JM	1	7/12/19	No meter reading but actuals, past reading of 1
		2										
31	CHOWEN AVE S & W 41ST ST	1	SW									Water to high - No meter reading , no actuals, past 12 yrds
		2										
32	E 42ND ST & BLOOMINGTON AVE S	1	S						ZL	8	11/7/19	No meter reading but logs for WO 265312
		2								10	11/8/19	
33	E 43RD ST & PARK AVE S	1	SW								11/22/19	No meter reading associated with the asset No maximo? what is MX 285459?
		2										
34	W 44TH ST & LAKE HARRIET PARKWAY	1	SW								10/17/19	No meter reading - log says could not do due to high water
		2										
35	E 44TH ST & OAKLAND AVE S	1	SW	6/5/19		0.0			JM	2	6/5/19	Check MX 265988 historic (2020) 2 yrds
		2										
36	E 46TH ST & 31ST AVE S	1	S	10/16/19	JM	1.5			JM	1.50	10/16/19	
		2										
37	46TH AVE S & GODFREY RD	1	S	7/10/19	JM	0.0			JM	0.00	7/10/19	meter reading of 0
		2										
38	W 47TH ST & YORK AVE S	1	SW	5/15/19	JM	0.0			JM	0.00	5/15/19	meter reading of 0
		2										
39	W 47TH ST & WASHBURN AVE S	1	SW									No record - This is in the Storm MH layer not GC. that means no metering. Is it a GC?
		2									10/17/20	Julie says water is too high to do
40	W 47TH ST & LAKE HARRIET PARKWAY	1	SW									Water to high - No meter reading , no actuals
		2										

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41	W 48TH ST & YORK AVE S	1	SW						JM	1	5/15/19	Actuals but no meter reading associated with asset
		2										
42	QUEEN AVE S & LAKE HARRIET PARKWAY	1	SW	7/23/19	JM	0.0			JM	0.00	7/23/19	meter reading of 0
		2										
43	16TH AVE S & E MINNEHAHA PKWY	1	SW	4/4/19	JM	0.0			JM	0.00	4/4/19	meter reading of 0
		2										
44	SHERIDAN AVE S & W 50TH ST	1	SW	6/14/2019	JM	0.0			JM	0.00	6/14/2019	meter reading of 0
		2										
45	JAMES AVE S & MINNEHAHA CREEK	1	SW									Julie says cannot do due to high water
		2										
46	MORGAN AVE S & W 53RD ST	1	SW	10/18/19	JM	12.0			JM	12.00	10/18/19	
		2										
47	E 55TH ST & PORTLAND AVE S	1	SW	6/28/19	JM	2.0			JM	2.00	6/28/19	
		2										
48	E 56TH ST & PORTLAND AVE S	1	SW	9/5/19	JM	10.0			JM	10.00	9/5/19	
		2										
49	E 57TH ST & PORTLAND AVE S	1	SW						JM	3	9/1019	
		2										
50	E 57TH ST & PORTLAND AVE S	1	SW	9/25/19		2.5				2.50	9/25/19	
		2										
51	GIRARD AVE S BETWEEN W 59TH ST & W 60TH ST	1	SW						JM	3.00	5/14/19	Actuals but no meter reading - 2020 has 3 yrds
		2										
52	E 59TH ST & 12TH AVE S	1	S	5/7/19		5.0				5.00	5/7/19	
		2										
53	GIRARD AVE S & W 60TH ST	1	SW	5/15/19		1.5				1.50	5/15/19	
		2										
54	GIRARD AVE S, W 60TH ST - DUPONT AVE S	1	SW									no WOs no actuals, 2017 meter reading:17 yrds
		2										
55	GRASS LAKE TERRACE, GIRARD TO JAMES AVE S	1	SW	5/14/19		4.5				4.50	5/14/19	
		2										
56	GRASS LAKE SERVICE ROAD BEHIND #6035 JAMES AVE S	1	SW	5/10/19		1.5				1.50	5/10/19	
		2										
57	GRASS LAKE SERVICE ROAD BEHIND #6077 JAMES AVE S	1	SW	5/10/19		1.0				1.00	5/10/19	
		2										
58	GRASS LAKE SERVICE ROAD BEHIND #1416 W 61ST ST	1	SW	5/10/19		1.0				1.00	5/10/19	
		2										
59	W 61ST ST & GRASS LAKE SERVICE ROAD	1	SW	5/10/19		1.0				1.00	5/10/19	
		2										
60	IRVING AVE S & W 61ST ST	1	SW									No Actuals says use 2 vacs no meter history
		2										
61	E RIVER RD & CECIL ST	1	E	6/24/19	LJ	8.0	N	Y	LJ	8	6/24/19	
		2										
62	HIAWATHA PARK REFECTORY TURN-A-ROUND	1	S	5/3/19		1.5				1.50	5/3/19	
		2										
63	33RD AVE N & 1ST ST N/RAILROAD TRACKS	1	N	6/14/19	LJ	1.0	N	N	LJ	1	6/14/19	
		2										
64	26TH AVE N & PACIFIC (N TRANSFER STATION)	1	N	6/4/19	LJ	1.0	N	N	LJ	1	6/4/19	
		2										
65	SOUTH TRANSFER STATION	1	N	5/7/19		2.0				2.00	5/7/19	

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65	SOUTH TRANSFER STATION	2										
66	MAPLE PLACE & EAST ISLAND AVE	1	E	6/27/19	LJ	1.0	N	N	LJ	1	6/27/19	
		2										
67	DELASALLE DR & E ISLAND	1	E	7/9/19	LJ	1.0	N	N	LJ	1	7/9/19	
		2										
68	W ISLAND - 300' S OF MAPLE PLACE	1	E	6/28/19	LJ	1.0	N	N	LJ	1	6/28/19	
		2										
69	EASTMAN AVE & W ISLAND	1	E	7/9/19		1.0				1.00	7/9/19	no meter reading historical from 2017
		2										
70	ROYALSTON & 5TH AVE N	1	N	6/13/19	LJ	1.0	N	N	LJ	1	6/13/19	
		2										
71	THE MALL & E LAKE OF THE ISLES	1	SW									No actuals
		2										
72	S OF 37TH AVE NE & ST ANTHONY PKWY	1	E	7/10/19	LJ	3.0	Y	Y	LJ	2	7/10/19	
		2										
73	4552 KNOX AVE N (IN ALLEY BEHIND)	1	N	6/4/19	LJ	1.0	Y	Y	LJ	1	6/4/19	
		2										
74	STEVENS AVE S 300' S OF MINNEHAHA CREEK	1	SW									No Maximo. was in large structures. add in mx
		2										
75	IRVING AVE N (IMPOUND LOT)	1	N									No WOs
		2										
76	MARKET PLAZA & EXCELSIOR BLVD	1	SW	6/13/19		12.0				12.00	6/13/19	
		2										
77	ALLEY - 38TH TO 39TH ST & NICOLLET TO BLAISDELL AVE	1	SW						ZL	1	6/14/19	Actuals but no meter - 2020 had 1 yd
		2										
78	SHINGLE CREEK WETLAND - W SIDE	1	N	6/19/19	LJ	4.0	Y	Y	LJ	4	6/19/19	
		2										
79	SHINGLE CREEK WETLAND - EAST SIDE	1	N	8/21/19	LJ	29.0	Y	Y	LJ	13	8/23/19	
		2										
80	WOODLAWN BLVD & E 50TH ST	1	S	5/6/19					JM	4	5/6/19	
		2										
81	WOODLAWN BLVD & E 53RD ST	1	S									lake water to high
		2										
82	12TH AVE S & POWDERHORN TERRACE	1	S									Would not do. Joe felt unsafe.
		2										
83	13TH AVE S & POWDERHORN TERRACE	1	S						JM	1	5/2/19	
		2										
84	3421 15TH AVE S (180' W OF CL)	1	S	4/9/19	JM	4.0			JM	4.00	4/9/19	
		2										
85	3329 14TH AVE S	1	S	4/4/19	JM	1.5			JM	1.50	4/4/19	
		2										
86	13TH AVE S & E 35TH ST	1	S						JM	4.00	4/8/19	
		2										
87	3318 10TH AVE S	1	S	4/4/19	JM	2.0			JM	2.00	4/4/19	
		2										
88	ACROSS THE STREET FROM 702, NO. BD. VAN WHITE BLVD.	1	N	5/6/19	LJ	1.0	Y	Y	LJ	1	5/6/19	
		2										
89	ACROSS THE STREET FROM 706, NO. BD. VAN WHITE BLVD.	1	N	5/7/19	LJ	1.0	Y	Y	LJ	1	5/7/19	
		2										
90	10TH AVE. NO. & ALDRICH AVE. NO. (S.W.C.)	1	N	5/7/19	LJ	2.0	Y	Y	LJ	2	5/7/19	

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90	10TH AVE. NO. & ALDRICH AVE. NO. (S.W.C.)	2										
91	SO. BD. VAN WHITE BLVD., 200' SO. OF 8TH AVE. NO.	1	N	5/10/19	LJ	2.0	Y	Y	LJ	1	5/10/19	
		2										
92	ACROSS THE STREET FROM 701, SO. BD. VAN WHITE BLVD.	1	N	5/7/19	LJ	2.0	Y	Y	LJ	2	5/7/19	
		2										
93	SO. BD. VAN WHITE BLVD., 250' SO. OF 10TH AVE. NO	1	N	5/20/19	LJ	2.0	Y	Y	LJ	4	5/20/19	
		2										
94	10TH AVE. NO. & NO. BD. VAN WHITE BLVD. (S.W.C.)	1	N	5/9/19	LJ	3.0	Y	Y	LJ	4	5/9/19	
		2										
95	WEST SIDE OF ALDRICH AVE. NO. & 9TH AVE. NO.	1	N	5/15/19	LJ	4.0	Y	Y	LJ	4	5/15/19	
		2										
96	8TH AVE. NO. & NO. BD. VAN WHITE BLVD. (N.E.C.)	1	N	7/9/19	LJ	1.0	N	N	LJ	1	7/9/19	
		2										
97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W) #1	1	N	7/25/19	LJ	3.0	Y	Y	LJ	4	7/25/19	
		2										
97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W) #2	1	N	7/29/19	LJ	3.0	Y	Y	LJ	3	7/29/19	
		2										
97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W) #3	1	N	7/29/19	LJ	4.0	Y	Y	LJ	4	7/31/19	
		2										
98	MALMQUIST LN. & HUMBOLDT NO.	1	N	7/12/19	LJ	1.0	N	Y	LJ	2	7/12/19	
		2										
99	SHINGLE CREEK DR. & HUMBOLDT NO.	1	N	8/28/19	LJ	2.0	Y	N	LJ	2	8/28/19	
		2										
100	SO. OF 49TH AVE. NO. & HUMBOLDT NO.	1	N	8/27/19	LJ	2.0	Y	N	LJ	2	8/27/19	
		2										
101	NO. OF 49TH AVE. NO. & HUMBOLDT NO.	1	N						LJ		10/31/19	No meter but has actuals WO 266085
		2										
102	28TH ST. E. & HIAWATHA * MNDOT HIAWATHA	1	S									No WOs
		2										
103	E. LAKE ST. & HIAWATHA * MNDOT HIAWATHA	1	S									No WOs
		2										
104	NAWADAHA LN./SERVICE RD. & HIAWATHA * MNDOT HIAWATHA	1	S									No WOs
		2										
105	MINNEHAHA PARKWAY (NO. SIDE) S.B. LANE * MNDOT HIAWATHA	1	S									No WOs
		2										
106	E. 50TH ST. (SW COR) & HIAWATHA * MNDOT HIAWATHA	1	S									No WOs
		2										
107	E. 54TH ST. & RIVERVIEW RD. * MNDOT HIAWATHA RE-ROUTE	1	S									No WOs
		2										
108	ALLEY SUMP MH WEST OF COLUMBUS AVE S & E 37TH ST - no as-builts	1	S						JM	1	5/17/19	
		2										
109	22ND AVE N AND W RIVER ROAD	1	N	8/12/19	LJ	2.0	Y	Y	LJ	2	8/12/19	
		2										
110	W. CALHOUND PARKWAY 100' NO. OF RICHFIELD RD.	1	SW	5/20/19	JM	2.0			JM	2.00	5/20/19	
		2										
111	RICHFIELD RD. NEAR W. CORNER OF THE PARKING LOT	1	SW						JM	1.25	6/4/19	Actuals but no meter reading - 2020 had 1.25 yrds
		2										
112	W. 36TH ST. 30' W. OF CALHOUN PARKWAY	1	SW	7/15/19	JM	3.5			JM	4	7/15/19	Actuals but no meter reading - 2020 had 4 yrds
		2										

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113	20' EAST OF VAN WHITE MEM. BLVD (N.B.) AND 5TH AVE N (1016 - 5TH AVE N)	1	N	5/30/19	LJ	1.0	Y	Y	LJ	1	5/30/19	
		2										
114	DUPONT AVE. NO. & 4TH AVE. NO.	1	N	5/31/19	LJ	2.0	Y	Y	LJ	3	5/31/19	
		2										
115	VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	1	N	5/29/19	LJ	3.0	Y	Y	LJ	4	5/29/19	
		2										
116	400' NORTH (60' INTO POND) VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	1	N	9/3/19	LJ	1.0	Y	N	LJ	1	9/3/19	
		2										
117	300' NORTH (WEST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	1	N	9/24/19	ZL	3.0	Y	Y	ZL	5	9/24/19	
		2										
118	200' NORTH (POND SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 10TH AVE N	1	N	6/13/19	LJ	3.0	Y	Y	LJ	3	6/5/19	
		2										
119	11TH AVE N AND VAN WHITE BLVD (N.B.)	1	N	5/13/19	LJ	1.0	Y	N	LJ	1	5/13/19	
		2										
120	VAN WHITE MEM. BLVD (S.B.) (160' so. of fremont ave. no. on the e. side of the street)	1	N	5/13/19	LJ	1.0	Y	N	LJ	1	5/13/19	
		2										
121	50' NORTH (EAST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND FREMONT AVE N	1	N	5/13/19	LJ	1.0	Y	N	LJ	1	5/13/19	Actuals but no meter reading - 2018 1 yrd
		2										
122	MINNEHAHA PARKWAY @ 39TH AVE S N SIDE OF PKWY	1	N						JM	4	11/15/19	
		2										
123	COLUMBUS AVE S SOUTH OF E 37TH ST REROUTE - no as-builts	1	SW	6/10/19	JM	2.0			JM	2.00	6/10/19	
		2										
124	COLUMBUS AVE S - CHICAGO AVE S ALLEY - no as-builts	1	SW	6/10/19	JM	2.0			JM	2.00	6/10/19	
		2										
125	COLUMBUS AVE S ACROSS FROM #3644 - no as-builts	1	SW	6/10/19	JM	1.5			JM	1.50	6/10/19	
		2										
126	E 37TH ST AND COLUMBUS S # 3640 COLUMBUS - no as-builts	1	SW	6/10/19	JM	1.0			JM	1.00	6/10/19	
		2										
127	E 37TH ST AND COLUMBUS S # 3700 COLUMBUS - no as-builts	1	SW						JM	1.00	6/10/19	
		2										
128	W 27TH ST AND LAKE OF THE ISLES PKWY - no as-builts	1	SW	7/11/19	JM	2.5			JM	2.50	7/11/19	
		2										
129	YARD SUMPS, 26TH AND HIAWATHA	1	S									No Maximo not on lois' list
		2										
130	YARD SUMPS, 26TH AND HIAWATHA	1	S									No Maximo
		2										
131	YARD SUMPS, 26TH AND HIAWATHA	1	S									No Maximo
		2										
132	YARD SUMPS, 26TH AND HIAWATHA	1	S									No Maximo not on lois' list
		2										
133	ALLEY DRY WELL, BETWEEN HUMBOLDT/IRVING AVE S AND W 25TH ST/26TH ST, no as-builts	1	N						JM		6/6/19	No meter reading because it in storm manhole w sump. Add meter? or Make GC?
		2										
134	W 22ND ST @ E LAKE OF THE ISLES BLVD, no as-builts	1	N						JM		6/7/19	lake level to high
		2										
135	CHICAGO AVE S BETWEEN WASHINGTON AVE S AND 2ND ST S - no as-builts	1	NE									No actuals no meter

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135	CHICAGO AVE S BETWEEN WASHINGTON AVE S AND 2ND ST S - no as-builts	2										
136	111 22ND AVE N (ALLEY BETWEEN 1ST ST N AND 2ND ST N AT VACATED 21ST AVE N)	1	N	9/24/19	LJ	2.0	N	Y	LJ	2	9/26/19	
		2										
137	W 44TH ST @ LAKE HARRIET PKWY EAST (Installed on existing 54" Concrete Pipe)	1	N	9/27/19	JM	4.0			JM	4.00	9/27/19	
		2										
138	EWING AVE S BETWEEN W. FRANKLIN AVE AND W 22ND ST - Pending as-built info	1	N						JM		5/17/19	No meter reading but actuals - no historical data
		2										
139	EWING AVE S @ W FRANKLIN AVE - Pending as-built info	1	N	10/7/19	LJ	2.0	N	Y	LJ	2	10/7/19	
		2										
140	E LAKE ST WEST OF 14TH AVE S (Hennepin County const. Lake St.)	1	S	6/20/19	JM	1.5			JM	1.50	6/20/19	
		2										
141	W LAKE ST EAST OF 14TH AVE S (Hennepin County const. Lake St.)	1	S	6/26/19	JM	3.0			JM	3.00	6/26/19	
		2										
142	18TH AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.)	1	S	5/6/19	JM	1.0			JM	1.00	5/6/19	
		2										
143	LONGFELLOW AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.)	1	S	5/1/19	JM	1.0			JM	1.00	5/1/19	
		2										
144	31ST AVE S NORTH OF E LAKE ST (Hennepin County const.. Lake St.)	1	S						JM	1.5	6/25/19	No Meter reading for 2019 but actuals - 2018 was 1.5
		2										
145	CEDAR AVE S AND E MINNEHAHA PARKWAY (20' S. of S. curb of Minnehaha & 5' W. of W. curb of Cedar)	1	S						JM	0	11/6/19	Joe M - creek water to high
		2										
146	E LAKE ST AND 46TH AVE S 12' W OF THE W CURB AND 9' SO OF THE N CURB ON LAKE ST (added 10/31/07) (service pending)	1	S	6/21/19	JM	1.5			JM	1.50	6/21/19	
		2										
147	E LAKE ST AND 47TH AVE S 6' S OF THE N CURB ON LAKE ST AND 1' W OF THE W CURB ON 47TH AVE EXTENDED (added 10/31/07) (service pending)	1	S	6/21/19	JM	1.5			JM	1.50	6/21/19	
		2										
148	E LAKE ST AT 42ND AVE S (8.4' W of the E curb on 42nd St and 38' N of the N curb on Lake St) (Hennepin Co. Construction) (added 11/1/07) (service pending)	1	S	5/3/19	JM	4.0			JM	4.00	5/3/19	
		2										
149	W 44TH ST AND ALDRICH AVE S SWC	1	SW	6/12/19	JM	3.5			JM	3.50	6/12/19	
		2										
150	W RIVER ROAD AND 23RD AVE N	1	N	10/9/19	LJ	2.0	N	Y	LJ	3	10/9/19	
		2										
151	DIAMOND LK RD & CLINTON AVE S	1	SW	7/24/19	JM	2.0			JM	2.00	7/24/19	
		2										
152	3RD AVE. SO. & 2ND ST. S.	1	N	9/9/19	LJ	1.0	N	N	LJ	1	9/9/19	Didn't pull from Cognos WO 266101, listed as GC172
		2										
153	PLEASANT AVE & W LAKE ST	1	SW	6/18/19	JM	6.0			JM	6.00	6/18/19	
		2										
154	W LAKE ST AND DUPONT AVE S	1	SW	6/17/19	JM	5.0			JM	5.00	6/17/19	
		2										
155	W LAKE ST AND BLAISDELL AVE S	1	SW						JM	0.5	6/5/19	Actuals but no meter reading - 2020 .5 yds
		2										
156	W 43RD ST & E LAKE HARRIET PARKWAY	1	SW									No actuals for 2019 - 3.5 cu yd in 2018
		2										
157	STEVENS AVE S & DIAMOND LK RD	1	SW									None
		2										
158	E 61ST ST & COLUMBUS AVE S	1	SW						JM	5	5/21/19	No Meter reading for 2019 but actuals - 2020 says 5yds

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		2										
159	2ND AVE N & 7TH ST N (Target Center)	1	N	9/19/19	LJ	1.0	Y	N	LJ	1	9/19/19	
		2										
160	2ND AVE N & 6TH ST N	1	N	9/17/19	LJ	1.0	N	N	LJ	1	9/17/19	
		2										
161	3RD AVE N & WASHINGTON AVE N	1	N	9/5/19	LJ	1.0	Y	N	LJ	1	9/5/19	
		2										
162	ULYSSES ST NE (WINTER ST NE TO HENNEPIN AVE)	1	N									None
		2										
163	PLYMOUTH AVE N & WEST SIDE OF RIVER	1	N	8/8/19	LJ	1.0	N	N	LJ	1	8/8/19	
		2										
164	PLYMOUTH AVE N & EAST SIDE OF RIVER	1	N	7/11/19	LJ	1.0	N	Y	LJ	1	7/11/19	
		2										
165	1409 Washington Ave N	1	N	9/3/19	LJ	1.0	N	N	LJ	1	9/3/19	
		2										
166	Thomas Ave S & Dean Pkwy to Kenilworth Lagoon (Lake of the Isles) (Burka- plan sheet only)	1	SW	6/4/19	JY	6.0			JY	6.00	6/4/19	
		2										
167	E River Rd north of Washington Ave SE (CCLRT) no information on file per Lois E 11/15/2013	1	NE									No Actuals
		2										
168	Dowling Ave N Alley Drain between Morgan Ave N and Newton Ave N	1	N	4/23/19	JM	1.0			JM	1.00	4/23/19	
		2										
169	Dowling Ave N Alley Drain between Newton Ave N and Oliver Ave N	1	N	6/4/19	LJ	1.0			LJ	1.00	6/4/19	
		2										
170	DOWLING AVE N & OLIVER AVE N	1	N									This is listed in Maximo WO 386900 as GC #162
		2										
171	Newton Ave N at Dowling Ave N sump MH	1	N	4/24/2019	JM	1.0			JM	1.00	4/24/2019	Not in cognos WO 266110
		2										
172	25TH AVENUE SE @ U OF M	1	NE	10/30/19	LJ	1.0	N	N	LJ	2	10/30/19	GIS Calls this GC 152
		2										
173	37th Ave N and Logan Ave N (SE corner)	1	NE									No WOs of any type aginst this asset
		2										
174	Bridal Veil Circle and Kasota Ave (Bridal Veil Creek built by MPCA)	1	NE									No WOs of any type aginst this asset
		2										
175	54th St W east of Upton Ave S - plan sheet only changed during construction - no records on file	1	SW						JM	2	7/22/19	
		2										
176	16th Ave S and 6th St S (NW) ASB 2365	1	NE									No WOs
		2										
177	16th Ave S midblock pedestrian walkway west side SE of 6th St S ASB 2365	1	NE									No Actuals, No work
		2										
178	16th Ave S and LRT Tracks SE of 6th St S ASB 2365	1	NE									No Actuals, No work
		2										
179	16th Ave S and 6th St S (SE) ASB 2364	1	NE									No Actuals, No work
		2										
180	16th Ave S midblock pedestrian walkway east side SE of 6th St S ASB 2364	1	NE									No Actuals, No work
		2										
181	16th Ave S and LRT Tracks SE of 6th St S ASB 2364	1	NE									No Actuals, No work
		2										
182	24th Ave SE circa 590' south of Elm St SE (incomplete record)	1	NE						LJ	2.75	12/24/19	Ask about the three WOs
		2										
183	24th Ave SE circa 1156' south of Elm St SE (incomplete record)	1	NE						LJ	2.9	12/23/19	Ask about the 358350. Close out?

2019 Grit Chamber Data

183	24th Ave SE circa 1150' south of Elm St SE (incomplete record)	2										
184	25th Ave SE and Como Ave SE (no records) box culvert part of energy dissipation for Como Tunnel Surcharge	1	NE									No MX - need to add in Maximo
		2										
185	New Van Whithe Blvd Bridge - South of Bassett Creek	1	N						LJ	3	12/23/19	
		2										

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Stormwater Monitoring Results and Data Analysis

In 2019, 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 (**Table 1 and Figure 1**). 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.

All the lakes in Minneapolis fall into either the mesotrophic or eutrophic category. Bde Maka Ska, Harriet, and Wirth are mesotrophic with moderately clear water and some algae. Brownie, Cedar, Isles, Hiawatha, Loring, and Nokomis are eutrophic with higher amounts of algae. Powderhorn and Spring are hypereutrophic with high nutrient concentrations and the potential for severe algal blooms. Trends in lake water quality can be seen by using the annual average TSI since the early 1990s.

Table 1. Water quality trends in Minneapolis lakes from 1991-2019.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
Lake Bde Maka Ska	Brownie Lake	
	Cedar Lake	
Wirth Lake	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Lake Nokomis	
	Loring Pond	
	Powderhorn Lake	
	Spring Lake	

There has been a significant improvement in water quality indicators in Bde Maka Ska since the early 1990s (linear regression, $p < 0.01$); however, TSI scores have stabilized since 2006. The TSI score at Lake Bde Maka Ska between 2017 and 2019 was higher than the previous few years due to higher chlorophyll-*a* and total phosphorus concentrations but were still below the early 1990s scores. The 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, $p < 0.001$). The TSI score at Wirth Lake in 2018 and 2019 was slightly above the previous few years due to increased chlorophyll-*a* and total phosphorus concentrations.

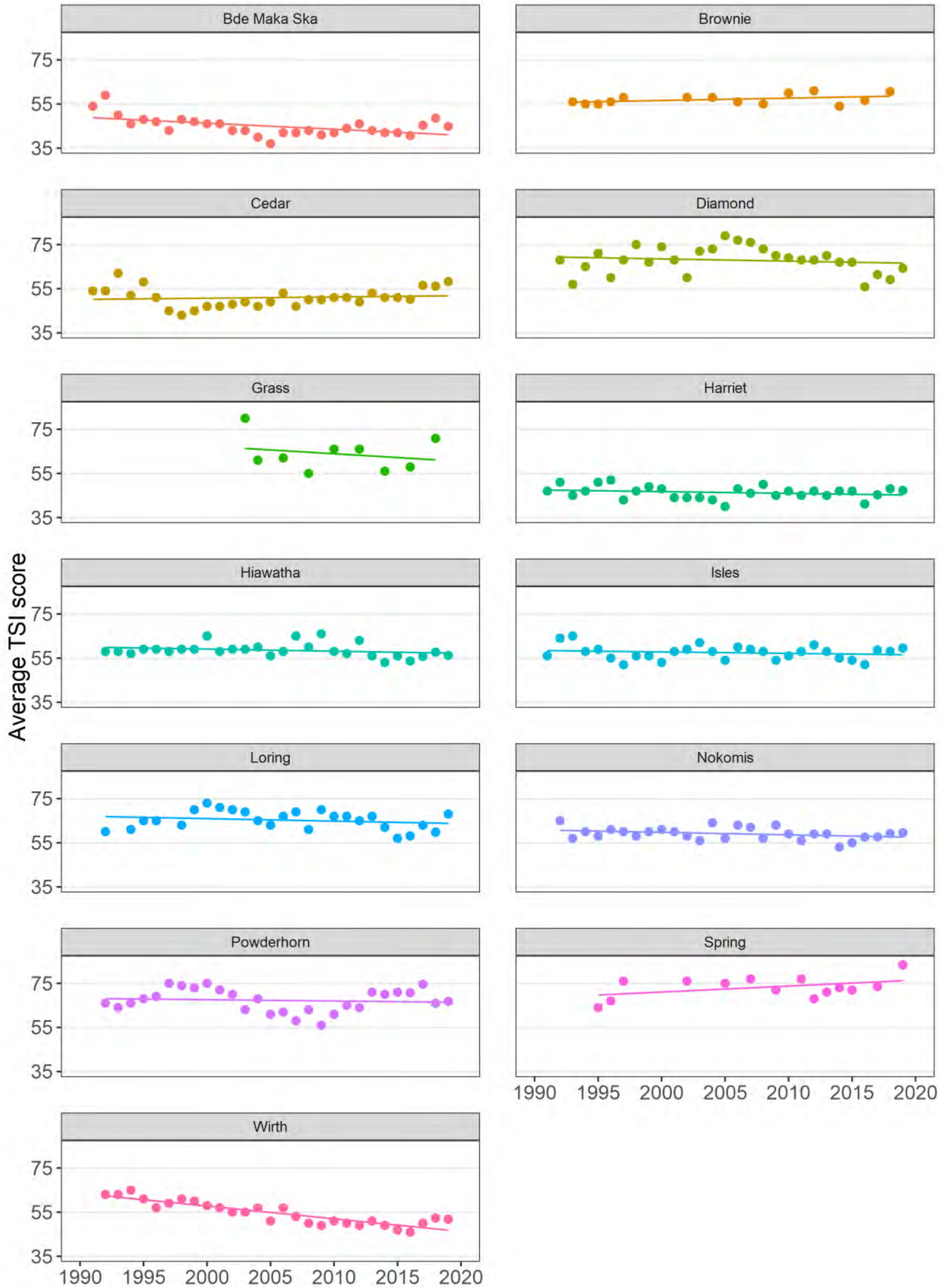
Most of the Minneapolis lakes have no directional trend in water quality indicators since the early 1990s. The water quality in Brownie Lake has been relatively stable, with no significant trend since 1993. Brownie Lake is monitored every other year and was not monitored in 2019. The water quality in Cedar Lake showed improvement following restoration efforts through the late 1990s, had a slow decline in the 2000s, and has remained stable since. The Cedar Lake TSI scores between 2017 and 2019 have been the highest since the early 1990s due to higher chlorophyll-*a* concentrations.

Previously, Lake Nokomis had seen a significant improvement in water quality following a biomanipulation project in 2010; however, with higher algal concentrations in 2018 and 2019, TSI scores have stabilized and there is no statistically significant trend (linear regression, $p > 0.05$). Lake Hiawatha is heavily influenced by the inflow from Minnehaha Creek and the lake has poorer water quality during drought years.

The last few years has experienced above average spring and summer precipitation and led to low TSI scores compared to 2000's. The water quality in Lake of the Isles varies from year to year, with higher TSI scores between 2017 and 2019 compared to the previous few years due to increased chlorophyll-*a* concentrations, but there is no significant trend in any direction since 1991. Loring Pond experienced decreased water quality immediately following a dredging project in 1997; however, conditions have slowly returned to levels similar to pre-1997. The TSI score at Loring Pond in 2019 was higher than previous years due to higher chlorophyll-*a* concentrations.

Powderhorn Lake has experienced a wide variation in water quality, with the worst TSI scores in the late 1990s and the best scores in the late 2000s. Powderhorn had poor water quality between 2013 and 2017, with blue green algae blooms leading to low water clarity. TSI scores decreased in 2018 and 2019 because severe algal blooms did not occur and chlorophyll-*a* concentrations decreased. Water quality in Spring Lake is variable, but there is no significant trend in any direction since 1994. Spring Lake is also monitored every other year and was monitored in 2019. The TSI score increased in 2019 due to higher chlorophyll-*a* and total phosphorus concentrations.

Diamond Lake and Grass Lake are not included in this analysis, since TSI scores are only appropriate for deeper lake systems and there are no water clarity measurements available in these lakes. There are no lakes in Minneapolis with significant decline in water quality indicators since the early 1990s.



Bde Maka Ska
Brownie
Cedar
Diamond
Grass
Harriet
Hiawatha
Isles
Loring
Nokomis
Powderhorn
Spring
Wirth
Average TSI score
75
55
35
1990
1995
2000
2005
2010
2015
2020

Figure 1. TSI scores and regression analysis for selected Minneapolis lakes 1991–2019. 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 <0.1).

NPDES Land Use Sites Monitoring Results (Stormwater Runoff Monitoring)

In 2019, snowmelt stormwater runoff monitoring was carried out at four sites representative of multi-family residential, recreational/parkland, commercial/high-rise, and commercial/industrial land uses. (In previous Annual Reports, the following material appeared in Appendix A as A4.)

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.

As part of the NPDES permit, a two-year study of quarterly Fat Oil and Grease (FOG) grab samples was conducted with the intent to sample 6 sites. If a FOG sample was measured greater than 15 mg/L at a site, then that site would continue to be monitored.

FOG in stormwater can come from a variety of sources such as: vehicles, industry, food waste and gas stations. 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.

METHODS

Grab Sampling

FOG samples were collected in an amber glass bottle. The bottle was either attached to a modified pool skimmer pole or if flow depth was not adequate a clean white 5-gallon bucket was lowered into the storm sewer to collect an aliquot and poured directly into the glass container. Standard FOG sampling protocol was followed, and the FOG bottles were not rinsed with stormwater. Rinsing could introduce additional FOG material which would stick to the inside glass container walls and produce artificially high results.

In 2018 all FOG samples were collected at four representative land use sites, if the site was accessible. In 2018, the 61st and Lyndale became inaccessible due a construction project but it was accessible again in 2019. The Pershing site is only accessible for grab sampling for snowmelt samples due to equipment installed in the site.

In 2019 only snowmelt FOG samples were collected at the representative land use sites. The remainder of 2019 FOG samples were collected at two of the 24th & Elm infiltration basin inlets (north and south) and two of the inlets into the Winter Infiltration Basin (west and south). In 2019 neither of the 24th & Elm Infiltration Basin or Winter Infiltration Basin outlets produced any flow when personnel were present and could not be sampled. All FOG samples were analyzed at Instrumental Research Incorporated (IRI) Laboratory in Fridley, Minnesota. The methodology for FOG analysis can be found in the snowmelt section below.

Figure 23-1 shows the location of the four representative land use sites and their location within the City of Minneapolis, MN. **Figure 23-2** show the location of the 24th and Elm infiltration basin north and south inlets, and **Figure 23-3** shows the Winter Infiltration Basin south and west inlets.

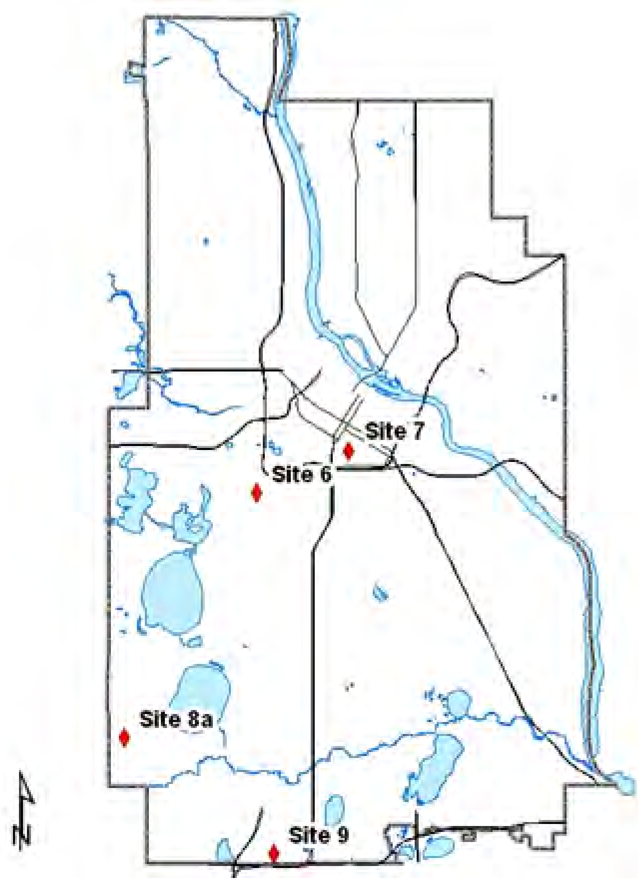


Figure 23-1. Map of the 2018 and 2019 Minneapolis NPDES representative land use monitoring sites.

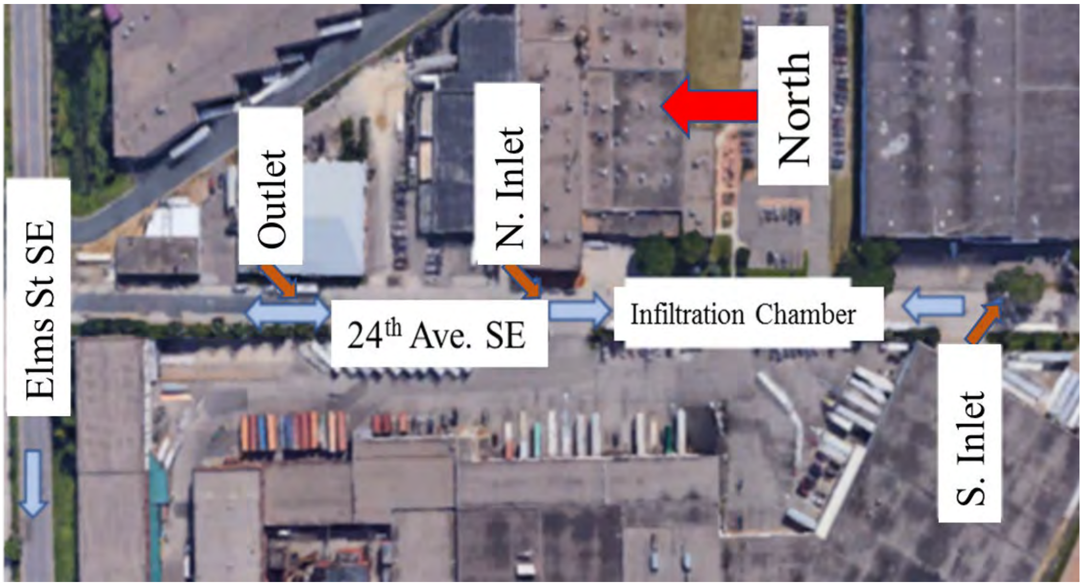


Figure 23-2. Aerial photo of 24th & Elm Infiltration Chamber and its inlets and outlet. Blue arrows show the direction of flow. Only the inlets were monitored for FOG.

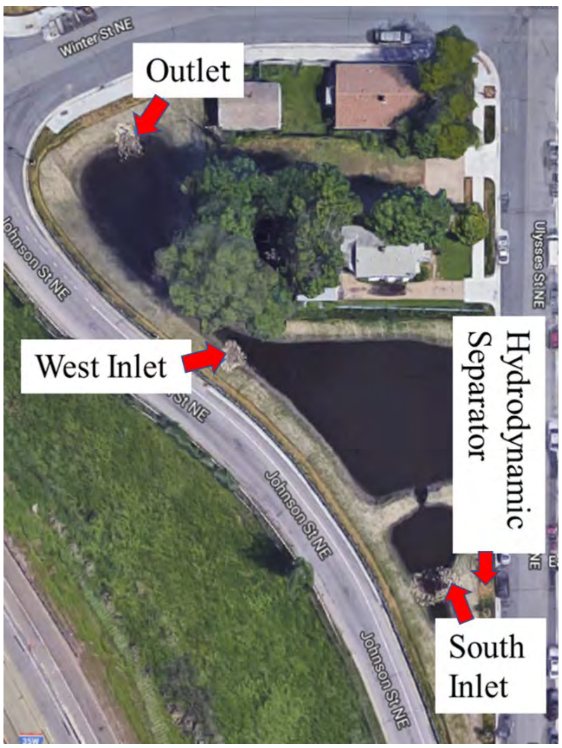


Figure 23-3. Aerial photo of the Winter Infiltration Basin. Only the south and west inlets were monitored for FOG samples.

Table 23-1 shows the land use and drainage area for four of the sampled sites. **Table 23-2** shows the 24th & Elm and Winter Infiltration basins land use and drainage area.

Table 23-1. The land use sites used for FOG monitoring in Minneapolis in 2018 and 2019.

Site ID	Site 6	Site 7	Site 8a	Site 9
Location	22nd St and Aldrich Ave S	E 14th St and Park Ave S	Pershing Field east of 49th St and Chowen Ave	335 ft. east of 61st St and Harriet Ave S
Land Use	Multi–Family Residential	Commercial/Industrial/ High Rise Residential	Recreational/Parkland	Commercial/Industrial
Drainage Area	8.9 acres	13.1 acres	2.5 acres	34.9 acres

Table 23-2. The 2019 24th & Elm and Winter Infiltration Basins sites monitored for FOG in 2019.

Site ID	24th & Elm Infiltration Basin North Inlet	24th & Elm Infiltration Basin South Inlet	Winter Infiltration Basin West Inlet	Winter Infiltration Basin South Inlet
Location	24th Ave SE	24th Ave SE	Johnson St NE	Ulysses St NE
Land Use	Light Industrial	Light Industrial	Frontage Road	Industrial
Drainage Area	3.9 acres	10.3 acres	1.2 acres	30.2 acres

FIELD QUALITY ASSURANCE SAMPLES

A variety of quality control quality assurance 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 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 2019. As part of the overall QA/QC 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.

Field measurements were recorded on a Field Measurement Form in the 2019 Field Log Book. 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 Storm Water Monitoring Program Manual (MPRB, 2001). For data reported below the reporting limit, the reporting limit value was divided in half for use in statistical calculations.

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 **Section 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. The time that each grab sample was collected was recorded onto field sheets. A complete description of methods can be found in the Storm Water Monitoring Program Manual (MPRB, 2001). Common statistics were calculated using Microsoft Excel.

Results and Discussion

All 2018 and 2019 Fat Oil and Grease (FOG) samples were grab samples and are shown in **Table 23-3.** Two samples from 61st & Lyndale taken on 3/12/19 and 3/13/19 were over the 15 mg/L MPCA established NPDES permit threshold.

Table 23-3. 2018 and 2019 FOG event dates and grab samples collected. The 3/12/19 and 3/13/19 FOG samples were greater than 15 mg/L.

Date Sampled	Time	Site Location	FOG mg/L
1/10/2018	13:15	14th & Park	<5.00
1/19/2018	14:05	14th & Park	6
7/12/2018	18:50	14th & Park	<5.00
10/1/2018	12:45	14th & Park	<5.00
1/10/2018	13:50	22nd & Aldrich	8
1/19/2018	14:35	22nd & Aldrich	8
7/13/2018	9:46	22nd & Aldrich	<5.00
10/1/2018	12:55	22nd & Aldrich	<5.00
1/19/2018	13:35	61st & Lyndale	<5.00
1/26/2018	12:20	61st & Lyndale	9
3/19/2018	14:25	Pershing	<5.00
3/26/2018	14:45	Pershing	<5.00
3/12/2019	13:50	14th & Park	9
3/13/2019	14:00	14th & Park	10
3/13/2019	14:25	22nd & Aldrich	7
3/19/2019	14:25	22nd & Aldrich	6
3/12/2019	13:15	61st & Lyndale	21
3/13/2019	13:38	61st & Lyndale	19
3/19/2019	13:20	Pershing	<5.00
3/20/2019	13:40	Pershing	<5.00
5/8/2019	13:35	24th & Elm In N	<5.00
6/27/2019	11:00	24th & Elm In N	<5.00
8/26/2019	13:20	24th & Elm in N	<5.00
9/12/2019	8:35	24th & Elm in N	<5.00
5/8/2019	13:25	24th & Elm In S	<5.00
6/27/2019	10:50	24th & Elm In S	<5.00
8/26/2019	13:20	24th & Elm In S	<5.00
9/12/2019	8:30	24th & Elm In S	<5.00
5/8/2019	13:50	Winter In S	<5.00
6/27/2019	11:16	Winter In S	<5.00
8/26/2019	13:45	Winter In S	6
9/12/2019	8:50	Winter In S	6
5/8/2019	14:05	Winter In W	5
6/27/2019	11:22	Winter In W	5
8/26/2019	13:50	Winter In W	5
9/12/2019	8:55	Winter In W	<5.00

CONCLUSION

In 2018, four sites were monitored for FOG. Two of the four sites did not meet the quarterly sampling frequency due to accessibility issues. All samples collected were below the 15 mg/L threshold. The 14th & Park and 22nd & Aldrich sites met the sampling frequency goal.

In 2019, eight sites were monitored for FOG. Four sites were only monitored for snowmelt FOG grabs, which included two samples on consecutive days. One of these sites, 61st and Lyndale, was above 15 mg/L. Four sites were monitored quarterly, but snowmelt samples were not collected at these sites. None of the four sites sampled quarterly were above 15 mg/L for FOG.

All the 2018 and 2019 FOG samples were below the 15 mg/L threshold except for the 2019 snowmelt samples collected at 61st & Lyndale. This site has industrial land use where FOG material is likely used by the industries surrounding it. It is unknown why all the 2018 61st & Lyndale FOG samples were below the 15 mg/L but both of the 2019 snowmelt FOG samples were above the 15 mg/L threshold. It could be a single spill event considering that the 2019 61st & Lyndale samples were taken on successive days on 3/12/19 and 3/13/19. 61st & Lyndale was not monitored for FOG after 2019 snowmelt.

An attempt should be made to sample FOG at the 61st and Lyndale site to determine if the 2019 data was an anomaly and if FOG is present during the rest of the year in grab samples. Safety considerations are limiting at this site due to high truck traffic volume and limited site lines for drivers. MPRB will continue to attempt to sample 6 sites quarterly for FOG.

2019 Snowmelt Sample Collection

In 2019 two snowmelt grab samples were collected at four sites in mid to late March.

Table 23-4 shows the parameters tested for each sample collected. **Table 23-5** 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 23-4. The list of monitored chemical parameters for the NPDES permit. (Winter snowmelt samples were grab samples for all parameters.)

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 23-5. Analysis method, reporting limit, and holding times for parameters used by Instrumental Research, Inc. and Pace Laboratories. ‡Metals and DOC were analyzed by 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 2340 C	2.0 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	0.050 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

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 (November-March) 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.

Table 23-6 shows the 2019 chemistry data for the sampled events. Stormwater concentrations can be extremely variable because there are multiple factors affecting the concentration of pollutants.

The red underlined data in **Table 23-6** are data that failed a blind laboratory monthly performance standard. Internal QAQC procedures flag the data for an entire month for any parameter if the blind standard fails ± 20% recovery. It was deemed the data can be used with caution, noting that performance standards were outside the 80-120% recovery standards.

Table 23-6. 2019 NDPES snowmelt sampled event data by site. NES=not enough sample. Red underlined data failed a blind monthly performance standard. ND = no data.

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP mg/L	TN mg/L	NO3 NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	pH std units	*E. Coli* MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
3/12/2019	13:50	14th & Park	Grab	0.426	0.105	7.31	0.876	9247	380	78	34	14707	526	9	8.0	23	50	7	250	34
3/13/2019	14:00	14th & Park	Grab	0.467	0.120	3.47	0.893	850	60	119	49	1415	202	10	8.4	60	31	19	218	15
		Geo. Mean		**0.446**	**0.112**	**5.04**	**0.885**	**2803**	**151**	**96**	**41**	**4562**	**326**	**9**	**8.2**	**37**	**40**	**12**	**233**	**23**
3/13/2019	14:25	22nd & Aldrich	Grab	0.729	0.426	8.15	0.792	950	88	105	48	1642	237	7	7.6	228	30	19	181	24
3/19/2019	14:25	22nd & Aldrich	Grab	1.116	0.665	5.33	0.133	200	42	158	65	408	187	6	ND	345	27	32	181	19
		Geo. Mean		**0.902**	**0.532**	**6.59**	**0.325**	**436**	**61**	**129**	**56**	**818**	**210**	**7**	**7.6**	**280**	**29**	**25**	**181**	**21**
3/12/2019	13:15	61st & Lyndale	Grab	0.419	0.046	10.9	7.16	3799	480	413	109	6130	414	21	11.5	<1	31	10	141	37
3/13/2019	13:38	61st & Lyndale	Grab	0.504	0.053	3.75	1.32	2049	156	379	85	3463	295	19	10.7	214	37	14	242	NES
		Geo. Mean		**0.459**	**0.049**	**6.39**	**3.08**	**2790**	**274**	**395**	**96**	**4607**	**349**	**20**	**11.1**	**214**	**34**	**12**	**185**	**37**
3/19/2019	13:20	Pershing	Grab	0.649	0.229	3.74	<0.030	15	68	26	24	145	131	<5.00	7.4	24	5	0	<20	48
3/20/2019	13:40	Pershing	Grab	0.415	0.198	3.08	<0.030	5	38	22	15	83	62	<5.00	7.3	4	4	1	<20	21
		Geo. Mean		**0.519**	**0.213**	**3.39**	**<0.0.30**	**9**	**51**	**24**	**19**	**109**	**90**	**<5.00**	**7.3**	**10**	**4**	**1**	**<20**	**32**

Best Management Practices Monitoring Results

Best management practices (BMPs) include procedures and structures designed to help reduce pollutants in stormwater runoff. The City and the MPRB carry out BMP monitoring as part of the effort to determine and improve system/BMP effectiveness through adaptive management.

In 2019, monitoring was continued with multiple BMP projects.
These included:

- Powderhorn Inlets.
- Winter Infiltration Basin
- 24th & Elm Infiltration Chamber
- Minneapolis Sculpture Garden

Background

Best management practices (BMPs) include procedures and structures designed to help reduce water pollution through good housekeeping practices like street sweeping. Monitoring of BMPs in Minneapolis is done as a part of the NPDES MS4 stormwater permit activities (permit #MN0061018).

POWDERHORN LAKE INLETS

BACKGROUND

A major restoration plan for Powderhorn Lake was undertaken in 1999 due to poor lake conditions that included installation of Continuous Deflective Separators (CDS) to control trash and solids. A drawing of a CDS unit is shown in **Figure 24-1**.

The Powderhorn Lake watersheds are shown in **Figure 24-2**. In 2001, five CDS grit chambers were installed at the outlets to the larger watersheds flowing to Powderhorn Lake in order to remove solids from stormwater inflow **Figure 24-3**.

Despite this and other restoration work, the lake was listed as impaired and placed on the EPA 303d list based on eutrophication and biological indicators in 2001. At the time of the listing, Powderhorn Lake was trending towards better water quality and was subsequently delisted after meeting state standards for several years.

Powderhorn was relisted on the EPA 303d list as impaired for nutrients in 2018 after relapsing to poor water quality. The purpose of monitoring the stormwater inlets into Powderhorn Lake is to measure and quantify the external nutrient load of the main tributaries into the lake. Information collected will help create an effective future plan to decrease the amount of nutrients impacting Powderhorn Lake.

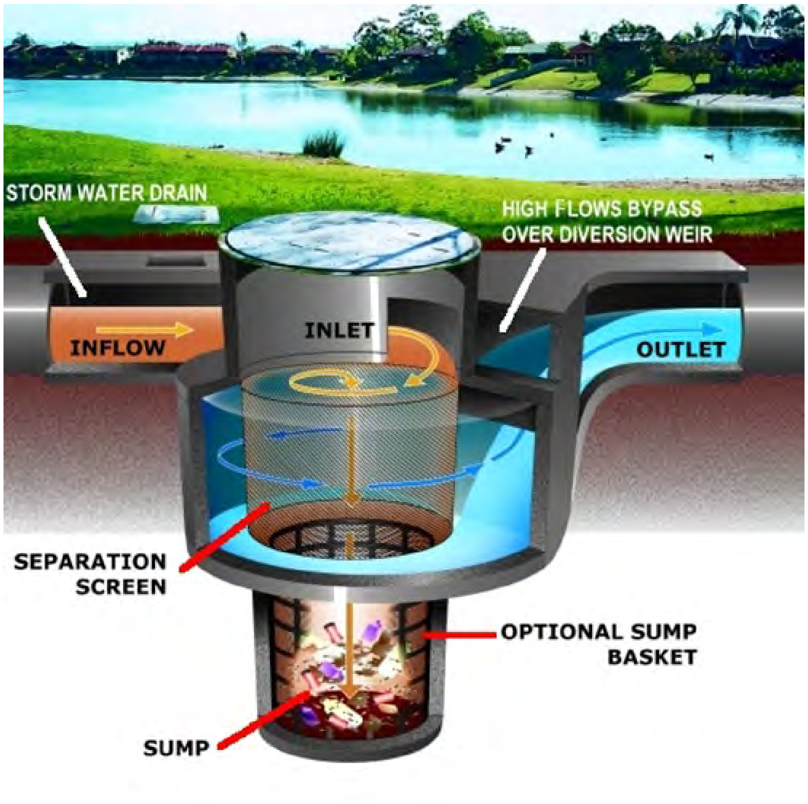


Figure 24-1. Cross section showing components of a CDS grit chamber unit.

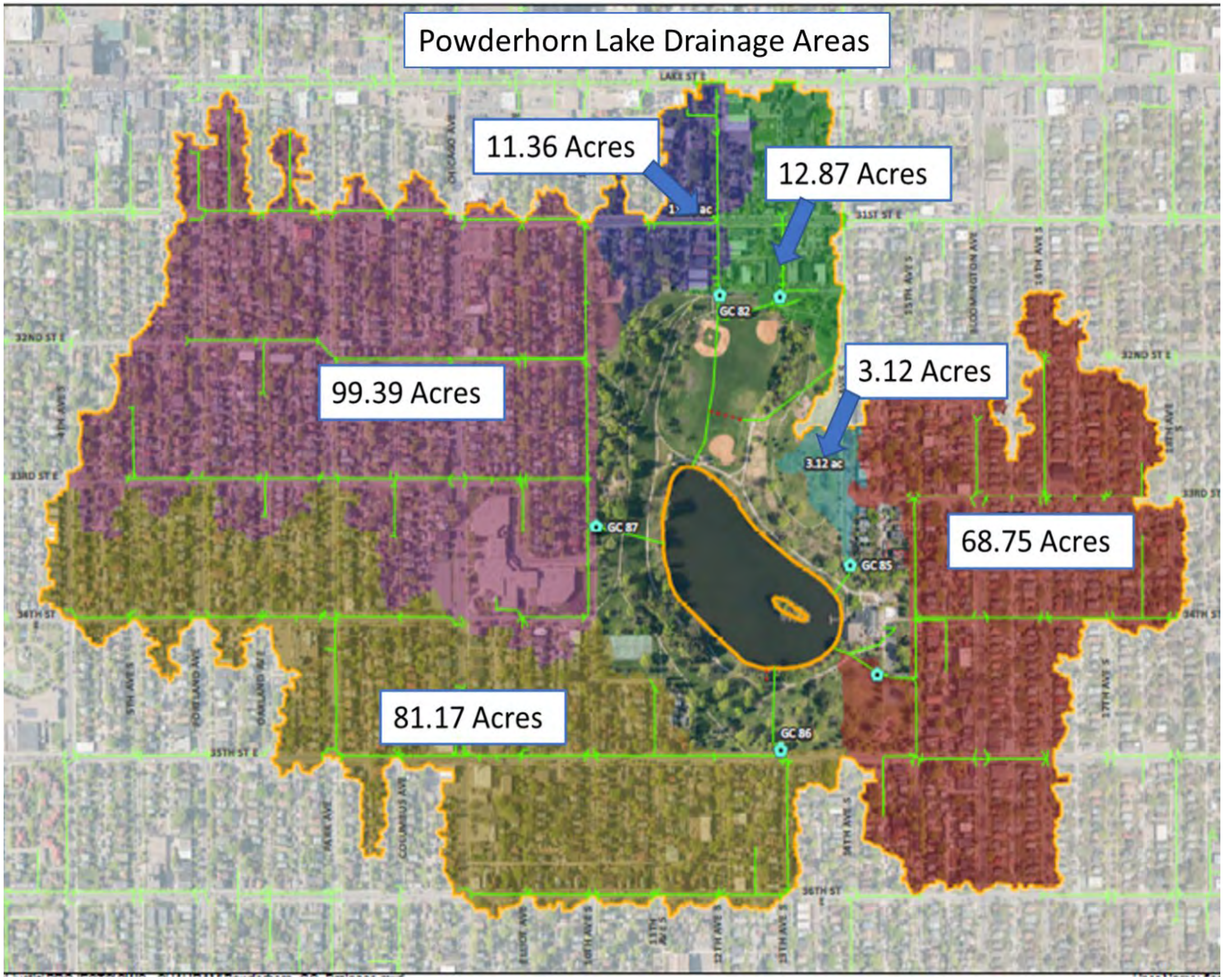


Figure 24-2. Powderhorn Lake individual watershed drainage areas acreage. All inlets have CDS units except the small 3.12 acre area which has a sump.

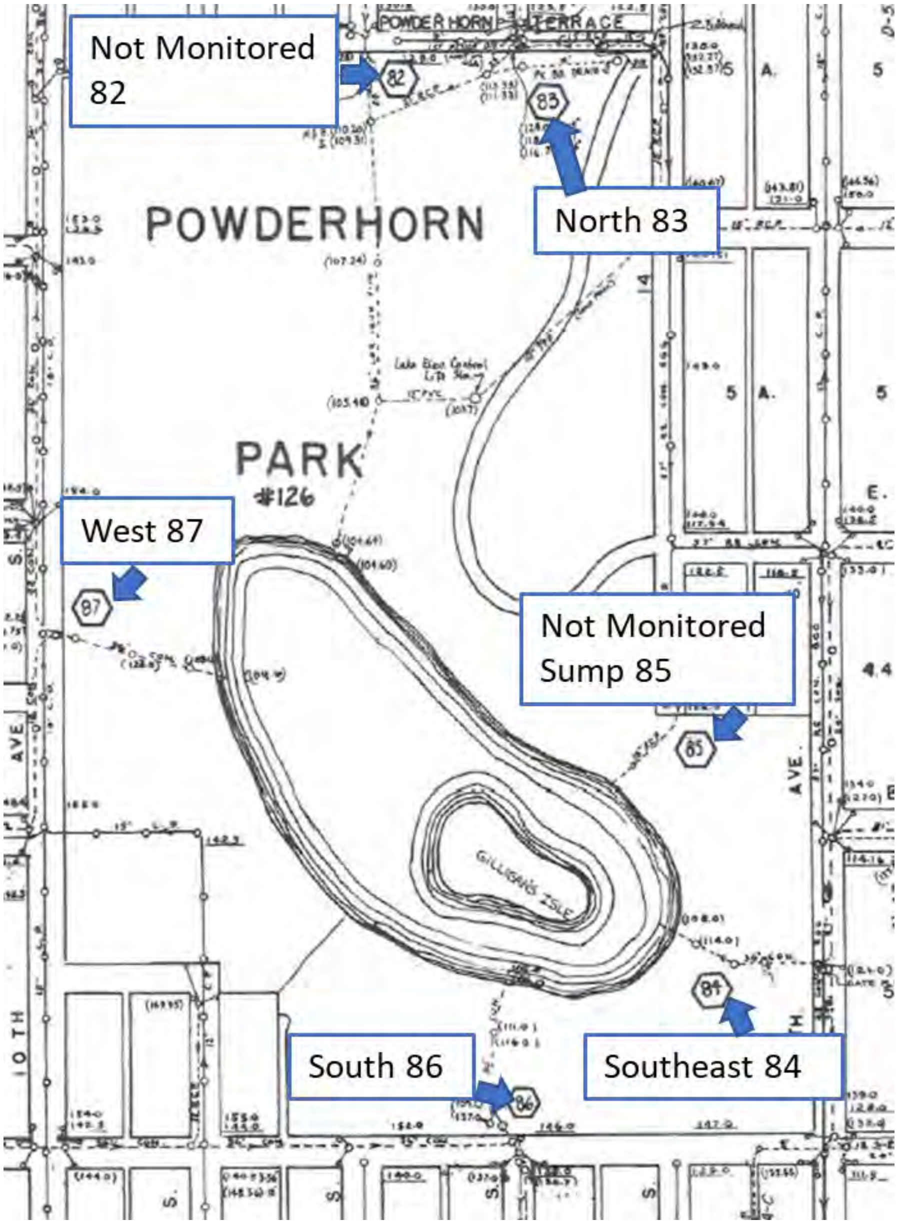


Figure 24-3. Storm sewer map of CDS grit chambers 82-87 surrounding Powderhorn Park.

There are five CDS grit chambers, and one sump structure installed in stormwater pipes leading to Powderhorn Lake. A sump is a pit, usually in a catch basin, that settles out solids. **Table 24.1** shows the Powderhorn CDS grit chamber assigned numbers, location, and drainage areas for each CDS unit. CDS unit 82 was not monitored since it is adjacent to and has an almost identical watershed to CDS unit 83. Sump 85 was not monitored because the watershed was very small (3.1 acres) which is about 1% of the watershed.

Table 24.1. A list of the six water quality structures surrounding Powderhorn Lake, their names, monitoring status, drainage areas, and locations.

Monitoring ID Name	BMP Type	CDS/Grit ID	Drainage (Acres)	Location
Not Monitored	CDS Hydrodynamic Separator	82	11.4	12th Avenue S and Powderhorn Terrace
Inlet North	CDS Hydrodynamic Separator	83	12.9	13th Avenue S and Powderhorn Terrace
Inlet Southeast	CDS Hydrodynamic Separator	84	68.8	3421 15th Avenue S
Not Monitored	Sump Manhole	85	3.1	3329 14th Avenue S
Inlet South	CDS Hydrodynamic Separator	86	81.2	13th Avenue S and East 35th Street
Inlet West	CDS Hydrodynamic Separator	87	99.4	3318 10th Ave S @ Back of sidewalk opposite of house #3318

METHODS

Site Installation

Before sites could be installed, reconnaissance was done at each of the four CDS units (83, 84, 86, 87) to assess site conditions. It was discovered that the CDS units had not received regular maintenance for some time. Significant debris and solids had built up in the CDS units and had accumulated in the upstream pipe inverts. At each of the sites both the CDS units and upstream pipes needed maintenance before equipment could be installed. In 2019, only the Inlet North site and Inlet Southeast sites were able to be fully cleaned and made operational. The Inlet South site was partially cleaned and installed but significant debris including 8-inches of sand and leaves were found in the upstream pipe invert. The debris made monitoring impossible at this site because it buried the AV probe and intake strainer. The Inlet West site had 4-feet of standing water in the upstream pipe due to a plugged CDS unit being plugged. The site was not cleaned until the fall of 2019, so equipment could not be installed.

Monitoring equipment at each of the sites included: ISCO 2150 datalogger, 2105 interface module, 2103ci cell phone modem or 2015ci combined interface module/modem, low-profile AV probe, and a 3700 ISCO sampler complete with tubing and intake strainer. The equipment at the Inlet North was hung from eyebolts below grade in the manhole. All other sites used above-grade monitoring boxes with drilled access holes for tubing and cables below grade into the manhole collars. Monitoring boxes are rectangular 4’ x 3’ x 3’ wooden boxes installed above grade to house both the sampler and datalogger equipment.

The datalogger used the cell phone modem to remotely upload data to a MPRB database from Monday through Friday. The cell phone antenna was installed at each site to allow communication with the datalogger. The datalogger could also be called up and programmed remotely to turn the samplers on or off, adjust the level, pacing, or triggers.

Sample Collection

The samplers were flow-paced and equipped with 24 one-liter bottles, 3/8" inner diameter vinyl tubing, and an intake strainer. The cable and tubing were anchored with zip-ties to the sidewall eyebolts or side-iron ladders. The sampler was programmed to multiplex, taking four flow-paced samples per bottle, allowing for 96 flow-paced samples per storm hydrograph.

Ideally, all monitoring would be done below the CDS units in order to enable sampling of nutrient inputs from organic material >3/8" that may decompose within the CDS chamber. This ideal installation was achieved at the Powderhorn Inlet North and Inlet Southeast locations. Equipment at the Inlet South and Inlet West sites had to be installed above the CDS units due to access issues. So nutrients released from organic decomposition within the CDS unit will not be accounted for at these two sites.

CDS grit chamber 83 is named Powderhorn Inlet North for this study. Monitoring equipment (AV and intake strainer) were installed downstream of the CDS unit on 7/17/19 using a stainless-steel spring ring in the 21-inch reinforced concrete pipe (RCP). The sampler was flow-paced at 500 cf. All equipment was hung below grade from ½" eyebolts. This site manhole was located on a steep muddy hillside which made challenging work of removing the manhole cover and extracting the sampler after each storm. All equipment was removed on 10/30/19.

CDS grit chamber 84 was called Powderhorn Inlet Southeast. Monitoring equipment (AV and intake strainer) was installed downstream of the CDS unit on 8/9/19 using a stainless-steel anchor plate secured to the invert of the 36-inch RCP pipe. The sampler was flow-paced at 600 cf and at a trigger depth of 1-inch. Equipment was above grade in a monitoring box/doghouse. All equipment was removed on 10/30/19.

CDS grit chamber 86 was called Powderhorn Inlet South. Monitoring equipment (AV and intake strainer) was installed upstream of the CDS unit on 9/23/19 using a stainless-steel anchor plate secured to the invert of the 42-inch RCP pipe. The sampler was initially flow-paced at 600 cf and at a trigger depth of 1-inch. The pacing was changed on 10/1/19 to 1000 cf to try and better capture the entire hydrograph of storms. This was unsuccessful as sand and debris buried the AV probe and intake strainer. Equipment was above grade in a monitoring box/doghouse. All equipment was removed on 10/30/19.

CDS grit chamber 87 was called Powderhorn Inlet West. In 2019, this site could not be installed upstream of the CDS unit due to a plugged CDS unit and 4-feet of standing water in the upstream pipe. The MPRB will work with the City Public Works to get these sites and pipes vacuumed out and jetted before 2020.

CDS grit chamber 82 and sump 85 were not monitored as part of this project.

RESULTS & DISCUSSION

Sample Collection

In 2019, samples were collected from storms ranging from 0.19" to 1.88''. Samples were collected from 13 individual storms at both the Powderhorn Inlet North and Powderhorn Inlet. Due to challenges from sediment in the upstream pipe, stormwater from one storm was collected at the Powderhorn Inlet South sites. Data from these samples are shown in **Table 24-2**. **Table 24-2** shows precipitation 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 inches and separated by eight hours or more from other precipitation.

Table 24-2. Precipitation and sample collection at the Powderhorn Lake inlets. Sample events were marked Full if all chemical parameters were analyzed. If samples were marked Partial, some chemical parameters were not run due to low volume or expired holding times. NS indicates storms that were not sampled.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr)	Hours since last Rain.	Powderhorn Inlet North	Powderhorn Inlet Southeast	Powderhorn Inlet South
8/13/2019	15:00	8/13/2019	23:15	0.65	8.25	0.08	68	Full	NS	NS
8/15/2019	17:45	8/16/2019	1:15	0.70	7.50	0.09	43	Full	NS	NS
8/17/2019	23:30	8/18/2019	3:15	1.88	3.75	0.50	46	Full	Full	NS
8/26/2019	11:15	8/26/2019	14:00	0.79	2.75	0.29	146	NS	Full	NS
9/1/2019	8:15	9/1/2019	10:00	0.29	1.75	0.17	138	Full	Full	NS
9/2/2019	20:45	9/3/2019	0:00	0.31	3.25	0.10	35	Full	Full	NS
9/9/2019	10:15	9/9/2019	17:45	0.22	7.50	0.03	23	Partial	Full	NS
9/11/2019	1:45	9/11/2019	10:45	1.12	9	0.12	32	Full	Full	NS
9/12/2019	1:30	9/12/2019	17:00	0.94	15.5	0.06	15	Full	Full	NS
9/29/2019	1:30	9/29/2019	8:45	0.37	9	0.04	171	NS	Full	Full
9/30/2019	3:00	9/30/2019	18:00	0.19	15	0.01	6	Full	Full	NS
10/1/2019	9:45	10/1/2019	17:15	0.66	7.50	0.09	16	Full	Full	NS
10/2/2019	11:15	10/3/2019	2:00	0.44	14.75	0.03	18	NS	Full	NS
10/5/2019	1:45	10/5/2019	17:00	0.80	15.25	0.05	48	Full	NS	NS
10/9/2019	23:30	10/11/2019	7:30	0.57	32	0.02	102	Full	Full	NS
10/21/2019	11:00	10/22/2019	8:45	0.22	10	0.02	8	Full	Full	NS

Figures 24-4, 24-5, and **24-6** are stage and discharge graphs for the Powderhorn Inlet North, Powderhorn Inlet Southeast, and Powderhorn Inlet South.

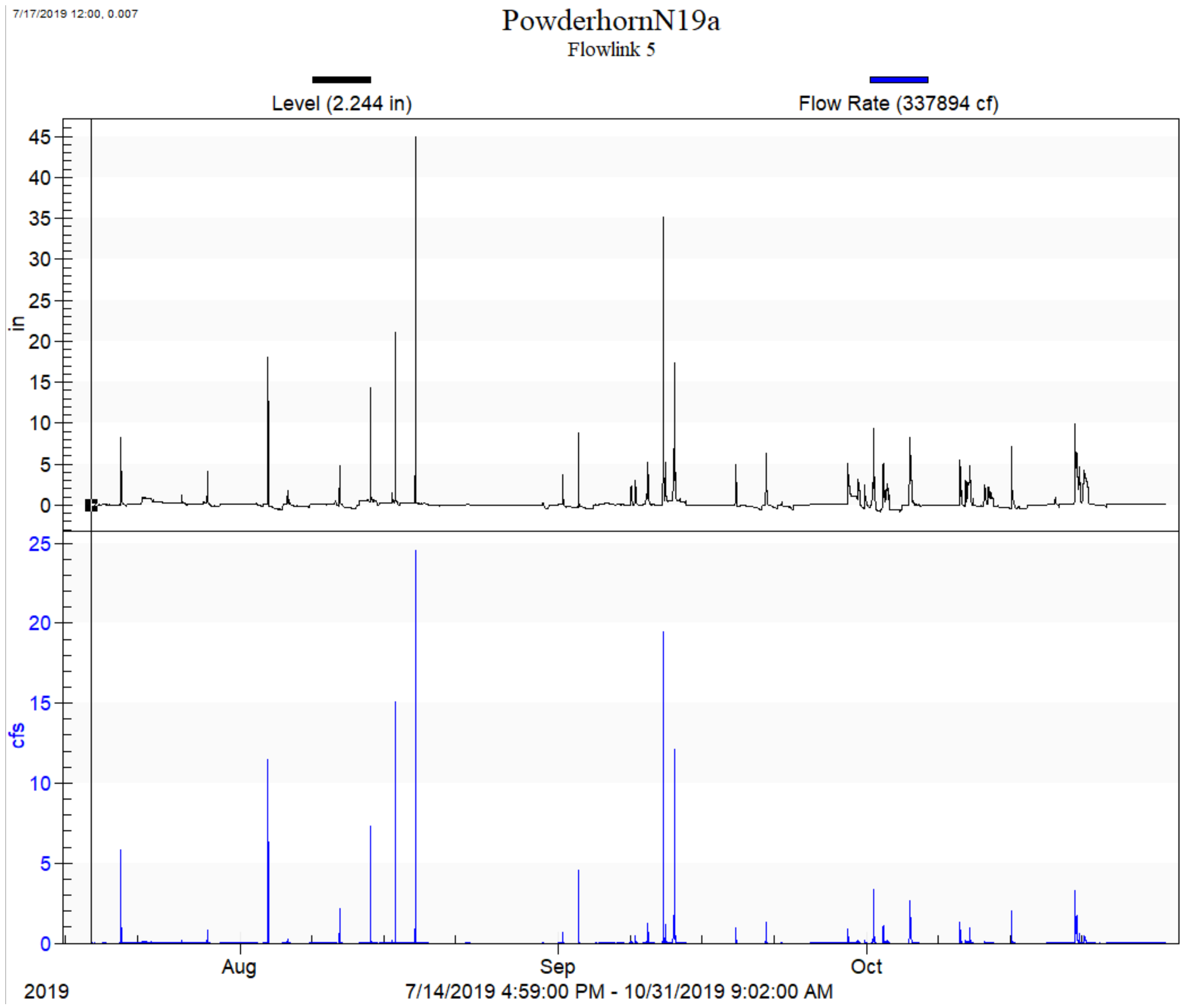


Figure 24-4. The Powderhorn Inlet North stage and discharge from July 14 to October 31, 2019. The upper graph is stage in inches and lower graph is discharge in cfs.

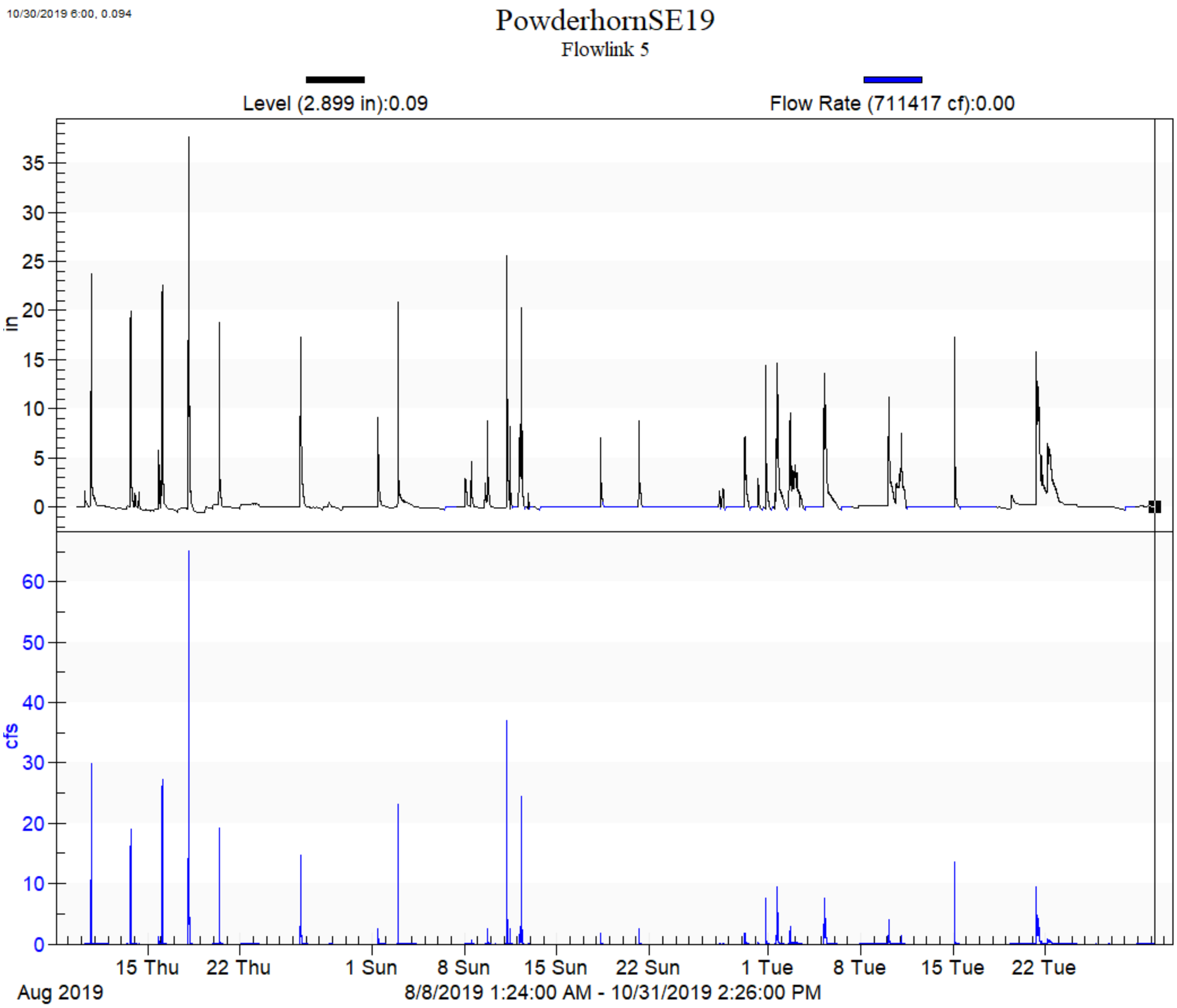


Figure 24-5. The Powderhorn Inlet Southeast stage and discharge from August 8 to October 31, 2019. The upper graph is stage in inches and lower graph is discharge in cfs.

Figure 24-6 shows that state in the pipe at the Powderhorn Inlet meets or exceeds 50" for almost every storm. The high stage level indicates that the CDS unit is partially plugged. A plugged CDS causes stormwater to back up the inlet pipe, settle out solids, and untreated stormwater flows through the overflow directly to the lake. The pipe then appears to have slowly drained down between storms through the CDS unit screen. This site also had a significant amount of sand and organic matter burying the AV probe and intake strainer, **Figure 24-7**. The AV probe and intake strainer were offset from the invert but were still buried by a large amount of solids. When the front of the AV probe is buried it is unable to obtain accurate velocity measurements during storms.

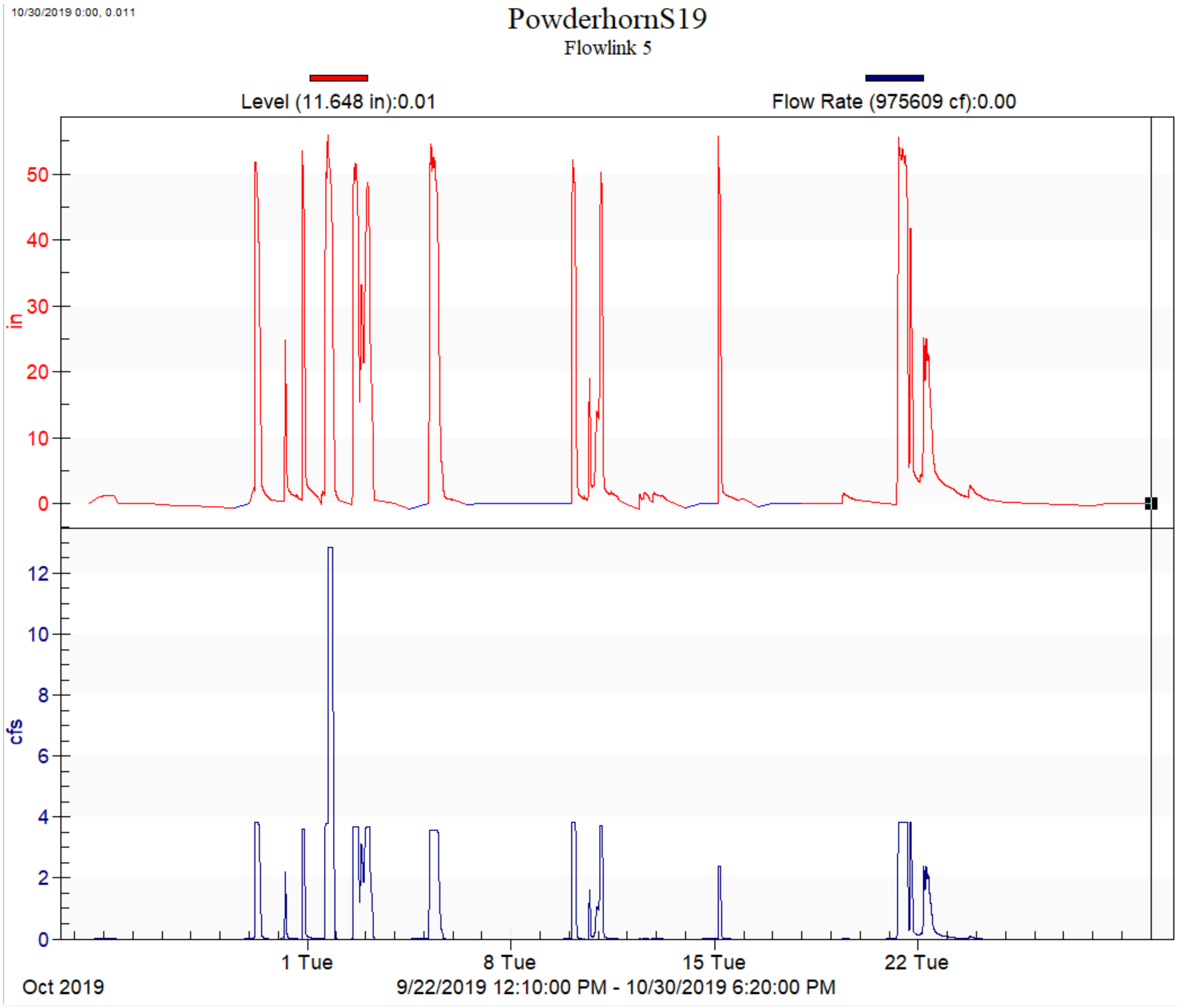


Figure 24-6. The Powderhorn Inlet South stage and discharge from September 22 to October 30, 2019. The upper graph is stage in inches and lower graph is discharge in cfs. Note each storm produces 50"+ of stage, indicating the CDS unit is plugged and backing up.

Figure 24-7. 2019 Powderhorn Inlet South offset AV probe and intake strainer after removing 8” of sand and debris.

Table 24-3 shows the chemistry data for samples collected at the Powderhorn inlets. Data shown in red and underlined failed the blind monthly laboratory standard for that test and month. When the laboratory cannot recover the blind standard at ± 20%, then it is marked for that month. This data was deemed usable but should be used with caution.

Both Powderhorn Inlet North and Southeast each show a significant number of storms sampled in a short period of time. Powderhorn Inlet South was only able to sample one storm. A geometric mean was calculated for sampled parameters at the Powderhorn Inlets North and Southeast. The high geometric means show Powderhorn Inlet Southeast is a contributor to Powderhorn Lake. The Powderhorn Inlet Southeast had high phosphorus, solids, and metals. Lead at this inlet is quite high and should be investigated for possible source reduction. The source of the lead is unknown, but one possibility may be exterior lead paint coming from the older residential buildings.

Table 24-3. **2019 Powderhorn Inlet Stormwater chemistry events data. Cells with less than values (<) indicate that the concentration of that parameter was below reporting limit. NC = not calculated. NES = not enough sample. Data that are underlined and red had a blind performance standard failure for that month, for that parameter.**

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP 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	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
8/13/2019	17:06	Powderhorn In N	Composite	0.098	0.023	0.557	0.071	NES	14	93	44	32	111	NES	NES	NES	NES
8/16/2019	3:21	Powderhorn In N	Composite	0.110	0.030	0.610	0.130	<2.00	8	22	10	18	<20	10	6	58	5
8/18/2019	3:45	Powderhorn In N	Composite	0.126	0.027	0.791	0.153	<2.00	12	49	16	15	23	12	18	39	2
9/1/2019	11:13	Powderhorn In N	Composite	0.169	0.065	2.24	<0.030	10	42	25	15	80	49	17	4	65	15
9/2/2019	23:26	Powderhorn In N	Composite	0.371	0.044	1.26	0.189	<2.00	18	15	6	35	22	8	5	25	6
9/9/2019	18:51	Powderhorn In N	Composite	0.180	0.018	1.38	0.282	3	20	38	20	60	50	16	7	50	NES
9/11/2019	6:04	Powderhorn In N	Composite	0.153	0.032	1.12	0.149	<2.00	10	31	14	10	29	10	10	25	3
9/11/2019	11:48	Powderhorn In N	Composite	0.107	0.034	0.763	0.174	<2.00	12	13	7	18	<20	14	3	27	3
9/12/2019	4:22	Powderhorn In N	Composite	0.093	0.017	0.905	0.149	<2.00	10	15	8	28	<20	10	4	21	3
9/30/2019	5:36	Powderhorn In N	Composite	0.283	0.033	1.56	<0.030	4	28	23	19	63	63	12	3	44	16
10/1/2019	11:10	Powderhorn In N	Composite	0.198	0.048	1.09	0.137	2	20	41	21	53	67	17	7	54	7
10/5/2019	6:14	Powderhorn In N	Composite	0.115	0.024	0.689	0.139	<2.00	10	22	10	35	36	12	5	37	3
10/11/2019	4:06	Powderhorn In N	Composite	0.197	0.013	1.24	0.145	4	26	24	16	78	63	17	4	43	9
10/22/2019	8:21	Powderhorn In N	Composite	0.160	0.014	0.941	0.041	<2.00	16	26	15	38	46	19	4	33	6
		Geo. Mean		**0.155**	**0.027**	**1.01**	**0.134**	**3**	**16**	**27**	**14**	**34**	**46**	**13**	**5**	**38**	**5**
9/29/2019	8:41	Powderhorn In S	Composite	0.411	0.104	1.76	<0.030	5	28	36	30	68	81	19	6	74	23
		Geo. Mean		**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**
8/17/2019	14:02	Powderhorn In SE	Composite	0.335	0.039	1.78	0.167	<2.00	24	114	35	44	83	23	36	98	5
8/26/2019	18:17	Powderhorn In SE	Composite	0.317	0.022	1.19	<0.030	<2.00	24	85	28	53	56	15	17	56	7
9/1/2019	13:13	Powderhorn In SE	Composite	0.471	0.076	2.31	<0.030	4	44	72	35	93	123	23	12	99	43
9/3/2019	0:46	Powderhorn In SE	Composite	0.345	0.016	1.88	0.095	<2.00	22	127	48	63	95	16	34	83	10
9/9/2019	18:33	Powderhorn In SE	Composite	0.490	0.028	1.84	<0.030	3	36	165	57	90	128	28	33	108	10
9/11/2019	7:50	Powderhorn In SE	Composite	0.591	0.058	1.10	0.053	<2.00	26	267	56	73	89	26	59	74	3
9/11/2019	11:33	Powderhorn In SE	Composite	0.158	0.012	0.770	0.100	<2.00	16	34	12	28	33	21	8	36	4
9/12/2019	10:00	Powderhorn In SE	Composite	0.349	0.028	1.01	0.048	<2.00	24	168	35	48	76	30	39	65	3
9/29/2019	7:57	Powderhorn In SE	Composite	0.556	0.117	2.41	<0.030	6	58	62	33	108	107	20	8	63	44
9/30/2019	20:15	Powderhorn In SE	Composite	0.527	0.038	2.64	0.095	3	26	217	88	60	185	33	49	182	9
10/1/2019	19:09	Powderhorn In SE	Composite	0.253	0.035	0.797	0.044	<2.00	14	69	28	30	83	14	15	61	4
10/3/2019	1:01	Powderhorn In SE	Composite	0.185	0.026	0.638	0.083	<2.00	18	36	17	43	53	12	10	48	6
10/10/2019	4:22	Powderhorn In SE	Composite	0.327	0.068	1.12	0.113	<2.00	20	30	20	58	63	18	5	44	10
10/11/2019	1:24	Powderhorn In SE	Composite	0.217	0.031	0.992	0.151	<2.00	30	30	19	78	80	17	7	49	NES
10/22/2019	4:10	Powderhorn In SE	Composite	0.315	0.102	0.862	<0.030	<2.00	20	42	23	<5.00	60	20	8	42	10
		Geo. Mean		**0.338**	**0.038**	**1.29**	**0.087**	**4**	**25**	**79**	**31**	**57**	**81**	**20**	**17**	**67**	**8**

CONCLUSION

A complete picture of the external load to Powderhorn Lake cannot be determined at this time since two of the sites were not monitored due to sediment buildup and maintenance needs. When additional sites are online, the data will provide a fuller picture of the external load to Powderhorn Lake.

The Powderhorn Lake CDS BMP's have had neglected cleaning and maintenance for some time. A previous MPRB Powderhorn CDS study (2002-2003) had shown the manufacturer recommendation of spring and fall cleaning was inadequate for the amount of organic matter flowing to these sites.

Monitoring not possible at the South and West inlet sites in 2019. They could not be monitored because the CDS units and upstream pipes weren't cleaned. When the inlet BMP's are cleaned on a regular schedule it should be possible to collect accurate flow data and flow-paced storm samples. Regular maintenance of the CDS units will not only remove solids but allow for a better assessment of the external load to Powderhorn Lake.

Judging by the amount of trash appearing to bypass the Powderhorn Inlet Southeast into Powderhorn Lake it may be undersized or in need of more frequent maintenance due to its larger watershed. Minneapolis Public Works reported in 2019 that this CDS unit was extremely full when cleaned. The phosphorus, solids, and metals reaching Powderhorn Lake are also of concern at this inlet and this site is likely a contributor to the external load.

After cleaning, future monitoring data should be more complete by adding additional inlets at the South and West sites. The West inlet is the largest watershed at 99 acres, and the South inlet is the second largest at 81 acres. The complete data will be used to inform a plan to mitigate the external load to the lake and improve in-lake condition

Winter Infiltration Basin

BACKGROUND

The Winter Infiltration Basin (WIB) Best Management Practice (BMP) was monitored as part of the Federal NPDES Permit. The WIB was built to collect solids and infiltrate stormwater, **Figure 27-1**. When stormwater is infiltrated into the ground, it can both filter out pollutants and reduce the volume of water discharged to surface waters. The WIB has two inlets and one outlet. A hydrodynamic separator, grit chamber 162, collects solids before water is discharged to the BMP through the south inlet. The west inlet has no upstream pretreatment. Both inlets have flared end reinforced concrete pipes (RCP) with trash racks. The outlet has a flared end RCP with a trash rack, but water flows into it not out of it. Water that does not infiltrate leaves the BMP discharges to the City of Minneapolis stormwater system and to the Mississippi River.

The watershed that drains to the WIB is 31.32 acres. The west inlet watershed is 1.17 acres. The south inlet watershed is 30.15 acres.

The west inlet major land use is 51% industrial and 27% residential. The south inlet major land use is 57% industrial and 20% residential.

The WIB was monitored as part of the NPDES permit to assess BMP performance in the City of Minneapolis. 2019 was the last year of the three-year monitoring of this BMP. The study lasted from 2017 through 2019. The goal was to assess the functionality of the BMP, for stormwater volume control, rate control, and pollution reduction.

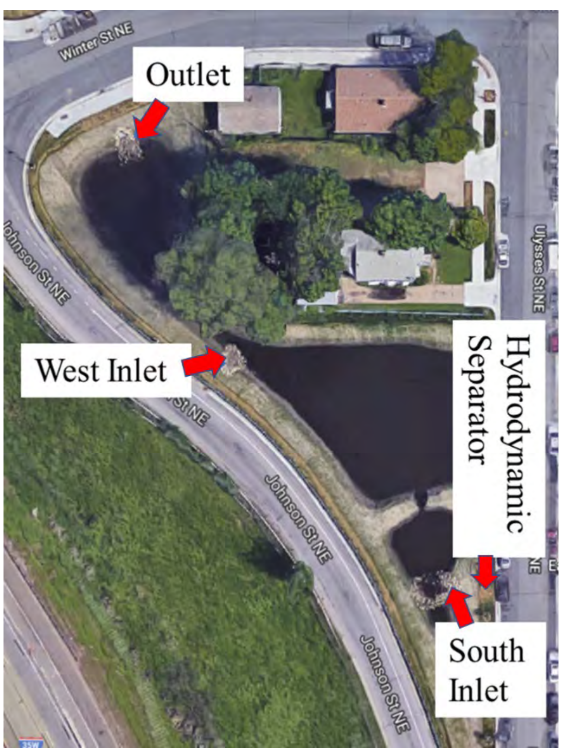


Figure 27-1. Aerial photo of the Winter Infiltration Basin. It has two inlets and one outlet.

METHODS

Site Installation

The MPRB used the best available technology for monitoring equipment at each site which included: an ISCO 2150 datalogger, a 2105 interface module, a 2105ci or a 2103ci cell phone modem, an antenna, a low-profile AV probe, and a 3700 ISCO sampler. The AV probes were secured with a stainless-steel anchor plate or a stainless steel spring ring. All sites required secure above-ground monitoring boxes with flexible conduit to protect the AV-cable and sampler tubing.

Each datalogger used a cell phone modem to remotely upload data to a Flowlink database each morning (before the start of the workday) Monday through Friday. All dataloggers could also be called up and programmed remotely to turn samplers on or off, adjust the level, pacing, or triggers.

The samplers were flow-paced and equipped with 24 one-liter bottles, 3/8” ID (inner diameter) vinyl tubing, and an intake strainer. The sampler was programmed to multiplex, taking four flow-paced samples per bottle, allowing for 96 flow-paced samples per storm. The WIB west inlet is a 12-inch RCP pipe, the south inlet is a 24-inch RCP pipe, and the outlet is a 20-inch RCP pipe.

In 2019, equipment at the west and south inlets were installed on 4/29/19 and equipment at the outlet was installed on 5/1/19. All equipment was removed on 10/31/19.

Sample Collection

Historical data from previous years was used to set the pacing parameters. Pacing samplers can be a dynamic process to fully sample storms. For example, some changes need to be made to adjust to wet or dry years. In 2019, the west inlet was set to trigger at 0.80 inches and initially paced at 25 cubic feet, but pacing was changed on 8/9/19 to 50 cubic feet due to the wet year. The south inlet was set with a 1.5-inch trigger and paced at 600 cubic feet. The outlet was set with a 1-inch trigger and initially paced at 50 cubic feet. The outlet pacing was changed on 5/23/19 to 25 cubic feet. Due to the wet year, on 6/28/19 outlet pacing was changed back to 50 cubic feet, and finally pacing was increased again on 8/9/19 to 75 cubic feet to fully sample the entire storm hydrograph.

RESULTS & DISCUSSION

Sample Collection

In 2019, samples from nineteen storm events were collected at the west inlet and samples from eighteen storm events were collected at the south inlet, **Table 27-2**. Four of the 6 sampled events had greater than 1” of stage in the outlet. Outlet events were rare because most of the stormwater was infiltrated and didn’t produce outlet events. Three NPDES quarterly *E. coli* and Fat Oil and Grease (FOG) grab samples were collected at both inlets at this site in 2019.

Even though the hydrodynamic separator was cleaned April 23, 2019 large amounts of debris continued to bypass the separator in 2019. Debris constantly became caught in the upstream side of the inlet trash rack, **Figure 27-2** and **Figure 27-3**. The debris needed to be cleaned off the inside of the trash rack frequently to prevent damming up the inlet outfall and caused standing water to back up the pipe. The hydrodynamic separator may be undersized or needs very frequent maintenance.

Figure 27-2. Photo of the south 24” inlet flared-end outfall and trash building up on the inside of the grate.

Figure 27-3. Looking upstream, a closer photo of the south inlet and trash building up on the inside of the grate.

The west inlet is also in need of frequent maintenance. Significant amounts of debris were caught in the upstream side of the trash rack damming the outfall and creating backwater conditions, **Figure 27-4**. Since the west inlet is a 12” pipe, removing the trash rack, or cutting off the bottom irons should be considered.

Figure 27-4. Photo of the west 12” inlet flared-end outfall and debris building up on the inside of the grate.

Figure 27-5 is a picture of the WIB outlet taken in spring. The photo shows the basin contains water, but no water is reaching the outlet since most of the stormwater is infiltrating. Since almost all water infiltrated in the basin, it was rare for stormwater to reach the outlet, and there were few opportunities to capture samples from water leaving the basin.

Figure 27-5. Photo of the WIB outlet. Standing water can be seen in the basin waiting to infiltrate and it has not reached the outlet. The brown box contains the monitoring equipment and the gray conduit armors the AV cable and sampler pump tubing.

Table 27-1 shows the 2019 storm events that were sampled. A total of 19 storms were either fully or partially sampled at the WIB. The precipitation amounts varied from 0.22” to 1.88”. In 2019 the WIB was able to fully infiltrate storms that had less than 0.80” of precipitation. Three NPDES *E. coli* and FOG samples were collected from the inlets. No NPDES *E. coli* or FOG samples were collected at the outlet because no water flowed out of the basin while staff were present.

Table 27-1. The 2019 precipitation events captured at Winter Infiltration Basin. The rain gauge was located at the MPRB SSSC at 38th and Bryant Ave. S. A precipitation event was defined as a storm greater than 0.10 inches and separated by eight hours or more from other precipitation events. Full = all chemical parameters. Partial = some chemical parameters were not run due to low volume or expired holding times. NS = storm not sampled.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr)	Hours since last Rain.	Winter Basin In South	Winter Basin In West	Winter Basin Outlet
5/8/2019	9:30	5/8/2019	23:45	1.42	14.25	0.10	102	E. coli/Full	E. coli/Full	Full
5/18/2019	22:30	5/20/2019	0:15	0.78	25.75	0.03	17	Full	Full	NS
5/21/2019	16:45	5/22/2019	11:15	1.04	18.5	0.06	41	Full	NS	NS
5/27/2019	5:00	5/27/2019	18:45	1.51	13.75	0.11	114	NS	Full	Full
6/4/2019	15:15	6/4/2019	20:30	0.23	5.25	0.04	188	Full	Full	NS
6/20/2019	14:15	6/20/2019	19:45	0.26	5.5	0.05	217	Partial	Full	NS
6/23/2019	2:00	6/24/2019	17:30	0.88	39.5	0.02	54	Full	Full	Full
6/27/2019	9:00	6/27/2019	11:15	0.20	2.25	0.09	64	E. coli	E. coli/Full	NS
7/15/2019	17:15	7/15/2019	18:30	0.93	1.25	0.74	145	NS	Full	Full
8/10/2019	13:45	8/10/2019	18:30	0.49	4.75	0.10	117	NS	Full	NS
8/15/2019	17:45	8/16/2019	1:15	0.70	7.5	0.09	43	Full	NS	NS
8/17/2019	23:30	8/18/2019	3:15	1.88	3.75	0.50	46	Full	NS	NS
8/26/2019	11:15	8/26/2019	14:00	0.79	2.75	0.29	146	E. coli	E. coli	NS
9/7/2019	22:30	9/8/2019	11:00	0.17	12.5	0.01	119	Partial	NS	NS
9/9/2019	10:15	9/9/2019	17:45	0.22	7.5	0.03	23	Full	Full	NS
9/11/2019	1:45	9/11/2019	10:45	1.12	9	0.12	32	Full	Full	NS
9/12/2019	1:30	9/12/2019	17:00	0.94	15.5	0.06	15	E. coli/Full	E. coli/Full	NS
10/2/2019	11:15	10/3/2019	2:00	0.44	14.75	0.03	18	Partial	Full	NS
10/5/2019	1:45	10/5/2019	17:00	0.80	15.25	0.05	48	Full	Full	NS

The stage and discharge graphs for the WIB inlet are shown in **Figure 27-6** and **Figure 27-7**. The stage and discharge graph for the outlet is shown in **Figure 27-8**. The outlet graph shows relatively few events even though 2019 was the wettest year on record. Water deeper than 1” of stage flowed out of the basin only a few times in 2019.

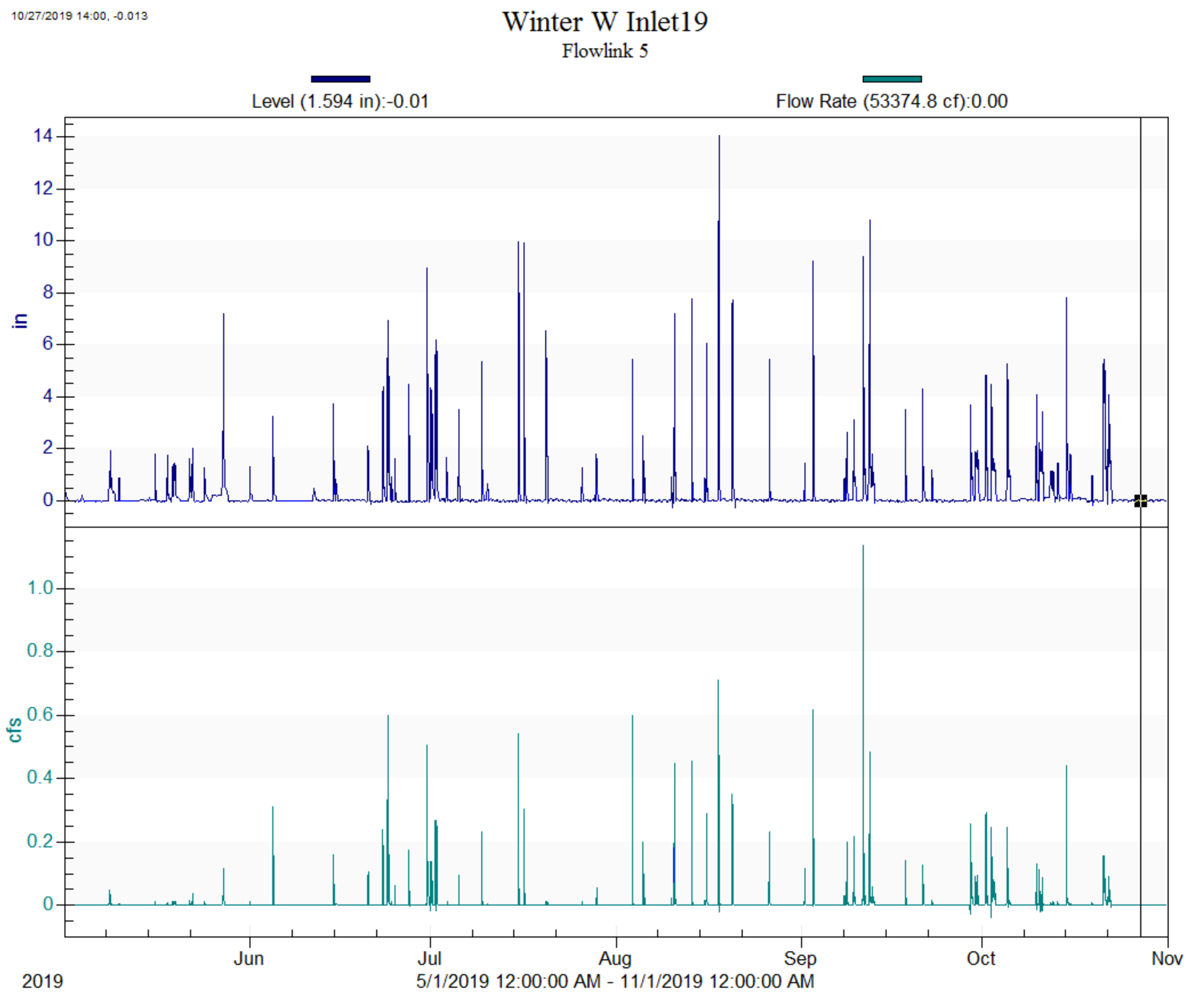


Figure 27-6. The 2019 Winter Basin west inlet stage and discharge graph from May 1 through November 1. The upper graph is stage in inches and the lower graph is discharge in cfs.

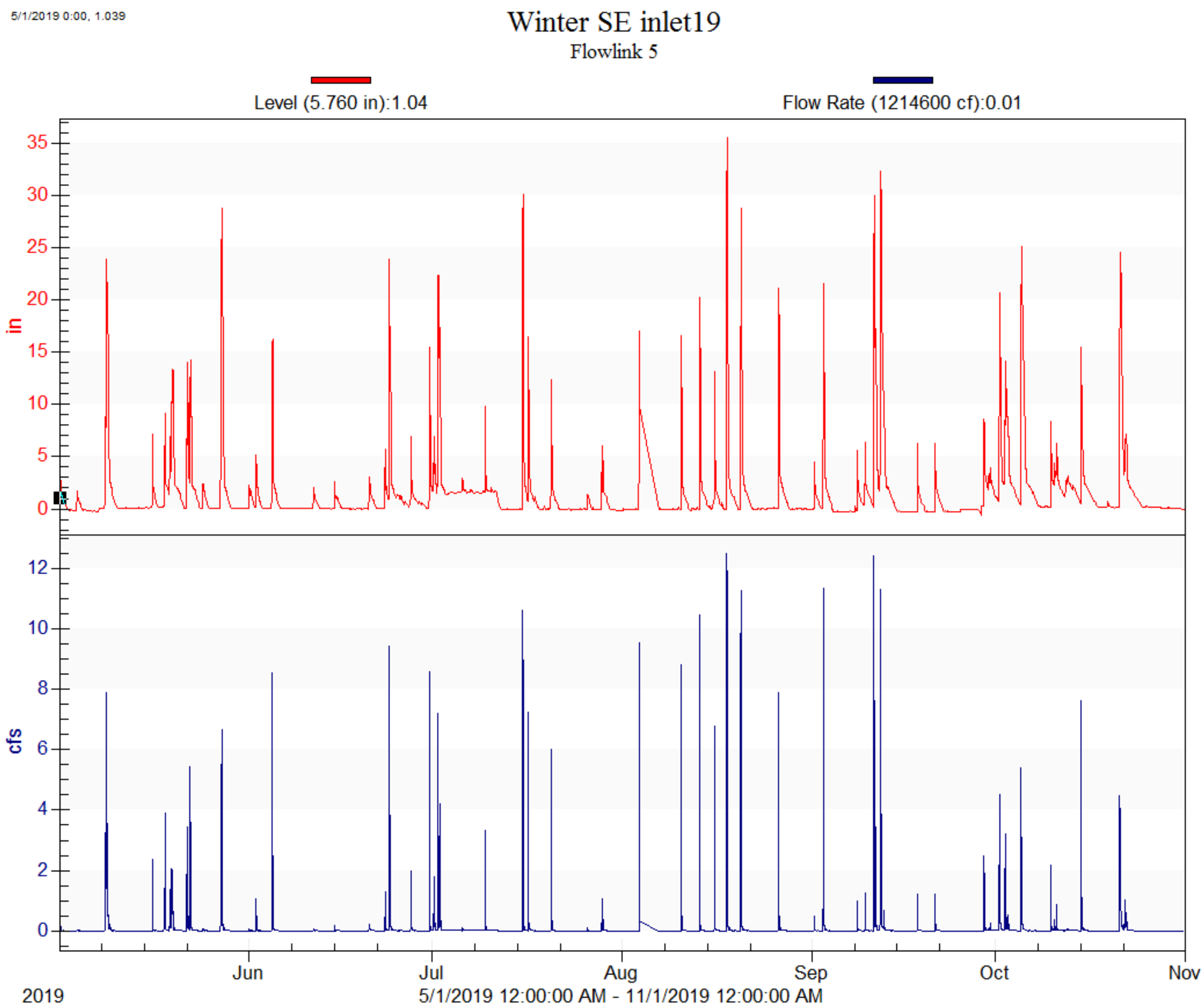


Figure 27-7. The 2019 Winter Basin south inlet stage and discharge graph from May 1 through November 1. The upper graph is stage in inches and the lower graph is discharge in cfs.

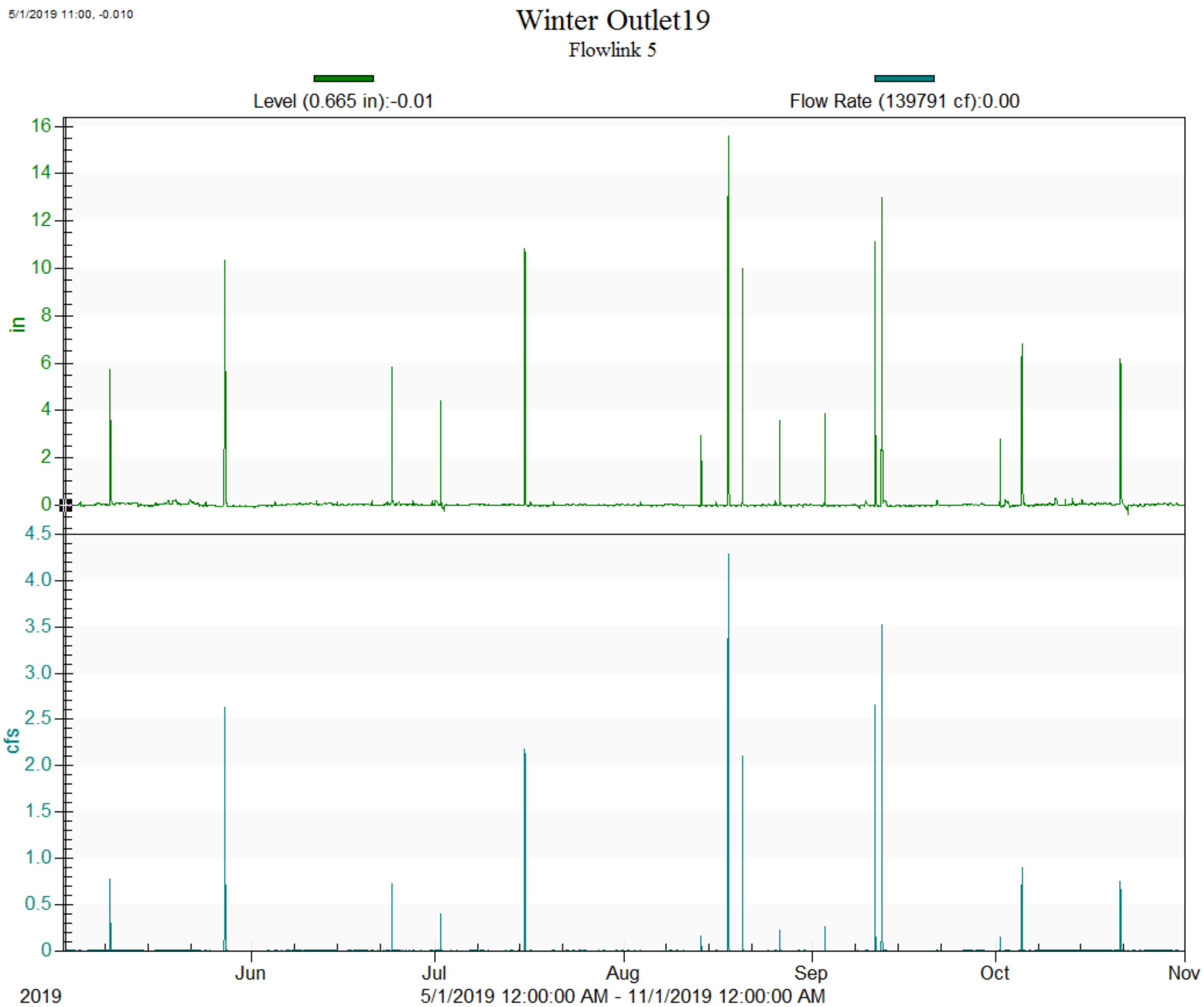


Figure 27-8. The 2019 Winter Basin outlet stage and discharge graph from May 1 through November 1. The upper graph is stage in inches and the lower graph is discharge in cfs.

Storm Event Data and Statistics

Table 27-2 shows the 2019 Winter Infiltration Basin sample chemistry data. Some of the events sampled were analyzed for limited parameters because of low volume or expired holding times. Due to limited outflow from the BMP in 2019 a concerted effort was made to collect outlet samples. This effort resulted in four outlet samples being collected.

In 2019, the March TDP, TN, September TDP, and October Zn parameters failed the MPRB blind monthly laboratory performance standard, and the effected data in **Table 27-2** are marked in red and bold. The data can be used with caution, noting that performance standards were outside the 80-120% recovery standard limits.

Table 27-3 shows the 2019 statistical comparisons for the WIB inlets and outlet.

Table 27-2. **2019 Winter Infiltration Basin south inlet water chemistry events data. ND = data not available due to expired holding time or sample not taken. NES = not enough sample for analysis. Data that are red and underlined had a blind performance standard failure for that month, for that parameter.**

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP 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	pH std units	*E. Coli* MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
5/8/2019	13:50	Winter In S	Grab	0.323	0.037	1.20	0.265	6	16	160	46	68	104	<5.00	7.9	1296	23	14	230	4
5/8/2019	18:22	Winter In S	Composite	0.241	0.037	0.874	0.205	4	18	111	31	54	66	ND	ND	ND	22	11	174	3
5/18/2019	7:11	Winter In S	Composite	0.273	0.009	2.42	0.787	10	30	125	37	76	105	ND	ND	ND	27	13	223	8
5/19/2019	16:00	Winter In S	Composite	0.076	0.015	0.837	0.357	4	16	11	4	45	16	ND	ND	ND	11	2	98	4
5/27/2019	13:09	Winter In S	Composite	0.091	0.033	0.549	0.158	<2.00	14	29	9	28	<20	ND	ND	ND	10	3	70	2
6/4/2019	23:49	Winter In S	Composite	0.561	0.028	2.14	0.468	4	26	332	73	60	202	ND	ND	ND	58	36	591	5
6/20/2019	20:10	Winter In S	Composite	0.703	0.081	4.01	0.062	NES	40	75	37	NES	167	ND	ND	ND	NES	NES	NES	NES
6/23/2019	10:21	Winter In S	Composite	0.428	0.029	1.78	0.315	5	22	176	50	58	129	ND	ND	ND	38	20	310	6
6/27/2019	11:16	Winter In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.3	24196	ND	ND	ND	ND
8/16/2019	6:31	Winter In S	Composite	0.149	0.023	0.723	0.169	3	24	59	14	53	43	ND	ND	ND	11	6	143	4
8/18/2019	1:06	Winter In S	Composite	0.209	0.013	1.03	0.288	3	24	133	32	48	62	ND	ND	ND	19	11	202	4
8/26/2019	13:45	Winter In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND	17329	ND	ND	ND	ND
9/8/2019	11:55	Winter In S	Composite	0.178	0.023	1.20	0.288	11	32	36	14	80	47	ND	ND	ND	20	6	128	NES
9/9/2019	18:54	Winter In S	Composite	0.186	0.015	1.54	0.439	6	30	56	17	70	53	ND	ND	ND	18	11	229	6
9/11/2019	7:12	Winter In S	Composite	0.204	0.015	0.920	0.149	<2.00	18	99	24	30	60	ND	ND	ND	22	14	151	2
9/12/2019	8:50	Winter In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	7.4	24196	ND	ND	ND	ND
10/2/2019	11:44	Winter In S	Composite	0.051	NES	<0.500	<0.030	NES	36	NES	NES	68	50	ND	ND	ND	NES	NES	NES	NES
10/5/2019	5:10	Winter In S	Composite	0.147	<0.010	0.689	0.149	3	22	88	23	43	74	ND	ND	ND	25	11	268	2
5/8/2019	14:05	Winter In W	Grab	0.281	0.060	1.18	0.160	7	16	113	45	78	129	5	7.5	727	32	9	186	9
5/8/2019	17:00	Winter In W	Composite	0.239	0.041	1.07	0.105	5	14	113	45	60	114	ND	ND	ND	26	8	171	7
5/18/2019	6:19	Winter In W	Composite	0.246	0.019	2.66	0.563	4	20	185	97	55	128	ND	ND	ND	NES	NES	NES	NES
5/19/2019	11:31	Winter In W	Composite	0.082	0.007	0.910	0.146	3	14	29	15	43	36	ND	ND	ND	13	1	46	5
5/27/2019	15:43	Winter In W	Composite	0.076	0.020	<0.500	0.127	4	12	17	8	33	128	ND	ND	ND	12	1	49	4

6/4/2019	20:44	Winter In W	Composite	0.140	0.014	1.81	0.386	5	15	39	14	53	52	ND	ND	ND	19	3	84	8
6/20/2019	16:53	Winter In W	Composite	0.398	0.051	3.47	0.938	26	32	55	36	172	170	ND	ND	ND	49	5	151	45
6/23/2019	23:35	Winter In W	Composite	0.116	0.013	1.06	0.303	3	10	53	18	50	57	ND	ND	ND	18	5	91	7
6/27/2019	11:22	Winter In W	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5	6.6	723	ND	ND	ND	ND
6/27/2019	12:51	Winter In W	Composite	0.210	0.016	1.77	0.388	8	20	40	17	75	67	ND	ND	ND	21	4	110	11
7/15/2019	20:03	Winter In W	Composite	0.183	0.016	1.67	0.340	4	30	60	28	55	66	ND	ND	ND	23	3	145	9
8/10/2019	18:01	Winter In W	Composite	0.119	0.018	1.35	0.459	6	16	29	13	62	62	ND	ND	ND	15	3	83	5
8/26/2019	13:50	Winter In W	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5	7.3	17329	ND	ND	ND	ND
9/8/2019	13:07	Winter In W	Composite	0.212	0.030	1.57	0.161	5	22	19	9	53	36	ND	ND	ND	13	1	44	8
9/9/2019	19:03	Winter In W	Composite	0.159	0.009	1.22	0.290	5	18	40	22	60	60	ND	ND	ND	19	6	96	7
9/11/2019	7:03	Winter In W	Composite	0.190	0.009	1.01	0.196	<2.00	16	33	12	23	29	ND	ND	ND	16	4	56	4
9/12/2019	8:55	Winter In W	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.2	8164	ND	ND	ND	ND
10/3/2019	6:10	Winter In W	Composite	0.093	0.014	<0.500	0.083	2.0	16	13	6	33	32	ND	ND	ND	13	2	56	4
10/5/2019	9:27	Winter In W	Composite	0.062	<0.010	<0.500	0.111	<2.00	8	18	9	23	36	ND	ND	ND	11	2	53	2
5/8/2019	18:17	Winter Outlet	Composite	0.170	0.016	0.672	0.205	10	14	46	13	53	33	ND	ND	ND	19	6	97	3
5/27/2019	13:10	Winter Outlet	Composite	0.070	0.036	0.520	0.171	3	14	5	3	25	36	ND	ND	ND	8	1	41	3
6/23/2019	23:57	Winter Outlet	Composite	0.183	0.027	1.16	0.325	4	16	44	14	53	52	ND	ND	ND	19	6	90	6
7/15/2019	20:17	Winter Outlet	Composite	0.246	0.034	1.64	0.441	6	20	62	17	60	56	ND	ND	ND	24	9	181	8

Table 27-3. 2019 Winter Infiltration Basin data showing statistics for the inlets and outlet. COV=Coefficient of Variation. All data below the reporting limit were transformed into half the reporting limit for statistical calculations (e.g. Cl <2 becomes 1). NC = not collected.

Site ID	Statistical Function	TP mg/L	TDP 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	pH std unit	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
Winter In South	MEAN (geometric)	0.202	0.021	1.09	0.204	4	23	80	24	53	62	4	7.5	10708	21	9	189	4
Winter In South	MEAN (arithmetic)	0.255	0.026	1.34	0.274	5	25	106	29	56	79	4	7.5	16754	23	12	217	4
Winter In South	MAX	0.703	0.081	4.01	0.787	11	40	332	73	80	202	6	7.9	24196	58	36	591	8
Winter In South	MIN	0.051	0.005	0.250	0.015	1	14	11	4	28	10	3	7.3	1296	10	2	70	2
Winter In South	MEDIAN	0.204	0.023	1.03	0.265	4	24	93	27	56	62	4	7.4	20763	22	11	202	4
Winter In South	STDEV	0.183	0.019	0.947	0.191	3	8	81	19	16	53	2	0.3	10802	13	9	131	2
Winter In South	NUMBER	15	14	15	15	13	15	14	14	14	15	4	3	4	13	13	13	12
Winter In South	COV	0.718	0.726	0.705	0.696	0.688	0.316	0.764	0.631	0.288	0.676	0.5	0.04	0.645	0.542	0.732	0.606	0.421
Winter In West	MEAN (geometric)	0.155	0.017	1.06	0.237	4	16	41	18	51	64	4	7.1	2937	18	3	84	7
Winter In West	MEAN (arithmetic)	0.175	0.021	1.34	0.297	5	17	54	24	58	75	5	7.2	6736	20	4	95	9
Winter In West	MAX	0.398	0.060	3.47	0.938	26	32	185	97	172	170	5	7.5	17329	49	9	186	45
Winter In West	MIN	0.062	0.005	0.250	0.083	1	8	13	6	23	29	3	6.6	723	11	1	44	2
Winter In West	MEDIAN	0.171	0.016	1.20	0.243	4	16	40	16	54	61	5	7.3	4446	18	3	84	7
Winter In West	STDEV	0.089	0.016	0.852	0.222	6	6	46	23	35	44	1	0.4	7885	10	2	48	10
Winter In West	NUMBER	16	16	16	16	16	16	16	16	16	16	4	4	4	15	15	15	15
Winter In West	COV	0.508	0.751	0.634	0.748	1.09	0.367	0.863	0.935	0.598	0.583	0.3	0.05	1.17	0.497	0.625	0.506	1.12
Winter Outlet	MEAN (geometric)	0.152	0.027	0.90	0.266	5	16	28	10	45	43	NC	NC	NC	16	4	90	4
Winter Outlet	MEAN (arithmetic)	0.167	0.028	1.00	0.286	6	16	39	12	48	44	NC	NC	NC	17	5	102	5
Winter Outlet	MAX	0.246	0.036	1.64	0.441	10	20	62	17	60	56	NC	NC	NC	24	9	181	8
Winter Outlet	MIN	0.070	0.016	0.520	0.171	3	14	5	3	25	33	NC	NC	NC	8	1	41	3

Winter Outlet	MEDIAN	0.177	0.031	0.914	0.265	5	15	45	14	53	44	NC	NC	NC	19	6	94	4
Winter Outlet	STDEV	0.073	0.009	0.505	0.123	3	3	24	6	15	12	NC	NC	NC	7	3	58	2
Winter Outlet	NUMBER	4	4	4	4	4	4	4	4	4	4	NC	NC	NC	4	4	4	4
Winter Outlet	COV	0.435	0.320	0.508	0.431	0.538	0.177	0.613	0.525	0.324	0.262	NC	NC	NC	0.385	0.581	0.570	0.530

Table 27-4 shows volume and load reductions for the Winter Infiltration Basin. The load calculations used the geometric mean of the chemical parameter as the calculation concentration. Winter Infiltration Basin had an 85-95% removal efficiency for all chemical parameters and a 92% stormwater infiltration efficiency. The high removal percentages show that the BMP worked well even in an extremely wet year.

Table 27-4. Infiltration and load calculations for the 2019 performance of the Winter Infiltration Basin.

Site	Total Vol (L)	TP (lbs.)	TDP (lbs.)	TN (lbs.)	NO3NO2 (lbs.)	Cl (lbs.)	Hardness (lbs.)	TSS (lbs.)
Winter Basin In S	34,393,585	15.3	1.59	82.9	15.5	272	1776	6038
Winter Basin In W	1,511,409	0.5	0.06	3.5	0.8	13	55	136
Winter Outlet	3,956,395	1.3	0.24	7.9	2.3	45	138	247
Percent removed	92%	92%	86%	91%	86%	84%	92%	96%

Site	Total Vol (L)	VSS (lbs.)	TDS (lbs.)	COD (lbs.)	FOG (lbs.)	Cu (lbs.)	Pb (lbs.)	Zn (lbs.)	DOC (lbs.)
Winter Basin In S	34,393,585	1787	4027	4679	300	1.6	0.71	14.3	283
Winter Basin In W	1,511,409	61	170	215	14	0.06	0.01	0.28	23
Winter Outlet	3,956,395	84	393	377	NC	0.14	0.04	0.78	37
Percent removed	92%	95%	91%	92%	NC	92%	95%	95%	88%

CONCLUSION

The 2019 load data shows the WIB was highly effective at removing pollutants and infiltrating water even in an extremely wet year with consistently saturated soils in the WIB. The only parameter of concern in 2019 was the high levels of Zn measured at the south inlet. Further investigation should be made to try and uncover the source of the Zn and the reason behind the increase. The south inlet watershed contains a foundry, auto repair business, and a fencing company that could be considered possible sources.

There was one incident in 2019 where oil with metal parts (nuts/bolts) were dumped at the south inlet WIB hillside. The oil killed all the vegetation in a two-foot square patch of the WIB. The owner of the auto repair business, located across the street, was contacted and he said he thought he knew who was responsible and would tell them not to do it again. No oil was found dumped again.

The WIB inlets need more frequent maintenance. Trash is building up inside the trash racks at both inlet outfalls. The bottoms of these trash-racks could be cut off and removed as a potential solution to the buildup. The hydrodynamic separator at the south inlet should be cleaned more frequently and investigated for frequent solids bypass. Sand is accumulating by both inlet outfalls and needs to be removed.

The WIB infiltrates most of the stormwater it receives, but more large and intense storms could be collected to verify that the WIB is working properly.

Finally, the vegetation appears to be growing well and helping to treat stormwater, amend the soil, and provide habitat for the wide variety of insects and animals (ducks, butterflies, grasshoppers, etc.) observed at the WIB. Management of the vegetation should include continuing to remove invasive plants, especially cattails. **Figure 27-9** shows a Monarch butterfly on an Aster plant at the south inlet.

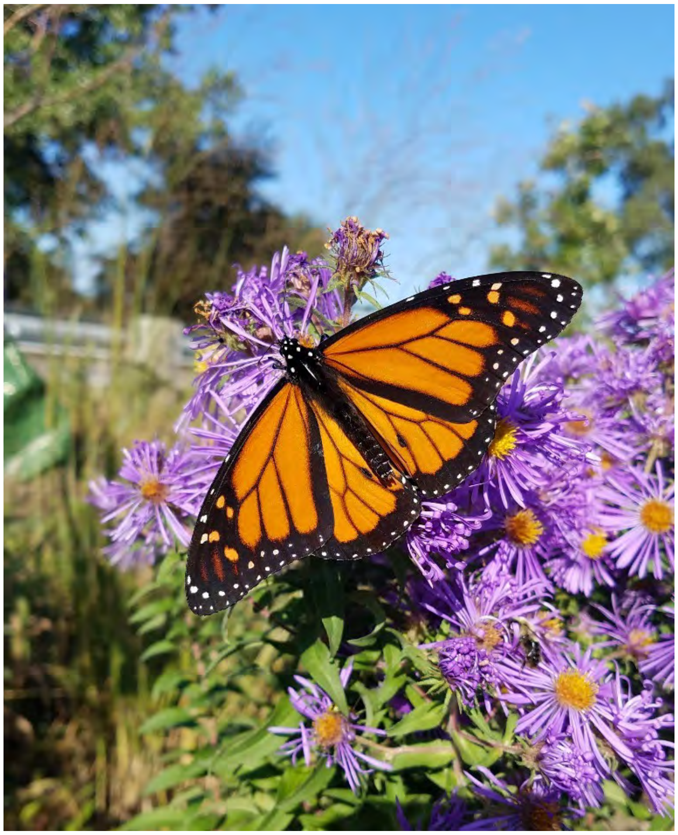


Figure 27-9. A 2019 fall photograph of a Monarch butterfly on an Aster plant at the south

24th & Elm Infiltration Chamber
BACKGROUND

The 24th & Elm Infiltration Chamber (EIC) shown in **Figure 26-1** was constructed in 2016 by the City of Minneapolis Public Works Department and was partially funded by a grant from the Mississippi Watershed Management Organization. The infiltration chamber has a 14.27 acre watershed and was built to remove solids and infiltrate stormwater from an area with light industrial and mixed land uses**.** The EIC treats stormwater first by removing and concentrating solids in a Contech™ Continuous Deflective Hydrodynamic Separator (CDS) as shown in **Figure 26-2.** The CDS units are located at the north and south inlets. The BMP then infiltrates stormwater in an infiltration chamber in order to both capture pollutants and reduce the volume of water discharged to the Mississippi River. Reducing stormwater volume alleviates hydraulic pressure on downstream stormwater conveyance infrastructure. The EIC was not built to treat the dissolved fraction of nutrients and chemicals in stormwater, but these fractions may adhere to particles in the soil.

The BMP has two inlets: The north inlet is a 36-inch reinforced concrete pipe (RCP) with a 3.93 acre watershed, and the south inlet is a 36-inch RCP with a 10.34 acre watershed. Both the north and south inlets have hydrodynamic separators (grit chambers 182 & 183, respectively. **Figure 26-3** shows the clean-out manhole and the inside of the north hydrodynamic separator. The largest part of the EIC is a cement infiltration box that is open at the bottom in order to promote infiltration and is located under 24th Ave. SE. This underground infiltration chamber is 12 feet wide, 462 feet long and 10 feet high. The EIC has the unique feature in that a backflow preventer is located on the Elm Street SE pipe. The backflow preventer allows high floodwater to leave the 24th Ave SE pipe, but prevents water entering the 24th Ave SE infiltration basin from the Elm Street pipe. The outlet and north inlet are the same pipe; therefore, dataloggers and samplers were placed at different locations to capture inflow to the EIC and any outflow from the EIC through this shared pipe. Under normal conditions, most of the water entering the EIC infiltrates, but under a large or intense storm the area can produce outflow that drains to the Mississippi River via the Elm St. SE pipe. This BMP will be monitored a minimum of three years, beginning in 2017.

Figure 26-1. Aerial photo of 24th & Elm Infiltration Chamber and its inlets and outlet. Blue arrows show the direction of flow.

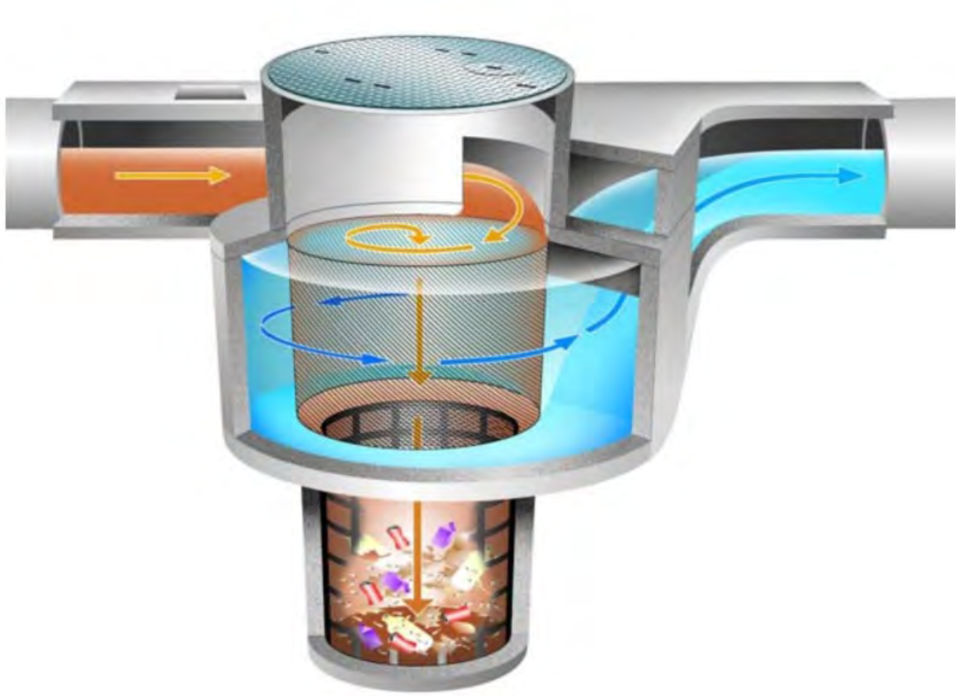


Figure 26-2. Shows a side view of a Contech™ Continuous Deflective Hydrodynamic Separator CDS unit.

Figure 26-3. Photograph of the top clean-out manhole access of the north Contech hydrodynamic CDS separator.

A backflow preventer shown in **Figure 26-4**, is located at the T-intersection in the stormwater pipe between 24th Avenue and Elm Street. The device is intended to allow water to leave the 24th Avenue pipe but prevent water from backflowing from the Elm Street pipe to the 24th Avenue pipe, overwhelming the infiltration practice with untreated water. The construction plans showing the location of the backflow preventer at the 24th Street pipe were not correct. The backflow preventer access manhole is located by the 24th Street stop sign. The backflow preventer appears intact, in working order, and located ~36" above the invert of the pipe.

Figure 26-4. Photograph of the backflow preventer at 24th Ave. SE, and Elm St. SE. The backflow preventer is approximately 36" above the 24th pipe invert.

METHODS

Site Installation

Monitoring equipment at each of the sites included: ISCO 2150 datalogger, 2105 interface module, 2103ci cell phone modem or 2015ci combined interface/modem, low-profile AV probe, and a 3700 ISCO sampler. The equipment at the north inlet and outlet was hung from eyebolts below grade at each manhole. Installation at the south inlet required a cross hanger due to its shallow depth. The datalogger used the cell phone modem to remotely upload data to a MPRB database from Monday through Friday. A cell phone antenna was embedded in the street to allow communication. The dataloggers could be called up and programmed remotely to turn the samplers on or off, adjust the level, pacing, or triggers.

The north inlet was installed on 5/2/19. On 5/10/19, the south inlet and outlet monitoring equipment were installed. Both inlets were installed downstream of the hydrodynamic separators. Access to the inlets at 24th & Elm was very cramped to work in and part of the north inlet pipe had to be removed to facilitate access, **Figure 26-5**. All equipment was removed on 11/1/19.

The samplers were flow-paced and equipped with 24 one-liter bottles, 3/8" ID (inner diameter) vinyl tubing, and an intake strainer. The sampler was programmed to multiplex, taking four flow-paced samples per bottle, allowing for 96 flow-paced samples per storm.

Figure 26-5. Photograph of the 36-inch north inlet at 24th & Elm prior to equipment installation. Note the hydrodynamic separator upstream on the right. The blue arrow shows the direction of flow. Note, part of the pipe had to be cut away to allow access.

Sample Collection

In 2019, the north inlet was set to trigger at 0.80 inches of stage and flow paced at 100 cubic feet. The south inlet was set to trigger at 1.25 inches of stage and flow paced at 150 cubic feet. The outlet trigger was set for 0.80 inches and initially paced at 10 cubic feet. Due to the wet year, the outlet pacing was changed to 20 cubic feet on 5/25/19, and to 50 cubic feet on 7/16/19, and finally to 60 cubic feet on 8/9/19.

The issue of semi-trucks parking on top of manholes appears to have been resolved after City traffic control installed no parking signs at each site in the spring. This change made the samplers and equipment accessible when needed.

RESULTS & DISCUSSION

Sample Collection

In 2019, 11 samples were collected at the north inlet, and 15 samples were collected at the south inlet. Ten storms were sampled at the outlet, as shown in **Table 26-1**. 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 more than 0.10 inches of rain separated by eight hours or more from other precipitation. The largest storm sampled was on 8/17-8/19 with 1.88 inches of precipitation.

Table 26-1. The 2019 precipitation events captured at 24th & Elm Infiltration BMP. Sample events were marked Full if all chemical parameters were analyzed. In samples marked Partial some chemical parameters were not run due to low volume or expired holding times. NS indicates storms that were not sampled.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr.)	Hours since last Rain.	24th & Elm North Inlet	24th & Elm South Inlet	24th & Elm Outlet
5/8/2019	9:30	5/8/2019	23:45	1.42	14.25	0.10	102	Full/E. *coli*	Full/E. *coli*	NS
5/27/2019	5:00	5/27/2019	18:45	1.51	13.75	0.11	114	NS	Full	NS
6/4/2019	15:15	6/4/2019	20:30	0.23	5.25	0.04	188	Full	Full	NS
6/20/2019	14:15	6/20/2019	19:45	0.26	5.5	0.05	217	NS	Full	Full
6/23/2019	2:00	6/24/2019	17:30	0.88	39.5	0.02	54	Partial	Full	Full
6/27/2019	9:00	6/27/2019	11:15	0.20	2.25	0.09	64	E. *coli*	Full/E. *coli*	NS
7/15/2019	17:15	7/15/2019	18:30	0.93	1.25	0.74	145	Full	NS	Full
8/10/2019	13:45	8/10/2019	18:30	0.49	4.75	0.10	117	NS	Full	Full
8/17/2019	23:30	8/18/2019	3:15	1.88	3.75	0.50	46	Full	NS	Full
8/26/2019	11:15	8/26/2019	14:00	0.79	2.75	0.29	146	Full/E. *coli*	Full/E. *coli*	Full
9/1/2019	8:15	9/1/2019	10:00	0.29	1.75	0.17	138	NS	Full	NS
9/2/2019	20:45	9/3/2019	0:00	0.31	3.25	0.10	35	Full	Full	Full
9/11/2019	1:45	9/11/2019	10:45	1.12	9	0.12	32	Full	Full	Full
9/12/2019	1:30	9/12/2019	17:00	0.94	15.5	0.06	15	Full/E. *coli*	Full/E. *coli*	Full
10/9/2019	23:30	10/11/2019	7:30	0.57	32	0.02	102	Full	Full	NS
10/21/2019	4:00	10/21/2019	14:45	1.01	10.75	0.09	131	Full	Full	Full

Figures 26-6 and **26-7** show the north inlet and south inlet stage and discharge measured in 2019. **Figure 26-8** shows the outlet stage and discharge measured in 2019. Due to the wet year, the outlet had more events in 2019 than in previous years, but no water left the site. In 2019 both outlet velocity signal strength and velocity spectrum data were collected and discussed with Teledyne/ISCO technical support to evaluate the quality of velocity readings and interpret any negative velocities seen at the outlet. Negative velocities are usually caused by either something in front of the AV probe

(e.g. flat rock) reflecting the signal as a mirror or water flowing backwards over the AV probe. The AV probe and intake strainer were offset further up the outlet side of the pipe, out of the standing water and sediment. This appears to have minimized some of the negative velocities measured at the outlet, but they were still present. It is theorized the negative velocities recorded were real and caused by water being impounded and then draining down.

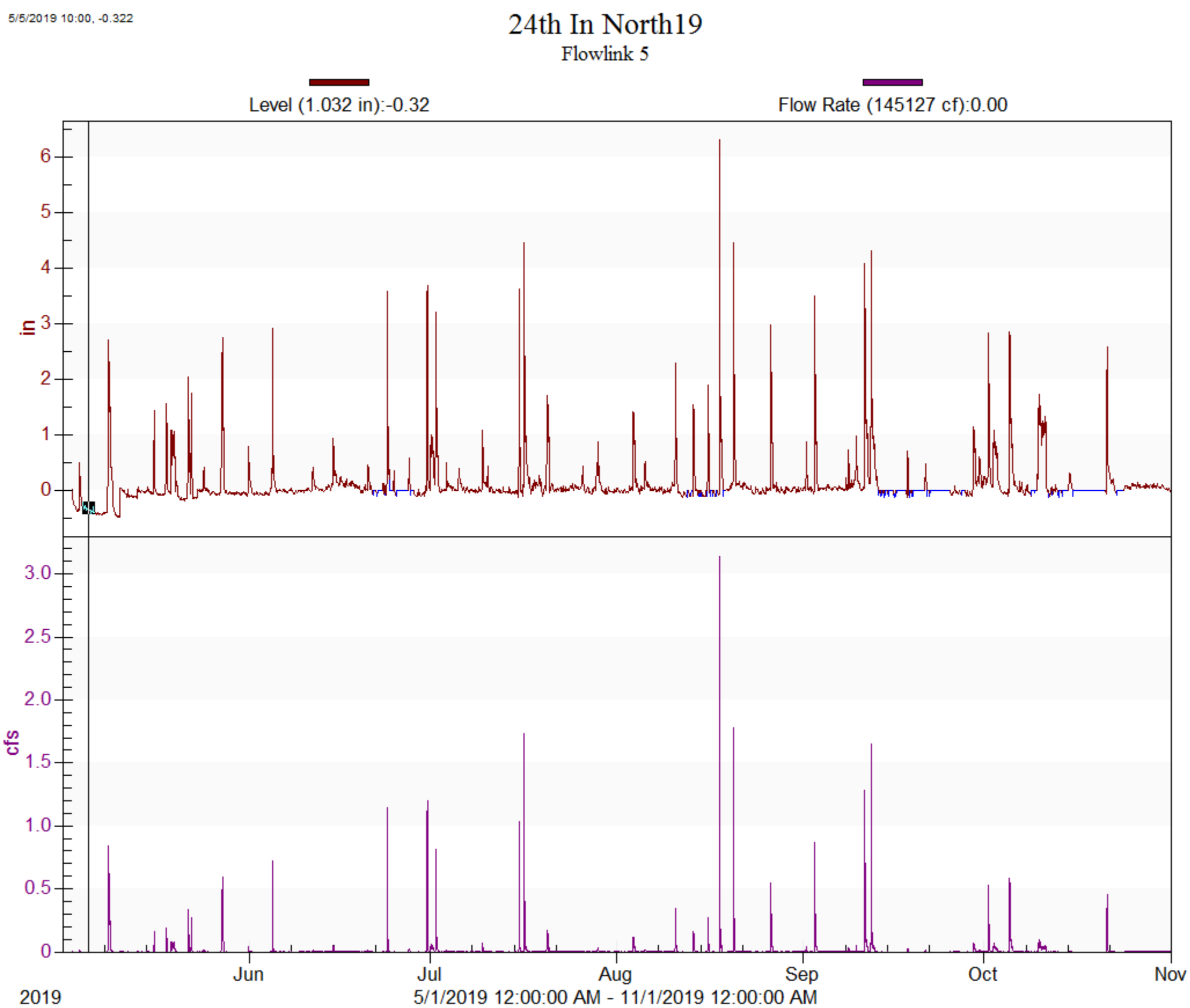


Figure 26-6. 2019 24th & Elm north inlet stage and discharge graphs from May 1 through November 11. The upper graph is stage in inches and the lower graph is discharge in cfs.

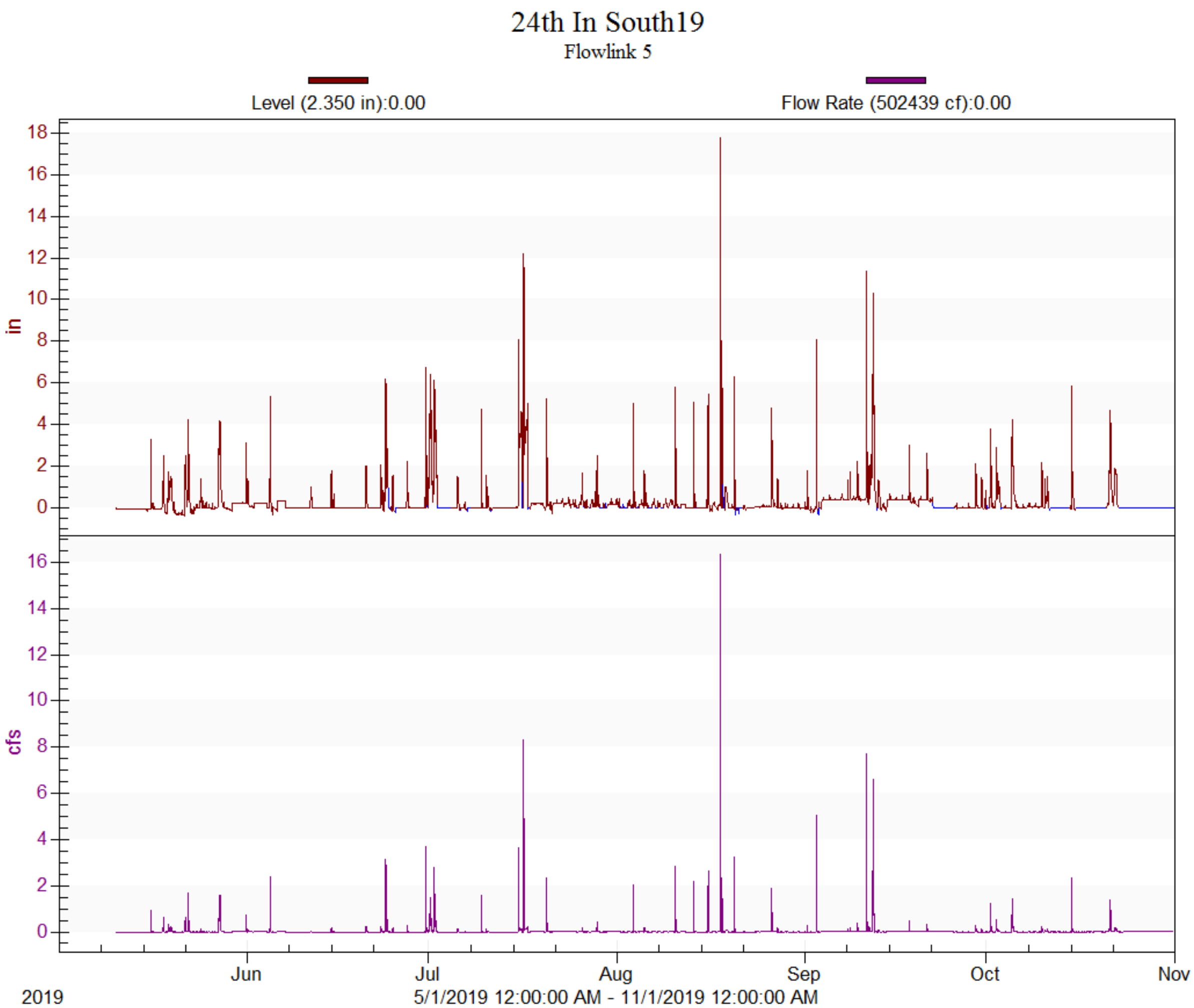


Figure 26-7. 2019 24th & Elm south inlet stage and discharge graphs from May 1 through November 1. The upper graph is stage in inches and the lower graph is discharge is in cfs.

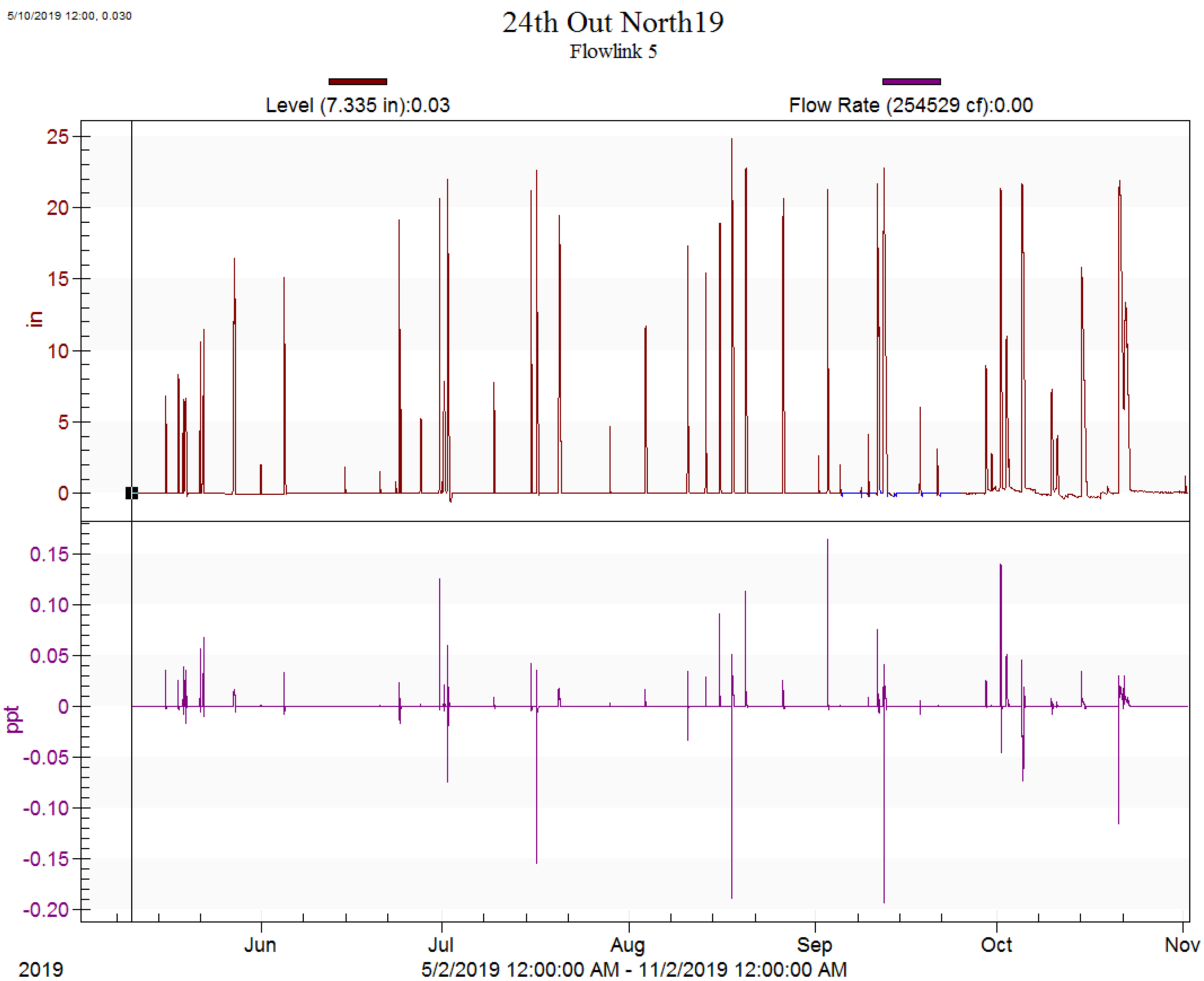


Figure 26-8. 2019 24th & Elm outlet stage and discharge graphs from May 1 through November 2. The upper graph is stage in inches and the lower graph is discharge is in cfs. Note the negative velocities.

Figure 26-9 shows the stage of both the outlet and north inlet for the same period of record (8/15/19 - 9/15/19). The significant stage difference between the two was unexpected since they are hydrologically connected with only a hydrodynamic separator between them. It appears that the head upstream of the hydrodynamic separator is significantly higher than the downstream head. In 2019, there was a significant amount of sand and very fine silt (3-4”) building up in the outlet pipe invert.

The most likely explanation of the head difference between the outlet and north inlet is that the hydrodynamic separator is partially plugged and causes stormwater to back-up the outlet pipe. This situation may cause water to bypass the hydrodynamic emergency overflow weir during large storms. When stormwater backs up the outlet pipe, it is temporarily impounded which allows suspended sediment to settle out in the outlet pipe. The impounded water in the outlet pipe then slowly drains through the partially plugged CDS, between storms, back toward the infiltration chamber. This theory could explain both the positive and negative velocities that were recorded, and why sediment has built up in the outlet pipe. Water likely drains down slow enough (<0.3 ft/sec) that negative velocities are not always picked up by the AV probe, complicating calculation and interpretation of the mass balance of both water and loading.

No water in the outlet pipe appears to have reached the backflow preventer and exited the EIC system. The outlet only sampled positive flows and likely sampled much of the fine sediment previously settled and/or resuspended in the invert, skewing the chemistry data, so a true picture of the outlet chemistry cannot be made. A mass balance should not be calculated using the outlet chemistry because no water left the site.

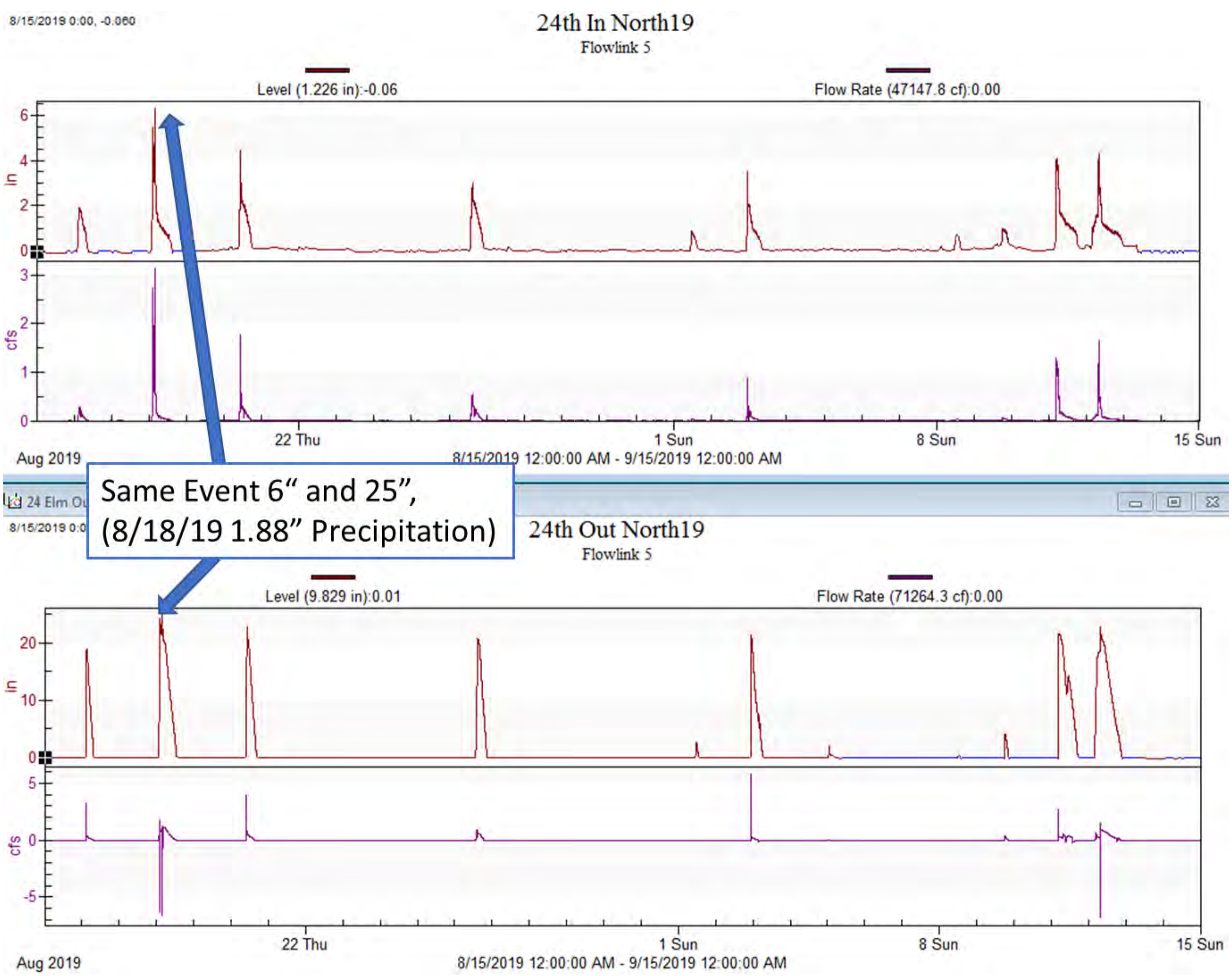


Figure 26-9. 2019, 24th & Elm outlet stage/discharge and north inlet stage/discharge graphs compared from 8/15- 9/15. The outlet is showing a higher stage than the north inlet for the same event(s).

Storm Event Data and Statistics

Table 26-2 shows the 2019, 24th & Elm Stormwater water chemistry data. Some of the stormwater samples collected were analyzed for limited parameters because of low volume or expired holding times.

The March TDP, TLN, TN, September TDP, and October data that are bold and red in **Table 26-**2 because these parameters failed MPRB's blind laboratory monthly performance standard for that month. It was deemed that the data can be used with caution, since performance standards were outside the 80-120% recovery standards for those samples.

Table 26-2. **2019 24th & Elm Stormwater chemistry data. Cells with less than values (<) indicate that the concentration of that parameter was below reporting limit. ND = no data is available due to expired holding time or low volume. NES = not enough sample. Data that are underlined and red had a blind performance standard failure for that month, for that parameter.**

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP 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	pH std units	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
5/8/2019	13:35	24th & Elm In N	Grab	0.288	0.030	1.63	0.587	10	32	209	60	103	105	<5.00	8.1	118	24	26	145	9
6/4/2019	22:11	24th & Elm In N	Composite	0.186	0.018	1.59	0.484	7	28	82	23	70	69	ND	ND	ND	20	9	70	6
6/23/2019	22:42	24th & Elm In N	Composite	0.085	<0.010	0.759	0.183	19	18	38	11	80	36	ND	ND	ND	13	4	36	4
6/27/2019	11:00	24th & Elm In N	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	6.8	1126	ND	ND	ND	ND
7/15/2019	21:32	24th & Elm in N	Composite	0.134	0.017	1.19	0.299	5	28	76	15	50	36	ND	ND	ND	11	4	45	6
8/18/2019	3:59	24th & Elm in N	Composite	0.069	<0.010	0.542	0.156	<2.00	22	49	9	38	<20	ND	ND	ND	9	2	34	2
8/26/2019	13:20	24th & Elm in N	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND		<5.00		187	ND	ND	ND	ND
8/26/2019	20:05	24th & Elm in N	Composite	0.078	0.014	0.599	0.149	5	24	27	6	48	30	ND	ND	ND	21	4	38	5
9/3/2019	2:49	24th & Elm in N	Composite	0.077	0.009	0.728	0.229	4	24	29	6	58	16	ND	ND	ND	14	3	28	5
9/11/2019	14:53	24th & Elm in N	Composite	0.086	0.005	0.621	<0.030	5	28	32	10	58	23	ND	ND	ND	10	4	32	6
9/12/2019	8:35	24th & Elm in N	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.3	1576	ND	ND	ND	ND
9/12/2019	13:18	24th & Elm in N	Composite	0.055	0.006	<0.500	<0.030	4	22	34	11	38	<20	ND	ND	ND	7	3	23	2
10/10/2019	4:38	24th & Elm in N	Composite	0.119	0.013	1.11	0.182	3	34	58	14	90	102	ND	ND	ND	63	5	63	8
10/21/2019	13:27	24th & Elm in N	Composite	0.186	0.023	<0.500	<0.030	3	32	82	17	25	53	ND	ND	ND	17	7	54	4
5/8/2019	13:25	24th & Elm In S	Grab	0.284	0.074	1.35	0.157	9	24	95	36	93	88	<5.00	7.5	10	19	7	135	9
5/27/2019	13:08	24th & Elm In S	Composite	0.070	0.025	<0.500	0.103	<2.00	12	13	6	28	105	ND	ND	ND	10	1	<20	2
6/4/2019	21:35	24th & Elm In S	Composite	0.218	0.033	1.71	0.355	3	20	106	24	68	746	ND	ND	ND	18	6	78	6
6/20/2019	17:49	24th & Elm In S	Composite	0.681	0.231	2.60	0.044	14	48	40	21	170	106	ND	ND	ND	14	2	92	27
6/23/2019	23:09	24th & Elm In S	Composite	0.157	0.106	1.20	0.168	4	10	21	8	53	40	ND	ND	ND	9	2	29	6
6/27/2019	10:50	24th & Elm In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.0	1081	ND	ND	ND	ND
6/27/2019	13:05	24th & Elm In S	Composite	0.161	0.025	1.70	0.424	9	19	15	7	90	40	ND	ND	ND	13	1	32	9
8/10/2019	18:24	24th & Elm In S	Composite	0.118	0.039	0.716	0.167	5	16	31	10	45	133	ND	ND	ND	10	2	37	3
8/26/2019	13:20	24th & Elm In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.5	<10	ND	ND	ND	ND
8/26/2019	17:10	24th & Elm In S	Composite	0.075	0.017	<0.500	0.093	2	16	14	6	53	16	ND	ND	ND	8	2	23	3
9/1/2019	11:36	24th & Elm In S	Composite	0.164	0.016	1.026	0.239	22	42	16	8	120	47	ND	ND	ND	NES	NES	NES	NES
9/3/2019	0:43	24th & Elm In S	Composite	0.138	0.032	0.777	0.173	4	16	47	9	43	22	ND	ND	ND	8	3	29	3
9/11/2019	11:20	24th & Elm In S	Composite	0.061	0.009	<0.500	0.111	2	14	7	2	43	<20	ND	ND	ND	9	1	<20	2
9/12/2019	5:17	24th & Elm In S	Composite	0.068	0.019	0.742	0.142	6	14	10	4	55	<20	ND	ND	ND	10	1	<20	2
9/12/2019	8:30	24th & Elm In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.2	19863	ND	ND	ND	ND
10/10/2019	16:07	24th & Elm In S	Composite	0.387	0.268	0.812	0.310	4	22	11	6	70	36	ND	ND	ND	15	1	36	4
10/11/2019	3:07	24th & Elm In S	Composite	0.274	0.211	1.01	0.435	8	24	10	6	88	53	ND	ND	ND	17	1	31	NES
10/21/2019	11:11	24th & Elm In S	Composite	0.109	0.023	0.581	0.143	<2.00	14	20	8	35	26	ND	ND	ND	12	1	23	2
6/20/2019	17:41	24th & Elm Outlet	Composite	0.405	0.029	3.09	<0.030	130	168	59	28	535	102	ND	ND	ND	16	2	48	NES
6/23/2019	22:57	24th & Elm Outlet	Composite	0.198	0.012	1.49	0.440	15	40	76	19	130	70	ND	ND	ND	16	9	66	10
7/15/2019	19:49	24th & Elm Outlet	Composite	0.295	0.021	1.83	0.498	11	44	108	22	88	66	ND	ND	ND	20	9	81	12
8/10/2019	18:43	24th & Elm Outlet	Composite	0.220	0.015	1.04	0.319	3	36	126	22	63	48	ND	ND	ND	26	12	84	11
8/18/2019	5:08	24th & Elm Outlet	Composite	0.118	<0.010	0.753	0.239	<2.00	32	60	12	48	43	ND	ND	ND	14	5	47	6
8/26/2019	16:53	24th & Elm Outlet	Composite	0.092	0.010	0.643	0.220	2	24	39	8	55	33	ND	ND	ND	10	4	58	5
9/3/2019	3:01	24th & Elm Outlet	Composite	0.238	0.020	1.32	0.331	6	40	176	23	83	54	ND	ND	ND	18	12	93	7
9/11/2019	13:29	24th & Elm Outlet	Composite	0.148	0.009	0.799	<0.030	<2.00	28	53	14	55	36	ND	ND	ND	18	5	50	5
9/12/2019	6:07	24th & Elm Outlet	Composite	0.140	0.008	0.642	<0.030	<2.00	36	97	17	68	36	ND	ND	ND	13	6	54	NES
10/21/2019	12:15	24th & Elm Outlet	Composite	0.180	0.011	0.711	0.220	3	30	67	15	48	43	ND	ND	ND	16	5	43	4

Table 26-3 shows the statistics calculated from the 24th & Elm inlet and outlet samples. Statistics were only calculated for a chemical parameter if there were two or more measured values. When statistical analysis was performed on the data sets, and values below the reporting limit were present, half of the reporting limit was used in the calculations.

In **Table 26-3,** when comparing the geometric means of the inlets and outlet chemical concentrations, the outlet concentration was higher than the inlets for many parameters. The higher outlet pollutant concentration is likely due to large storms causing resuspension of sediment in the outlet pipe and/or the intake strainer collecting the fine sediment covering the invert. In 2019 no water left the site.

Table 26-4 shows the water balance and chemical load calculations for the 24th & Elm Infiltration Chamber. The load calculations used the geometric mean of the chemical parameter as the final concentration. Conversions were made to express the concentration in pounds.

Percent removal was not calculated because the outlet did not function as designed. It is likely that the north hydrodynamic separator was partially plugged which allowed water to back up and stagnate in the outlet pipe. This issue caused three problems: 1) sedimentation occurred in the outlet pipe, 2) resuspended sediment later mixed with water from subsequent storm events, and 3) positive velocities were recorded, but the low negative velocities of the impounded outlet pipe water slowly draining down were not. Velocity readings must be above 0.3 ft/sec to be recorded by the AV probe. Since the percent removal calculation would not have applied to the conditions of a particular storm, it was not calculated.

The backflow preventer is located approximately 36 inches off the outlet invert. Water in the outlet pipe never reached this stage to send water to Elm St. In 2019, all stormwater was infiltrated, so the EIC was 100% effective.

It appears that the hydrodynamic separators have not been cleaned since construction. The lack of maintenance is creating conditions where water in the north inlet does not drain properly. In the early winter 2019, the hydrodynamic separators were assigned grit chamber numbers, GPS coordinates, and added to the maintenance cleaning schedule. After the hydrodynamic separators are cleaned the outlet pipe should also be jetted and cleaned. Thorough cleaning should remove the sand and fine sediment, which will preserve the infiltration basin service life.

Table 26-3. 2019 24th & Elm stormwater data showing statistics of the inlets and outlet. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations. NC = not calculated.

Site ID	Statistical Function	TP mg/L	TDP 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	pH std unit	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
24th & Elm in N	MEAN (geometric)	0.109	0.011	0.712	0.116	4	26	53	13	55	33	2.5	7.4	445	16	5	45	5
24th & Elm in N	MEAN (arithmetic)	0.124	0.013	0.843	0.210	6	27	65	17	60	45	2.5	7.4	752	19	6	52	5
24th & Elm in N	MAX	0.288	0.030	1.63	0.587	19	34	209	60	103	105	2.5	8.1	1576	63	26	145	9
24th & Elm in N	MIN	0.055	0.005	0.250	0.015	1	18	27	6	25	10	2.5	6.8	118	7	2	23	2
24th & Elm in N	MEDIAN	0.086	0.013	0.728	0.182	5	28	49	11	58	36	2.5	7.3	657	14	4	38	5
24th & Elm in N	STDEV	0.071	0.008	0.479	0.186	5	5	52	15	24	34	0	0.680	716	16	7	34	2
24th & Elm in N	NUMBER	11	11	11	11	11	11	11	11	11	11	4	3	4	11	11	11	11
24th & Elm in N	COV	0.569	0.629	0.568	0.886	0.866	0.188	0.802	0.926	0.401	0.765	0.000	0.092	0.953	0.827	1.06	0.663	0.418
24th & Elm In S	MEAN (geometric)	0.155	0.043	0.805	0.172	4	19	21	8	62	47	2.5	7.3	215	12	2	30	4
24th & Elm In S	MEAN (arithmetic)	0.198	0.075	0.998	0.204	6	21	30	11	70	99	2.5	7.3	5241	12	2	41	6
24th & Elm In S	MAX	0.681	0.268	2.60	0.435	22	48	106	36	170	746	2.5	7.5	19863	19	7	135	27
24th & Elm In S	MIN	0.061	0.009	0.250	0.044	1	10	7	2	28	10	2.5	7.0	10	8	1	10	2
24th & Elm In S	MEDIAN	0.157	0.032	0.81	0.167	4	16	16	8	55	40	2.5	7.3	546	11	1	30	3
24th & Elm In S	STDEV	0.163	0.088	0.644	0.122	6	11	31	9	38	183	0	0.24	9761	4	2	36	7
24th & Elm In S	NUMBER	15	15	15	15	15	15	15	15	15	15	4	4	4	14	14	14	13
24th & Elm In S	COV	0.825	1.17	0.645	0.596	0.931	0.518	1.02	0.863	0.536	1.86	0.000	0.03	1.86	0.301	0.914	0.878	1.10
24th & Elm Outlet	MEAN (geometric)	0.186	0.012	1.07	0.125	4	40	78	17	82	50	NC	NC	NC	16	6	60	7
24th & Elm Outlet	MEAN (arithmetic)	0.203	0.014	1.23	0.231	17	48	86	18	117	53	NC	NC	NC	17	7	62	7
24th & Elm Outlet	MAX	0.405	0.029	3.09	0.498	130	168	176	28	535	102	NC	NC	NC	26	12	93	12
24th & Elm Outlet	MIN	0.092	0.005	0.642	0.015	1	24	39	8	48	33	NC	NC	NC	10	2	43	4
24th & Elm Outlet	MEDIAN	0.189	0.012	0.92	0.230	3	36	72	18	65	46	NC	NC	NC	16	5	56	6
24th & Elm Outlet	STDEV	0.093	0.007	0.767	0.174	40	43	41	6	149	21	NC	NC	NC	4	3	18	3
24th & Elm Outlet	NUMBER	10	10	10	10	10	10	10	10	10	10	0	0	0	10	10	10	8
24th & Elm Outlet	COV	0.457	0.523	0.623	0.753	2.33	0.893	0.481	0.336	1.27	0.398	NC	NC	NC	0.265	0.501	0.283	0.405

Table 26-4. 2019 24th & Elm stormwater water balance, chemical load calculations in pounds. ND = no data.

Site	Vol Liters	TP lbs.	TDP lbs.	TN lbs.	NO_3NO_2 lbs.	Cl lbs.	Hardness lbs.	TSS lbs.	VSS lbs.	TDS lbs.	COD lbs.	FOG lbs.	Cu lbs.	Pb lbs.	Zn lbs.	DOC lbs.
24th & Elm in N	4,109,532	0.99	0.099	6.45	1.05	41	237	483	118	499	302	23	0.141	0.043	0.407	43
24th & Elm in S	14,227,465	4.86	1.34	25.3	5.41	132	590	662	258	1,955	1,481	78	0.371	0.051	0.950	140
24th & Elm Out	7,207,447	2.96	0.197	17.1	1.98	67	632	1,245	270	1,310	793	ND	0.257	0.097	0.959	109

CONCLUSION

In 2019 the 24th & Elm Infiltration Chamber infiltrated all the stormwater it received. No water reached the 36" stage required to flow out the backflow preventer and leave the site.

The cause of the negative velocities at the outlet was difficult to determine. The backflow preventer did not fail. It is theorized that observed negative velocities were caused by the north hydrodynamic CDS separator screens being plugged, which then caused water to back up in the outlet pipe. Impounded water then emptied slowly from the outlet pipe back into the infiltration chamber. Periodic settling and resuspension of sediment with water entering and exiting the same pipe made the outlet chemistry irrelevant to use. A mass balance could not be calculated.

Both the north and south inlet CDS separators had not been cleaned since construction in 2016 but will now be cleaned at least twice a year. Special attention should be given to cleaning and power washing the screens. Any accumulated sediment in the outlet invert should be jetted and removed. The outlet AV probe will be offset in future monitoring to reduce the possibility of being buried and causing signal reflection.

The infiltration chamber generally appears to be functioning as designed and is treating and infiltrating a large amount of stormwater. No stormwater appeared to have left the site in 2019, so it was 100% effective. Regular maintenance of the hydrodynamic separators should be continued to keep the EIC functioning for as long as possible.

Following cleaning, 2020 monitoring will likely show the EIC working better and allow for an accurate mass balance to be calculated by minimizing or eliminating the regular outflow backups of stormwater in the outlet pipe. Monitoring may determine if functionality is affected by cleaning the CDS unit and screens.

Minneapolis Sculpture Garden

BACKGROUND

The Minneapolis Park Board collected monthly grab samples from a large underground stormwater reuse cistern installed at the Minneapolis Sculpture Garden to compare the quality of the water collected in the cistern to Minnesota Pollution Control Agency (MPCA) water quality guidelines for stormwater harvesting and use for irrigation, **Table 25-1**.

In June 2017 the Minneapolis Sculpture Garden finished construction of an 80,000-gallon underground cistern. The purpose of the cistern is to collect overflow water from three areas: the Spoonbridge and Cherry sculpture, runoff from the southern 2/3rds of the garden paths, and runoff from a portion of Parade Field for reuse in irrigation at the Sculpture Garden. **Figure 25-1** shows construction plans for the Minneapolis Sculpture Garden and the location of the underground stormwater runoff storage cistern. **Figure 25-2** shows the underground cistern chambers during construction prior to their burial. **Figure 25-3** shows the north manhole used to sample the cistern.

The construction project was funded by the Mississippi Watershed Management Organization (MWMO). Water quality was monitored due to the interest of the City of Minneapolis and MWMO in this stormwater capture and reuse system.

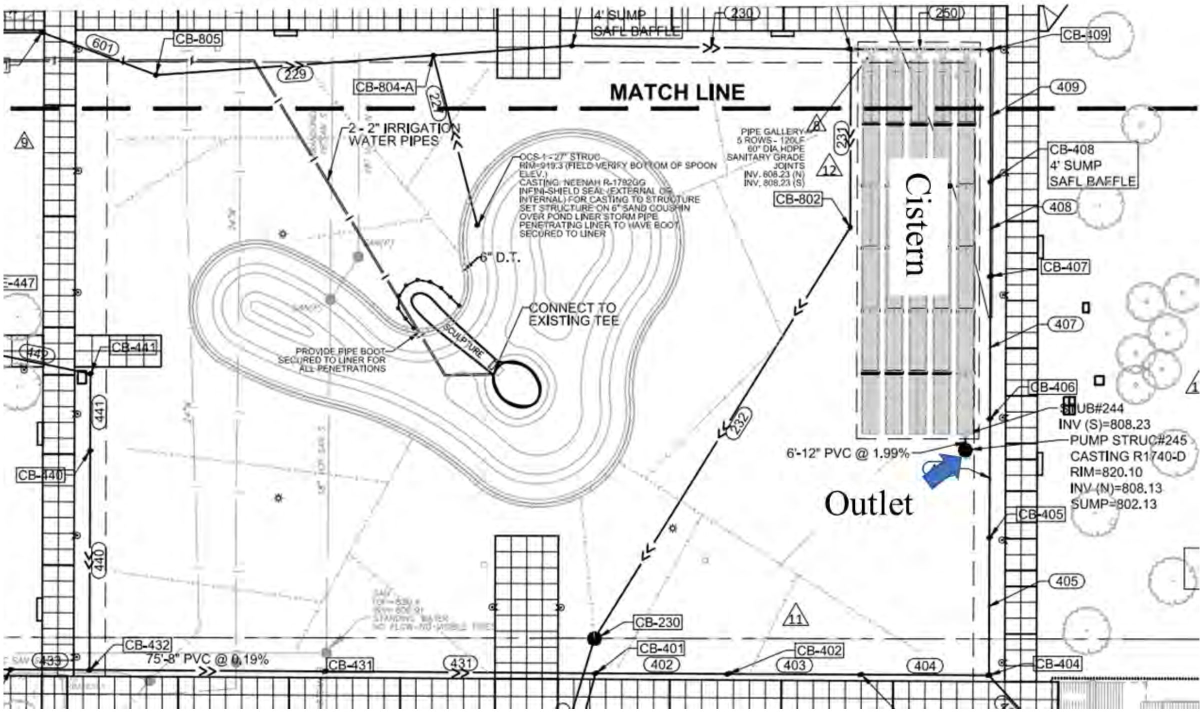


Figure 25-1. Drawing of the underground cistern and drainage system at the Minneapolis Sculpture Garden.

Figure 25-2. Photograph of the 80,000-gallon underground cistern under construction.

Figure 25-3. Photograph of the north manhole where sampling occurred at the underground cistern.

METHODS

Sample Collection

In 2018 and 2019, from spring through fall, monthly grab samples were collected from the Sculpture Garden underground cistern and analyzed for parameters referenced in the MPCA chemical guidelines, **Table 25-1**. The northwest manhole lid was removed, and a clean white bucket was lowered via rope. The bucket was rinsed with cistern water before taking a sample. Except for the *E. coli* sub sample, analyte containers were rinsed one time and then filled. The pH and temperatures were taken from the bucket after the aliquots were poured off.

Table 25-1. The MPCA summary of guidelines for stormwater reuse systems for irrigation.

Water Quality Parameter	Chloride	TSS	pH	*E. coli*	Copper	Zinc	Temperature	Turbidity
Impact of Parameter	Plant Health; Corrosion of Metals	Irrigation System Function	Plant Health	Public Health	Plant Health	Plant Health	Public Health	Irrigation System Function
Water Quality Guideline -Public Access Areas	500 mg/L	5 mg/L	6-9	126 *E. coli*/100mL	0.2 mg/L (longterm use); 5 mg/L (shortterm use)	2 mg/L (longterm use); 10 mg/L (shortterm use)	Guidance to be determined at a future date	2-3 NTU

RESULTS & DISCUSSION

In 2018 and 2019, from spring through fall, monthly grab samples were collected from the Sculpture Garden cistern and chemistry data are shown in **Table 25-2**. Except for TSS, all the chemical parameters measured were below the MPCA guidelines for water reuse irrigation purposes.

Many of the TSS values were above the 5 mg/L MPCA guidelines. The increased TSS values may be from dead grass clippings falling in the manhole when removing and reinstalling the cover for sampling. Replacing this non-standard manhole cover with a standard manhole cover should be considered, as it is extremely difficult to remove.

Table 25-2. The 2018 – 2019 chemistry data for grab samples collected at the Minneapolis Sculpture

Garden underground cistern. NC = Not Collected. TBD = to be decided. When a blind monthly laboratory performance standard failed, the data are underlined in red.

Date Sampled	Time	Site Location	Sample Type	TP mg/L	Cl mg/L	TSS mg/L	pH std units	E. Coli MPN	Cu ug/L	Zn ug/L	Temp °F	Turb NTU
5/1/2018	13:30	Sculpture Garden	Grab	NC	32	10	NC	<1	NC	NC	NC	NC
5/16/2018	12:45	Sculpture Garden	Grab	0.237	22	3	6.9	9	8	<20.0	45.4	<5.00
6/11/2018	14:45	Sculpture Garden	Grab	0.249	25	5	7.1	16	6	<20.0	66.7	<5.00
7/5/2018	13:30	Sculpture Garden	Grab	0.275	21	10	8.8	8	4	15	72.8	<5.00
8/7/2018	8:30	Sculpture Garden	Grab	0.374	23	30	8.7	<1	2	9	72.7	<5.00
9/17/2018	13:40	Sculpture Garden	Grab	0.669	27	63	8.5	13	8	10	71.5	<5.00
10/25/2018	9:05	Sculpture Garden	Grab	0.275	26	3	7.4	1	7	10	61.8	<5.00
4/25/2019	12:25	Sculpture Garden	Grab	0.337	38	6	7.0	16	11	19	42	NC
6/27/2019	14:25	Sculpture Garden	Grab	0.311	26	12	8.1	31	4	10	68	<5.00
7/10/2019	11:30	Sculpture Garden	Grab	0.305	25	4	7.9	52	5	6	70	<5.00
8/7/2019	10:00	Sculpture Garden	Grab	0.398	23	50	8.8	16	5	21	76	<5.00
9/5/2019	11:00	Sculpture Garden	Grab	0.281	23	16	8.1	3	3	6	72	<5.00
10/7/2019	13:30	Sculpture Garden	Grab	0.292	25	8	8.6	2	2	16	68	<5.00
		MPCA Guidelines		NA	500	5	6-9	126	200 longer use, 5,000 shorter use	2000 longer use, 10,000 shorter use	TBD	2-3

CONCLUSION

The water quality in the cistern at the Sculpture Garden met the MPCA water reuse irrigation guidelines, except for TSS. The higher TSS levels could be due to grass clippings falling into the manhole when removing or reinstalling the manhole cover to sample.

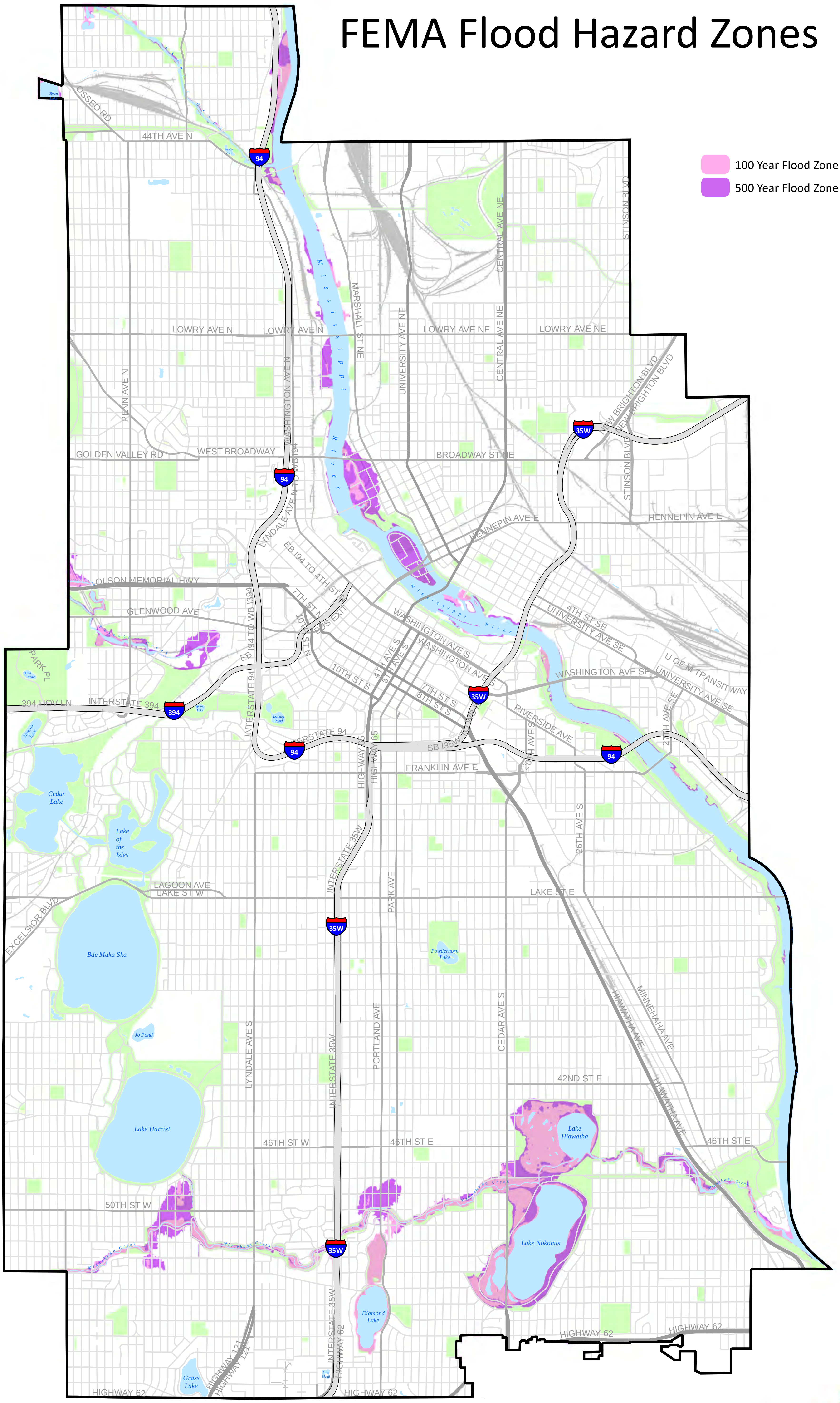
Further exploration will need to be done to definitively know the source of the TSS in the reuse cistern water. A different type of manhole cover, that is easier to remove, and additional sources of TSS should be investigated further. Additionally, water from the outlet should be sampled to see what is leaving the cistern.

An important consideration is that the collected stormwater was not used for irrigation in either 2018 or 2019. The reuse-water is planned to be used in 2020 for irrigation of the Sculpture Garden.

Once the system is able to be used normally, it could be monitored again to determine if the guidelines are still met when the system is used as it was designed.

Appendix B

FEMA Flood Hazard Zones



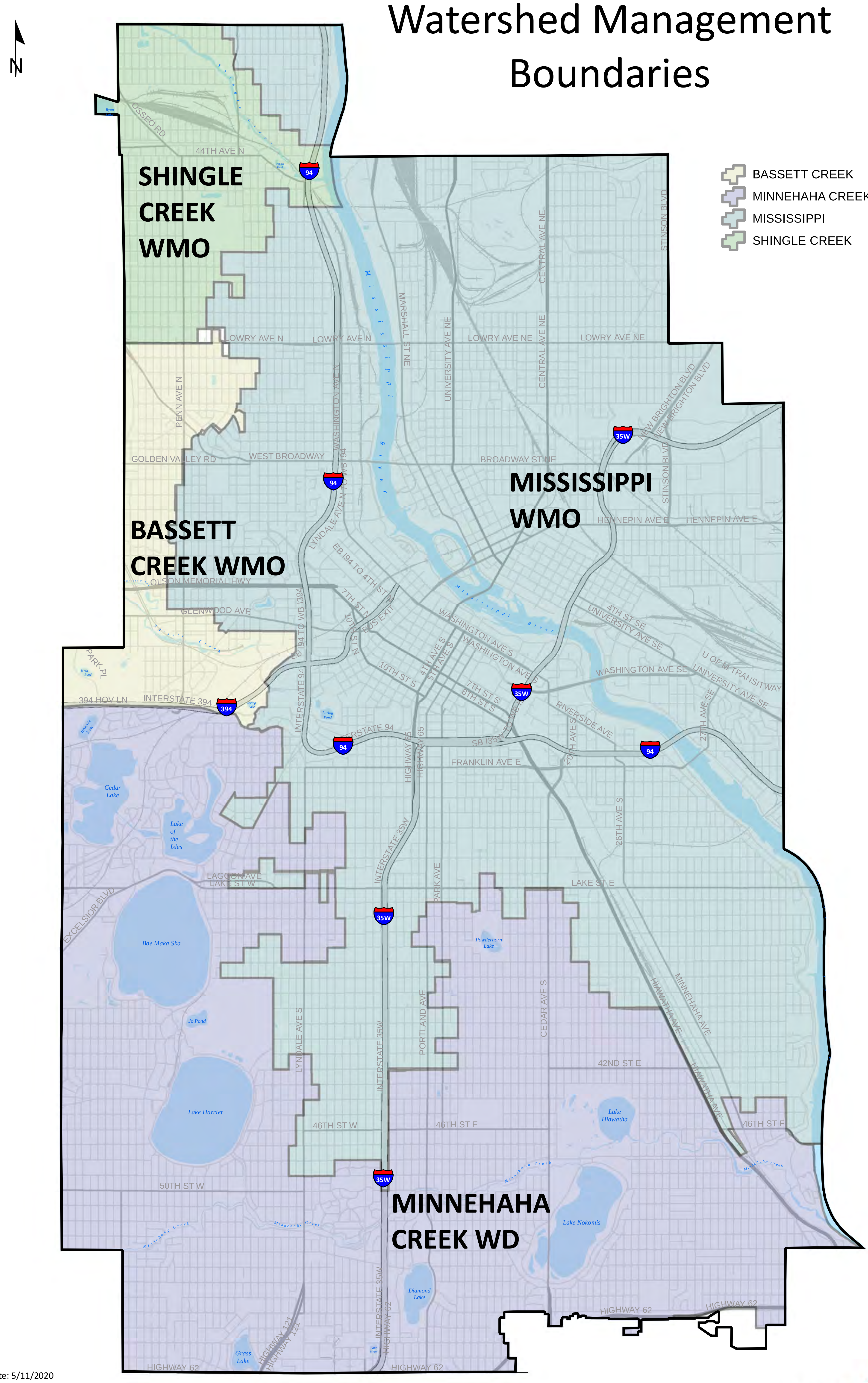
Date: 5/11/2020

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



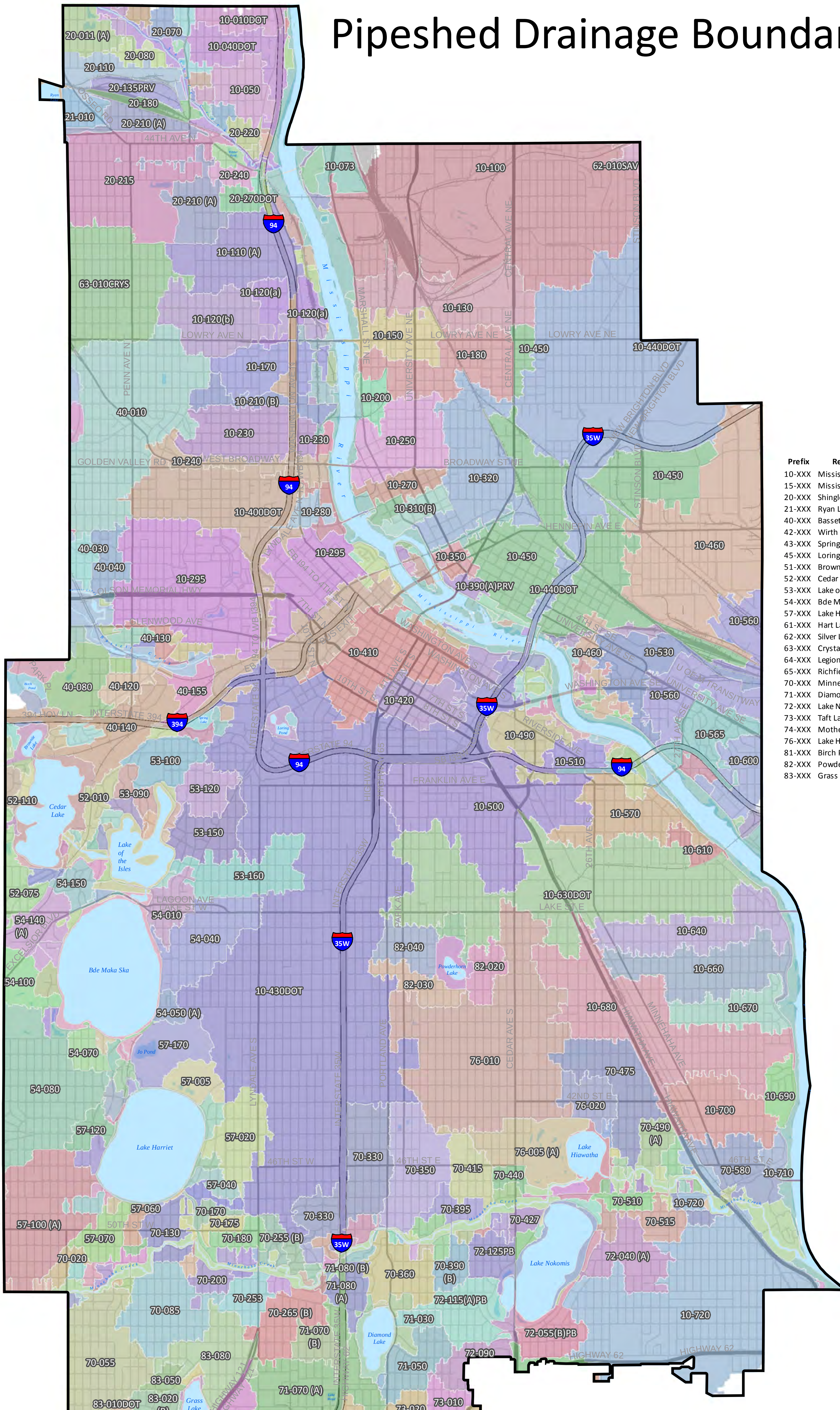
Date: 5/11/2020

Source: Board of Water and Soil Resources
Effective Date : 02-12-2020
Accessed : 05-06-2020

Appendix B2

Minneapolis Public Works

Pipeshed Drainage Boundaries



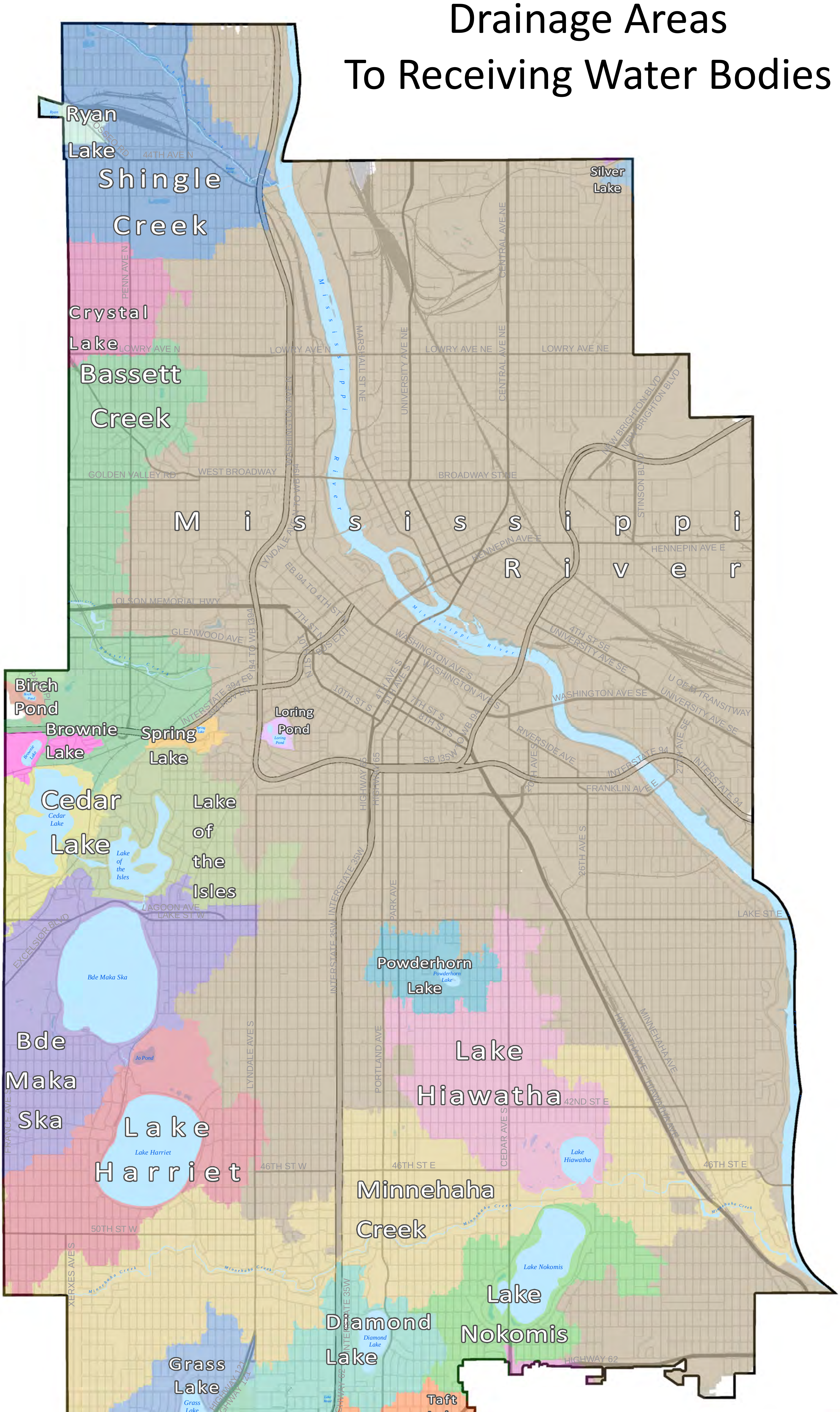
Prefix	Receiving Water
10-XXX	Mississippi River (Mpls)
15-XXX	Mississippi River (UofM)
20-XXX	Shingle Creek
21-XXX	Ryan Lake
40-XXX	Bassett Creek
42-XXX	Wirth Lake
43-XXX	Spring Lake
45-XXX	Loring Pond
51-XXX	Brownie Lake
52-XXX	Cedar Lake
53-XXX	Lake of the Isles
54-XXX	Bde Maka Ska
57-XXX	Lake Harriet
61-XXX	Hart Lake
62-XXX	Silver Lake
63-XXX	Crystal Lake
64-XXX	Legion Lake
65-XXX	Richfield Lake
70-XXX	Minnehaha Creek
71-XXX	Diamond Lake
72-XXX	Lake Nokomis
73-XXX	Taft Lake
74-XXX	Mother Lake
76-XXX	Lake Hiawatha
81-XXX	Birch Pond
82-XXX	Powderhorn Lake
83-XXX	Grass Lake

Date: 5/11/2020
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 05-07-2020; Accessed : 05-07-2020

Appendix B3

Minneapolis Public Works

Drainage Areas To Receiving Water Bodies

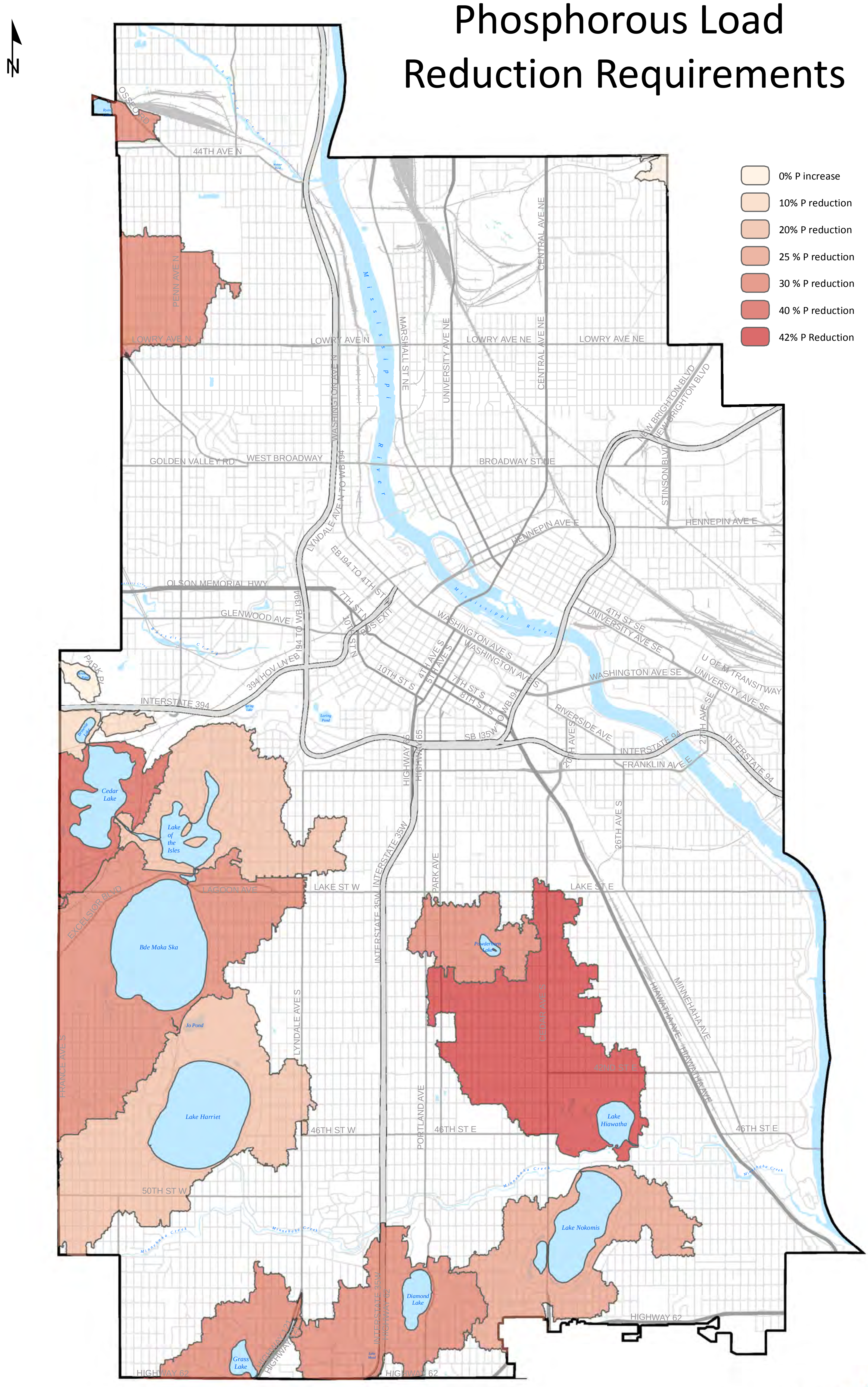


Date: 5/12/2020
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 05-07-2020; Accessed : 05-07-2020

Appendix B4

Minneapolis Public Works

Phosphorous Load Reduction Requirements

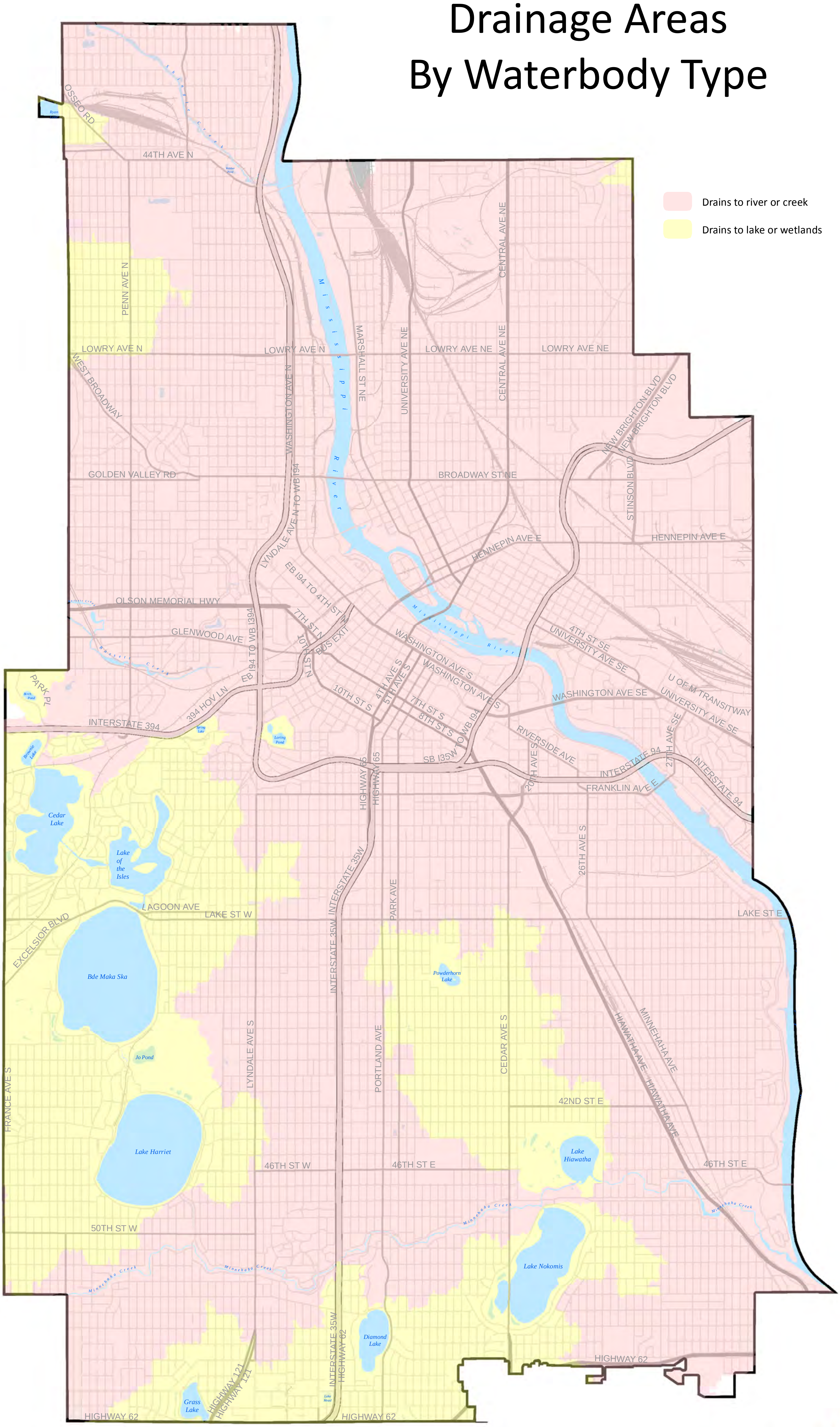


Date: 5/11/2020
Source: Minneapolis Public Works - Surface Water & Sewers

Appendix B5

Minneapolis Public Works

Drainage Areas By Waterbody Type

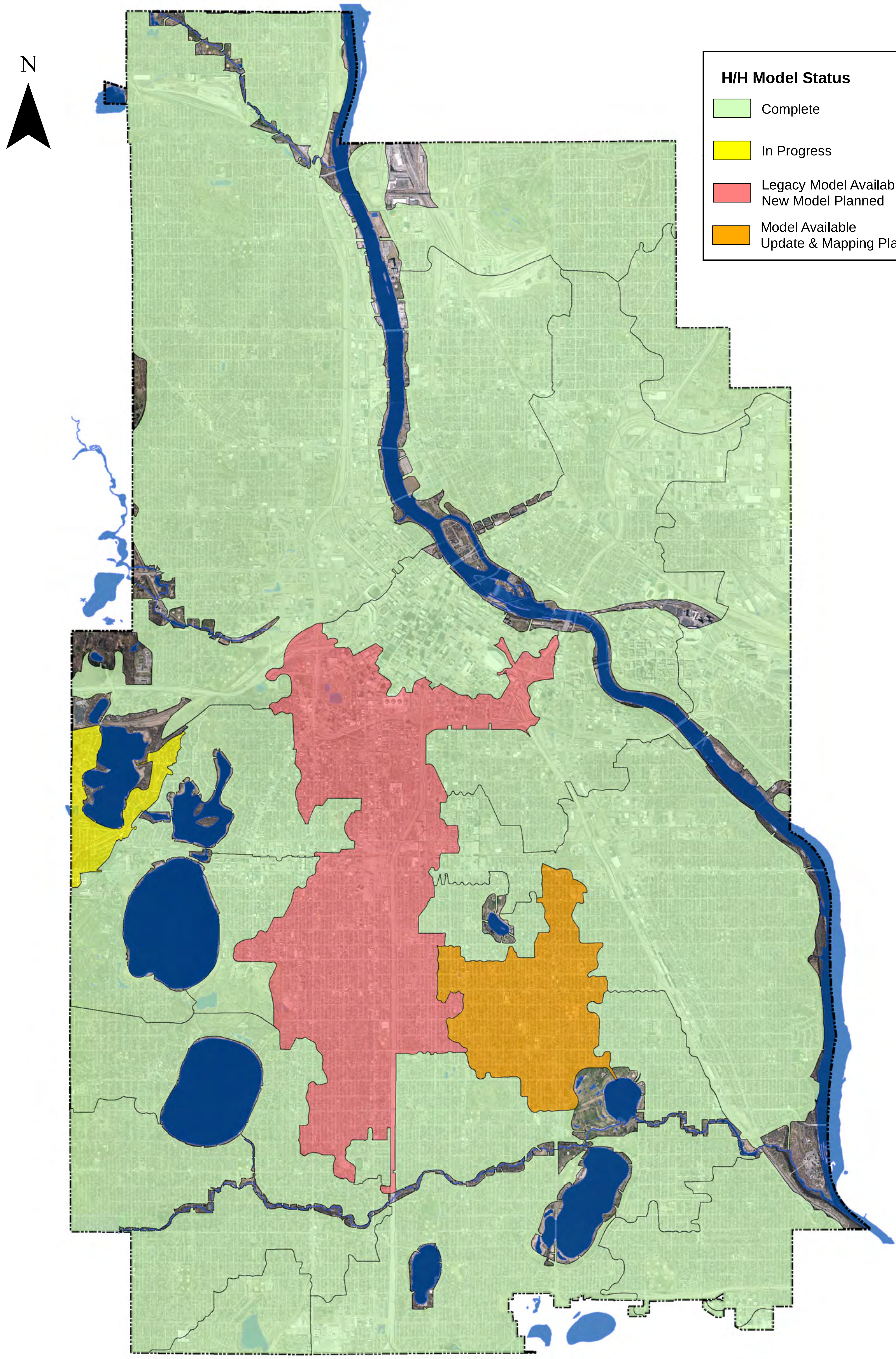


Date: 5/11/2020
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 05-07-2020; Accessed : 05-07-2020

Appendix B6

Minneapolis Public Works

Hydrologic / Hydraulic Storm Modeling Status



Document Path: M:\PWSWS\MODELS\RESOURCES\Hydraulic Modeling Status\2020_June_Model Status.mxd

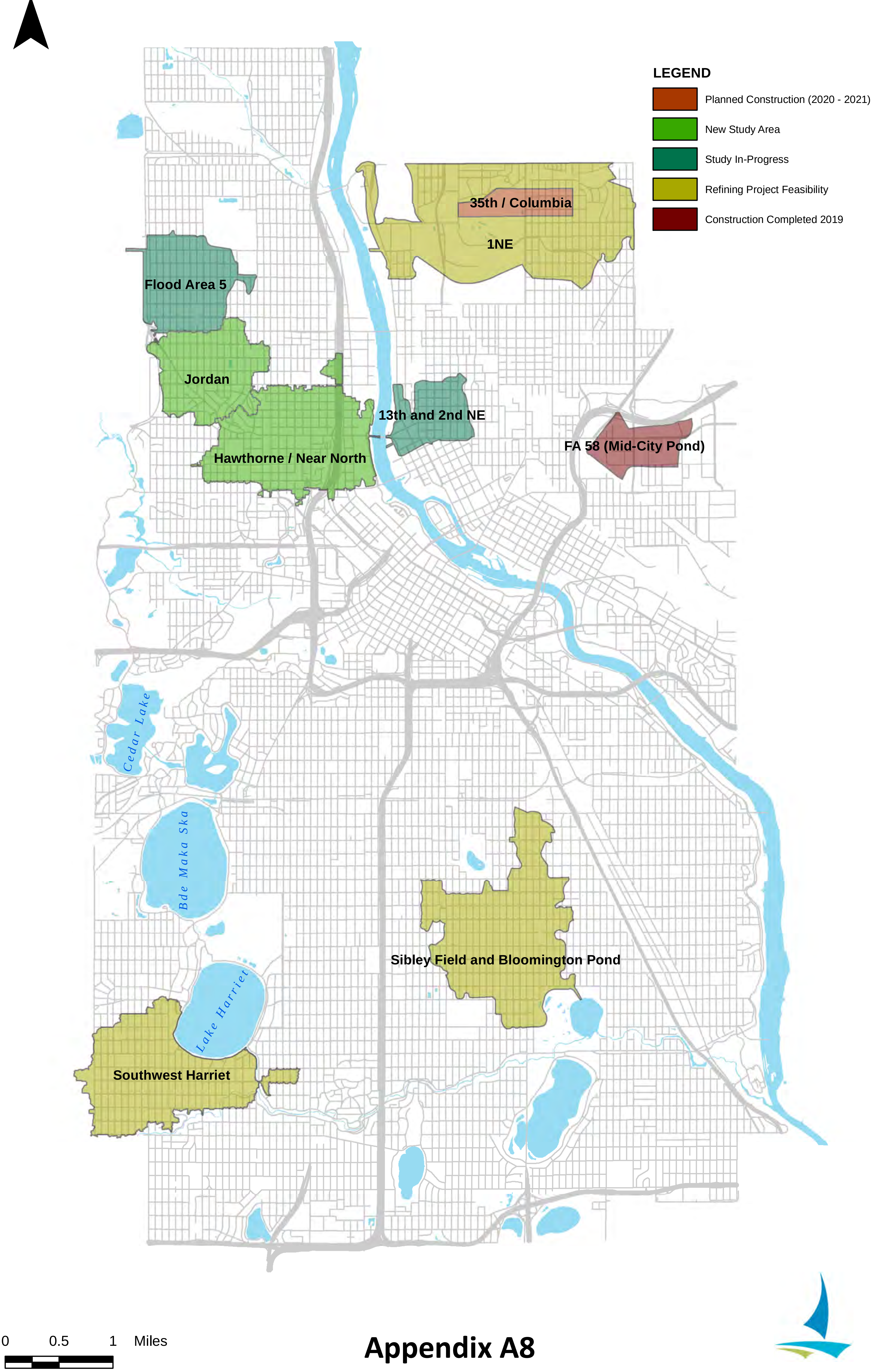
Appendix B7

Minneapolis
City of Lakes

Surface Water & Sewers Division
Regional Hydrologic / Hydraulic Model
June 2020 Project Status

4,200 2,100 0 4,200
Feet

Current Flood Mitigation Study Areas



Appendix A8

Appendix A

Minneapolis
City of Lakes

Bassett Creek Watershed Management Commission

March 4, 2020

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

RE: 2019 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 2019 this assessment was $35,805. Further, watershed commissioners representing Minneapolis and Minneapolis city staff participate in, guide, and help implement the programs of the BWCMC, including its public education program. In 2019, approximately 7% 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.

In 2019, the BCWMC performed or participated in the following education and outreach activities:

BCWMC Website - The BCWMC maintained its new user-friendly website in 2019 and maintained the information including latest news, contact list, meeting calendar, meeting materials, watershed plan, data, and projects. In 2019, there were approximately 4,978 unique users and 7,687 sessions.

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. In 2019, 103 classes totaling 2,681 students participated in Lesson 1 and 58 classes with 1,516 students also participated in Lesson 2. In all, 1,266 students in the Bassett Creek Watershed participated in these lessons in 2019.

Also in 2019 WMWA updated its "10 Things" brochure in cooperation with Hennepin County. This publication is used at tabling events and is offered at city brochure racks. It succinctly lists 10 actions average residents can take to improve waters in their community.

WMWA also participated in the Plymouth Kids Fest in August and interacted with hundreds of children and their parents about water quality and stormwater runoff.

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 displays an exhibit at the State Fair to educate the public about watersheds and its Adopt-a-Drain program. In 2019, the Clean Water Minnesota Media Campaign provided its members with monthly, 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 used these stories in social media and its website homepage. Find more information at www.cleanwatermn.org.

Participation in Community Events and Meetings – The BCWMC used its new educational display materials (including watershed map, banners, and bean bag toss game) and participated in the Golden Valley Arts and Music Festival (September 14th), the Golden Valley Sustainability Fair (September 20th), the annual meeting of Association of Medicine Lake Area Citizens, and at a restoration event at Westwood Nature Center. BCWMC volunteers talked with event participants, provided education on water resources, and gave away educational items like dog waste disposal bag dispensers, watershed maps, cups showing the amount of deicer needed for a certain space, native seeds, and written educational materials.

Bassett Creek Watershed 50th Anniversary Tour and Celebration – On June 27th, the BCWMC held a 50th anniversary event with a tour of watershed projects and an evening reception featuring keynote speaker Mark Seeley. Long time Commission Engineer, Len Kremer, gave a presentation on the history of the organization and its involvement in the large flood control project. Approximately 74 people attended the tour and/or celebration event including some city council members, residents, and multiple partners. A commemorative booklet was also produced that includes BCWMC history, accomplishments, priorities, and future goals.

Chloride Education – The BCWMC focused much effort on addressing over salting in 2019 including working with other partners in the Metro area who are concerned about over salting. BCWMC created information cards for residents to hand out at businesses that are applying too much salt. Approximately about 3,000 cards were handed out educating about smart salting practices. A companion website (saltsmart.info) was also created for residents and property managers to find more information about salt best management practices.

BCWMC produced a video on dressing right for winter weather that had a Facebook reach of 12,000 with over 7,000 views. 6,400 of those views were unique (not repeat) views.

On September 24th the BCWMC hosted a free "Smart Salting for Property Managers" certification training course. Approximately 15 people attended the course.

Four BCWMC guest column articles related to over salting were publishing in the Sun Post in 2019 (see below).

Partnership with Metro Blooms for Harrison Neighborhood Project – Since 2016, the BCWMC has partnered with and supported the Metro Blooms' Harrison Neighborhood Project. The project aims to engage residents, and commercial businesses, train youth, and install water quality practices in Minneapolis' Near North neighborhood. The BCWMC collaborates on grant-funded projects and offers its own financial support. Since 2016, these programs have resulted in engagement with and bioswale installations on 37 residential properties; participation by neighborhood residents at 4 community block parties; engagement with 11 commercial property owners about possible BMP installations; and training of 15 local sustainable landcare stewards.

Aquatic Invasive Species (AIS) Education – In 2019, the BCWMC received a Hennepin County AIS Prevention Grant to assist with AIS education and early detection. Lake-specific AIS identification and education cards were developed for 6 priority lakes in the watershed including Parkers, Lost, Northwood, Sweeney, Twin, and Medicine Lakes. These cards are intended for in-person dissemination among lake homeowners (neighbor to neighbor). The cards include photos and descriptions of key AIS that may enter the lake (or those that are already in the lake in the case of Medicine). The cards also include important information on a lake homeowner's personal responsibility in AIS prevention. As an example, the Medicine Lake card can be found here.

The BCWMC also facilitated an AIS Early Detection Training course at the Plymouth Library on July 23rd. Approximately 24 people attended the training from the BCWMC and surrounding watersheds.

Volunteer Monitoring Programs – The BCWMC entered agreements with the Metropolitan Council and Hennepin County to participate in the Citizen Assisted Monitoring Program (CAMP) and the River Watch Program, respectively. In 2019, volunteers collected data from 9 locations on lakes in the watershed. Through River Watch, students from the Nawayee Center School in Minneapolis collected data on Bassett Creek at Morgan Ave. Find the 2019 River Watch Report here.

Commissioner Training Sponsorship – The BCWMC reimbursed Commissioners for registration costs to attend the Minnesota Association of Watershed Districts Conference and Annual Meeting.

Creek Crossing Signs – In 2019, city partners installed creek signs at 6 locations including 3 in Plymouth and 3 in Golden Valley, bringing the total creek signs watershed-wide to 7 crossings.

Educational Guest Columns in Local Papers – Each month, the BCWMC education consultant, on the Commission's behalf, submitted an article related to water resources to the Sun Post local newspaper. The following articles were published in the online newspaper. Some of these appeared in printed versions as well.

January 2019: The Impact of Road Salt on Wildlife and Soil
March 2019: How to Stop the Cycle of Over Salting
May 2019: Celebrating 50 Years – The Formation of the BCMWC
July 2019: Who Takes Care of Our Lakes and Streams
August 2019: Please Don't Feed the Algae
September 2019: Smart Salting Training Course for Property Managers
December 2019: Smart Salting Education Program

Social Media – The BCWMC continued with weekly posts on its Facebook page. The BCWMC made 89 Facebook posts reaching 57,882 people and had 5,155 engagements. The page currently has 323 followers, which is a 32% increase from the previous year.

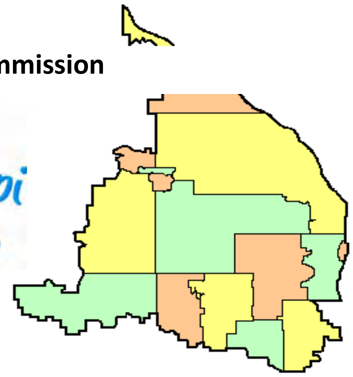
Financial Sponsorship for Organizations – The BCWMC financially sponsored the Children's Water Festival.

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



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Email: judie@jass.biz • Website: www.shinglecreek.org

National Pollutant Discharge Elimination System (NPDES) Phase Education and Public Outreach Program 2019 Annual Report II

The Shingle Creek and West Mississippi Watershed Management Commissions conducted education and public outreach activities in 2019 in fulfillment of their Third Generation Watershed Management Plan Watershed Education and Public Outreach Program goals.

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 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, and 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. 2019 was the sixth year of the program. Two persons 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.

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. 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.

Table 1. Watershed PREP Program participation growth.

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
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

Table 2. 2019 schools and students participating in Lesson 1: What is a Watershed?

Date	School	School District	City	Watershed	Classes	Students
2/28	Hassan	Elk River	Rogers	Elm	4	119
2/21	Lakeview Elementary	Robbinsdale	Robbinsdale	Shingle	3	62
3/25	Plymouth Creek	Wayzata	Plymouth	Bassett	4	110
3/27	Sunset Hill	Wayzata	Plymouth	Bassett	4	116
4/4	Neill Elementary	Robbinsdale	Crystal	Bassett	3	68
4/12	Gleason Lake	Wayzata	Plymouth	Minnehaha	4	92
4/30	Meadow Ridge Elementary	Wayzata	Plymouth	Elm	4	116
5/1	Meadow Ridge Elementary	Wayzata	Plymouth	Elm	2	58
5/3	Oakwood	Wayzata	Plymouth	Minnehaha	3	84
5/13&15	Kimberly Lane	Wayzata	Plymouth	Bassett	6	145
5/14	Zachary Lane Elementary	Robbinsdale	Plymouth	Bassett	4	96
4/30	Northport Elementary	Robbinsdale	Brooklyn Ctr	Shingle	2	45
5/14	Forest Elementary	Robbinsdale	Crystal	Shingle	3	83
5/21&22	Rush Creek	Osseo	Maple Grove	Elm	5	127
9/25	Noble Elementary	Robbinsdale	Golden Valley	Bassett	2	52
10/1	Rice Lake	Osseo	Maple Grove	Elm	3	73
10/3	Rice Lake	Osseo	Maple Grove	Elm	2	47
10/4	Rice Lake	Osseo	Maple Grove	Elm	2	46
10/9-10	Elm Creek Elementary	Osseo	Maple Grove	Elm	4	93
10/16/19	Monroe Elementary	Anoka-Henn	Brooklyn Park	W. Miss	4	112
10/23	FAIR Pilgrim Lane Magnet	Robbinsdale	Crystal	Shingle	1	24
10/24	SEA Magnet	Robbinsdale	Golden Valley	Bassett	3	84
10/30	Rogers	Elk River	Rogers	Elm	4	116
10/31	Palmer Lake	Osseo	Brooklyn Park	Shingle	3	70
11/4-5	Weaver Lake	Osseo	Maple Grove	Elm	4	118
11/11	Good Shepherd	Parochial	St. Louis Park	Bassett	2	33
11/15	Meadowbrook	Hopkins	Golden Valley	Bassett	2	55
11/19-20	Dayton	Anoka-Henn	Dayton	Elm	3	85
11/21-22	Oxbow Creek	Anoka-Henn	Champlin	W. Miss	7	191
11/25-26	Basswood	Osseo	Maple Grove	Elm	6	161
				Total	**103**	**2,681**

Table 3. 2019 schools and students participating in Lesson 2: The Incredible Journey

Date	School	School District		Watershed	Classes	Students
227	Hassan	Elk River	Rogers	Elm	4	118
2/6	Lakeview Elementary	Robbinsdale	Robbinsdale	Shingle	3	61
4/3	Neill Elementary	Robbinsdale	Crystal	Bassett	3	68
4/23&24	Rush Creek	Osseo	Maple Grove	Elm	5	127
29-Apr	Northport Elementary	Robbinsdale	Brooklyn Ctr	Shingle	2	46
5/7	Forest Elementary	Robbinsdale	Crystal	Shingle	3	84
9/30	Rice Lake	Osseo	Maple Grove	Elm	3	71
10/3	Rice Lake	Osseo	Maple Grove	Elm	2	47
10/7-8	Elm Creek	Osseo	Maple Grove	Elm	4	92
10/14-15	Basswood	Osseo	Maple Grove	Elm	6	175
10/22	Rogers	Elk River	Rogers	Elm	4	118
10/23	FAIR Pilgrim Lane Magnet	Robbinsdale	Crystal	Shingle	1	24
10/29	Palmer Lake	Osseo	Brooklyn Park	Shingle	3	68
11/6-7	Oxbow Creek	Anoka-Henn	Champlin	W. Miss	7	194
11/8	Meadowbrook	Hopkins	Golden Valley	Bassett	3	83
11/12	Meadowbrook	Hopkins	Golden Valley	Bassett	2	56
11/18-19	Dayton	Anoka-Henn	Dayton	Elm	3	84
				Total	**58**	**1,516**

Community Education and Outreach. The PREP educators provided outreach at three community and school events. Because of the nature of these events, it is difficult to keep a tally of the number of contacts made and citizens engaged. Events are detailed in Table 4.

Table 4. 2019 Watershed PREP community education and outreach participation

Date	Event	Location	Watershed	# of Attendees
4/27	Arbor Day Event	Maple Grove	EC/SC	62 children "planted" trees in the watershed
8/1	Plymouth Kids Fest	Plymouth	BC/EC/SC	4,000
11/12	Filmed Meadowbrook Program for video promotion			

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.

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
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.

Press Releases and Newspaper Articles
The Commissions received news media coverage of some of its projects in 2019:
- After the Shingle Creek Commission announced receipt of a federal grant, local cable access CCX Media did a story on the Crystal Lake Management Plan.
- MPR News did a story on lake alum treatments that featured the Bass Lake project in the Shingle Creek watershed.
- The Commissions distributed a press release announcing the receipt of an award from the Environmental Initiative for the Biochar enhanced Filters project. The project and award were featured in *Municipal Sewer and Water Magazine*, a national trade journal. It was also featured on the blog of the Biochar Project, a nonprofit in Australia.

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 2019 the site received over 3,105 visitors and over 9,900 pageviews. Most of the pageviews are to the meetings and project review pages, but there was significant traffic to the page dedicated to the biochar filters project (366 pageviews) and Twin Lake carp management page (305 pageviews).

Social Media. The Commission established a Facebook page in 2016. During 2019 there were 147 followers, 4,481 reaches and 7,492 impressions. A reach is logged when a timeline post is seen by an individual viewer, while impressions are the number of times a post was seen. Viewers were "engaged" 714 times. An engagement is a click to open a post, view a photo or video, make a comment, or click on a reaction emoji. Commission posts were "liked" 304 times, "shared" 53 times, 104 photos were opened and 14 comments were made.

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. The 2019 website activity is shown on the last page of this report.

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 project includes the additional benefit of creating habitat for pollinators. An agreement between Metro Blooms and the Shingle Creek Commission, as fiscal agent, to move the stormwater runoff.

Phase One of the project began with creation of a name, tag line and logo. 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 included a roll out of the Pledge campaign on the Metro Blooms and WMWA websites where citizens can enter the square footage of their new plantings, creation of a *Pledge to Plant* banner for events, and a social media campaign that began in 2016. The campaign was promoted at the State Fair and other 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 but the median pledge covers 250 square feet. Most of the Pledges come 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 and at events Educators attended in 2019. Pledges were not tallied in 2019.

Pledge campaign materials will be included in the 2020 Metro Bloom workshop handouts.

<u>Rain Garden Workshops</u>
The Commissions partnered with WMWA to sponsor three Rain Garden workshops through Metro Blooms in 2019. 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. In 2019 Metro Blooms offered Creating Resilient Yard workshops providing an overview of Minnesota's changing weather patterns and ways to mitigate the impact in your own yard. The presenters offered recommendations for individual properties and options for establishing mowable, native alternatives to "grass" turf, raingarden basics, and other resilient yard practices. Attendees also received one-on-one design assistance from landscape professionals and Master Gardeners. The locations and number of participants are shown in Table 5.

Table 5. 2019 Rain garden workshop locations and participation.

Location	Date	No. Participants

Champlin – Champlin City Hall	April 4	16
Crystal partnering w/Golden Valley, New Hope, Robbinsdale–Crystal Community Ctr	May 9	38
Plymouth – St Barnabas Church	May 2	37

Shingle Creek Cleanup

The 18th Annual Great Shingle Creek Cleanup was held the week of April 21-27, 2019. Each city sponsored its own cleanup, which could be a special event or simply a request that the existing Adopt-a-Park volunteers schedule their spring cleanup during that week.

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. Only one lake, Meadow Lake in New Hope, was monitored by volunteers in 2019.

Streams. Routine stream macroinvertebrate monitoring in both watersheds is conducted by volunteers through Hennepin County's River Watch 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 River Watch protocols to collect physical, chemical, and biological data to help determine the health of streams in the watershed. Two sites on Shingle Creek were monitored in 2019 – the long-term (24 years) site next to Park Center High School in Brooklyn Park, monitored by students from Park Center High School; and a site at Webber Park Falls in Minneapolis, monitored by students from Avail Academy in Fridley.

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 macroinvertebrates and vegetation. In 2019, BP-5 Brookdale Park in Brooklyn Park and CR-1 Wetland 639W in Crystal were monitored in the Shingle Creek watershed. The sites in the West Mississippi watershed were the BP-1 Environmental Preserve wetlands and BP-7 Zane Sports Park, both in Brooklyn Park.

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:

WMWA

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 the Freshwater Society, Hennepin County Environment and Energy, and Three Rivers Park District. The Mississippi WMO also participates but is not a formal member. 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 is also available on the WMWA website.

Other Partnerships

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;
- BlueThumb, 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.

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:

Staff Presentations

- 2018 Annual Water Quality Monitoring report findings
- Biochar- and Iron-Enhanced Sand Filter Project update and final report
- Twin Lake Carp Management Project update
- 2019 Lake and Stream Monitoring update
- SRP Reduction Project update and results
- FEMA Flood Modeling update
- FEMA Flood Modeling amendment
- Becker Park updates
- Bass and Pomerleau Alum Treatment preliminary results
- Connections II introduction
- River Park project introduction

Guest Speakers

Representatives from Metro Blooms presented Phase II of their proposed 5-year stormwater retrofit project for the Autumn Ridge Apartments in Brooklyn Park. The residents were seeking a second Shingle Creek Partnership Cost Share Grant to help fund the project. Representatives from Metro Blooms returned later in the year to present the progress achieved in Phase II.

Other

- The Commission made contributions to fund the annual Road Salt Symposium presented by Fortin Consulting and the Water Summit sponsored by the Freshwater Society.
- Shingle Creek Commission made application for an Environmental Initiative Award in the category, Environmental Innovation, that recognizes “a partnership working on the next environmental breakthrough.” The application was for the Biochar- and Iron-Enhanced Sand Filter project. The Commission received an Honorable Mention.
- Consideration of an Enhanced Street Sweeper as a capital project on the CIP.

Evaluation:

No specific evaluation of this programming has been completed

Public Works Department
Surface Water & Sewers Division
309 2nd Ave S - Room 300
Minneapolis, MN 55401
www.minneapolismn.gov

No comments were received on the SWMP or 2019 Annual Report.

CITY OF MINNEAPOLIS

Public Works - Street Maintenance Division

Standard Operating Procedure for Vehicle Related Spills (VRS)

May 13, 2020

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)
     Rick Jorgensen: 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 WATER BODY
(within Minneapolis City Limits)

Surface Water	Area (acres)	Impervious %	Population 2010	Single Family / Duplex %	Multi Family %	Inst. %	Comm. %	Ind. %	R.O.W. %	Golf Course %	Park, Rec., or Preserve %	Rail %	Airport %	Open Water %
Bassett Creek	1,621.2	40.6%	15,766	43.1%	1.2%	3.5%	2.1%	3.9%	24.2%	0.0%	20.4%	1.6%	0.0%	0.0%
Bde Maka Ska	1,250.2	45.3%	14,482	34.9%	8.7%	1.7%	5.9%	0.1%	20.6%	4.7%	15.6%	0.0%	0.0%	0.0%
Birch Pond	38.8	10.3%	4	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	99.9%	0.0%	0.0%	0.0%
Brownie Lake	93.9	40.3%	321	30.9%	0.0%	0.0%	28.6%	0.0%	18.6%	0.0%	18.2%	3.1%	0.0%	0.6%
Cedar Lake	287.8	31.5%	1,853	38.0%	1.1%	2.2%	0.4%	0.0%	18.6%	0.1%	37.8%	0.7%	0.0%	1.3%
Crystal Lake	420.9	41.7%	5,728	62.0%	1.7%	2.6%	0.7%	0.0%	30.3%	0.0%	2.7%	0.0%	0.0%	0.0%
Diamond Lake	663.7	47.8%	6,291	45.6%	4.0%	2.2%	3.6%	7.9%	27.8%	0.0%	8.9%	0.0%	0.0%	0.0%
Grass Lake	324.7	43.3%	2,707	59.0%	0.1%	3.2%	2.3%	0.0%	29.9%	0.0%	4.9%	0.0%	0.0%	0.6%
Hart Lake	3.3	51.2%	21	24.8%	0.0%	0.0%	19.2%	0.0%	52.7%	0.0%	0.0%	3.3%	0.0%	0.0%
Lake Harriet	1,120.5	38.6%	9,867	46.6%	1.8%	2.8%	1.5%	0.0%	20.2%	0.0%	26.1%	0.0%	0.0%	1.1%
Lake Hiawatha	1,243.4	42.9%	16,515	49.8%	2.9%	2.9%	2.0%	0.0%	26.9%	10.4%	5.1%	0.0%	0.0%	0.0%
Lake Nokomis	695.8	35.1%	5,776	47.7%	0.1%	2.1%	0.4%	0.0%	22.9%	0.0%	26.6%	0.0%	0.0%	0.2%
Lake of the Isles	769.8	44.5%	11,516	42.6%	10.0%	2.3%	3.2%	0.3%	23.8%	0.0%	17.5%	0.0%	0.0%	0.3%
Legion Lake	2.1	43.0%	23	60.5%	0.0%	0.0%	0.0%	0.0%	39.5%	0.0%	0.0%	0.0%	0.0%	0.0%
Loring Pond	27.2	16.2%	36	0.0%	3.1%	3.5%	0.1%	0.0%	1.3%	0.0%	91.5%	0.0%	0.0%	0.5%
Minnehaha Creek	3,347.4	38.6%	32,559	53.0%	0.8%	3.2%	1.5%	0.2%	24.2%	0.7%	15.9%	0.0%	0.0%	0.0%
Mississippi River	20,313.0	57.7%	237,734	29.2%	6.0%	6.5%	6.1%	12.0%	28.8%	1.5%	7.8%	2.5%	0.1%	0.1%
Mother Lake	30.5	45.4%	112	25.3%	0.0%	1.5%	0.1%	0.0%	63.9%	0.0%	0.0%	0.0%	9.2%	0.0%
Powderhorn Lake	322.7	43.5%	6,483	44.3%	5.7%	3.7%	1.6%	0.0%	27.1%	0.0%	17.5%	0.0%	0.0%	0.1%
Richfield Lake	57.6	65.0%	356	27.2%	3.4%	1.0%	27.7%	0.1%	40.6%	0.0%	0.0%	0.0%	0.0%	0.0%
Ryan Lake	60.6	42.3%	506	50.3%	0.0%	0.0%	0.0%	10.0%	28.3%	0.0%	2.2%	8.8%	0.0%	0.5%
Shingle Creek	1,457.7	44.7%	11,571	40.5%	1.2%	2.3%	1.1%	8.8%	19.9%	1.2%	22.2%	3.8%	0.0%	0.3%
Silver Lake	25.0	41.2%	206	66.1%	3.4%	0.0%	2.2%	0.0%	28.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Spring Lake	50.0	32.6%	208	40.2%	0.3%	6.4%	0.0%	0.0%	15.7%	0.0%	37.1%	0.0%	0.0%	0.2%
Taft Lake	138.9	45.1%	1,228	57.6%	0.0%	0.0%	0.0%	0.0%	42.1%	0.0%	0.2%	0.0%	0.0%	0.0%
Wirth Lake	40.6	6.1%	25	0.2%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	99.6%	0.0%	0.0%	0.0%
Grand Total	**34,407.3**	**50.9%**	**381,894**	**36.2%**	**4.6%**	**4.9%**	**4.5%**	**7.8%**	**26.7%**	**1.6%**	**11.7%**	**1.7%**	**0.0%**	**0.2%**

Stormwater Retrofit Plan

Introduction/background

The City of Minneapolis developed this retrofit plan to address stormwater quality from existing development. While new development and redevelopment are required to manage stormwater on-site, older developments may have been constructed before stormwater management was required or modern criteria were established. Retrofitting existing unmanaged or inadequately managed stormwater runoff will help the City improve water quality in lakes, creeks, wetlands, and the Mississippi River.

Retrofits include new installations or upgrades to existing Best Management Practices (BMPs) in developed areas where there is a lack of adequate stormwater treatment. Stormwater retrofit goals may include, among other things, the correction of prior design or performance deficiencies, flood mitigation, disconnecting impervious areas, improving recharge and infiltration performance, addressing pollutants of concern, demonstrating new technologies and supporting stream restoration activities.

This retrofit plan is required under the City's 2018 NPDES MS4 permit, which states in Part III.C.6.i:

i. Retrofit plan

(1) Develop a retrofit plan to evaluate the ability to implement structural stormwater BMPs in areas of the Permittee's jurisdiction that currently do not have stormwater runoff treatment or where existing structural stormwater BMPs could be enhanced to improve pollutant removal capability. The Permittee must submit the retrofit plan to the Agency for review and approval within 24 months of receiving permit coverage. Once approved by the Agency, the retrofit plan will become an enforceable part of the SWMP.

(2) At a minimum, the retrofit plan must include a discussion of the following:

(a) Retrofits on lands the Permittee owns, including public parcels of land or public right-of-way areas for implementation of structural stormwater BMPs.

(b) Developing strategies to encourage privately owned parcels to install stormwater retrofits to reduce and/or treat stormwater runoff from privately owned impervious surfaces.

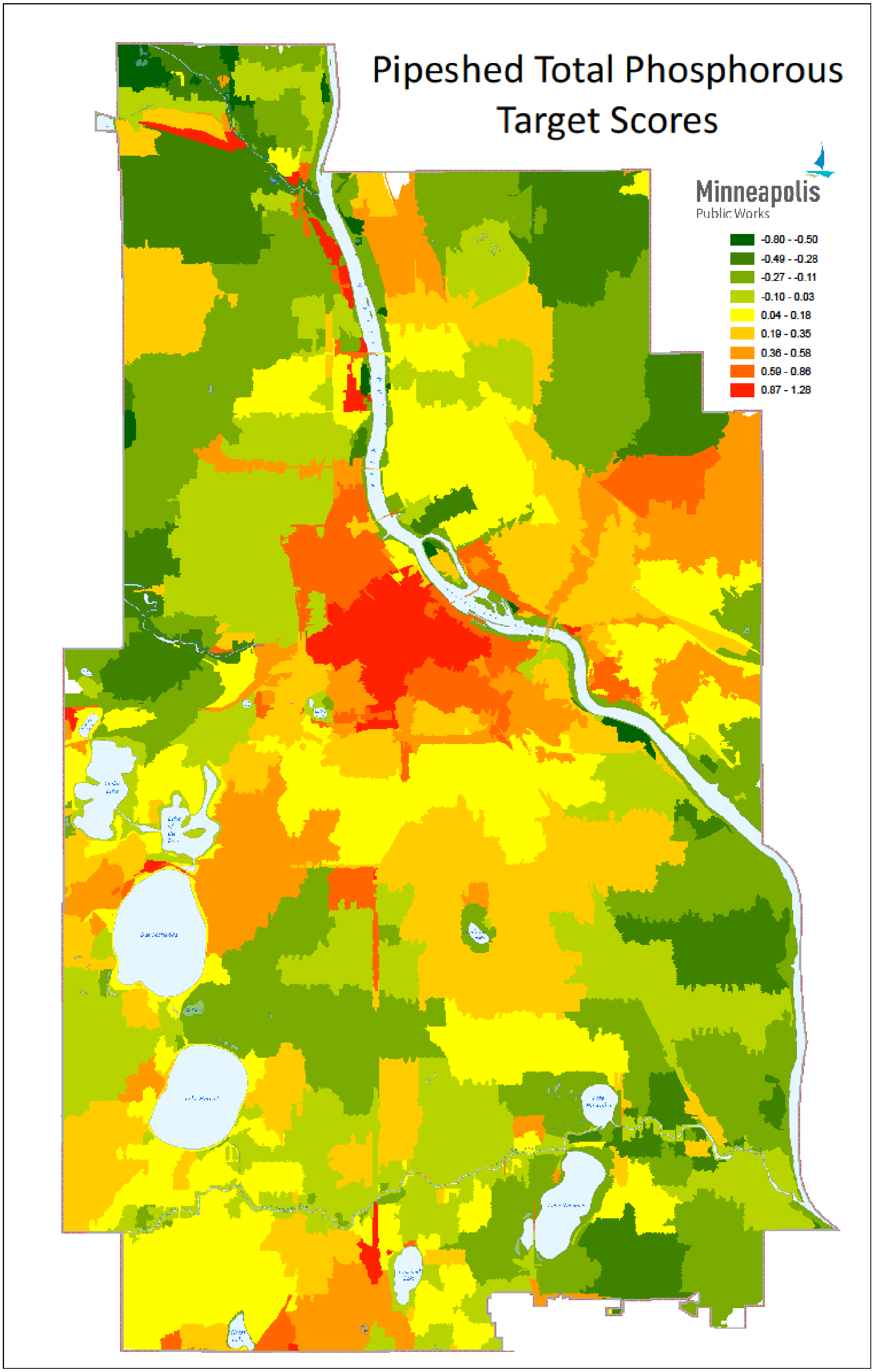
The City has developed several tools and programs to identify and implement retrofit projects, including completion of the water quality model, ongoing city-wide flood modeling, development of a prioritization tool, and use of the tool to add water quality and water resource protection to infrastructure projects.

Water Quality Model

The City developed a GIS based water quality model that estimates TP and TSS loads from pipesheds. The model uses impervious area through land use and water quality BMPs to determine loads for each pipeshed. The City continually updates the data in the model to more accurately assess loads and treatment, including adding new or modified structural BMPs and performing quality control review on existing BMPs and the pipe network. The results of the water quality model are used for stormwater quantity, quality, and comprehensive planning.

The TP loads are compared to the allowed concentrations in the receiving waterbody to determine the pipeshed phosphorus target score. This metric is the parameter from the water quality model used in the comprehensive stormwater prioritization. This metric is used as one of the factors to develop the water quality prioritization tool.

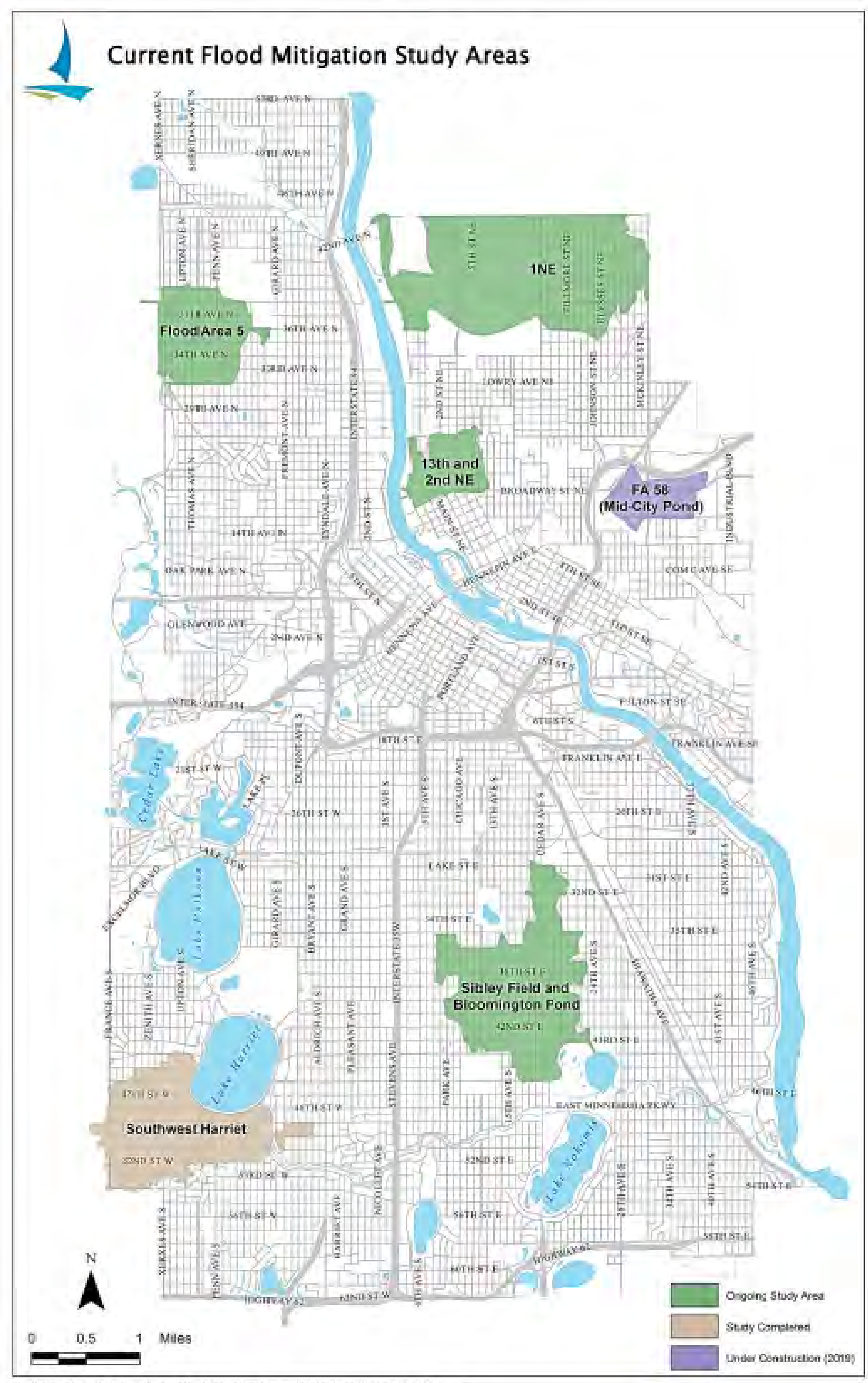
Figure 1: The factor calculated as the TP load compared to the receiving waterbody allowed concentration



Flood Modeling

Hydrologic and hydraulic modeling has been completed for most of the City. The modeling identifies structures at risk of flooding in various design storms and can be used to model specific storms. The number of structures that flood is used to identify specific areas and pipesheds where flood risks are the greatest. The City uses this information to prioritize comprehensive stormwater assessment studies, and to inform flood mitigation needs for other City infrastructure projects. The comprehensive stormwater studies consider water quality and green infrastructure solutions as part of the study recommendations. The City recently completed studies for the areas shown on the following map.

Figure 2: Flood Study Areas – Studies in progress or completed

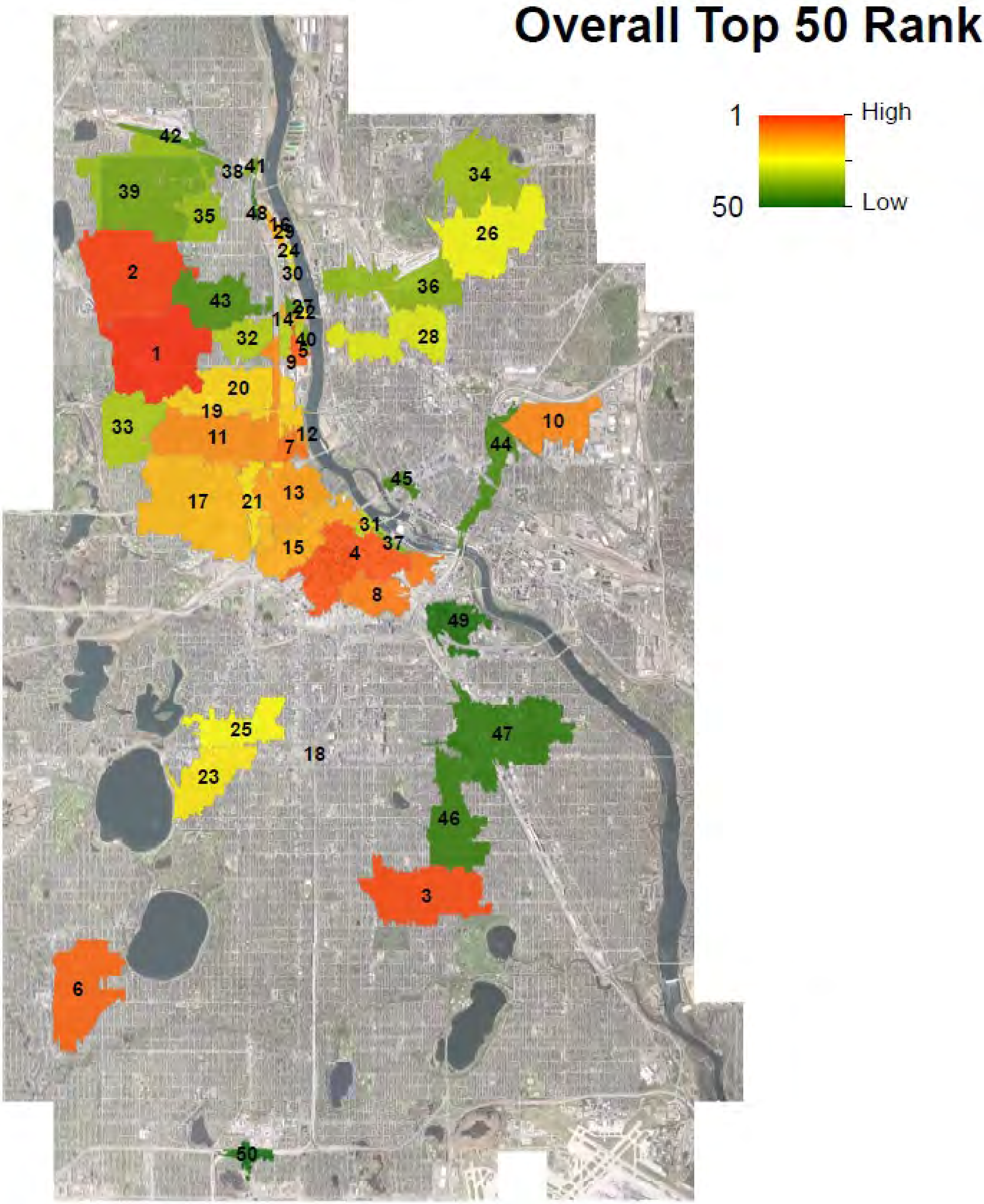


Comprehensive Stormwater Studies

Comprehensive stormwater studies are being conducted throughout the City to find locations where projects can provide multiple benefits related to flood reduction, water quality, and infrastructure condition. Studies areas are prioritized based on flood modeling, water quality modeling, asset management, planned road construction, and Racially Concentrated Areas of Poverty (RCAP). The next comprehensive stormwater study area encompasses five adjacent pipesheds in north Minneapolis. Water quality improvements will be recommended as a part of these studies.

The areas where comprehensive stormwater studies are conducted will not be studied separately as part of the water quality pipeshed studies described later in this retrofit plan. Recommendations from the comprehensive stormwater studies may be included in the water quality CIP selection and funding decisions described later in this retrofit plan. Stormwater facilities constructed from results of the comprehensive stormwater studies will be incorporated into the water quality model.

Figure 3: 50 Highest ranked Comprehensive Stormwater Study pipesheds



Stormwater Infrastructure Condition Assessments and Asset Management

The City is in the process of assessing the condition of stormwater pipes and conveyance structures. This assessment involves inspection using CCTV. The City has completed the majority of stormwater manholes, and much of the accessible sections of pipe. The asset management program uses risk-based approach by quantifying the Likelihood of Failure (LOF) and Consequence of Failure (COF) for each asset. Risk (ROF) is calculated by multiplying LOF and COF to rank each element. Elements of the system scored with the highest COF and ROF are evaluated for increased assessment and design needs. The highest LOF and ROF scores are also used to determine repairs and upgrades where other city infrastructure projects are planned.

Prioritization Tool

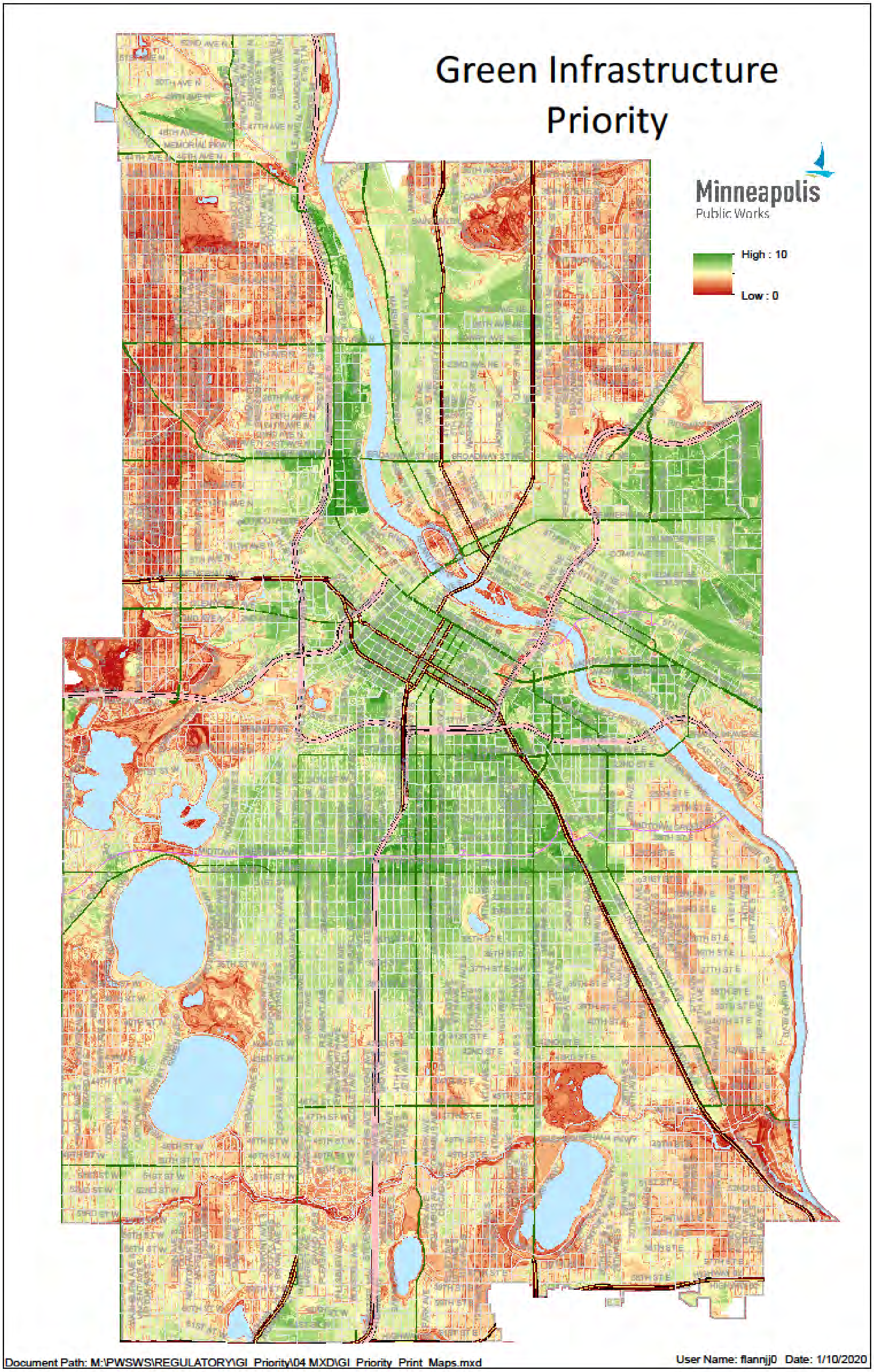
The City created the prioritization tool to identify areas of the city where green infrastructure improvements and water quality studies should be funded. The intent of the tool is to determine which areas of the city provide a more cost-effective opportunity relative to other parts of the city. The tool is a planning level tool, not intended to replace design.

Use

The prioritization tool is being used for short, medium, and long-term assessment of funding for water quality projects. The tool is being used to:

- Short: Assess other infrastructure projects to add water quality improvements
- Medium: Select water quality study areas
- Long: Rank potential projects for CIP planning

Figure 4: Green Infrastructure Prioritization Map



SHORT-TERM

The most common short-term use of the tool is on street improvement projects. The extent of the street reconstruction is compared to the tool to determine the priority. Where the priority is high (green), the City adds water quality improvements with a goal of one-inch of runoff over the impervious portion of the drainage area and the minimum treatment is 0.55-inches of runoff over the impervious portion of the reconstructed ROW area. Where the priority is medium (yellow), the goal is to provide stormwater management for 0.55-inches over impervious areas, and the minimum treatment is to provide vegetated stormwater management practices. The medium areas help to gain experience meeting future requirements that may be implemented with changes to the City's stormwater ordinance. Where the priority is low (red), impervious conversion to pervious and native plantings is the goal, and strategic opportunities for stormwater management are considered, but not using an established goal. Due to the nature of long, linear street projects, each project may have some portions in a spectrum of priorities, and the goals along the corridor as grouped to reflect the differences in priority.

MEDIUM-TERM

The City conducts pipeshed or area studies to identify stormwater solutions. These studies have largely been focused on flooding issues where water quality improvements are considered. The prioritization tool is used to identify pipesheds or areas to conduct studies where the focus is water quality. The first round of pipeshed studies for water quality retrofit is being conducted on pipesheds draining to impaired waterbodies on 'typical' representations of the city. More specific portions of the city, such as downtown and heavy industrial areas, will be included in future rounds of pipeshed studies. These areas are still considered for other evaluations, including studies on vegetation success and salt application, but will be studied for retrofit opportunities once the process has been better defined. The initial pipeshed studies will be used to determine methods to expand citywide analysis and data needs and to streamline future TMDL responses.

LONG-TERM

The tool will be used to identify capital improvement projects and to inform other city infrastructure projects were combined efforts can realize cost savings. As the City identifies projects, the prioritization tool can be used to rank the projects and assign to future years according to available funding. CIP planning is conducted annually, so as project priorities shift, the tool can continue to feed into the selected projects.

Parameters

The tool utilizes factors that determine the impact of water quality improvements and the suitability of the area to construct water quality improvements. These factors are weighted and combined to create the prioritization tool, which is a map that shows the high priority areas in green and the low priority areas in red. The combined factors are intended to reflect the most cost-effective parts of the city to retrofit existing development.

As new and updated sources of data become available, the tool will be updated to reflect the changes. The tool is intended to change as the city changes and will be used both at the individual project level, and at the long-range capital improvement planning level. The factors used to create the current version of the tool are described as follows. The combined suitability and impact equally influence the prioritization. The individual factors are weighted within their group.

SUITABILITY

The suitability group of factors reflect conditions that allow for structural BMPs, specifically infiltration practices. The factors rely mostly on soil conditions and consist of:

Factor	Source	Weight
Estimated soil infiltration rate	US Web Soil Survey; MNGS Hennepin County Geologic Atlas	30%
Depth to bedrock	MNGS Hennepin County Geologic Atlas	10%
Depth to groundwater	MN DNR	10%
Karst prone areas	MN DNR	15%

Slope	MN DNR LiDAR	25%
Wellhead protection areas	MN Department of Health	10%

Additional data that the City will incorporate as it becomes available include:

- Soil mapping and infiltration potential – while soil information is included, it is largely classified as urban soil. The City has other sources of soil information that are not in a format that can easily be added to this prioritization. The City also supports efforts to better define and map urban soils data.
- Hotspot sources
- Soil or groundwater contamination

IMPACT

The impact group of factors reflect the need and benefit of providing water quality and green infrastructure improvements. These factors are largely based on data from the water quality model and include the City's metric to consider environmental equity for culturally and economically disadvantaged populations.

Factor	Source	Weight
Sub-watershed TP load	Minneapolis Water Quality Model	20%
Pipeshed TP target score	Minneapolis Water Quality Model and Lake Hiawatha TMDL	30%
BMP drainage area TP treatment	Minneapolis Water Quality Model	20%
Distance to parks	City of Minneapolis and MPRB	10%
Racially concentrated areas of poverty	US Census 2010	20%

Additional data that the City will incorporate as it becomes available include:

- Available land – this includes parcels owned by government agencies that may be under-utilized.
- Land use – the model currently accounts for land use types.
- Future development – portions of the city are subject to more development by private entities, that may fall under the City's stormwater ordinance, so provide stormwater improvements. The City's 2040 plan is expected to increase impervious and density, so areas where more up-zoning is expected to occur may require more city intervention
- Climate change – the City continues to experience record stormwater and temperature impacts due to climate change. These impacts do not follow the developed predictions used
- TMDLs – as TMDLs are implemented, the TP target score will be adjusted and a determination made to decide whether a TMDL weighting factor should be added to the prioritization tool.

Citywide stormwater quality retrofit plan

The City uses the prioritization tool to select water quality retrofit opportunities. The opportunities come from studies to identify stand-alone projects, and from coordination with other city infrastructure projects. The stand-alone projects and coordinated infrastructure projects will be assessed annually as part of the stormwater capital project plan.

1. Project opportunity identification
    a. Existing stormwater facility modifications
    b. Available space identification
    c. Pipeshed studies
    d. TMDL requirements
2. Annual project selection
    a. Infrastructure coordination assessment
    b. CIP selection based on funding and priority

Existing stormwater facility modifications

The City operates several stormwater facilities throughout the City. Some of the facilities were constructed to provide stormwater quantity control and could be modified to provide water quality treatment. Modifying existing stormwater facilities can provide a cost-effective water quality treatment option with limited disruption to the surrounding development. The following table summarizes the City's inventory of existing stormwater facilities. This does not include facilities that are in design or construction in 2020.

Facility type	Number of facilities
Grit chamber	159
Wet pond	18
Surge basin	3
Detention basin	6

The City has started evaluating the stormwater modification potential through a survey of 18 of the City's facilities. The City is also in the process of designing modification of another facility to provide water quality treatment.

- Stormwater facility modification potential study – 18 facilities
- Stormwater facility modification design – 1 facility with approximately 20 acres of drainage area
- Grit chamber evaluation – evaluate downstream conditions for existing stormwater facilities and opportunities to create new stormwater facilities.

Available space investigations

One of the most challenging aspects of retrofitting developed urban areas is finding space to construct stormwater management facilities. In Minneapolis, this is further complicated with the significant flooding issues experienced from climate change, topography, and the condition of the conveyance system. The City does own and manage land in the city. Additionally, the MPRB has extensive tracts of land throughout the city. The main types of available land for retrofit opportunities consist of:

- Right of way (ROW)
- MRRB land
- City-owned parcels

Redevelopment projects provide further opportunities to improve water quality, and these are managed by the City through the City's stormwater ordinance.

Private parcels still make up the majority of the City. The City encourages voluntary retrofit and water quality treatment on private parcels through the stormwater utility credit program. This program accepts applications to reduce the stormwater utility fee on a property through installation of stormwater management devices.

The City does not have a formal program for public private partnerships or regional treatment planning; however, both of these options may be considered through proposals and as identified in pipeshed studies.

ROW analysis

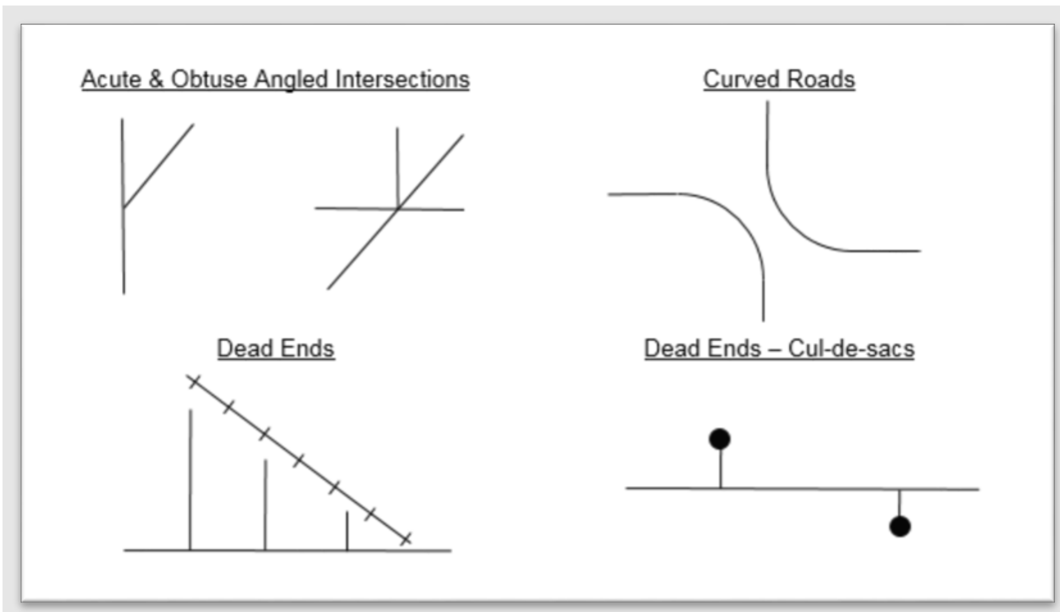
The City manages the right of way (ROW), which consists of about a quarter of the City's land. The ROW is mostly impervious and required to function for transportation purposes. The main pervious portion of the ROW consists of slighted raised or crowned turf grass or trees under grates.

EXCESS IMPERVIOUS

Past development of the ROW resulted in larger than necessary impervious surfaces. Modern designs often result in road diets or a reduction in the width of impervious and vehicle travel areas. Additionally, the ROW typically collects runoff from adjacent areas, so receives and conveys most of the City's stormwater. The combination of stormwater collection and impervious reduction results in the opportunity to provide green infrastructure through small distributed facilities that mimic natural hydrology. Where impervious conversion to stormwater management or habitat enhancements occur in conjunction with planned infrastructure, cost savings through multiple program goals can be achieved.

The City conducted an GIS assessment of the City's right of way to identify excess impervious areas. The areas are mapped and ranked. Road projects and other infrastructure projects can be compared to these opportunity areas. The areas are also included in the pipeshed studies to quickly identify available spaces for potential stormwater treatment. The searches conducted consist of[1]:

- *Acute & Obtuse Angled Intersections:* Intersections that meet at angles that are not 90 degrees (see diagram below). Such intersections often have unused impervious space that can be converted into a BMP or at least removed and turned into green space.
- *Dead Ends:* Streets and alleys that dead end may be ideal candidates for BMPs or impervious surface removal. Dead end streets also include former intersections that have been closed and turned into 90-degree curves (see diagram).
- *Wide Roads:* Minor streets with curb to curb widths that are larger than necessary may be candidates for impervious surface removal.
- *Medians:* Streets throughout the city with medians have space that could be converted into a BMP or have impervious surface removed.
- *Unpaved Alleys:* The City has a program to pave alleys that are not. This program may also be expanded to address alleys in poor condition with stormwater improvement needs.
- *Alleys with VCP and poor condition:* The City surveys the condition of roads and alleys. The condition of alleys was compared to alleys with VCP (vitrified clay pipe), which is being replaced.



The searches resulted in the quantities in the following table. The angled intersections and dead ends were manually evaluated to filter for errors in the geoprocessing.

Impervious opportunities	Results
Angled intersections	330 intersections
Dead ends	202 ends
Curved roads	60 points
Medians	12 miles
Wide roads	162 miles
Unpaved alleys	74 alleys
Alleys with VCP	10 alleys

[1] M:\PWSWS\REGULATORY\GI_Priority\BMP_Potential

BOULEVARD ENHANCEMENTS

The space between the sidewalk and the curb, or boulevard, provides opportunities for stormwater management and habitat enhancement. The boulevard's location next to the gutter and downgradient of the sidewalk and parcel development is conveniently located for collecting and treating stormwater. The ROW has competing demands, and the City has safety and aesthetic goals for the city that include reducing vehicle travel lanes and adding buffers between travel modes (cars, bikes, and pedestrians). While these areas provide opportunities for stormwater management, they also provide opportunities for impervious reduction and habitat improvement. The City is working on stormwater runoff reduction through two programs:

- <u>Blooming boulevards</u>: The City sponsors the blooming boulevards program, which funds outreach and conversion of typical planted areas between the sidewalk and curb (boulevard) to enhance the vegetation and lower the ground to allow water to drain across the planted area.
- <u>Boulevard vegetation restoration standards</u>: The City has started changing how the boulevards are planted. In 2015 the City passed a resolution[2] encouraging pollinator plantings throughout the city. The City is in the process of developing new boulevard restoration options through the Transportation Action Plan (TAP) design guidelines for road projects that would allow and standardize native and pollinator plants.

MPRB coordination

The Minneapolis Park and Recreation Board (MPRB) is a co-permittee with the City of Minneapolis on their shared NPDES MS4 Phase I permit. The MPRB and the City are jointly responsible for ensuring that the permit requirements are met.

The MPRB owns, operates, and manages the designated park land within the City. This includes regional parks, neighborhood parks, and "parklets" as well as parkways and trail corridors. The MPRB conducts park modifications through its master planning process and the MPRB maintains the city's street trees and is working on increasing the amount and diversity of the city's tree canopy. The MPRB is committed to improving environmental habitat through vegetation enhancements and stormwater management.

In 2019 the MPRB began drafting their Comprehensive Plan entitled "Parks for All". As part of the Plan development the MPRB has established numerous workgroups to delve into various topic areas such as Art, Culture, and History, Climate Resilience, Public Health, Gentrification, and Water Resources. Both the Climate Resilience and Water Resources work groups have begun incorporating ideas for integrating water quality and flood management practices into future park planning. There is a strong drive to ensure that as parks are redeveloped they meet multiple needs and incorporate stacked, layered benefits for the community. This plan is expected to be completed and adopted by the MPRB Board in early 2021 and the plan will guide how the City and the MPRB will collaborate on water quality and flood related projects within the parks, on parkways, and through shoreline and streambank stabilization projects.

City-owned parcel analysis

The City owns and operates parcels throughout the City. The parcels are either for city operations or parcels for redevelopment. The operations parcels include office and maintenance facilities as well as stormwater management facilities. These parcels are evaluated for stormwater management retrofit site analysis and pollution prevention. The parcels containing stormwater management facilities are evaluated for retrofit opportunities as previously described. The redevelopment parcels are owned by Community Planning and Economic Development (CPED) and consist mainly of single-family parcels. The number of CPED parcels varies and may have future development plans. The City-owned parcels have been identified and are considered during pipeshed studies.

Pipeshed studies

The City selects pipesheds to study for stormwater modifications within three categories. The pipesheds are selected based on the prioritization tools developed. The pipeshed studies for retrofit opportunities are being conducted through water quality focus; however, the City also considers water quality improvement opportunities through its comprehensive stormwater studies and through flood mitigation studies. The comprehensive stormwater studies prioritization uses the *Pipeshed TP Target Score* parameter described above.

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[2] http://www.minneapolismn.gov/sustainability/policies/minneapolis-pollinator-resolution

- Water quality pipesheds
- Comprehensive stormwater studies
- Flood area studies

The water quality pipeshed studies will vary in the level of detail reviewed to identify potential opportunities. The schedule for pipeshed studies follows:

- Phase 1: Two pilot pipeshed studies to identify opportunities, develop the process, and identify different levels of studies. The pipesheds will be selected using the prioritization tool and to reflect more typical development conditions. The downtown and industrial areas of the city with high priority will be evaluated in later rounds to benefit from lessons learned.
- Phase 2: Pilot pipeshed study to coincide with impairment monitoring and assessment
- Phase 3: Select pipesheds to perform detailed analysis and initiate citywide data collection needs.
- Phase 4: Evaluate lower priority pipesheds using broader analysis. The broader analysis is initially expected to focus on available space results. Future broader analysis studies may focus on other factors, determined from lessons learned through more detailed pipeshed studies.
- Phase 5: Identify waterbodies for targeted pipeshed studies. The waterbodies will be selected based on impairments and TMDL requirements.

Phases 4 and 5 will be continuously conducted to address citywide retrofit needs.

TMDL requirements

The City's TMDLs include the following waterbodies and associated pollutants:

Waterbody name	Pollutant of concern	Type of WLA
Shingle Creek; Lower Shingle Creek Watershed	Nitrogenous biochemical oxygen demand	Categorical
Shingle Creek; Upper Shingle Creek Watershed	Nitrogenous biochemical oxygen demand	Categorical
Lake Nokomis	Phosphorus	Individual
Wirth Lake	Phosphorus	Categorical
Silver Lake	Phosphorus	Categorical
Crystal Lake	Phosphorus	Categorical
Ryan Lake	Phosphorus	Categorical
Shingle Creek	Chloride	Categorical
Lake Hiawatha	Phosphorus	Individual
Minnehaha Creek; Lake Minnetonka to Mississippi River	Escherichia coli	Categorical
Powderhorn	Chloride	Categorical
Silver	Chloride	Categorical
Minnehaha Creek	Chloride	Categorical
Spring	Chloride	Categorical
Diamond	Chloride	Categorical

Waterbody name	Pollutant of concern	Type of WLA
Bassett Creek	Chloride	Categorical
Wirth	Chloride	Categorical
Brownie	Chloride	Categorical
Loring (South Bay)	Chloride	Categorical
Bassett Creek Medicine Lake to Mississippi River	E. coli	Categorical
Shingle Creek Eagle Creek/Bass Creek to Mississippi River	E. coli	Categorical
Mississippi River	TSS	Categorical

The TMDLs that identify stormwater management facilities as part of the mitigation requirements consist of the Lake Nokomis and Lake Hiawatha TMDLs, which applies to the those two lakesheds and to the direct drainage areas to Minnehaha Creek, which drains to Lake Hiawatha. The City expects the pending Lake Pepin TMDL to govern the nutrient and sediment impairment needs and will adjust as further guidance is issued.

The specific projects identified to address these TMDLs can be found in the ***MS4 TMDL Assessment*** that was submitted to the MPCA in November 2018.

Private parcel retrofit

The City encourages retrofit of existing development through its stormwater fee reduction program. This program allows private entities to apply for a reduction in their stormwater utility fee through implementation of stormwater retrofit facilities.

The City's stormwater ordinance currently requires new and redevelopment to meet stormwater standards, including water quality treatment. The City is updating the stormwater ordinance to strengthen the stormwater requirements.

As opportunities are identified through pipeshed studies, the City will pursue retrofit and maintenance agreements on parcels with owners of the properties. The most common types of properties include:

- Other government properties:
    - Schools
    - Government offices and maintenance facilities
- Non-profit organizations: environmental groups, churches
- Industrial parcels: these often have large amounts of impervious that are used sporadically.

Stream and shoreline restoration

The City of Minneapolis is home to a 12-mile reach of the Mississippi River, three creeks, and 17 lakes, ponds, and wetlands. These waterbodies are impacted by urbanization in the city. With the increase in stormwater runoff rate and runoff volume that is a symptom of increased impervious surface these natural waterbodies can be degraded and subject to erosion. Repairing and restoring the shorelines and banks of these waterbodies have a measurable effect on water quality.

Bassett, Minnehaha, and Shingle Creeks flow through highly developed areas where there is limited space for a vegetated buffer between the creeks and the adjacent impervious surfaces. This environment increases the potential for streambank erosion and associated negative water quality impacts. All three of the watershed management organizations (WMOs) have identified stream restoration as a cost effective and simple best management practice for minimizing the amount of sediment, phosphorus, and e Coli that are transported downstream.

Much of the land directly adjacent to the creeks is owned and managed by the MPRB. In 2005, the MPRB conducted an Erosion Site Survey that identified numerous problem areas along Bassett Creek and Shingle Creek through Golden Valley, Robbinsdale, and Minneapolis. The problems include degraded vegetative diversity and invasive species, areas of active bank erosion, and deposition of sediments.

MPRB staff completed the inventory by walking the length of the creeks and identifying, locating, and documenting sites of significant bank erosion and sediment deposition, as well as the presence of obstructions, storm sewer outlet structures, and other utilities within the stream channel. Documentation included location of the site on aerial photographs, notes on the details of each site, and a digital photograph of each site. The inventory includes estimates of the extent of erosion measured as a percent of the entire bank. Each site was classified as minor (less than 25%), moderate (25 – 50%), or severe (more than 50%). Typically, the causes of erosion were related to the following:

- heavy foot traffic resulting in surface runoff across exposed slopes, steep slopes, or shaded slopes,
- storm sewer outfalls discharging above the normal water level of the creek,
- incising of the stream channel and cut bank formation due to elevated flow rates.

In response to this erosion survey, the Bassett Creek Watershed Management Commission (BCWMC), in partnership with the City of Minneapolis and the MPRB, has performed stream restoration projects along multiple reaches of the Main Stem of Bassett Creek. In addition, there is an upcoming project scheduled for a reach of Bassett Creek between Glenwood Avenue and the entrance of the new Bassett Creek Tunnel.

The goals of the stream stabilization project include:

- Stabilize eroding banks to improve water quality.
- Preserve natural beauty along the creeks and contribute to the natural habitat and species diversification by planting eroded areas with native vegetation.
- Prevent future channel erosion along the creeks and the resultant negative water quality impact of such erosion on downstream water bodies.

There are a variety of techniques that can be used to stabilize streambanks. These include:

- Riprap: Riprap (also called stone toe protection) is used to protect the toe of the stream bank. In-stream riprap typically consists of cobble-sized rock (six inches to 12 inches in diameter). The riprap is keyed into the streambed and extends up the bank to approximately the bankfull level elevation. The bankfull level is the elevation of the water in the channel during a 1.5-year return frequency runoff event. In some cases, this level may be below the top of the stream bank. Riprap is typically used in conjunction with planting of the upper banks to provide full bank protection. Riprap is especially effective in heavily shaded areas, where it is difficult to establish vegetation.
- Root Wads: Root wads are constructed from root balls with sections of their tree trunks attached. Removed trees will be salvaged for their use as root wads. The tree trunks are buried into the bottom of the stream bank, with the root wad end sticking out into the stream. Supporting footer logs and boulders are often used to stabilize the root wads.
- Biologs: Biologs are natural fiber rolls made from coir fiber that are laid along the toe of the stream bank slope to stabilize the toe of the stream bank. Biologs 10 – 22 inches in diameter are typically used. Because they are made of natural fiber, vegetation can grow on the biologs. When needed, grading of the stream bank slope above the biolog is used to create a more stable slope (2:1 to 3:1).

- J-Vanes: J-vanes (also called rock vanes) are constructed of boulders embedded into the creek bottom. The vanes are embedded in the stream bank and are oriented upstream to direct the flow away from that bank. J-vanes typically occupy no more than one-third of the channel width.
- Live Stakes: Live stakes are dormant stem cuttings, typically willow and dogwood species. They are collected and installed during the dormant season (late fall to early spring) and grow new roots and leaves, quickly and cheaply establishing woody vegetation on a stream bank. The willows and dogwoods grow into stands that provide long lasting bank protection.
- Live Fascines: Live fascines also use dormant willow and dogwood cuttings installed during the dormant season. In this case, the cuttings are bundled together and planted in a row parallel to the stream flow. They can be effective in reducing sheet erosion along a slope because a portion of the fascine extends above the ground surface.
- Site Grading: In many places, the eroding bank will be graded to a 3:1 slope. This provides a stable slope that will not naturally slough, and it provides a surface that is flat enough on which vegetation can be planted or seeded.

Many of these same techniques can be used to stabilize the riverbanks and lakeshores within the city. The Mississippi Watershed Management Organization (MWMO) has developed a guidance document to help restore the natural landscape of the Mississippi River Critical Area as it passes through an urbanized Minneapolis corridor. Traditional riverbank stabilization methods used have focused on hard armoring practices such as riprap and block, void of any vegetation when installed. The bioengineered practices laid out in the MWMO guide prioritizes restoration that will resolve near bank erosion issues and improve aquatic and terrestrial habitat within a corridor that has become so fragmented. That guidance document can be found here: https://www.mwmo.org/wp-content/uploads/2017/11/Part-II_Installation_Manual_20171117.pdf

The City of Minneapolis, the MPRB, and the Minnehaha Creek Watershed District are working collaboratively to address erosion issues along Minnehaha Creek. This collaborative effort is being guided by a Memorandum of Understanding between the three partners. That document can be found here: http://lims.minneapolismn.gov/File/2017-00430

Other analysis

As the City develops its stormwater CIP plan, additional analysis may be incorporated into the opportunity analyses. An example of another type of analysis to identify opportunities is using the water quality model to search for points in the model where the combination of high pollutant loads combined with shallow stormwater pipes exists.

Annual project selection

The City documents stormwater retrofit opportunities in a GIS based map that tracks the facilities through construction. After the facilities are built and accepted, they are transferred to the maintenance tracking database. The opportunities database includes facilities recommended through the analyses described in this document as well as facilities recommended by external partners, including community groups, other government agencies, and private developers. The City selects water quality improvement projects through two main channels, consisting of coordination with other infrastructure projects and analysis of documented stormwater opportunities.

a. Infrastructure coordination assessment – The Green Infrastructure Prioritization map is used by other infrastructure project managers to identify overlap with their projects. Further explanation of this process is in the *Prioritization Tool* section of this plan.
b. CIP selection based on funding and priority – The map will be used annually in conjunction with other datasets to inform CIP spending and select projects.

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

Selection of Management Strategies

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

Posting of Plant Protectant Applications

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

By Palmisano

Designating the utility rates for water, sewer, stormwater, solid waste, and recycling service effective with water meters read on and after January 1, 2019.

Resolved by The City Council of The City of Minneapolis:

Water Rate
Effective with utility billings for water meters read from and after January 1, 2019, the meter rates for water are hereby fixed and shall be collected as follows:

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

1. Three dollars and sixty-three cents ($3.63) per one hundred (100) cubic feet for customers not otherwise mentioned.

2. Three dollars and seventy-eight cents ($3.78) 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	$ 5.00
3/4-inch	7.50
1-inch	12.50
1 1/2-inch	25.00
2-inch	40.00
3-inch	80.00
4-inch	125.00
6-inch	250.00
8-inch	400.00
10-inch	575.00
12-inch	1,650.00

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:

   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)

The sanitary sewer rates and stormwater service rate shall be applied to utility billings for water meters read from and after January 1, 2019.

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 four dollars and twenty-one cents ($4.21) 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	$ 5.80
3/4-inch	8.70
1-inch	14.50
1 1/2-inch	29.00
2-inch	46.40
3-inch	92.80
4-inch	145.00
6-inch	290.00
8-inch	464.00
10-inch	667.00
12-inch	1,914.00

3. The sanitary sewer rate applicable outside the City of Minneapolis for all sewage flow generated is four dollars and twenty-one cents ($4.21) 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-one dollars and six cents ($31.06) 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.

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 thirteen dollars and nine cents ($13.09). 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 (3) 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 sixteen dollars and thirty-six cents ($16.36).

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 at thirteen dollars and nine cents ($13.09).

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 nine dollars and eighty-two cents ($9.82).

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 $ 13.09 = Monthly Fee

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

Land Use	Coefficient Applied
Bar-Rest.-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 and Recycling Rate

Solid waste and recycling variable rate charges associated with water meter read dates from and after January 1, 2019, the charges shall be as follows:

1. The base unit charge shall be twenty-four dollars and fifty-three cents ($24.53) 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	$15.89
Medium	1.00 ESU	$12.71
Low	.75 ESU	$ 9.27

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 can not 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 City of Minneapolis Stormwater Fee website . If you need additional information, please contact (612) 673-2965.

Last updated Mar 3, 2015

2019 Grit Chamber Data

370 Yearly total - Yards Vac'd 461.40

Grit ID	Location	Number of Inspections	Route	Date Inspected	Inspector	Estimated Volume In Cu. Yds.	Floatables Y/N	Cleaning Required Y/N	Maintenance Crew Leader	Volume Of Sediment Removed	Date Cleaned	Maintenance Comments
1	UPTON AVE N & 53RD AVE N	1	N	6/14/19	LJ	0.0	Y	Y	LJ	2	6/14/19	
		2										
2	UPTON AVE N & 53RD AVE N	1	N	4/8/19	LJ	1.0	N	N	LJ	1	4/8/19	
		2										
3	SHERIDAN AVE N, N OF 52ND AVE N	1	N								4/9/19	
		2	N	4/26/20	LJ	3.0			LJ		4/26/19	
4	RUSSELL AVE N NORTH OF 52ND AVE N	1	N	4/1/19	LJ	1.0	N	Y	LJ	1	4/1/19	
		2										
5	PENN AVE N & 52ND AVE N	1	N	4/1/19	LJ	1.0	N	Y	LJ	1	4/1/19	
		2										
6	PENN AVE N & 52ND AVE N	1	N	4/8/19	LJ	1.0	N	N	LJ	1	4/8/19	
		2										
7	OLIVER AVE N & 52ND AVE N	1	N	4/3/19	LJ	1.0	N	Y	LJ	1	4/3/19	
		2										
8	NEWTON AVE N & SHINGLE CREEK	1	N	6/10/19	LJ	1.0	N	Y	LJ	2	6/10/19	
		2										
9	OLIVER AVE N & 51ST AVE N	1	N	4/3/19	LJ	1.0	N	N	LJ	1	4/3/19	
		2										
10	MORGAN AVE N & 51ST AVE N	1	N	4/1/19	LJ	1.0	N	Y	LJ	1	4/1/19	
		2										
11	KNOX AVE N & 51ST AVE N	1	N	9/4/19	LJ	4.0	Y	Y	LJ	3	9/4/19	
		2										
12	KNOX AVE N & 50TH AVE N	1	N	4/4/19	LJ	9.0	Y	Y	LJ	8	4/5/19	
		2										
13	IRVING AVE N & 50TH AVE N	1	N	4/3/19	LJ	1.0	N	N	LJ	1	4/3/19	
		2										
14	JAMES AVE N, NORTH OF 49TH AVE N	1	N	4/1/19	LJ	1.0	N	Y	LJ	1	4/1/19	
		2										
15	21ST AVE N & 1ST ST N	1	N	11/2/19	MA	12.0			MA	12	11/2/19	
		2										
16	XERXES AVE N & 14TH AVE N	1	N	11/18/19	ZL	16.0			ZL	16	11/18/19	
		2										
17	XERXES AVE N & GLENWOOD AVE	1	N	6/12/19	LJ	4.0	Y	Y	LJ	2	6/13/19	
		2										
18	MORGAN AVE N & CHESNUT AVE	1	N	6/21/19	LJ	4.0	Y	Y	LJ	4	6/21/19	
		2										

2019 Grit Chamber Data

19	GIRARD AVE NO & CURRIE AVE NO	1	N	12/9/19		25.0				25	12/9/19	
		2	N	11/18/19		25.0				25	11/18/19	
20	BRIDAL VEIL TUNNEL OUTLET	1	E	10/4/19	LJ	2.0	Y	N	LJ	1	10/4/19	
		2										
21	LAKE OF THE ISLES PKWY & LOGAN AVE	1	SW	7/25/19	JM	8.0			JM	8	7/25/19	
		2										
22	W 22ND ST & JAMES AVE S	1	SW	6/5/19	JM	5.0			JM	5	6/5/19	
		2										
23	YARD SUMPS, 26TH & HIAWATHA	1	S									No record found? Ours where?
		2										
24	DREW AVE S & W LAKE ST	1	SW							5.00	5/21/19	
		2										
25	EXCELSIOR BLVD & MARKET PL	1	SW						JM	12	6/13/19	
		2										
26	W LAKE ST & ALDRICH AVE S	1	SW		JM	2.0			JM	2	6/19/19	
		2										
27	W 32ND ST & BRYANT AVE S	1	SW						LS	6.00	11/29/19	
		2										
28	W 33RD ST & HOLMES AVE S	1	SW							6.00	7/17/19	
		2										
29	W 33RD ST & GIRARD AVE S	1	SW							11.00	7/30/19	
		2										
30	YORK AVE S & W LAKE CALHOUN PARKWAY	1	SW						JM	1	7/12/19	No meter reading but actuals, past reading of 1
		2										
31	CHOWEN AVE S & W 41ST ST	1	SW									Water to high - No meter reading , no actuals, past 12 yrds
		2										
32	E 42ND ST & BLOOMINGTON AVE S	1	S						ZL	8	11/7/19	No meter reading but logs for WO 265312
		2								10	11/8/19	
33	E 43RD ST & PARK AVE S	1	SW								11/22/19	No meter reading associated with the asset No maximo? what is MX 285459?
		2										
34	W 44TH ST & LAKE HARRIET PARKWAY	1	SW								10/17/19	No meter reading - log says could not do due to high water
		2										
35	E 44TH ST & OAKLAND AVE S	1	SW	6/5/19		0.0			JM	2	6/5/19	Check MX 265988 historic (2020) 2 yrds
		2										
36	E 46TH ST & 31ST AVE S	1	S	10/16/19	JM	1.5			JM	1.50	10/16/19	
		2										
37	46TH AVE S & GODFREY RD	1	S	7/10/19	JM	0.0			JM	0.00	7/10/19	meter reading of 0
		2										
38	W 47TH ST & YORK AVE S	1	SW	5/15/19	JM	0.0			JM	0.00	5/15/19	meter reading of 0
		2										
39	W 47TH ST & WASHBURN AVE S	1	SW									No record - This is in the Storm MH layer not GC. that means no metering. Is it a GC?
		2									10/17/20	Julie says water is too high to do
40	W 47TH ST & LAKE HARRIET PARKWAY	1	SW									Water to high - No meter reading , no actuals
		2										

2019 Grit Chamber Data

41	W 48TH ST & YORK AVE S	1	SW						JM	1	5/15/19	Actuals but no meter reading associated with asset
		2										
42	QUEEN AVE S & LAKE HARRIET PARKWAY	1	SW	7/23/19	JM	0.0			JM	0.00	7/23/19	meter reading of 0
		2										
43	16TH AVE S & E MINNEHAHA PKWY	1	SW	4/4/19	JM	0.0			JM	0.00	4/4/19	meter reading of 0
		2										
44	SHERIDAN AVE S & W 50TH ST	1	SW	6/14/2019	JM	0.0			JM	0.00	6/14/2019	meter reading of 0
		2										
45	JAMES AVE S & MINNEHAHA CREEK	1	SW									Julie says cannot do due to high water
		2										
46	MORGAN AVE S & W 53RD ST	1	SW	10/18/19	JM	12.0			JM	12.00	10/18/19	
		2										
47	E 55TH ST & PORTLAND AVE S	1	SW	6/28/19	JM	2.0			JM	2.00	6/28/19	
		2										
48	E 56TH ST & PORTLAND AVE S	1	SW	9/5/19	JM	10.0			JM	10.00	9/5/19	
		2										
49	E 57TH ST & PORTLAND AVE S	1	SW						JM	3	9/1019	
		2										
50	E 57TH ST & PORTLAND AVE S	1	SW	9/25/19		2.5				2.50	9/25/19	
		2										
51	GIRARD AVE S BETWEEN W 59TH ST & W 60TH ST	1	SW						JM	3.00	5/14/19	Actuals but no meter reading - 2020 has 3 yrds
		2										
52	E 59TH ST & 12TH AVE S	1	S	5/7/19		5.0				5.00	5/7/19	
		2										
53	GIRARD AVE S & W 60TH ST	1	SW	5/15/19		1.5				1.50	5/15/19	
		2										
54	GIRARD AVE S, W 60TH ST - DUPONT AVE S	1	SW									no WOs no actuals, 2017 meter reading:17 yrds
		2										
55	GRASS LAKE TERRACE, GIRARD TO JAMES AVE S	1	SW	5/14/19		4.5				4.50	5/14/19	
		2										
56	GRASS LAKE SERVICE ROAD BEHIND #6035 JAMES AVE S	1	SW	5/10/19		1.5				1.50	5/10/19	
		2										
57	GRASS LAKE SERVICE ROAD BEHIND #6077 JAMES AVE S	1	SW	5/10/19		1.0				1.00	5/10/19	
		2										
58	GRASS LAKE SERVICE ROAD BEHIND #1416 W 61ST ST	1	SW	5/10/19		1.0				1.00	5/10/19	
		2										
59	W 61ST ST & GRASS LAKE SERVICE ROAD	1	SW	5/10/19		1.0				1.00	5/10/19	
		2										
60	IRVING AVE S & W 61ST ST	1	SW									No Actuals says use 2 vacs no meter history
		2										
61	E RIVER RD & CECIL ST	1	E	6/24/19	LJ	8.0	N	Y	LJ	8	6/24/19	
		2										
62	HIAWATHA PARK REFECTORY TURN-A-ROUND	1	S	5/3/19		1.5				1.50	5/3/19	
		2										
63	33RD AVE N & 1ST ST N/RAILROAD TRACKS	1	N	6/14/19	LJ	1.0	N	N	LJ	1	6/14/19	
		2										
64	26TH AVE N & PACIFIC (N TRANSFER STATION)	1	N	6/4/19	LJ	1.0	N	N	LJ	1	6/4/19	
		2										
65	SOUTH TRANSFER STATION	1	N	5/7/19		2.0				2.00	5/7/19	

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65	SOUTH TRANSFER STATION	2										
66	MAPLE PLACE & EAST ISLAND AVE	1	E	6/27/19	LJ	1.0	N	N	LJ	1	6/27/19	
		2										
67	DELASALLE DR & E ISLAND	1	E	7/9/19	LJ	1.0	N	N	LJ	1	7/9/19	
		2										
68	W ISLAND - 300' S OF MAPLE PLACE	1	E	6/28/19	LJ	1.0	N	N	LJ	1	6/28/19	
		2										
69	EASTMAN AVE & W ISLAND	1	E	7/9/19		1.0				1.00	7/9/19	no meter reading historical from 2017
		2										
70	ROYALSTON & 5TH AVE N	1	N	6/13/19	LJ	1.0	N	N	LJ	1	6/13/19	
		2										
71	THE MALL & E LAKE OF THE ISLES	1	SW									No actuals
		2										
72	S OF 37TH AVE NE & ST ANTHONY PKWY	1	E	7/10/19	LJ	3.0	Y	Y	LJ	2	7/10/19	
		2										
73	4552 KNOX AVE N (IN ALLEY BEHIND)	1	N	6/4/19	LJ	1.0	Y	Y	LJ	1	6/4/19	
		2										
74	STEVENS AVE S 300' S OF MINNEHAHA CREEK	1	SW									No Maximo. was in large structures. add in mx
		2										
75	IRVING AVE N (IMPOUND LOT)	1	N									No WOs
		2										
76	MARKET PLAZA & EXCELSIOR BLVD	1	SW	6/13/19		12.0				12.00	6/13/19	
		2										
77	ALLEY - 38TH TO 39TH ST & NICOLLET TO BLAISDELL AVE	1	SW						ZL	1	6/14/19	Actuals but no meter - 2020 had 1 yd
		2										
78	SHINGLE CREEK WETLAND - W SIDE	1	N	6/19/19	LJ	4.0	Y	Y	LJ	4	6/19/19	
		2										
79	SHINGLE CREEK WETLAND - EAST SIDE	1	N	8/21/19	LJ	29.0	Y	Y	LJ	13	8/23/19	
		2										
80	WOODLAWN BLVD & E 50TH ST	1	S	5/6/19					JM	4	5/6/19	
		2										
81	WOODLAWN BLVD & E 53RD ST	1	S									lake water to high
		2										
82	12TH AVE S & POWDERHORN TERRACE	1	S									Would not do. Joe felt unsafe.
		2										
83	13TH AVE S & POWDERHORN TERRACE	1	S						JM	1	5/2/19	
		2										
84	3421 15TH AVE S (180' W OF CL)	1	S	4/9/19	JM	4.0			JM	4.00	4/9/19	
		2										
85	3329 14TH AVE S	1	S	4/4/19	JM	1.5			JM	1.50	4/4/19	
		2										
86	13TH AVE S & E 35TH ST	1	S						JM	4.00	4/8/19	
		2										
87	3318 10TH AVE S	1	S	4/4/19	JM	2.0			JM	2.00	4/4/19	
		2										
88	ACROSS THE STREET FROM 702, NO. BD. VAN WHITE BLVD.	1	N	5/6/19	LJ	1.0	Y	Y	LJ	1	5/6/19	
		2										
89	ACROSS THE STREET FROM 706, NO. BD. VAN WHITE BLVD.	1	N	5/7/19	LJ	1.0	Y	Y	LJ	1	5/7/19	
		2										
90	10TH AVE. NO. & ALDRICH AVE. NO. (S.W.C.)	1	N	5/7/19	LJ	2.0	Y	Y	LJ	2	5/7/19	

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90	10TH AVE. NO. & ALDRICH AVE. NO. (S.W.C.)	2										
91	SO. BD. VAN WHITE BLVD., 200' SO. OF 8TH AVE. NO.	1	N	5/10/19	LJ	2.0	Y	Y	LJ	1	5/10/19	
		2										
92	ACROSS THE STREET FROM 701, SO. BD. VAN WHITE BLVD.	1	N	5/7/19	LJ	2.0	Y	Y	LJ	2	5/7/19	
		2										
93	SO. BD. VAN WHITE BLVD., 250' SO. OF 10TH AVE. NO	1	N	5/20/19	LJ	2.0	Y	Y	LJ	4	5/20/19	
		2										
94	10TH AVE. NO. & NO. BD. VAN WHITE BLVD. (S.W.C.)	1	N	5/9/19	LJ	3.0	Y	Y	LJ	4	5/9/19	
		2										
95	WEST SIDE OF ALDRICH AVE. NO. & 9TH AVE. NO.	1	N	5/15/19	LJ	4.0	Y	Y	LJ	4	5/15/19	
		2										
96	8TH AVE. NO. & NO. BD. VAN WHITE BLVD. (N.E.C.)	1	N	7/9/19	LJ	1.0	N	N	LJ	1	7/9/19	
		2										
97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W) #1	1	N	7/25/19	LJ	3.0	Y	Y	LJ	4	7/25/19	
		2										
97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W) #2	1	N	7/29/19	LJ	3.0	Y	Y	LJ	3	7/29/19	
		2										
97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W) #3	1	N	7/29/19	LJ	4.0	Y	Y	LJ	4	7/31/19	
		2										
98	MALMQUIST LN. & HUMBOLDT NO.	1	N	7/12/19	LJ	1.0	N	Y	LJ	2	7/12/19	
		2										
99	SHINGLE CREEK DR. & HUMBOLDT NO.	1	N	8/28/19	LJ	2.0	Y	N	LJ	2	8/28/19	
		2										
100	SO. OF 49TH AVE. NO. & HUMBOLDT NO.	1	N	8/27/19	LJ	2.0	Y	N	LJ	2	8/27/19	
		2										
101	NO. OF 49TH AVE. NO. & HUMBOLDT NO.	1	N						LJ		10/31/19	No meter but has actuals WO 266085
		2										
102	28TH ST. E. & HIAWATHA * MNDOT HIAWATHA	1	S									No WOs
		2										
103	E. LAKE ST. & HIAWATHA * MNDOT HIAWATHA	1	S									No WOs
		2										
104	NAWADAHA LN./SERVICE RD. & HIAWATHA * MNDOT HIAWATHA	1	S									No WOs
		2										
105	MINNEHAHA PARKWAY (NO. SIDE) S.B. LANE * MNDOT HIAWATHA	1	S									No WOs
		2										
106	E. 50TH ST. (SW COR) & HIAWATHA * MNDOT HIAWATHA	1	S									No WOs
		2										
107	E. 54TH ST. & RIVERVIEW RD. * MNDOT HIAWATHA RE-ROUTE	1	S									No WOs
		2										
108	ALLEY SUMP MH WEST OF COLUMBUS AVE S & E 37TH ST - no as-builts	1	S						JM	1	5/17/19	
		2										
109	22ND AVE N AND W RIVER ROAD	1	N	8/12/19	LJ	2.0	Y	Y	LJ	2	8/12/19	
		2										
110	W. CALHOUND PARKWAY 100' NO. OF RICHFIELD RD.	1	SW	5/20/19	JM	2.0			JM	2.00	5/20/19	
		2										
111	RICHFIELD RD. NEAR W. CORNER OF THE PARKING LOT	1	SW						JM	1.25	6/4/19	Actuals but no meter reading - 2020 had 1.25 yrds
		2										
112	W. 36TH ST. 30' W. OF CALHOUN PARKWAY	1	SW	7/15/19	JM	3.5			JM	4	7/15/19	Actuals but no meter reading - 2020 had 4 yrds
		2										

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113	20' EAST OF VAN WHITE MEM. BLVD (N.B.) AND 5TH AVE N (1016 - 5TH AVE N)	1	N	5/30/19	LJ	1.0	Y	Y	LJ	1	5/30/19	
		2										
114	DUPONT AVE. NO. & 4TH AVE. NO.	1	N	5/31/19	LJ	2.0	Y	Y	LJ	3	5/31/19	
		2										
115	VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	1	N	5/29/19	LJ	3.0	Y	Y	LJ	4	5/29/19	
		2										
116	400' NORTH (60' INTO POND) VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	1	N	9/3/19	LJ	1.0	Y	N	LJ	1	9/3/19	
		2										
117	300' NORTH (WEST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	1	N	9/24/19	ZL	3.0	Y	Y	ZL	5	9/24/19	
		2										
118	200' NORTH (POND SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 10TH AVE N	1	N	6/13/19	LJ	3.0	Y	Y	LJ	3	6/5/19	
		2										
119	11TH AVE N AND VAN WHITE BLVD (N.B.)	1	N	5/13/19	LJ	1.0	Y	N	LJ	1	5/13/19	
		2										
120	VAN WHITE MEM. BLVD (S.B.) (160' so. of fremont ave. no. on the e. side of the street)	1	N	5/13/19	LJ	1.0	Y	N	LJ	1	5/13/19	
		2										
121	50' NORTH (EAST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND FREMONT AVE N	1	N	5/13/19	LJ	1.0	Y	N	LJ	1	5/13/19	Actuals but no meter reading - 2018 1 yrd
		2										
122	MINNEHAHA PARKWAY @ 39TH AVE S N SIDE OF PKWY	1	N						JM	4	11/15/19	
		2										
123	COLUMBUS AVE S SOUTH OF E 37TH ST REROUTE - no as-builts	1	SW	6/10/19	JM	2.0			JM	2.00	6/10/19	
		2										
124	COLUMBUS AVE S - CHICAGO AVE S ALLEY - no as-builts	1	SW	6/10/19	JM	2.0			JM	2.00	6/10/19	
		2										
125	COLUMBUS AVE S ACROSS FROM #3644 - no as-builts	1	SW	6/10/19	JM	1.5			JM	1.50	6/10/19	
		2										
126	E 37TH ST AND COLUMBUS S # 3640 COLUMBUS - no as-builts	1	SW	6/10/19	JM	1.0			JM	1.00	6/10/19	
		2										
127	E 37TH ST AND COLUMBUS S # 3700 COLUMBUS - no as-builts	1	SW						JM	1.00	6/10/19	
		2										
128	W 27TH ST AND LAKE OF THE ISLES PKWY - no as-builts	1	SW	7/11/19	JM	2.5			JM	2.50	7/11/19	
		2										
129	YARD SUMPS, 26TH AND HIAWATHA	1	S									No Maximo not on lois' list
		2										
130	YARD SUMPS, 26TH AND HIAWATHA	1	S									No Maximo
		2										
131	YARD SUMPS, 26TH AND HIAWATHA	1	S									No Maximo
		2										
132	YARD SUMPS, 26TH AND HIAWATHA	1	S									No Maximo not on lois' list
		2										
133	ALLEY DRY WELL, BETWEEN HUMBOLDT/IRVING AVE S AND W 25TH ST/26TH ST, no as-builts	1	N						JM		6/6/19	No meter reading because it in storm manhole w sump. Add meter? or Make GC?
		2										
134	W 22ND ST @ E LAKE OF THE ISLES BLVD, no as-builts	1	N						JM		6/7/19	lake level to high
		2										
135	CHICAGO AVE S BETWEEN WASHINGTON AVE S AND 2ND ST S - no as-builts	1	NE									No actuals no meter

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135	CHICAGO AVE S BETWEEN WASHINGTON AVE S AND 2ND ST S - no as-builts											
		2										
136	111 22ND AVE N (ALLEY BETWEEN 1ST ST N AND 2ND ST N AT VACATED 21ST AVE N)	1	N	9/24/19	LJ	2.0	N	Y	LJ	2	9/26/19	
		2										
137	W 44TH ST @ LAKE HARRIET PKWY EAST (Installed on existing 54" Concrete Pipe)	1	N	9/27/19	JM	4.0			JM	4.00	9/27/19	
		2										
138	EWING AVE S BETWEEN W. FRANKLIN AVE AND W 22ND ST - Pending as-built info	1	N						JM		5/17/19	No meter reading but actuals - no historical data
		2										
139	EWING AVE S @ W FRANKLIN AVE - Pending as-built info	1	N	10/7/19	LJ	2.0	N	Y	LJ	2	10/7/19	
		2										
140	E LAKE ST WEST OF 14TH AVE S (Hennepin County const. Lake St.)	1	S	6/20/19	JM	1.5			JM	1.50	6/20/19	
		2										
141	W LAKE ST EAST OF 14TH AVE S (Hennepin County const. Lake St.)	1	S	6/26/19	JM	3.0			JM	3.00	6/26/19	
		2										
142	18TH AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.)	1	S	5/6/19	JM	1.0			JM	1.00	5/6/19	
		2										
143	LONGFELLOW AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.)	1	S	5/1/19	JM	1.0			JM	1.00	5/1/19	
		2										
144	31ST AVE S NORTH OF E LAKE ST (Hennepin County const.. Lake St.)	1	S						JM	1.5	6/25/19	No Meter reading for 2019 but actuals - 2018 was 1.5
		2										
145	CEDAR AVE S AND E MINNEHAHA PARKWAY (20' S. of S. curb of Minnehaha & 5' W. of W. curb of Cedar)	1	S						JM	0	11/6/19	Joe M - creek water to high
		2										
146	E LAKE ST AND 46TH AVE S 12' W OF THE W CURB AND 9' SO OF THE N CURB ON LAKE ST (added 10/31/07) (service pending)	1	S	6/21/19	JM	1.5			JM	1.50	6/21/19	
		2										
147	E LAKE ST AND 47TH AVE S 6' S OF THE N CURB ON LAKE ST AND 1' W OF THE W CURB ON 47TH AVE EXTENDED (added 10/31/07) (service pending)	1	S	6/21/19	JM	1.5			JM	1.50	6/21/19	
		2										
148	E LAKE ST AT 42ND AVE S (8.4' W of the E curb on 42nd St and 38' N of the N curb on Lake St) (Hennepin Co. Construction) (added 11/1/07) (service pending)	1	S	5/3/19	JM	4.0			JM	4.00	5/3/19	
		2										
149	W 44TH ST AND ALDRICH AVE S SWC	1	SW	6/12/19	JM	3.5			JM	3.50	6/12/19	
		2										
150	W RIVER ROAD AND 23RD AVE N	1	N	10/9/19	LJ	2.0	N	Y	LJ	3	10/9/19	
		2										
151	DIAMOND LK RD & CLINTON AVE S	1	SW	7/24/19	JM	2.0			JM	2.00	7/24/19	
		2										
152	3RD AVE. SO. & 2ND ST. S.	1	N	9/9/19	LJ	1.0	N	N	LJ	1	9/9/19	Didn't pull from Cognos WO 266101, listed as GC172
		2										
153	PLEASANT AVE & W LAKE ST	1	SW	6/18/19	JM	6.0			JM	6.00	6/18/19	
		2										
154	W LAKE ST AND DUPONT AVE S	1	SW	6/17/19	JM	5.0			JM	5.00	6/17/19	
		2										
155	W LAKE ST AND BLAISDELL AVE S	1	SW						JM	0.5	6/5/19	Actuals but no meter reading - 2020 .5 yds
		2										
156	W 43RD ST & E LAKE HARRIET PARKWAY	1	SW									No actuals for 2019 - 3.5 cu yd in 2018
		2										
157	STEVENS AVE S & DIAMOND LK RD	1	SW									None
		2										
158	E 61ST ST & COLUMBUS AVE S	1	SW						JM	5	5/21/19	No Meter reading for 2019 but actuals - 2020 says 5yds

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		2										
159	2ND AVE N & 7TH ST N (Target Center)	1	N	9/19/19	LJ	1.0	Y	N	LJ	1	9/19/19	
		2										
160	2ND AVE N & 6TH ST N	1	N	9/17/19	LJ	1.0	N	N	LJ	1	9/17/19	
		2										
161	3RD AVE N & WASHINGTON AVE N	1	N	9/5/19	LJ	1.0	Y	N	LJ	1	9/5/19	
		2										
162	ULYSSES ST NE (WINTER ST NE TO HENNEPIN AVE)	1	N									None
		2										
163	PLYMOUTH AVE N & WEST SIDE OF RIVER	1	N	8/8/19	LJ	1.0	N	N	LJ	1	8/8/19	
		2										
164	PLYMOUTH AVE N & EAST SIDE OF RIVER	1	N	7/11/19	LJ	1.0	N	Y	LJ	1	7/11/19	
		2										
165	1409 Washington Ave N	1	N	9/3/19	LJ	1.0	N	N	LJ	1	9/3/19	
		2										
166	Thomas Ave S & Dean Pkwy to Kenilworth Lagoon (Lake of the Isles) (Burka- plan sheet only)	1	SW	6/4/19	JY	6.0			JY	6.00	6/4/19	
		2										
167	E River Rd north of Washington Ave SE (CCLRT) no information on file per Lois E 11/15/2013	1	NE									No Actuals
		2										
168	Dowling Ave N Alley Drain between Morgan Ave N and Newton Ave N	1	N	4/23/19	JM	1.0			JM	1.00	4/23/19	
		2										
169	Dowling Ave N Alley Drain between Newton Ave N and Oliver Ave N	1	N	6/4/19	LJ	1.0			LJ	1.00	6/4/19	
		2										
170	DOWLING AVE N & OLIVER AVE N	1	N									This is listed in Maximo WO 386900 as GC #162
		2										
171	Newton Ave N at Dowling Ave N sump MH	1	N	4/24/2019	JM	1.0			JM	1.00	4/24/2019	Not in cognos WO 266110
		2										
172	25TH AVENUE SE @ U OF M	1	NE	10/30/19	LJ	1.0	N	N	LJ	2	10/30/19	GIS Calls this GC 152
		2										
173	37th Ave N and Logan Ave N (SE corner)	1	NE									No WOs of any type aginst this asset
		2										
174	Bridal Veil Circle and Kasota Ave (Bridal Veil Creek built by MPCA)	1	NE									No WOs of any type aginst this asset
		2										
175	54th St W east of Upton Ave S - plan sheet only changed during construction - no records on file	1	SW						JM	2	7/22/19	
		2										
176	16th Ave S and 6th St S (NW) ASB 2365	1	NE									No WOs
		2										
177	16th Ave S midblock pedestrian walkway west side SE of 6th St S ASB 2365	1	NE									No Actuals, No work
		2										
178	16th Ave S and LRT Tracks SE of 6th St S ASB 2365	1	NE									No Actuals, No work
		2										
179	16th Ave S and 6th St S (SE) ASB 2364	1	NE									No Actuals, No work
		2										
180	16th Ave S midblock pedestrian walkway east side SE of 6th St S ASB 2364	1	NE									No Actuals, No work
		2										
181	16th Ave S and LRT Tracks SE of 6th St S ASB 2364	1	NE									No Actuals, No work
		2										
182	24th Ave SE circa 590' south of Elm St SE (incomplete record)	1	NE						LJ	2.75	12/24/19	Ask about the three WOs
		2										
183	24th Ave SE circa 1156' south of Elm St SE (incomplete record)	1	NE						LJ	2.9	12/23/19	Ask about the 358350. Close out?

2019 Grit Chamber Data

183	24th Ave SE circa 1150' south of Elm St SE (incomplete record)	2										
184	25th Ave SE and Como Ave SE (no records) box culvert part of energy dissipation for Como Tunnel Surcharge	1	NE									No MX - need to add in Maximo
		2										
185	New Van Whithe Blvd Bridge - South of Bassett Creek	1	N						LJ	3	12/23/19	
		2										

NPDES Report - APPENDIX A12

STORMWATER MONITORING RESULTS AND DATA ANALYSIS

In 2019, 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 (**Table 1 and Figure 1**). 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.

All the lakes in Minneapolis fall into either the mesotrophic or eutrophic category. Bde Maka Ska, Harriet, and Wirth are mesotrophic with moderately clear water and some algae. Brownie, Cedar, Isles, Hiawatha, Loring, and Nokomis are eutrophic with higher amounts of algae. Powderhorn and Spring are hypereutrophic with high nutrient concentrations and the potential for severe algal blooms. Trends in lake water quality can be seen by using the annual average TSI since the early 1990s.

Table 1. Water quality trends in Minneapolis lakes from 1991-2019.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
Lake Bde Maka Ska	Brownie Lake	
	Cedar Lake	
Wirth Lake	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Lake Nokomis	
	Loring Pond	
	Powderhorn Lake	
	Spring Lake	

There has been a significant improvement in water quality indicators in Bde Maka Ska since the early 1990s (linear regression, $p < 0.01$); however, TSI scores have stabilized since 2006. The TSI score at Lake Bde Maka Ska between 2017 and 2019 was higher than the previous few years due to higher chlorophyll-*a* and total phosphorus concentrations but were still below the early 1990s scores. The 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, $p < 0.001$). The TSI score at Wirth Lake in 2018 and 2019 was slightly above the previous few years due to increased chlorophyll-*a* and total phosphorus concentrations.

Most of the Minneapolis lakes have no directional trend in water quality indicators since the early 1990s. 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 2019. The water quality in Cedar Lake showed improvement following restoration efforts through the late 1990s, had a slow decline in the 2000s, and has remained stable since. The Cedar Lake TSI scores between 2017 and 2019 have been the highest since the early 1990s due to higher chlorophyll-*a* concentrations.

Previously, Lake Nokomis had seen a significant improvement in water quality following a biomanipulation project in 2010; however, with higher algal concentrations in 2018 and 2019, TSI scores have stabilized and there is no statistically significant trend (linear regression, $p > 0.05$). Lake Hiawatha is heavily influenced by the inflow from Minnehaha Creek and the lake has poorer water quality during drought years.

The last few years has experienced above average spring and summer precipitation and led to low TSI scores compared to 2000's. The water quality in Lake of the Isles varies from year to year, with higher TSI scores between 2017 and 2019 compared to the previous few years due to increased chlorophyll-*a* concentrations, but there is no significant trend in any direction since 1991. Loring Pond experienced decreased water quality immediately following a dredging project in 1997; however, conditions have slowly returned to levels similar to pre-1997. The TSI score at Loring Pond in 2019 was higher than previous years due to higher chlorophyll-*a* concentrations.

Powderhorn Lake has experienced a wide variation in water quality, with the worst TSI scores in the late 1990s and the best scores in the late 2000s. Powderhorn had poor water quality between 2013 and 2017, with blue green algae blooms leading to low water clarity. TSI scores decreased in 2018 and 2019 because severe algal blooms did not occur and chlorophyll-*a* concentrations decreased. Water quality in Spring Lake is variable, but there is no significant trend in any direction since 1994. Spring Lake is also monitored every other year and was monitored in 2019. The TSI score increased in 2019 due to higher chlorophyll-*a* and total phosphorus concentrations.

Diamond Lake and Grass Lake are not included in this analysis, since TSI scores are only appropriate for deeper lake systems and there are no water clarity measurements available in these lakes. There are no lakes in Minneapolis with significant decline in water quality indicators since the early 1990s.

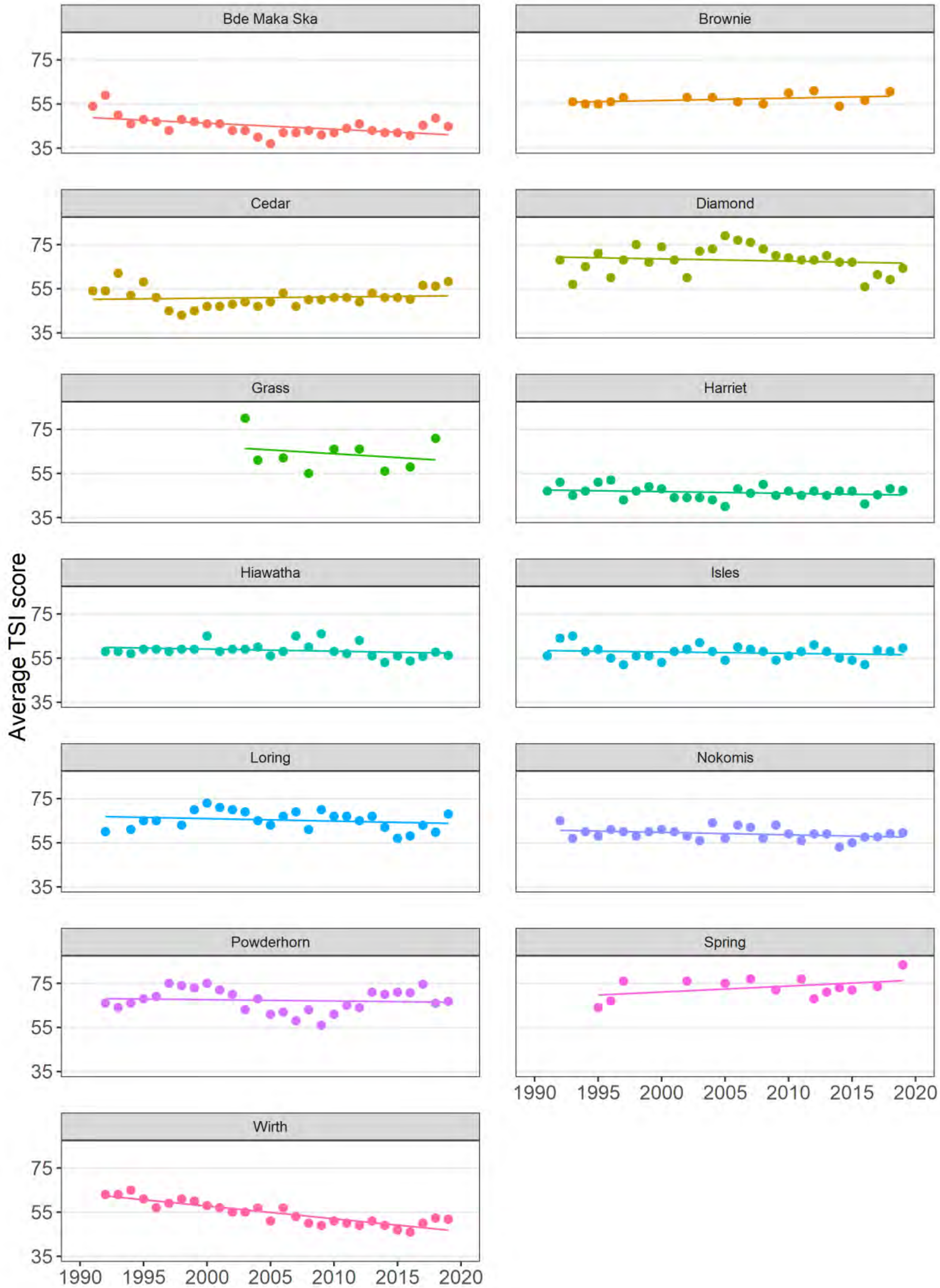

Bde Maka Ska
Brownie
Cedar
Diamond
Grass
Harriet
Hiawatha
Isles
Loring
Nokomis
Powderhorn
Spring
Wirth
Average TSI score
75
55
35
1990
1995
2000
2005
2010
2015
2020

Figure 1. TSI scores and regression analysis for selected Minneapolis lakes 1991–2019. 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 <0.1).

NPDES Land Use Sites Monitoring Results (Stormwater Runoff Monitoring)

In 2019, snowmelt stormwater runoff monitoring was carried out at four sites representative of multi-family residential, recreational/parkland, commercial/high-rise, and commercial/industrial land uses. (In previous Annual Reports, the following material appeared in Appendix A as A4.)

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.

As part of the NPDES permit, a two-year study of quarterly Fat Oil and Grease (FOG) grab samples was conducted with the intent to sample 6 sites. If a FOG sample was measured greater than 15 mg/L at a site, then that site would continue to be monitored.

FOG in stormwater can come from a variety of sources such as: vehicles, industry, food waste and gas stations. 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.

METHODS

Grab Sampling

FOG samples were collected in an amber glass bottle. The bottle was either attached to a modified pool skimmer pole or if flow depth was not adequate a clean white 5-gallon bucket was lowered into the storm sewer to collect an aliquot and poured directly into the glass container. Standard FOG sampling protocol was followed, and the FOG bottles were not rinsed with stormwater. Rinsing could introduce additional FOG material which would stick to the inside glass container walls and produce artificially high results.

In 2018 all FOG samples were collected at four representative land use sites, if the site was accessible. In 2018, the 61st and Lyndale became inaccessible due a construction project but it was accessible again in 2019. The Pershing site is only accessible for grab sampling for snowmelt samples due to equipment installed in the site.

In 2019 only snowmelt FOG samples were collected at the representative land use sites. The remainder of 2019 FOG samples were collected at two of the 24th & Elm infiltration basin inlets (north and south) and two of the inlets into the Winter Infiltration Basin (west and south). In 2019 neither of the 24th & Elm Infiltration Basin or Winter Infiltration Basin outlets produced any flow when personnel were present and could not be sampled. All FOG samples were analyzed at Instrumental Research Incorporated (IRI) Laboratory in Fridley, Minnesota. The methodology for FOG analysis can be found in the snowmelt section below.

Figure 23-1 shows the location of the four representative land use sites and their location within the City of Minneapolis, MN. **Figure 23-2** show the location of the 24th and Elm infiltration basin north and south inlets, and **Figure 23-3** shows the Winter Infiltration Basin south and west inlets.

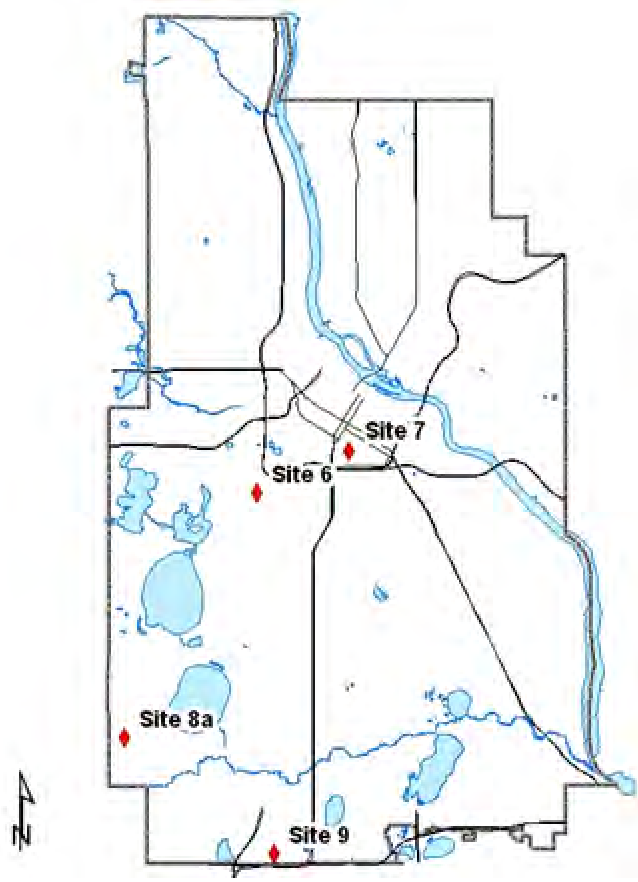


Figure 23-1. Map of the 2018 and 2019 Minneapolis NPDES representative land use monitoring sites.

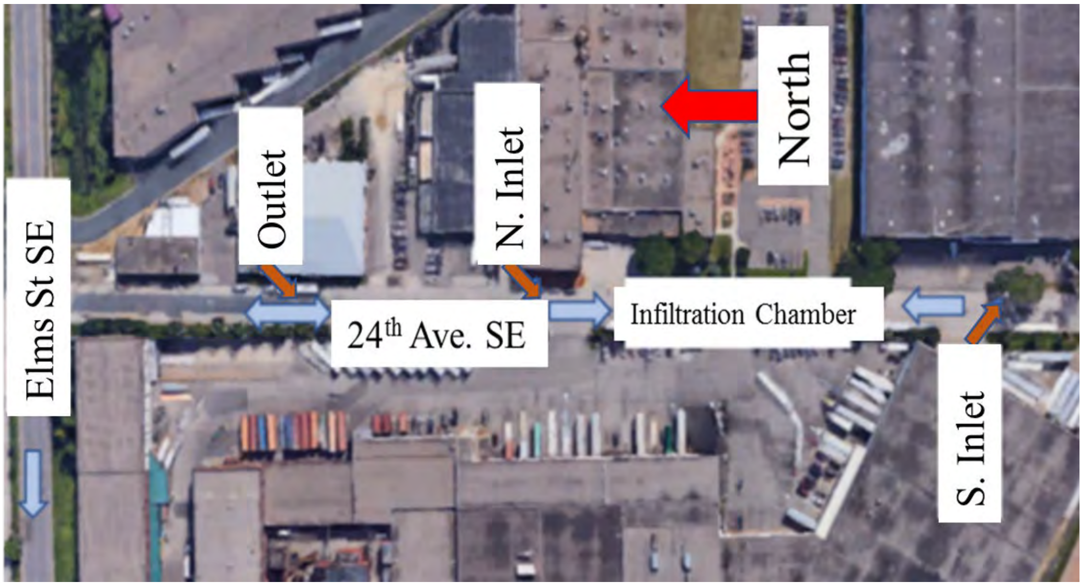


Figure 23-2. Aerial photo of 24th & Elm Infiltration Chamber and its inlets and outlet. Blue arrows show the direction of flow. Only the inlets were monitored for FOG.

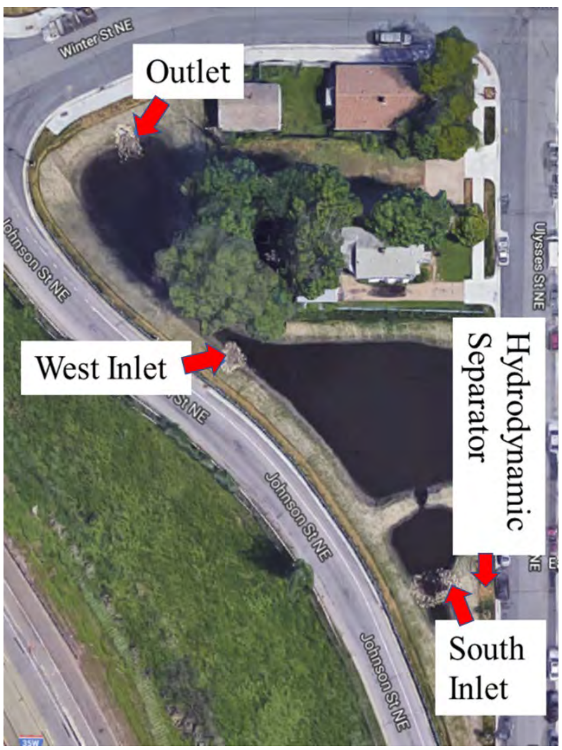


Figure 23-3. Aerial photo of the Winter Infiltration Basin. Only the south and west inlets were monitored for FOG samples.

Table 23-1 shows the land use and drainage area for four of the sampled sites. **Table 23-2** shows the 24th & Elm and Winter Infiltration basins land use and drainage area.

Table 23-1. The land use sites used for FOG monitoring in Minneapolis in 2018 and 2019.

Site ID	Site 6	Site 7	Site 8a	Site 9
Location	22nd St and Aldrich Ave S	E 14th St and Park Ave S	Pershing Field east of 49th St and Chowen Ave	335 ft. east of 61st St and Harriet Ave S
Land Use	Multi–Family Residential	Commercial/Industrial/ High Rise Residential	Recreational/Parkland	Commercial/Industrial
Drainage Area	8.9 acres	13.1 acres	2.5 acres	34.9 acres

Table 23-2. The 2019 24th & Elm and Winter Infiltration Basins sites monitored for FOG in 2019.

Site ID	24th & Elm Infiltration Basin North Inlet	24th & Elm Infiltration Basin South Inlet	Winter Infiltration Basin West Inlet	Winter Infiltration Basin South Inlet
Location	24th Ave SE	24th Ave SE	Johnson St NE	Ulysses St NE
Land Use	Light Industrial	Light Industrial	Frontage Road	Industrial
Drainage Area	3.9 acres	10.3 acres	1.2 acres	30.2 acres

FIELD QUALITY ASSURANCE SAMPLES

A variety of quality control quality assurance 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 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 2019. As part of the overall QA/QC 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.

Field measurements were recorded on a Field Measurement Form in the 2019 Field Log Book. 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 Storm Water Monitoring Program Manual (MPRB, 2001). For data reported below the reporting limit, the reporting limit value was divided in half for use in statistical calculations.

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 **Section 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. The time that each grab sample was collected was recorded onto field sheets. A complete description of methods can be found in the Storm Water Monitoring Program Manual (MPRB, 2001). Common statistics were calculated using Microsoft Excel.

Results and Discussion

All 2018 and 2019 Fat Oil and Grease (FOG) samples were grab samples and are shown in **Table 23-3.** Two samples from 61st & Lyndale taken on 3/12/19 and 3/13/19 were over the 15 mg/L MPCA established NPDES permit threshold.

Table 23-3. 2018 and 2019 FOG event dates and grab samples collected. The 3/12/19 and 3/13/19 FOG samples were greater than 15 mg/L.

Date Sampled	Time	Site Location	FOG mg/L
1/10/2018	13:15	14th & Park	<5.00
1/19/2018	14:05	14th & Park	6
7/12/2018	18:50	14th & Park	<5.00
10/1/2018	12:45	14th & Park	<5.00
1/10/2018	13:50	22nd & Aldrich	8
1/19/2018	14:35	22nd & Aldrich	8
7/13/2018	9:46	22nd & Aldrich	<5.00
10/1/2018	12:55	22nd & Aldrich	<5.00
1/19/2018	13:35	61st & Lyndale	<5.00
1/26/2018	12:20	61st & Lyndale	9
3/19/2018	14:25	Pershing	<5.00
3/26/2018	14:45	Pershing	<5.00
3/12/2019	13:50	14th & Park	9
3/13/2019	14:00	14th & Park	10
3/13/2019	14:25	22nd & Aldrich	7
3/19/2019	14:25	22nd & Aldrich	6
3/12/2019	13:15	61st & Lyndale	21
3/13/2019	13:38	61st & Lyndale	19
3/19/2019	13:20	Pershing	<5.00
3/20/2019	13:40	Pershing	<5.00
5/8/2019	13:35	24th & Elm In N	<5.00
6/27/2019	11:00	24th & Elm In N	<5.00
8/26/2019	13:20	24th & Elm in N	<5.00
9/12/2019	8:35	24th & Elm in N	<5.00
5/8/2019	13:25	24th & Elm In S	<5.00
6/27/2019	10:50	24th & Elm In S	<5.00
8/26/2019	13:20	24th & Elm In S	<5.00
9/12/2019	8:30	24th & Elm In S	<5.00
5/8/2019	13:50	Winter In S	<5.00
6/27/2019	11:16	Winter In S	<5.00
8/26/2019	13:45	Winter In S	6
9/12/2019	8:50	Winter In S	6
5/8/2019	14:05	Winter In W	5
6/27/2019	11:22	Winter In W	5
8/26/2019	13:50	Winter In W	5
9/12/2019	8:55	Winter In W	<5.00

CONCLUSION

In 2018, four sites were monitored for FOG. Two of the four sites did not meet the quarterly sampling frequency due to accessibility issues. All samples collected were below the 15 mg/L threshold. The 14th & Park and 22nd & Aldrich sites met the sampling frequency goal.

In 2019, eight sites were monitored for FOG. Four sites were only monitored for snowmelt FOG grabs, which included two samples on consecutive days. One of these sites, 61st and Lyndale, was above 15 mg/L. Four sites were monitored quarterly, but snowmelt samples were not collected at these sites. None of the four sites sampled quarterly were above 15 mg/L for FOG.

All the 2018 and 2019 FOG samples were below the 15 mg/L threshold except for the 2019 snowmelt samples collected at 61st & Lyndale. This site has industrial land use where FOG material is likely used by the industries surrounding it. It is unknown why all the 2018 61st & Lyndale FOG samples were below the 15 mg/L but both of the 2019 snowmelt FOG samples were above the 15 mg/L threshold. It could be a single spill event considering that the 2019 61st & Lyndale samples were taken on successive days on 3/12/19 and 3/13/19. 61st & Lyndale was not monitored for FOG after 2019 snowmelt.

An attempt should be made to sample FOG at the 61st and Lyndale site to determine if the 2019 data was an anomaly and if FOG is present during the rest of the year in grab samples. Safety considerations are limiting at this site due to high truck traffic volume and limited site lines for drivers. MPRB will continue to attempt to sample 6 sites quarterly for FOG.

2019 SNOWMELT SAMPLE COLLECTION

In 2019 two snowmelt grab samples were collected at four sites in mid to late March.

Table 23-4 shows the parameters tested for each sample collected. **Table 23-5** 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 23-4. The list of monitored chemical parameters for the NPDES permit. (Winter snowmelt samples were grab samples for all parameters.)

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 23-5. Analysis method, reporting limit, and holding times for parameters used by Instrumental Research, Inc. and Pace Laboratories. ‡Metals and DOC were analyzed by 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 2340 C	2.0 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	0.050 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

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 (November-March) 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.

Table 23-6 shows the 2019 chemistry data for the sampled events. Stormwater concentrations can be extremely variable because there are multiple factors affecting the concentration of pollutants.

The red underlined data in **Table 23-6** are data that failed a blind laboratory monthly performance standard. Internal QAQC procedures flag the data for an entire month for any parameter if the blind standard fails ± 20% recovery. It was deemed the data can be used with caution, noting that performance standards were outside the 80-120% recovery standards.

Table 23-6. 2019 NDPES snowmelt sampled event data by site. NES=not enough sample. Red underlined data failed a blind monthly performance standard. ND = no data.

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP mg/L	TN mg/L	NO3 NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	pH std units	*E. Coli* MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
3/12/2019	13:50	14th & Park	Grab	0.426	0.105	7.31	0.876	9247	380	78	34	14707	526	9	8.0	23	50	7	250	34
3/13/2019	14:00	14th & Park	Grab	0.467	0.120	3.47	0.893	850	60	119	49	1415	202	10	8.4	60	31	19	218	15
		Geo. Mean		**0.446**	**0.112**	**5.04**	**0.885**	**2803**	**151**	**96**	**41**	**4562**	**326**	**9**	**8.2**	**37**	**40**	**12**	**233**	**23**
3/13/2019	14:25	22nd & Aldrich	Grab	0.729	0.426	8.15	0.792	950	88	105	48	1642	237	7	7.6	228	30	19	181	24
3/19/2019	14:25	22nd & Aldrich	Grab	1.116	0.665	5.33	0.133	200	42	158	65	408	187	6	ND	345	27	32	181	19
		Geo. Mean		**0.902**	**0.532**	**6.59**	**0.325**	**436**	**61**	**129**	**56**	**818**	**210**	**7**	**7.6**	**280**	**29**	**25**	**181**	**21**
3/12/2019	13:15	61st & Lyndale	Grab	0.419	0.046	10.9	7.16	3799	480	413	109	6130	414	21	11.5	<1	31	10	141	37
3/13/2019	13:38	61st & Lyndale	Grab	0.504	0.053	3.75	1.32	2049	156	379	85	3463	295	19	10.7	214	37	14	242	NES
		Geo. Mean		**0.459**	**0.049**	**6.39**	**3.08**	**2790**	**274**	**395**	**96**	**4607**	**349**	**20**	**11.1**	**214**	**34**	**12**	**185**	**37**
3/19/2019	13:20	Pershing	Grab	0.649	0.229	3.74	<0.030	15	68	26	24	145	131	<5.00	7.4	24	5	0	<20	48
3/20/2019	13:40	Pershing	Grab	0.415	0.198	3.08	<0.030	5	38	22	15	83	62	<5.00	7.3	4	4	1	<20	21
		Geo. Mean		**0.519**	**0.213**	**3.39**	**<0.0.30**	**9**	**51**	**24**	**19**	**109**	**90**	**<5.00**	**7.3**	**10**	**4**	**1**	**<20**	**32**

Best Management Practices Monitoring Results

Best management practices (BMPs) include procedures and structures designed to help reduce pollutants in stormwater runoff. The City and the MPRB carry out BMP monitoring as part of the effort to determine and improve system/BMP effectiveness through adaptive management.

In 2019, monitoring was continued with multiple BMP projects.
These included:

- Powderhorn Inlets.
- Winter Infiltration Basin
- 24th & Elm Infiltration Chamber
- Minneapolis Sculpture Garden

Background

Best management practices (BMPs) include procedures and structures designed to help reduce water pollution through good housekeeping practices like street sweeping. Monitoring of BMPs in Minneapolis is done as a part of the NPDES MS4 stormwater permit activities (permit #MN0061018).

POWDERHORN LAKE INLETS

BACKGROUND

A major restoration plan for Powderhorn Lake was undertaken in 1999 due to poor lake conditions that included installation of Continuous Deflective Separators (CDS) to control trash and solids. A drawing of a CDS unit is shown in **Figure 24-1**.

The Powderhorn Lake watersheds are shown in **Figure 24-2**. In 2001, five CDS grit chambers were installed at the outlets to the larger watersheds flowing to Powderhorn Lake in order to remove solids from stormwater inflow **Figure 24-3**.

Despite this and other restoration work, the lake was listed as impaired and placed on the EPA 303d list based on eutrophication and biological indicators in 2001. At the time of the listing, Powderhorn Lake was trending towards better water quality and was subsequently delisted after meeting state standards for several years.

Powderhorn was relisted on the EPA 303d list as impaired for nutrients in 2018 after relapsing to poor water quality. The purpose of monitoring the stormwater inlets into Powderhorn Lake is to measure and quantify the external nutrient load of the main tributaries into the lake. Information collected will help create an effective future plan to decrease the amount of nutrients impacting Powderhorn Lake.

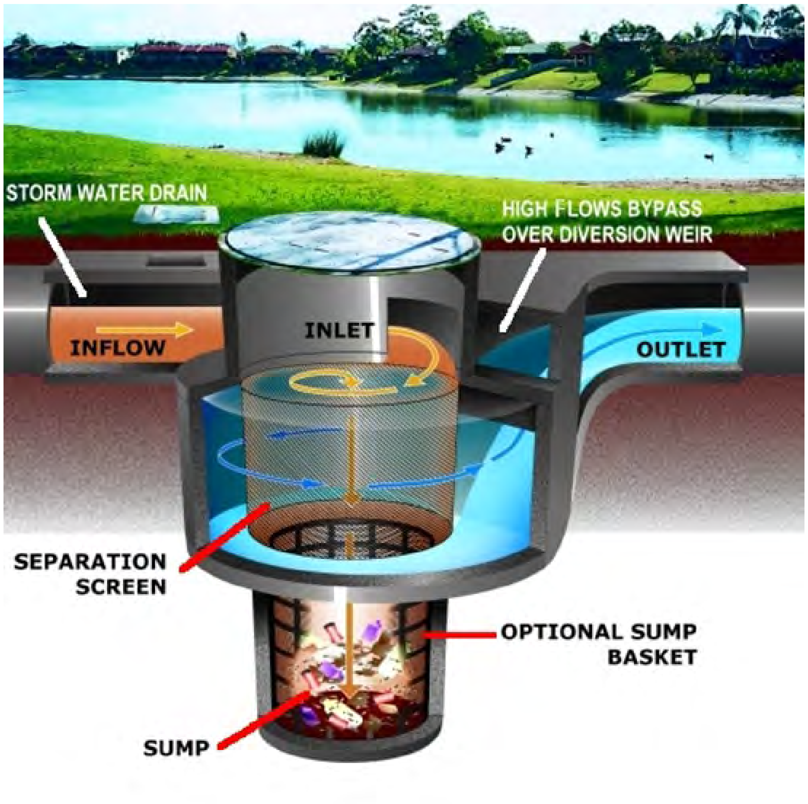


Figure 24-1. Cross section showing components of a CDS grit chamber unit.

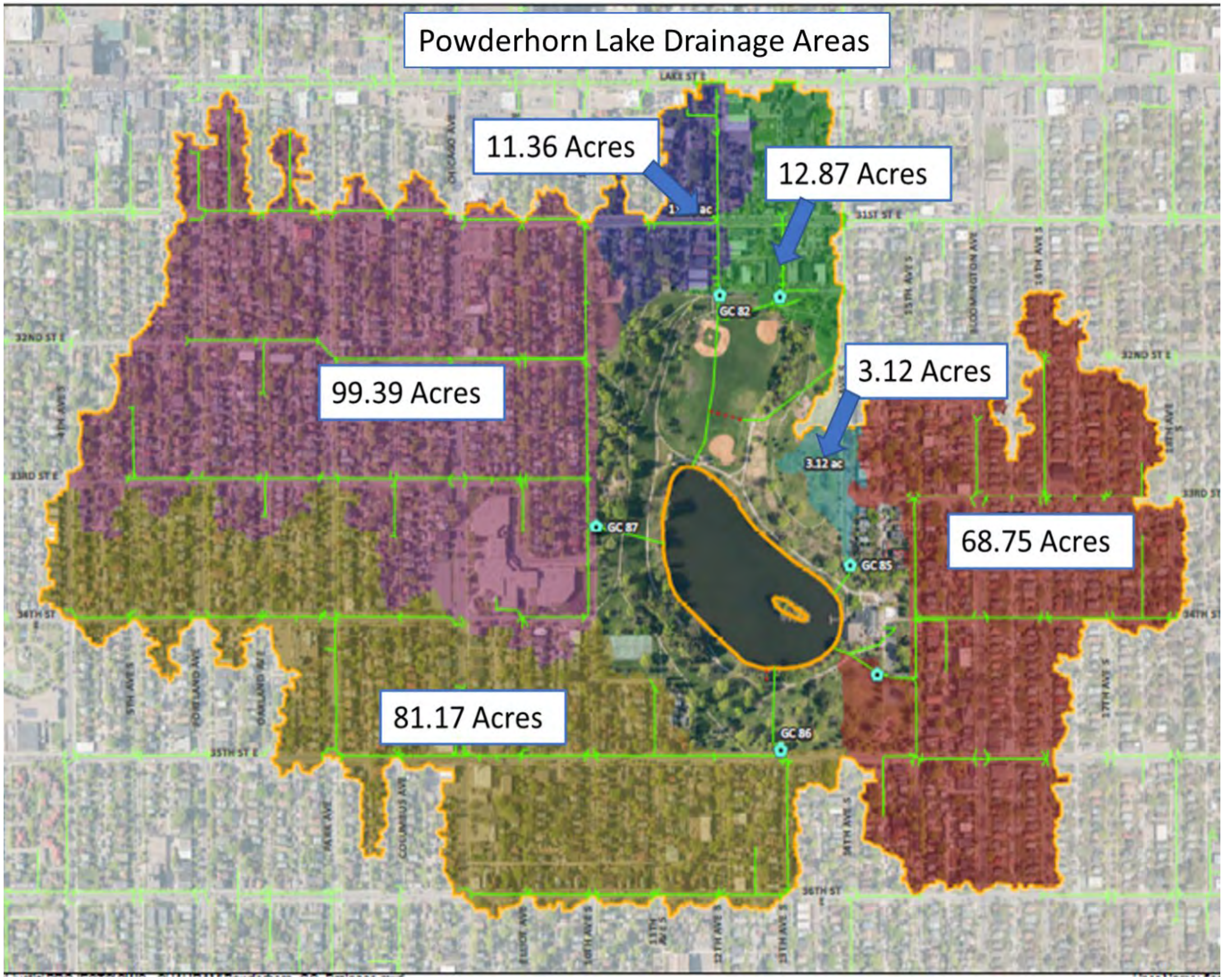


Figure 24-2. Powderhorn Lake individual watershed drainage areas acreage. All inlets have CDS units except the small 3.12 acre area which has a sump.

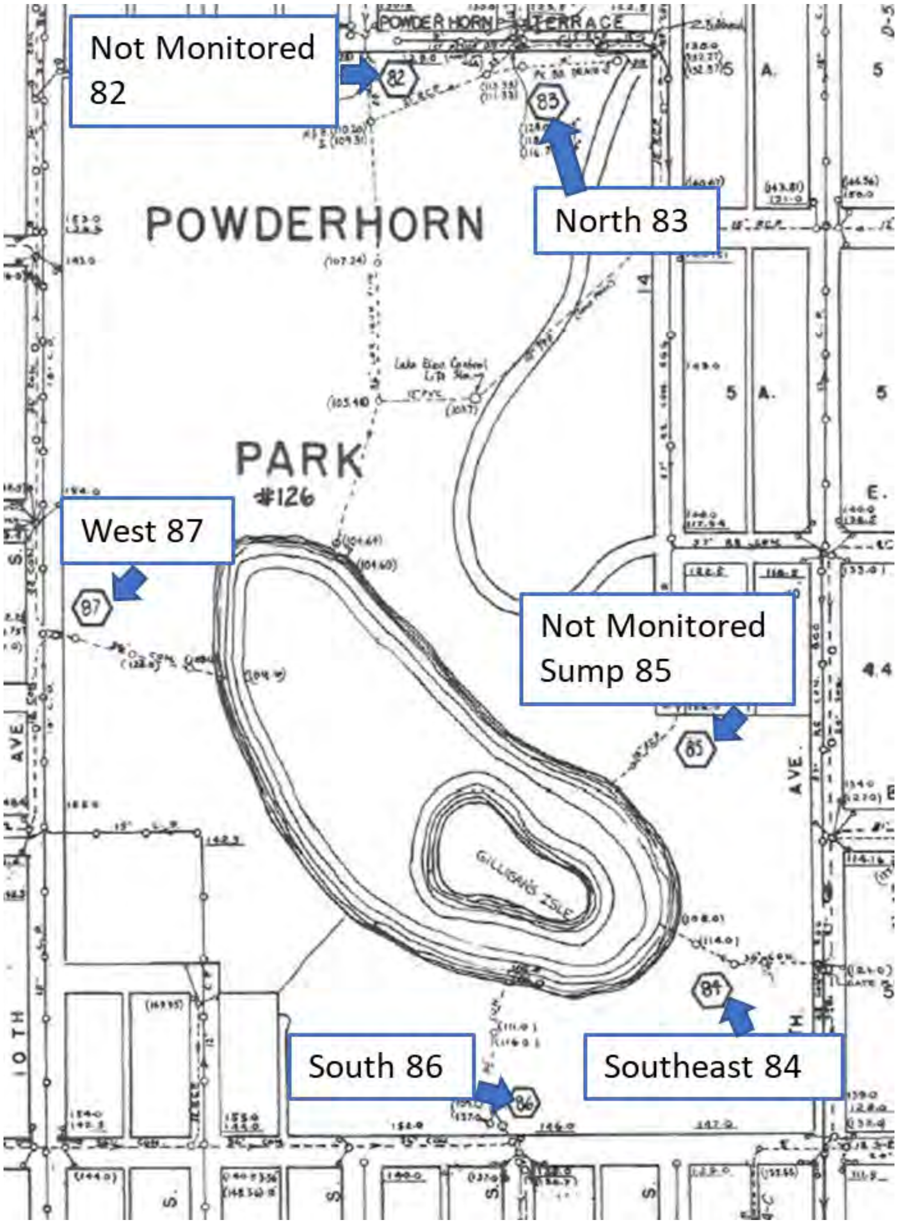


Figure 24-3. Storm sewer map of CDS grit chambers 82-87 surrounding Powderhorn Park.

There are five CDS grit chambers, and one sump structure installed in stormwater pipes leading to Powderhorn Lake. A sump is a pit, usually in a catch basin, that settles out solids. **Table 24.1** shows the Powderhorn CDS grit chamber assigned numbers, location, and drainage areas for each CDS unit. CDS unit 82 was not monitored since it is adjacent to and has an almost identical watershed to CDS unit 83. Sump 85 was not monitored because the watershed was very small (3.1 acres) which is about 1% of the watershed.

Table 24.1. A list of the six water quality structures surrounding Powderhorn Lake, their names, monitoring status, drainage areas, and locations.

Monitoring ID Name	BMP Type	CDS/Grit ID	Drainage (Acres)	Location
Not Monitored	CDS Hydrodynamic Separator	82	11.4	12th Avenue S and Powderhorn Terrace
Inlet North	CDS Hydrodynamic Separator	83	12.9	13th Avenue S and Powderhorn Terrace
Inlet Southeast	CDS Hydrodynamic Separator	84	68.8	3421 15th Avenue S
Not Monitored	Sump Manhole	85	3.1	3329 14th Avenue S
Inlet South	CDS Hydrodynamic Separator	86	81.2	13th Avenue S and East 35th Street
Inlet West	CDS Hydrodynamic Separator	87	99.4	3318 10th Ave S @ Back of sidewalk opposite of house #3318

METHODS

Site Installation

Before sites could be installed, reconnaissance was done at each of the four CDS units (83, 84, 86, 87) to assess site conditions. It was discovered that the CDS units had not received regular maintenance for some time. Significant debris and solids had built up in the CDS units and had accumulated in the upstream pipe inverts. At each of the sites both the CDS units and upstream pipes needed maintenance before equipment could be installed. In 2019, only the Inlet North site and Inlet Southeast sites were able to be fully cleaned and made operational. The Inlet South site was partially cleaned and installed but significant debris including 8-inches of sand and leaves were found in the upstream pipe invert. The debris made monitoring impossible at this site because it buried the AV probe and intake strainer. The Inlet West site had 4-feet of standing water in the upstream pipe due to a plugged CDS unit being plugged. The site was not cleaned until the fall of 2019, so equipment could not be installed.

Monitoring equipment at each of the sites included: ISCO 2150 datalogger, 2105 interface module, 2103ci cell phone modem or 2015ci combined interface module/modem, low-profile AV probe, and a 3700 ISCO sampler complete with tubing and intake strainer. The equipment at the Inlet North was hung from eyebolts below grade in the manhole. All other sites used above-grade monitoring boxes with drilled access holes for tubing and cables below grade into the manhole collars. Monitoring boxes are rectangular 4’ x 3’ x 3’ wooden boxes installed above grade to house both the sampler and datalogger equipment.

The datalogger used the cell phone modem to remotely upload data to a MPRB database from Monday through Friday. The cell phone antenna was installed at each site to allow communication with the datalogger. The datalogger could also be called up and programmed remotely to turn the samplers on or off, adjust the level, pacing, or triggers.

Sample Collection

The samplers were flow-paced and equipped with 24 one-liter bottles, 3/8" inner diameter vinyl tubing, and an intake strainer. The cable and tubing were anchored with zip-ties to the sidewall eyebolts or side-iron ladders. The sampler was programmed to multiplex, taking four flow-paced samples per bottle, allowing for 96 flow-paced samples per storm hydrograph.

Ideally, all monitoring would be done below the CDS units in order to enable sampling of nutrient inputs from organic material >3/8" that may decompose within the CDS chamber. This ideal installation was achieved at the Powderhorn Inlet North and Inlet Southeast locations. Equipment at the Inlet South and Inlet West sites had to be installed above the CDS units due to access issues. So nutrients released from organic decomposition within the CDS unit will not be accounted for at these two sites.

CDS grit chamber 83 is named Powderhorn Inlet North for this study. Monitoring equipment (AV and intake strainer) were installed downstream of the CDS unit on 7/17/19 using a stainless-steel spring ring in the 21-inch reinforced concrete pipe (RCP). The sampler was flow-paced at 500 cf. All equipment was hung below grade from ½" eyebolts. This site manhole was located on a steep muddy hillside which made challenging work of removing the manhole cover and extracting the sampler after each storm. All equipment was removed on 10/30/19.

CDS grit chamber 84 was called Powderhorn Inlet Southeast. Monitoring equipment (AV and intake strainer) was installed downstream of the CDS unit on 8/9/19 using a stainless-steel anchor plate secured to the invert of the 36-inch RCP pipe. The sampler was flow-paced at 600 cf and at a trigger depth of 1-inch. Equipment was above grade in a monitoring box/doghouse. All equipment was removed on 10/30/19.

CDS grit chamber 86 was called Powderhorn Inlet South. Monitoring equipment (AV and intake strainer) was installed upstream of the CDS unit on 9/23/19 using a stainless-steel anchor plate secured to the invert of the 42-inch RCP pipe. The sampler was initially flow-paced at 600 cf and at a trigger depth of 1-inch. The pacing was changed on 10/1/19 to 1000 cf to try and better capture the entire hydrograph of storms. This was unsuccessful as sand and debris buried the AV probe and intake strainer. Equipment was above grade in a monitoring box/doghouse. All equipment was removed on 10/30/19.

CDS grit chamber 87 was called Powderhorn Inlet West. In 2019, this site could not be installed upstream of the CDS unit due to a plugged CDS unit and 4-feet of standing water in the upstream pipe. The MPRB will work with the City Public Works to get these sites and pipes vacuumed out and jetted before 2020.

CDS grit chamber 82 and sump 85 were not monitored as part of this project.

RESULTS & DISCUSSION

Sample Collection

In 2019, samples were collected from storms ranging from 0.19" to 1.88''. Samples were collected from 13 individual storms at both the Powderhorn Inlet North and Powderhorn Inlet. Due to challenges from sediment in the upstream pipe, stormwater from one storm was collected at the Powderhorn Inlet South sites. Data from these samples are shown in **Table 24-2**. **Table 24-2** shows precipitation 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 inches and separated by eight hours or more from other precipitation.

Table 24-2. Precipitation and sample collection at the Powderhorn Lake inlets. Sample events were marked Full if all chemical parameters were analyzed. If samples were marked Partial, some chemical parameters were not run due to low volume or expired holding times. NS indicates storms that were not sampled.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr)	Hours since last Rain.	Powderhorn Inlet North	Powderhorn Inlet Southeast	Powderhorn Inlet South
8/13/2019	15:00	8/13/2019	23:15	0.65	8.25	0.08	68	Full	NS	NS
8/15/2019	17:45	8/16/2019	1:15	0.70	7.50	0.09	43	Full	NS	NS
8/17/2019	23:30	8/18/2019	3:15	1.88	3.75	0.50	46	Full	Full	NS
8/26/2019	11:15	8/26/2019	14:00	0.79	2.75	0.29	146	NS	Full	NS
9/1/2019	8:15	9/1/2019	10:00	0.29	1.75	0.17	138	Full	Full	NS
9/2/2019	20:45	9/3/2019	0:00	0.31	3.25	0.10	35	Full	Full	NS
9/9/2019	10:15	9/9/2019	17:45	0.22	7.50	0.03	23	Partial	Full	NS
9/11/2019	1:45	9/11/2019	10:45	1.12	9	0.12	32	Full	Full	NS
9/12/2019	1:30	9/12/2019	17:00	0.94	15.5	0.06	15	Full	Full	NS
9/29/2019	1:30	9/29/2019	8:45	0.37	9	0.04	171	NS	Full	Full
9/30/2019	3:00	9/30/2019	18:00	0.19	15	0.01	6	Full	Full	NS
10/1/2019	9:45	10/1/2019	17:15	0.66	7.50	0.09	16	Full	Full	NS
10/2/2019	11:15	10/3/2019	2:00	0.44	14.75	0.03	18	NS	Full	NS
10/5/2019	1:45	10/5/2019	17:00	0.80	15.25	0.05	48	Full	NS	NS
10/9/2019	23:30	10/11/2019	7:30	0.57	32	0.02	102	Full	Full	NS
10/21/2019	11:00	10/22/2019	8:45	0.22	10	0.02	8	Full	Full	NS

Figures 24-4, 24-5, and **24-6** are stage and discharge graphs for the Powderhorn Inlet North, Powderhorn Inlet Southeast, and Powderhorn Inlet South.

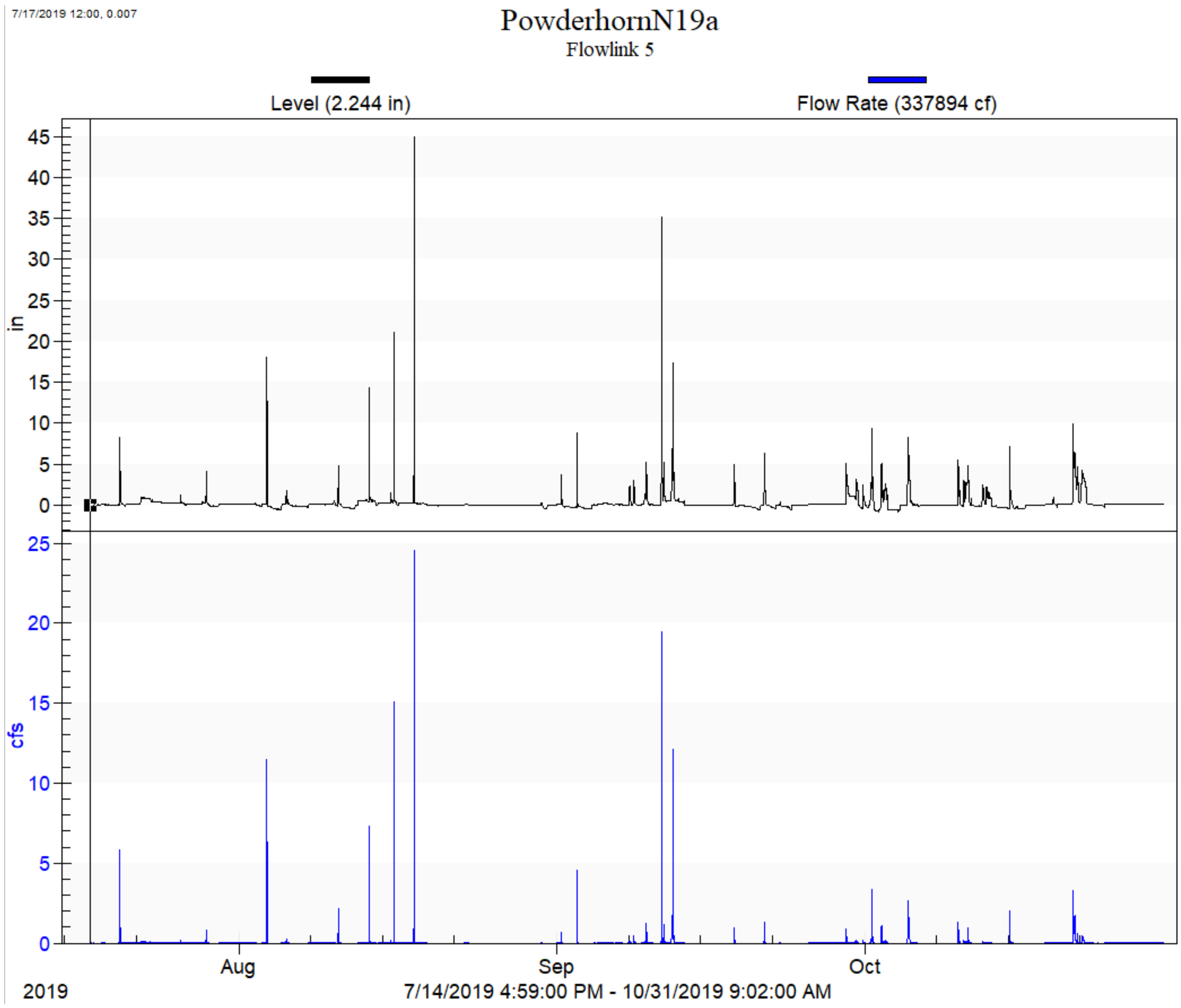


Figure 24-4. The Powderhorn Inlet North stage and discharge from July 14 to October 31, 2019. The upper graph is stage in inches and lower graph is discharge in cfs.

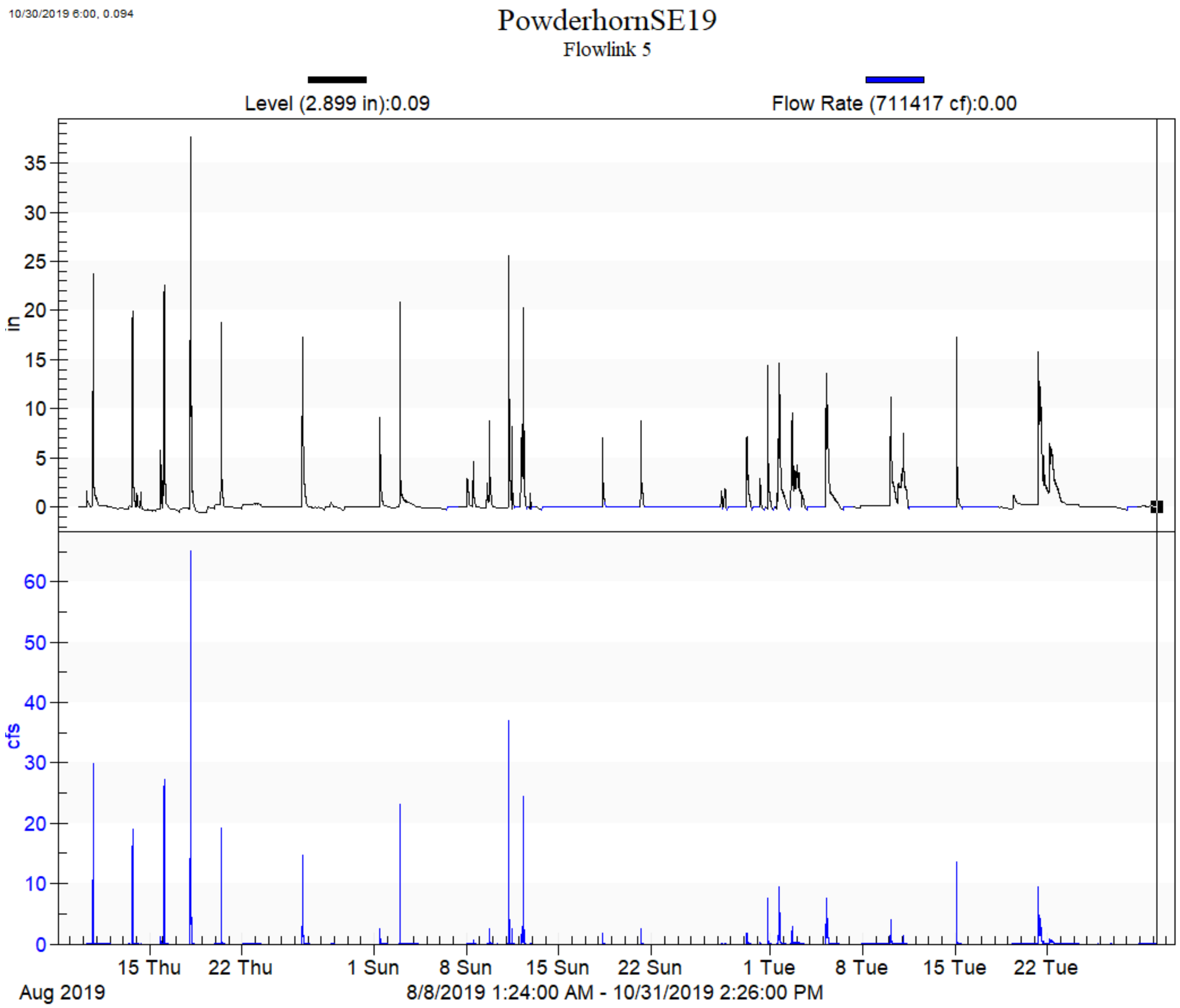


Figure 24-5. The Powderhorn Inlet Southeast stage and discharge from August 8 to October 31, 2019. The upper graph is stage in inches and lower graph is discharge in cfs.

Figure 24-6 shows that state in the pipe at the Powderhorn Inlet meets or exceeds 50" for almost every storm. The high stage level indicates that the CDS unit is partially plugged. A plugged CDS causes stormwater to back up the inlet pipe, settle out solids, and untreated stormwater flows through the overflow directly to the lake. The pipe then appears to have slowly drained down between storms through the CDS unit screen. This site also had a significant amount of sand and organic matter burying the AV probe and intake strainer, **Figure 24-7**. The AV probe and intake strainer were offset from the invert but were still buried by a large amount of solids. When the front of the AV probe is buried it is unable to obtain accurate velocity measurements during storms.

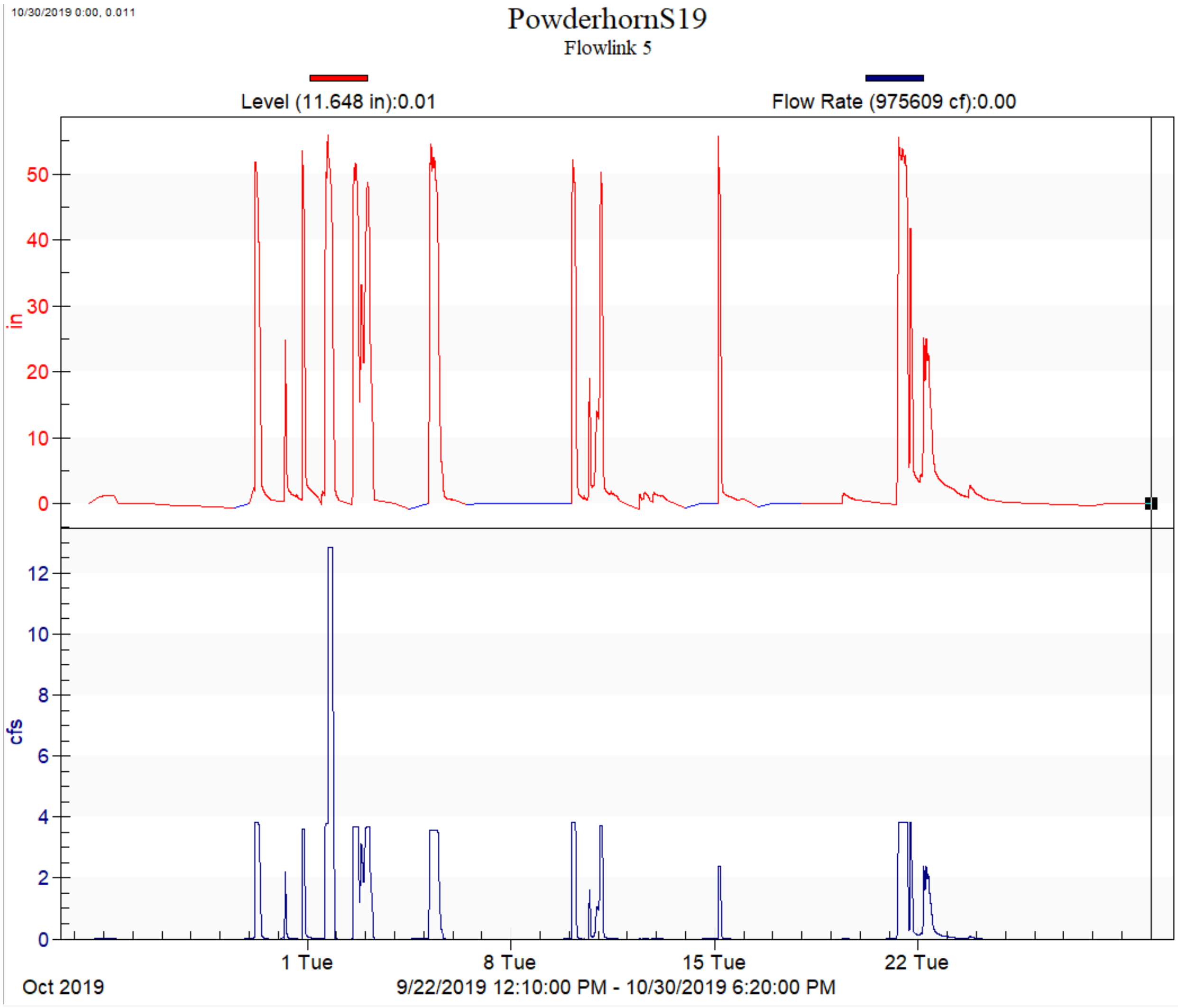


Figure 24-6. The Powderhorn Inlet South stage and discharge from September 22 to October 30, 2019. The upper graph is stage in inches and lower graph is discharge in cfs. Note each storm produces 50"+ of stage, indicating the CDS unit is plugged and backing up.

Figure 24-7. 2019 Powderhorn Inlet South offset AV probe and intake strainer after removing 8” of sand and debris.

Table 24-3 shows the chemistry data for samples collected at the Powderhorn inlets. Data shown in red and underlined failed the blind monthly laboratory standard for that test and month. When the laboratory cannot recover the blind standard at ± 20%, then it is marked for that month. This data was deemed usable but should be used with caution.

Both Powderhorn Inlet North and Southeast each show a significant number of storms sampled in a short period of time. Powderhorn Inlet South was only able to sample one storm. A geometric mean was calculated for sampled parameters at the Powderhorn Inlets North and Southeast. The high geometric means show Powderhorn Inlet Southeast is a contributor to Powderhorn Lake. The Powderhorn Inlet Southeast had high phosphorus, solids, and metals. Lead at this inlet is quite high and should be investigated for possible source reduction. The source of the lead is unknown, but one possibility may be exterior lead paint coming from the older residential buildings.

Table 24-3. **2019 Powderhorn Inlet Stormwater chemistry events data. Cells with less than values (<) indicate that the concentration of that parameter was below reporting limit. NC = not calculated. NES = not enough sample. Data that are underlined and red had a blind performance standard failure for that month, for that parameter.**

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP 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	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
8/13/2019	17:06	Powderhorn In N	Composite	0.098	0.023	0.557	0.071	NES	14	93	44	32	111	NES	NES	NES	NES
8/16/2019	3:21	Powderhorn In N	Composite	0.110	0.030	0.610	0.130	<2.00	8	22	10	18	<20	10	6	58	5
8/18/2019	3:45	Powderhorn In N	Composite	0.126	0.027	0.791	0.153	<2.00	12	49	16	15	23	12	18	39	2
9/1/2019	11:13	Powderhorn In N	Composite	0.169	0.065	2.24	<0.030	10	42	25	15	80	49	17	4	65	15
9/2/2019	23:26	Powderhorn In N	Composite	0.371	0.044	1.26	0.189	<2.00	18	15	6	35	22	8	5	25	6
9/9/2019	18:51	Powderhorn In N	Composite	0.180	0.018	1.38	0.282	3	20	38	20	60	50	16	7	50	NES
9/11/2019	6:04	Powderhorn In N	Composite	0.153	0.032	1.12	0.149	<2.00	10	31	14	10	29	10	10	25	3
9/11/2019	11:48	Powderhorn In N	Composite	0.107	0.034	0.763	0.174	<2.00	12	13	7	18	<20	14	3	27	3
9/12/2019	4:22	Powderhorn In N	Composite	0.093	0.017	0.905	0.149	<2.00	10	15	8	28	<20	10	4	21	3
9/30/2019	5:36	Powderhorn In N	Composite	0.283	0.033	1.56	<0.030	4	28	23	19	63	63	12	3	44	16
10/1/2019	11:10	Powderhorn In N	Composite	0.198	0.048	1.09	0.137	2	20	41	21	53	67	17	7	54	7
10/5/2019	6:14	Powderhorn In N	Composite	0.115	0.024	0.689	0.139	<2.00	10	22	10	35	36	12	5	37	3
10/11/2019	4:06	Powderhorn In N	Composite	0.197	0.013	1.24	0.145	4	26	24	16	78	63	17	4	43	9
10/22/2019	8:21	Powderhorn In N	Composite	0.160	0.014	0.941	0.041	<2.00	16	26	15	38	46	19	4	33	6
		Geo. Mean		**0.155**	**0.027**	**1.01**	**0.134**	**3**	**16**	**27**	**14**	**34**	**46**	**13**	**5**	**38**	**5**
9/29/2019	8:41	Powderhorn In S	Composite	0.411	0.104	1.76	<0.030	5	28	36	30	68	81	19	6	74	23
		Geo. Mean		**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**
8/17/2019	14:02	Powderhorn In SE	Composite	0.335	0.039	1.78	0.167	<2.00	24	114	35	44	83	23	36	98	5
8/26/2019	18:17	Powderhorn In SE	Composite	0.317	0.022	1.19	<0.030	<2.00	24	85	28	53	56	15	17	56	7
9/1/2019	13:13	Powderhorn In SE	Composite	0.471	0.076	2.31	<0.030	4	44	72	35	93	123	23	12	99	43
9/3/2019	0:46	Powderhorn In SE	Composite	0.345	0.016	1.88	0.095	<2.00	22	127	48	63	95	16	34	83	10
9/9/2019	18:33	Powderhorn In SE	Composite	0.490	0.028	1.84	<0.030	3	36	165	57	90	128	28	33	108	10
9/11/2019	7:50	Powderhorn In SE	Composite	0.591	0.058	1.10	0.053	<2.00	26	267	56	73	89	26	59	74	3
9/11/2019	11:33	Powderhorn In SE	Composite	0.158	0.012	0.770	0.100	<2.00	16	34	12	28	33	21	8	36	4
9/12/2019	10:00	Powderhorn In SE	Composite	0.349	0.028	1.01	0.048	<2.00	24	168	35	48	76	30	39	65	3
9/29/2019	7:57	Powderhorn In SE	Composite	0.556	0.117	2.41	<0.030	6	58	62	33	108	107	20	8	63	44
9/30/2019	20:15	Powderhorn In SE	Composite	0.527	0.038	2.64	0.095	3	26	217	88	60	185	33	49	182	9
10/1/2019	19:09	Powderhorn In SE	Composite	0.253	0.035	0.797	0.044	<2.00	14	69	28	30	83	14	15	61	4
10/3/2019	1:01	Powderhorn In SE	Composite	0.185	0.026	0.638	0.083	<2.00	18	36	17	43	53	12	10	48	6
10/10/2019	4:22	Powderhorn In SE	Composite	0.327	0.068	1.12	0.113	<2.00	20	30	20	58	63	18	5	44	10
10/11/2019	1:24	Powderhorn In SE	Composite	0.217	0.031	0.992	0.151	<2.00	30	30	19	78	80	17	7	49	NES
10/22/2019	4:10	Powderhorn In SE	Composite	0.315	0.102	0.862	<0.030	<2.00	20	42	23	<5.00	60	20	8	42	10
		Geo. Mean		**0.338**	**0.038**	**1.29**	**0.087**	**4**	**25**	**79**	**31**	**57**	**81**	**20**	**17**	**67**	**8**

CONCLUSION

A complete picture of the external load to Powderhorn Lake cannot be determined at this time since two of the sites were not monitored due to sediment buildup and maintenance needs. When additional sites are online, the data will provide a fuller picture of the external load to Powderhorn Lake.

The Powderhorn Lake CDS BMP's have had neglected cleaning and maintenance for some time. A previous MPRB Powderhorn CDS study (2002-2003) had shown the manufacturer recommendation of spring and fall cleaning was inadequate for the amount of organic matter flowing to these sites.

Monitoring not possible at the South and West inlet sites in 2019. They could not be monitored because the CDS units and upstream pipes weren't cleaned. When the inlet BMP's are cleaned on a regular schedule it should be possible to collect accurate flow data and flow-paced storm samples. Regular maintenance of the CDS units will not only remove solids but allow for a better assessment of the external load to Powderhorn Lake.

Judging by the amount of trash appearing to bypass the Powderhorn Inlet Southeast into Powderhorn Lake it may be undersized or in need of more frequent maintenance due to its larger watershed. Minneapolis Public Works reported in 2019 that this CDS unit was extremely full when cleaned. The phosphorus, solids, and metals reaching Powderhorn Lake are also of concern at this inlet and this site is likely a contributor to the external load.

After cleaning, future monitoring data should be more complete by adding additional inlets at the South and West sites. The West inlet is the largest watershed at 99 acres, and the South inlet is the second largest at 81 acres. The complete data will be used to inform a plan to mitigate the external load to the lake and improve in-lake condition

Winter Infiltration Basin

BACKGROUND

The Winter Infiltration Basin (WIB) Best Management Practice (BMP) was monitored as part of the Federal NPDES Permit. The WIB was built to collect solids and infiltrate stormwater, **Figure 27-1**. When stormwater is infiltrated into the ground, it can both filter out pollutants and reduce the volume of water discharged to surface waters. The WIB has two inlets and one outlet. A hydrodynamic separator, grit chamber 162, collects solids before water is discharged to the BMP through the south inlet. The west inlet has no upstream pretreatment. Both inlets have flared end reinforced concrete pipes (RCP) with trash racks. The outlet has a flared end RCP with a trash rack, but water flows into it not out of it. Water that does not infiltrate leaves the BMP discharges to the City of Minneapolis stormwater system and to the Mississippi River.

The watershed that drains to the WIB is 31.32 acres. The west inlet watershed is 1.17 acres. The south inlet watershed is 30.15 acres.

The west inlet major land use is 51% industrial and 27% residential. The south inlet major land use is 57% industrial and 20% residential.

The WIB was monitored as part of the NPDES permit to assess BMP performance in the City of Minneapolis. 2019 was the last year of the three-year monitoring of this BMP. The study lasted from 2017 through 2019. The goal was to assess the functionality of the BMP, for stormwater volume control, rate control, and pollution reduction.

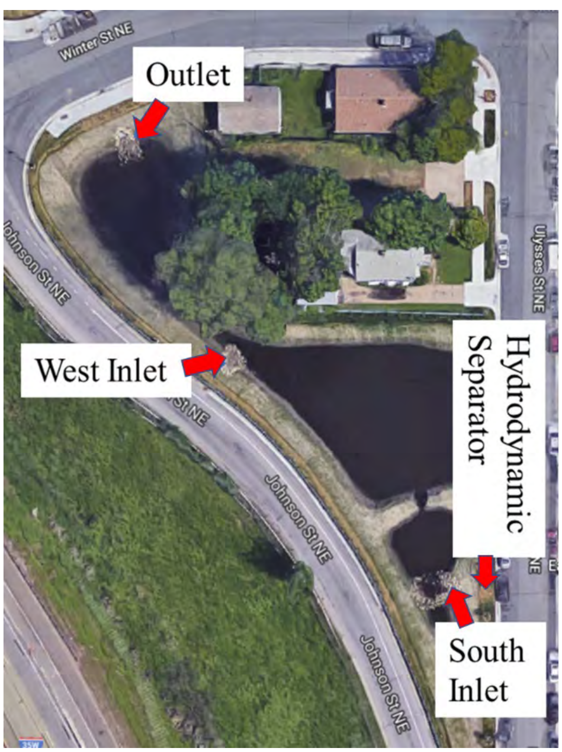


Figure 27-1. Aerial photo of the Winter Infiltration Basin. It has two inlets and one outlet.

METHODS

Site Installation

The MPRB used the best available technology for monitoring equipment at each site which included: an ISCO 2150 datalogger, a 2105 interface module, a 2105ci or a 2103ci cell phone modem, an antenna, a low-profile AV probe, and a 3700 ISCO sampler. The AV probes were secured with a stainless-steel anchor plate or a stainless steel spring ring. All sites required secure above-ground monitoring boxes with flexible conduit to protect the AV-cable and sampler tubing.

Each datalogger used a cell phone modem to remotely upload data to a Flowlink database each morning (before the start of the workday) Monday through Friday. All dataloggers could also be called up and programmed remotely to turn samplers on or off, adjust the level, pacing, or triggers.

The samplers were flow-paced and equipped with 24 one-liter bottles, 3/8" ID (inner diameter) vinyl tubing, and an intake strainer. The sampler was programmed to multiplex, taking four flow-paced samples per bottle, allowing for 96 flow-paced samples per storm. The WIB west inlet is a 12-inch RCP pipe, the south inlet is a 24-inch RCP pipe, and the outlet is a 20-inch RCP pipe.

In 2019, equipment at the west and south inlets were installed on 4/29/19 and equipment at the outlet was installed on 5/1/19. All equipment was removed on 10/31/19.

Sample Collection

Historical data from previous years was used to set the pacing parameters. Pacing samplers can be a dynamic process to fully sample storms. For example, some changes need to be made to adjust to wet or dry years. In 2019, the west inlet was set to trigger at 0.80 inches and initially paced at 25 cubic feet, but pacing was changed on 8/9/19 to 50 cubic feet due to the wet year. The south inlet was set with a 1.5-inch trigger and paced at 600 cubic feet. The outlet was set with a 1-inch trigger and initially paced at 50 cubic feet. The outlet pacing was changed on 5/23/19 to 25 cubic feet. Due to the wet year, on 6/28/19 outlet pacing was changed back to 50 cubic feet, and finally pacing was increased again on 8/9/19 to 75 cubic feet to fully sample the entire storm hydrograph.

RESULTS & DISCUSSION

Sample Collection

In 2019, samples from nineteen storm events were collected at the west inlet and samples from eighteen storm events were collected at the south inlet, **Table 27-2**. Four of the 6 sampled events had greater than 1" of stage in the outlet. Outlet events were rare because most of the stormwater was infiltrated and didn't produce outlet events. Three NPDES quarterly *E. coli* and Fat Oil and Grease (FOG) grab samples were collected at both inlets at this site in 2019.

Even though the hydrodynamic separator was cleaned April 23, 2019 large amounts of debris continued to bypass the separator in 2019. Debris constantly became caught in the upstream side of the inlet trash rack, **Figure 27-2** and **Figure 27-3**. The debris needed to be cleaned off the inside of the trash rack frequently to prevent damming up the inlet outfall and caused standing water to back up the pipe. The hydrodynamic separator may be undersized or needs very frequent maintenance.

Figure 27-2. Photo of the south 24” inlet flared-end outfall and trash building up on the inside of the grate.

Figure 27-3. Looking upstream, a closer photo of the south inlet and trash building up on the inside of the grate.

The west inlet is also in need of frequent maintenance. Significant amounts of debris were caught in the upstream side of the trash rack damming the outfall and creating backwater conditions, **Figure 27-4**. Since the west inlet is a 12” pipe, removing the trash rack, or cutting off the bottom irons should be considered.

Figure 27-4. Photo of the west 12” inlet flared-end outfall and debris building up on the inside of the grate.

Figure 27-5 is a picture of the WIB outlet taken in spring. The photo shows the basin contains water, but no water is reaching the outlet since most of the stormwater is infiltrating. Since almost all water infiltrated in the basin, it was rare for stormwater to reach the outlet, and there were few opportunities to capture samples from water leaving the basin.

Figure 27-5. Photo of the WIB outlet. Standing water can be seen in the basin waiting to infiltrate and it has not reached the outlet. The brown box contains the monitoring equipment and the gray conduit armors the AV cable and sampler pump tubing.

Table 27-1 shows the 2019 storm events that were sampled. A total of 19 storms were either fully or partially sampled at the WIB. The precipitation amounts varied from 0.22” to 1.88”. In 2019 the WIB was able to fully infiltrate storms that had less than 0.80” of precipitation. Three NPDES *E. coli* and FOG samples were collected from the inlets. No NPDES *E. coli* or FOG samples were collected at the outlet because no water flowed out of the basin while staff were present.

Table 27-1. The 2019 precipitation events captured at Winter Infiltration Basin. The rain gauge was located at the MPRB SSSC at 38th and Bryant Ave. S. A precipitation event was defined as a storm greater than 0.10 inches and separated by eight hours or more from other precipitation events. Full = all chemical parameters. Partial = some chemical parameters were not run due to low volume or expired holding times. NS = storm not sampled.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr)	Hours since last Rain.	Winter Basin In South	Winter Basin In West	Winter Basin Outlet
5/8/2019	9:30	5/8/2019	23:45	1.42	14.25	0.10	102	E. coli/Full	E. coli/Full	Full
5/18/2019	22:30	5/20/2019	0:15	0.78	25.75	0.03	17	Full	Full	NS
5/21/2019	16:45	5/22/2019	11:15	1.04	18.5	0.06	41	Full	NS	NS
5/27/2019	5:00	5/27/2019	18:45	1.51	13.75	0.11	114	NS	Full	Full
6/4/2019	15:15	6/4/2019	20:30	0.23	5.25	0.04	188	Full	Full	NS
6/20/2019	14:15	6/20/2019	19:45	0.26	5.5	0.05	217	Partial	Full	NS
6/23/2019	2:00	6/24/2019	17:30	0.88	39.5	0.02	54	Full	Full	Full
6/27/2019	9:00	6/27/2019	11:15	0.20	2.25	0.09	64	E. coli	E. coli/Full	NS
7/15/2019	17:15	7/15/2019	18:30	0.93	1.25	0.74	145	NS	Full	Full
8/10/2019	13:45	8/10/2019	18:30	0.49	4.75	0.10	117	NS	Full	NS
8/15/2019	17:45	8/16/2019	1:15	0.70	7.5	0.09	43	Full	NS	NS
8/17/2019	23:30	8/18/2019	3:15	1.88	3.75	0.50	46	Full	NS	NS
8/26/2019	11:15	8/26/2019	14:00	0.79	2.75	0.29	146	E. coli	E. coli	NS
9/7/2019	22:30	9/8/2019	11:00	0.17	12.5	0.01	119	Partial	NS	NS
9/9/2019	10:15	9/9/2019	17:45	0.22	7.5	0.03	23	Full	Full	NS
9/11/2019	1:45	9/11/2019	10:45	1.12	9	0.12	32	Full	Full	NS
9/12/2019	1:30	9/12/2019	17:00	0.94	15.5	0.06	15	E. coli/Full	E. coli/Full	NS
10/2/2019	11:15	10/3/2019	2:00	0.44	14.75	0.03	18	Partial	Full	NS
10/5/2019	1:45	10/5/2019	17:00	0.80	15.25	0.05	48	Full	Full	NS

The stage and discharge graphs for the WIB inlet are shown in **Figure 27-6** and **Figure 27-7**. The stage and discharge graph for the outlet is shown in **Figure 27-8**. The outlet graph shows relatively few events even though 2019 was the wettest year on record. Water deeper than 1" of stage flowed out of the basin only a few times in 2019.

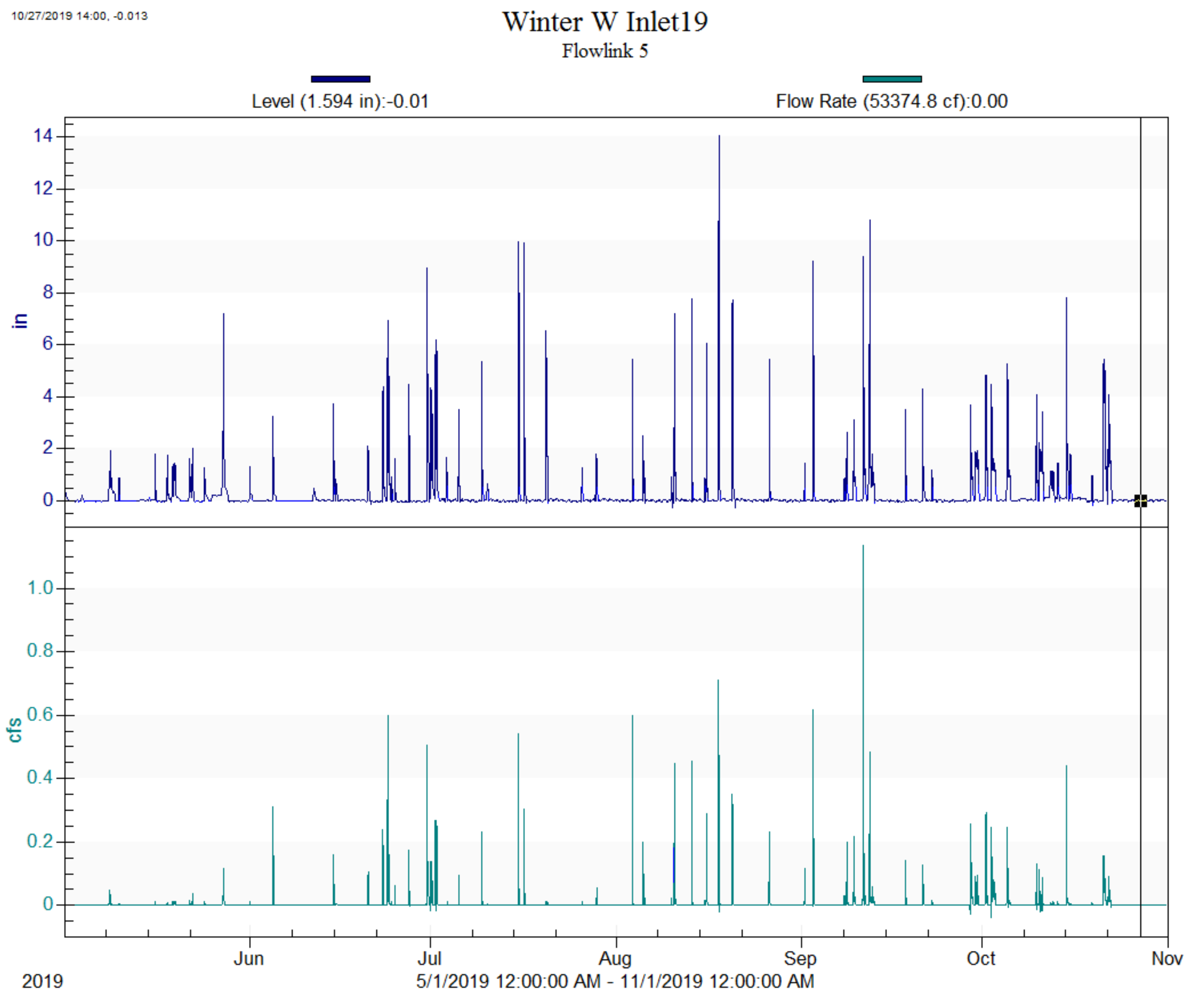


Figure 27-6. The 2019 Winter Basin west inlet stage and discharge graph from May 1 through November 1. The upper graph is stage in inches and the lower graph is discharge in cfs.

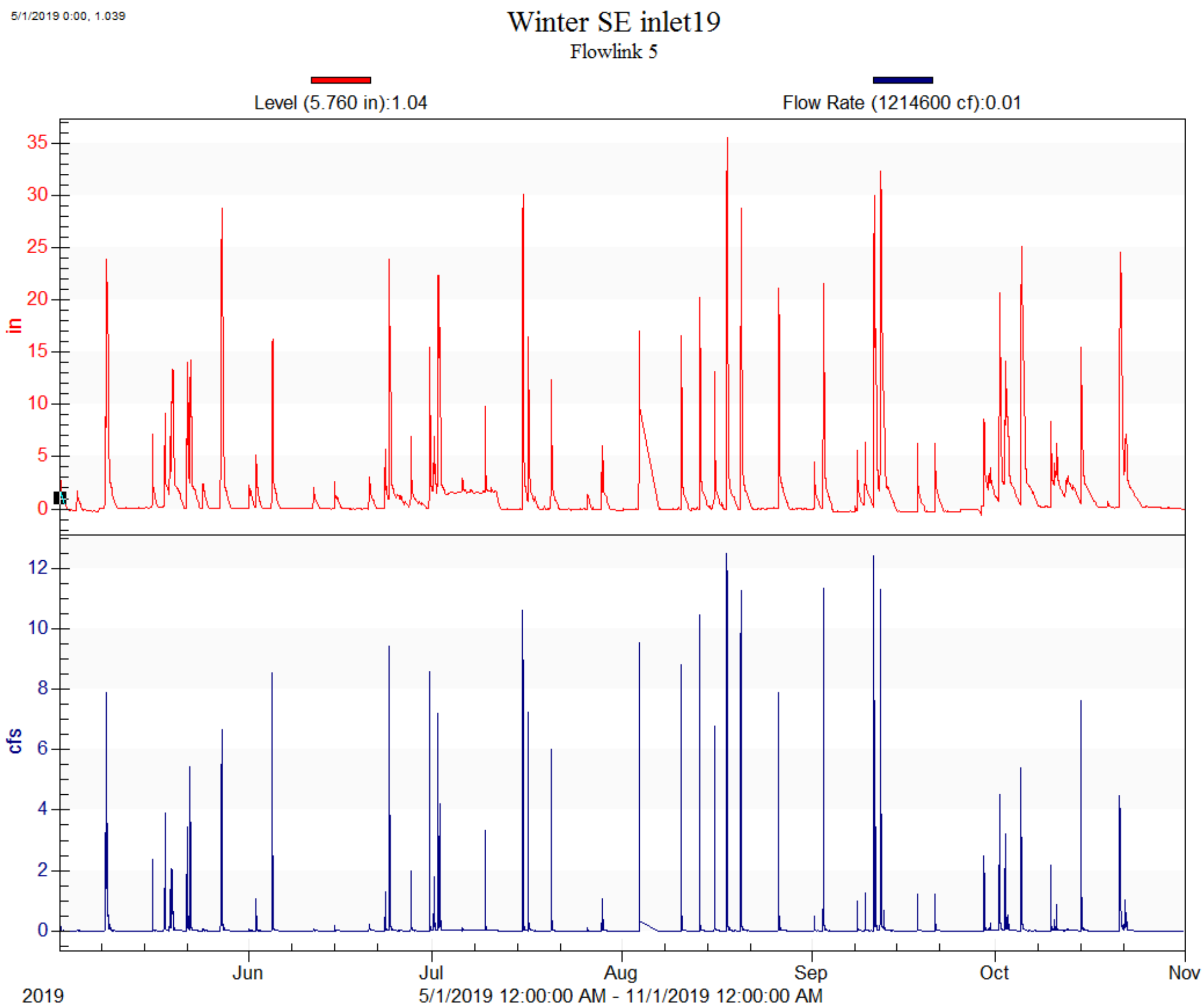


Figure 27-7. The 2019 Winter Basin south inlet stage and discharge graph from May 1 through November 1. The upper graph is stage in inches and the lower graph is discharge in cfs.

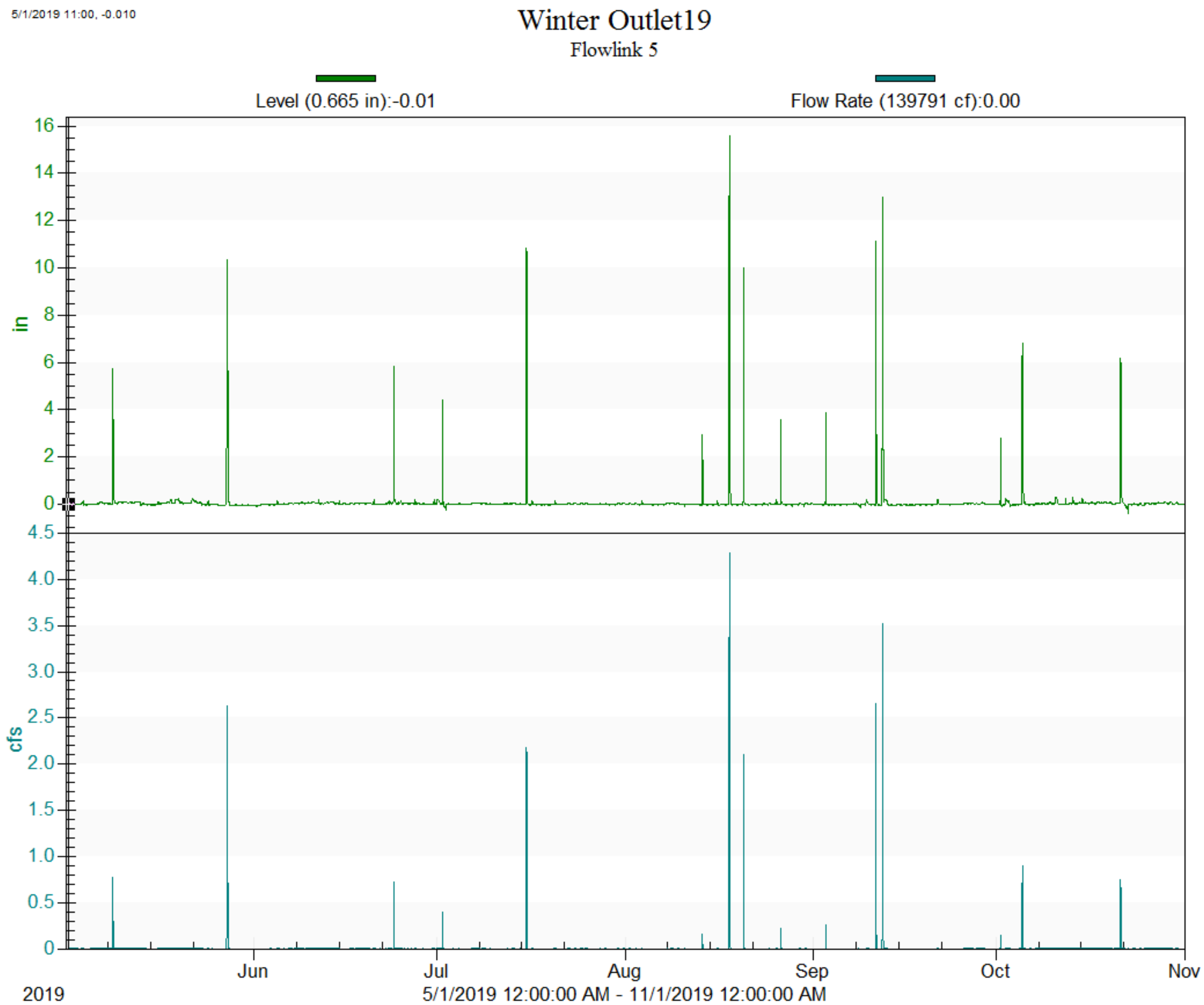


Figure 27-8. The 2019 Winter Basin outlet stage and discharge graph from May 1 through November 1. The upper graph is stage in inches and the lower graph is discharge in cfs.

Storm Event Data and Statistics

Table 27-2 shows the 2019 Winter Infiltration Basin sample chemistry data. Some of the events sampled were analyzed for limited parameters because of low volume or expired holding times. Due to limited outflow from the BMP in 2019 a concerted effort was made to collect outlet samples. This effort resulted in four outlet samples being collected.

In 2019, the March TDP, TN, September TDP, and October Zn parameters failed the MPRB blind monthly laboratory performance standard, and the effected data in **Table 27-2** are marked in red and bold. The data can be used with caution, noting that performance standards were outside the 80-120% recovery standard limits.

Table 27-3 shows the 2019 statistical comparisons for the WIB inlets and outlet.

Table 27-2. **2019 Winter Infiltration Basin south inlet water chemistry events data. ND = data not available due to expired holding time or sample not taken. NES = not enough sample for analysis. Data that are red and underlined had a blind performance standard failure for that month, for that parameter.**

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP 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	pH std units	*E. Coli* MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
5/8/2019	13:50	Winter In S	Grab	0.323	0.037	1.20	0.265	6	16	160	46	68	104	<5.00	7.9	1296	23	14	230	4
5/8/2019	18:22	Winter In S	Composite	0.241	0.037	0.874	0.205	4	18	111	31	54	66	ND	ND	ND	22	11	174	3
5/18/2019	7:11	Winter In S	Composite	0.273	0.009	2.42	0.787	10	30	125	37	76	105	ND	ND	ND	27	13	223	8
5/19/2019	16:00	Winter In S	Composite	0.076	0.015	0.837	0.357	4	16	11	4	45	16	ND	ND	ND	11	2	98	4
5/27/2019	13:09	Winter In S	Composite	0.091	0.033	0.549	0.158	<2.00	14	29	9	28	<20	ND	ND	ND	10	3	70	2
6/4/2019	23:49	Winter In S	Composite	0.561	0.028	2.14	0.468	4	26	332	73	60	202	ND	ND	ND	58	36	591	5
6/20/2019	20:10	Winter In S	Composite	0.703	0.081	4.01	0.062	NES	40	75	37	NES	167	ND	ND	ND	NES	NES	NES	NES
6/23/2019	10:21	Winter In S	Composite	0.428	0.029	1.78	0.315	5	22	176	50	58	129	ND	ND	ND	38	20	310	6
6/27/2019	11:16	Winter In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.3	24196	ND	ND	ND	ND
8/16/2019	6:31	Winter In S	Composite	0.149	0.023	0.723	0.169	3	24	59	14	53	43	ND	ND	ND	11	6	143	4
8/18/2019	1:06	Winter In S	Composite	0.209	0.013	1.03	0.288	3	24	133	32	48	62	ND	ND	ND	19	11	202	4
8/26/2019	13:45	Winter In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND	17329	ND	ND	ND	ND
9/8/2019	11:55	Winter In S	Composite	0.178	0.023	1.20	0.288	11	32	36	14	80	47	ND	ND	ND	20	6	128	NES
9/9/2019	18:54	Winter In S	Composite	0.186	0.015	1.54	0.439	6	30	56	17	70	53	ND	ND	ND	18	11	229	6
9/11/2019	7:12	Winter In S	Composite	0.204	0.015	0.920	0.149	<2.00	18	99	24	30	60	ND	ND	ND	22	14	151	2
9/12/2019	8:50	Winter In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	7.4	24196	ND	ND	ND	ND
10/2/2019	11:44	Winter In S	Composite	0.051	NES	<0.500	<0.030	NES	36	NES	NES	68	50	ND	ND	ND	NES	NES	NES	NES
10/5/2019	5:10	Winter In S	Composite	0.147	<0.010	0.689	0.149	3	22	88	23	43	74	ND	ND	ND	25	11	268	2
5/8/2019	14:05	Winter In W	Grab	0.281	0.060	1.18	0.160	7	16	113	45	78	129	5	7.5	727	32	9	186	9
5/8/2019	17:00	Winter In W	Composite	0.239	0.041	1.07	0.105	5	14	113	45	60	114	ND	ND	ND	26	8	171	7
5/18/2019	6:19	Winter In W	Composite	0.246	0.019	2.66	0.563	4	20	185	97	55	128	ND	ND	ND	NES	NES	NES	NES
5/19/2019	11:31	Winter In W	Composite	0.082	0.007	0.910	0.146	3	14	29	15	43	36	ND	ND	ND	13	1	46	5
5/27/2019	15:43	Winter In W	Composite	0.076	0.020	<0.500	0.127	4	12	17	8	33	128	ND	ND	ND	12	1	49	4

6/4/2019	20:44	Winter In W	Composite	0.140	0.014	1.81	0.386	5	15	39	14	53	52	ND	ND	ND	19	3	84	8
6/20/2019	16:53	Winter In W	Composite	0.398	0.051	3.47	0.938	26	32	55	36	172	170	ND	ND	ND	49	5	151	45
6/23/2019	23:35	Winter In W	Composite	0.116	0.013	1.06	0.303	3	10	53	18	50	57	ND	ND	ND	18	5	91	7
6/27/2019	11:22	Winter In W	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5	6.6	723	ND	ND	ND	ND
6/27/2019	12:51	Winter In W	Composite	0.210	0.016	1.77	0.388	8	20	40	17	75	67	ND	ND	ND	21	4	110	11
7/15/2019	20:03	Winter In W	Composite	0.183	0.016	1.67	0.340	4	30	60	28	55	66	ND	ND	ND	23	3	145	9
8/10/2019	18:01	Winter In W	Composite	0.119	0.018	1.35	0.459	6	16	29	13	62	62	ND	ND	ND	15	3	83	5
8/26/2019	13:50	Winter In W	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5	7.3	17329	ND	ND	ND	ND
9/8/2019	13:07	Winter In W	Composite	0.212	0.030	1.57	0.161	5	22	19	9	53	36	ND	ND	ND	13	1	44	8
9/9/2019	19:03	Winter In W	Composite	0.159	0.009	1.22	0.290	5	18	40	22	60	60	ND	ND	ND	19	6	96	7
9/11/2019	7:03	Winter In W	Composite	0.190	0.009	1.01	0.196	<2.00	16	33	12	23	29	ND	ND	ND	16	4	56	4
9/12/2019	8:55	Winter In W	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.2	8164	ND	ND	ND	ND
10/3/2019	6:10	Winter In W	Composite	0.093	0.014	<0.500	0.083	2.0	16	13	6	33	32	ND	ND	ND	13	2	56	4
10/5/2019	9:27	Winter In W	Composite	0.062	<0.010	<0.500	0.111	<2.00	8	18	9	23	36	ND	ND	ND	11	2	53	2
5/8/2019	18:17	Winter Outlet	Composite	0.170	0.016	0.672	0.205	10	14	46	13	53	33	ND	ND	ND	19	6	97	3
5/27/2019	13:10	Winter Outlet	Composite	0.070	0.036	0.520	0.171	3	14	5	3	25	36	ND	ND	ND	8	1	41	3
6/23/2019	23:57	Winter Outlet	Composite	0.183	0.027	1.16	0.325	4	16	44	14	53	52	ND	ND	ND	19	6	90	6
7/15/2019	20:17	Winter Outlet	Composite	0.246	0.034	1.64	0.441	6	20	62	17	60	56	ND	ND	ND	24	9	181	8

Table 27-3. 2019 Winter Infiltration Basin data showing statistics for the inlets and outlet. COV=Coefficient of Variation. All data below the reporting limit were transformed into half the reporting limit for statistical calculations (e.g. Cl <2 becomes 1). NC = not collected.

Site ID	Statistical Function	TP mg/L	TDP 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	pH std unit	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
Winter In South	MEAN (geometric)	0.202	0.021	1.09	0.204	4	23	80	24	53	62	4	7.5	10708	21	9	189	4
Winter In South	MEAN (arithmetic)	0.255	0.026	1.34	0.274	5	25	106	29	56	79	4	7.5	16754	23	12	217	4
Winter In South	MAX	0.703	0.081	4.01	0.787	11	40	332	73	80	202	6	7.9	24196	58	36	591	8
Winter In South	MIN	0.051	0.005	0.250	0.015	1	14	11	4	28	10	3	7.3	1296	10	2	70	2
Winter In South	MEDIAN	0.204	0.023	1.03	0.265	4	24	93	27	56	62	4	7.4	20763	22	11	202	4
Winter In South	STDEV	0.183	0.019	0.947	0.191	3	8	81	19	16	53	2	0.3	10802	13	9	131	2
Winter In South	NUMBER	15	14	15	15	13	15	14	14	14	15	4	3	4	13	13	13	12
Winter In South	COV	0.718	0.726	0.705	0.696	0.688	0.316	0.764	0.631	0.288	0.676	0.5	0.04	0.645	0.542	0.732	0.606	0.421
Winter In West	MEAN (geometric)	0.155	0.017	1.06	0.237	4	16	41	18	51	64	4	7.1	2937	18	3	84	7
Winter In West	MEAN (arithmetic)	0.175	0.021	1.34	0.297	5	17	54	24	58	75	5	7.2	6736	20	4	95	9
Winter In West	MAX	0.398	0.060	3.47	0.938	26	32	185	97	172	170	5	7.5	17329	49	9	186	45
Winter In West	MIN	0.062	0.005	0.250	0.083	1	8	13	6	23	29	3	6.6	723	11	1	44	2
Winter In West	MEDIAN	0.171	0.016	1.20	0.243	4	16	40	16	54	61	5	7.3	4446	18	3	84	7
Winter In West	STDEV	0.089	0.016	0.852	0.222	6	6	46	23	35	44	1	0.4	7885	10	2	48	10
Winter In West	NUMBER	16	16	16	16	16	16	16	16	16	16	4	4	4	15	15	15	15
Winter In West	COV	0.508	0.751	0.634	0.748	1.09	0.367	0.863	0.935	0.598	0.583	0.3	0.05	1.17	0.497	0.625	0.506	1.12
Winter Outlet	MEAN (geometric)	0.152	0.027	0.90	0.266	5	16	28	10	45	43	NC	NC	NC	16	4	90	4
Winter Outlet	MEAN (arithmetic)	0.167	0.028	1.00	0.286	6	16	39	12	48	44	NC	NC	NC	17	5	102	5
Winter Outlet	MAX	0.246	0.036	1.64	0.441	10	20	62	17	60	56	NC	NC	NC	24	9	181	8
Winter Outlet	MIN	0.070	0.016	0.520	0.171	3	14	5	3	25	33	NC	NC	NC	8	1	41	3

Winter Outlet	MEDIAN	0.177	0.031	0.914	0.265	5	15	45	14	53	44	NC	NC	NC	19	6	94	4
Winter Outlet	STDEV	0.073	0.009	0.505	0.123	3	3	24	6	15	12	NC	NC	NC	7	3	58	2
Winter Outlet	NUMBER	4	4	4	4	4	4	4	4	4	4	NC	NC	NC	4	4	4	4
Winter Outlet	COV	0.435	0.320	0.508	0.431	0.538	0.177	0.613	0.525	0.324	0.262	NC	NC	NC	0.385	0.581	0.570	0.530

Table 27-4 shows volume and load reductions for the Winter Infiltration Basin. The load calculations used the geometric mean of the chemical parameter as the calculation concentration. Winter Infiltration Basin had an 85-95% removal efficiency for all chemical parameters and a 92% stormwater infiltration efficiency. The high removal percentages show that the BMP worked well even in an extremely wet year.

Table 27-4. Infiltration and load calculations for the 2019 performance of the Winter Infiltration Basin.

Site	Total Vol (L)	TP (lbs.)	TDP (lbs.)	TN (lbs.)	NO3NO2 (lbs.)	Cl (lbs.)	Hardness (lbs.)	TSS (lbs.)
Winter Basin In S	34,393,585	15.3	1.59	82.9	15.5	272	1776	6038
Winter Basin In W	1,511,409	0.5	0.06	3.5	0.8	13	55	136
Winter Outlet	3,956,395	1.3	0.24	7.9	2.3	45	138	247
Percent removed	92%	92%	86%	91%	86%	84%	92%	96%

Site	Total Vol (L)	VSS (lbs.)	TDS (lbs.)	COD (lbs.)	FOG (lbs.)	Cu (lbs.)	Pb (lbs.)	Zn (lbs.)	DOC (lbs.)
Winter Basin In S	34,393,585	1787	4027	4679	300	1.6	0.71	14.3	283
Winter Basin In W	1,511,409	61	170	215	14	0.06	0.01	0.28	23
Winter Outlet	3,956,395	84	393	377	NC	0.14	0.04	0.78	37
Percent removed	92%	95%	91%	92%	NC	92%	95%	95%	88%

CONCLUSION

The 2019 load data shows the WIB was highly effective at removing pollutants and infiltrating water even in an extremely wet year with consistently saturated soils in the WIB. The only parameter of concern in 2019 was the high levels of Zn measured at the south inlet. Further investigation should be made to try and uncover the source of the Zn and the reason behind the increase. The south inlet watershed contains a foundry, auto repair business, and a fencing company that could be considered possible sources.

There was one incident in 2019 where oil with metal parts (nuts/bolts) were dumped at the south inlet WIB hillside. The oil killed all the vegetation in a two-foot square patch of the WIB. The owner of the auto repair business, located across the street, was contacted and he said he thought he knew who was responsible and would tell them not to do it again. No oil was found dumped again.

The WIB inlets need more frequent maintenance. Trash is building up inside the trash racks at both inlet outfalls. The bottoms of these trash-racks could be cut off and removed as a potential solution to the buildup. The hydrodynamic separator at the south inlet should be cleaned more frequently and investigated for frequent solids bypass. Sand is accumulating by both inlet outfalls and needs to be removed.

The WIB infiltrates most of the stormwater it receives, but more large and intense storms could be collected to verify that the WIB is working properly.

Finally, the vegetation appears to be growing well and helping to treat stormwater, amend the soil, and provide habitat for the wide variety of insects and animals (ducks, butterflies, grasshoppers, etc.) observed at the WIB. Management of the vegetation should include continuing to remove invasive plants, especially cattails. **Figure 27-9** shows a Monarch butterfly on an Aster plant at the south inlet.

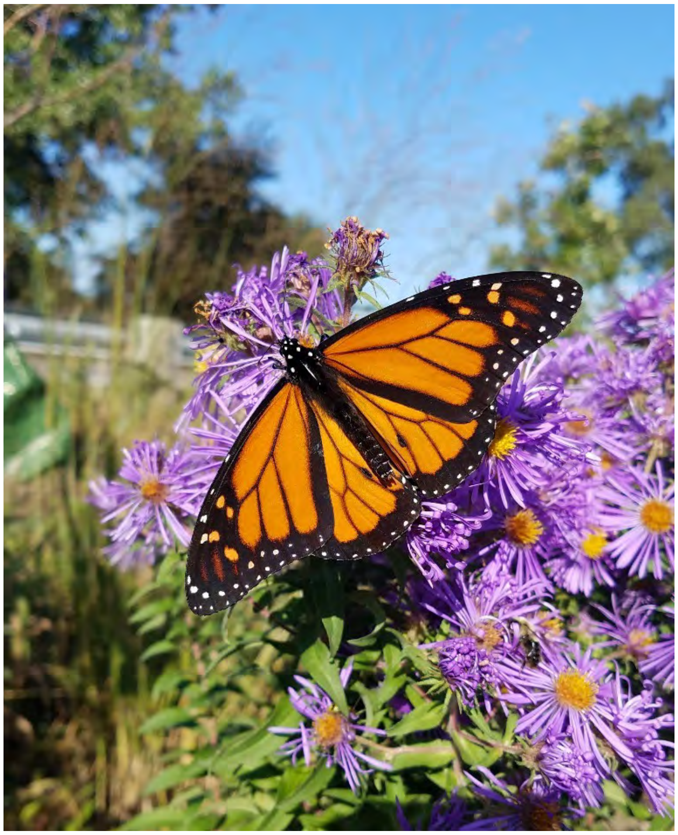


Figure 27-9. A 2019 fall photograph of a Monarch butterfly on an Aster plant at the south

24th & Elm Infiltration Chamber
BACKGROUND

The 24th & Elm Infiltration Chamber (EIC) shown in **Figure 26-1** was constructed in 2016 by the City of Minneapolis Public Works Department and was partially funded by a grant from the Mississippi Watershed Management Organization. The infiltration chamber has a 14.27 acre watershed and was built to remove solids and infiltrate stormwater from an area with light industrial and mixed land uses**.** The EIC treats stormwater first by removing and concentrating solids in a Contech™ Continuous Deflective Hydrodynamic Separator (CDS) as shown in **Figure 26-2.** The CDS units are located at the north and south inlets. The BMP then infiltrates stormwater in an infiltration chamber in order to both capture pollutants and reduce the volume of water discharged to the Mississippi River. Reducing stormwater volume alleviates hydraulic pressure on downstream stormwater conveyance infrastructure. The EIC was not built to treat the dissolved fraction of nutrients and chemicals in stormwater, but these fractions may adhere to particles in the soil.

The BMP has two inlets: The north inlet is a 36-inch reinforced concrete pipe (RCP) with a 3.93 acre watershed, and the south inlet is a 36-inch RCP with a 10.34 acre watershed. Both the north and south inlets have hydrodynamic separators (grit chambers 182 & 183, respectively. **Figure 26-3** shows the clean-out manhole and the inside of the north hydrodynamic separator. The largest part of the EIC is a cement infiltration box that is open at the bottom in order to promote infiltration and is located under 24th Ave. SE. This underground infiltration chamber is 12 feet wide, 462 feet long and 10 feet high. The EIC has the unique feature in that a backflow preventer is located on the Elm Street SE pipe. The backflow preventer allows high floodwater to leave the 24th Ave SE pipe, but prevents water entering the 24th Ave SE infiltration basin from the Elm Street pipe. The outlet and north inlet are the same pipe; therefore, dataloggers and samplers were placed at different locations to capture inflow to the EIC and any outflow from the EIC through this shared pipe. Under normal conditions, most of the water entering the EIC infiltrates, but under a large or intense storm the area can produce outflow that drains to the Mississippi River via the Elm St. SE pipe. This BMP will be monitored a minimum of three years, beginning in 2017.

Figure 26-1. Aerial photo of 24th & Elm Infiltration Chamber and its inlets and outlet. Blue arrows show the direction of flow.

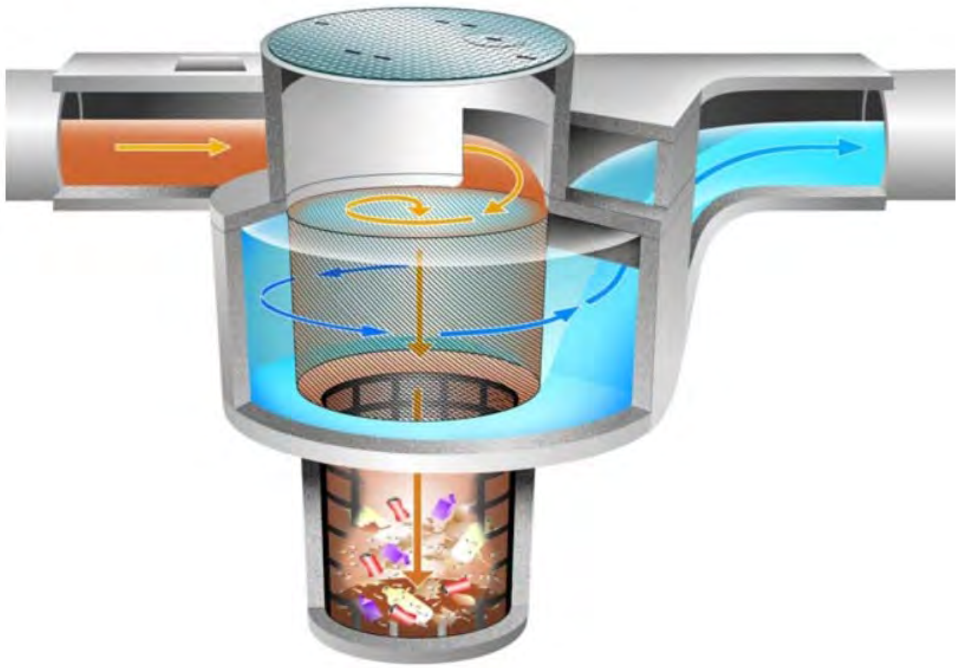


Figure 26-2. Shows a side view of a Contech™ Continuous Deflective Hydrodynamic Separator CDS unit.

Figure 26-3. Photograph of the top clean-out manhole access of the north Contech hydrodynamic CDS separator.

A backflow preventer shown in **Figure 26-4**, is located at the T-intersection in the stormwater pipe between 24th Avenue and Elm Street. The device is intended to allow water to leave the 24th Avenue pipe but prevent water from backflowing from the Elm Street pipe to the 24th Avenue pipe, overwhelming the infiltration practice with untreated water. The construction plans showing the location of the backflow preventer at the 24th Street pipe were not correct. The backflow preventer access manhole is located by the 24th Street stop sign. The backflow preventer appears intact, in working order, and located ~36" above the invert of the pipe.

Figure 26-4. Photograph of the backflow preventer at 24th Ave. SE, and Elm St. SE. The backflow preventer is approximately 36" above the 24th pipe invert.

METHODS

Site Installation

Monitoring equipment at each of the sites included: ISCO 2150 datalogger, 2105 interface module, 2103ci cell phone modem or 2015ci combined interface/modem, low-profile AV probe, and a 3700 ISCO sampler. The equipment at the north inlet and outlet was hung from eyebolts below grade at each manhole. Installation at the south inlet required a cross hanger due to its shallow depth. The datalogger used the cell phone modem to remotely upload data to a MPRB database from Monday through Friday. A cell phone antenna was embedded in the street to allow communication. The dataloggers could be called up and programmed remotely to turn the samplers on or off, adjust the level, pacing, or triggers.

The north inlet was installed on 5/2/19. On 5/10/19, the south inlet and outlet monitoring equipment were installed. Both inlets were installed downstream of the hydrodynamic separators. Access to the inlets at 24th & Elm was very cramped to work in and part of the north inlet pipe had to be removed to facilitate access, **Figure 26-5**. All equipment was removed on 11/1/19.

The samplers were flow-paced and equipped with 24 one-liter bottles, 3/8" ID (inner diameter) vinyl tubing, and an intake strainer. The sampler was programmed to multiplex, taking four flow-paced samples per bottle, allowing for 96 flow-paced samples per storm.

Figure 26-5. Photograph of the 36-inch north inlet at 24th & Elm prior to equipment installation. Note the hydrodynamic separator upstream on the right. The blue arrow shows the direction of flow. Note, part of the pipe had to be cut away to allow access.

Sample Collection

In 2019, the north inlet was set to trigger at 0.80 inches of stage and flow paced at 100 cubic feet. The south inlet was set to trigger at 1.25 inches of stage and flow paced at 150 cubic feet. The outlet trigger was set for 0.80 inches and initially paced at 10 cubic feet. Due to the wet year, the outlet pacing was changed to 20 cubic feet on 5/25/19, and to 50 cubic feet on 7/16/19, and finally to 60 cubic feet on 8/9/19.

The issue of semi-trucks parking on top of manholes appears to have been resolved after City traffic control installed no parking signs at each site in the spring. This change made the samplers and equipment accessible when needed.

RESULTS & DISCUSSION

Sample Collection

In 2019, 11 samples were collected at the north inlet, and 15 samples were collected at the south inlet. Ten storms were sampled at the outlet, as shown in **Table 26-1**. 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 more than 0.10 inches of rain separated by eight hours or more from other precipitation. The largest storm sampled was on 8/17-8/19 with 1.88 inches of precipitation.

Table 26-1. The 2019 precipitation events captured at 24th & Elm Infiltration BMP. Sample events were marked Full if all chemical parameters were analyzed. In samples marked Partial some chemical parameters were not run due to low volume or expired holding times. NS indicates storms that were not sampled.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr.)	Hours since last Rain.	24th & Elm North Inlet	24th & Elm South Inlet	24th & Elm Outlet
5/8/2019	9:30	5/8/2019	23:45	1.42	14.25	0.10	102	Full/E. *coli*	Full/E. *coli*	NS
5/27/2019	5:00	5/27/2019	18:45	1.51	13.75	0.11	114	NS	Full	NS
6/4/2019	15:15	6/4/2019	20:30	0.23	5.25	0.04	188	Full	Full	NS
6/20/2019	14:15	6/20/2019	19:45	0.26	5.5	0.05	217	NS	Full	Full
6/23/2019	2:00	6/24/2019	17:30	0.88	39.5	0.02	54	Partial	Full	Full
6/27/2019	9:00	6/27/2019	11:15	0.20	2.25	0.09	64	E. *coli*	Full/E. *coli*	NS
7/15/2019	17:15	7/15/2019	18:30	0.93	1.25	0.74	145	Full	NS	Full
8/10/2019	13:45	8/10/2019	18:30	0.49	4.75	0.10	117	NS	Full	Full
8/17/2019	23:30	8/18/2019	3:15	1.88	3.75	0.50	46	Full	NS	Full
8/26/2019	11:15	8/26/2019	14:00	0.79	2.75	0.29	146	Full/E. *coli*	Full/E. *coli*	Full
9/1/2019	8:15	9/1/2019	10:00	0.29	1.75	0.17	138	NS	Full	NS
9/2/2019	20:45	9/3/2019	0:00	0.31	3.25	0.10	35	Full	Full	Full
9/11/2019	1:45	9/11/2019	10:45	1.12	9	0.12	32	Full	Full	Full
9/12/2019	1:30	9/12/2019	17:00	0.94	15.5	0.06	15	Full/E. *coli*	Full/E. *coli*	Full
10/9/2019	23:30	10/11/2019	7:30	0.57	32	0.02	102	Full	Full	NS
10/21/2019	4:00	10/21/2019	14:45	1.01	10.75	0.09	131	Full	Full	Full

Figures 26-6 and **26-7** show the north inlet and south inlet stage and discharge measured in 2019. **Figure 26-8** shows the outlet stage and discharge measured in 2019. Due to the wet year, the outlet had more events in 2019 than in previous years, but no water left the site. In 2019 both outlet velocity signal strength and velocity spectrum data were collected and discussed with Teledyne/ISCO technical support to evaluate the quality of velocity readings and interpret any negative velocities seen at the outlet. Negative velocities are usually caused by either something in front of the AV probe

(e.g. flat rock) reflecting the signal as a mirror or water flowing backwards over the AV probe. The AV probe and intake strainer were offset further up the outlet side of the pipe, out of the standing water and sediment. This appears to have minimized some of the negative velocities measured at the outlet, but they were still present. It is theorized the negative velocities recorded were real and caused by water being impounded and then draining down.

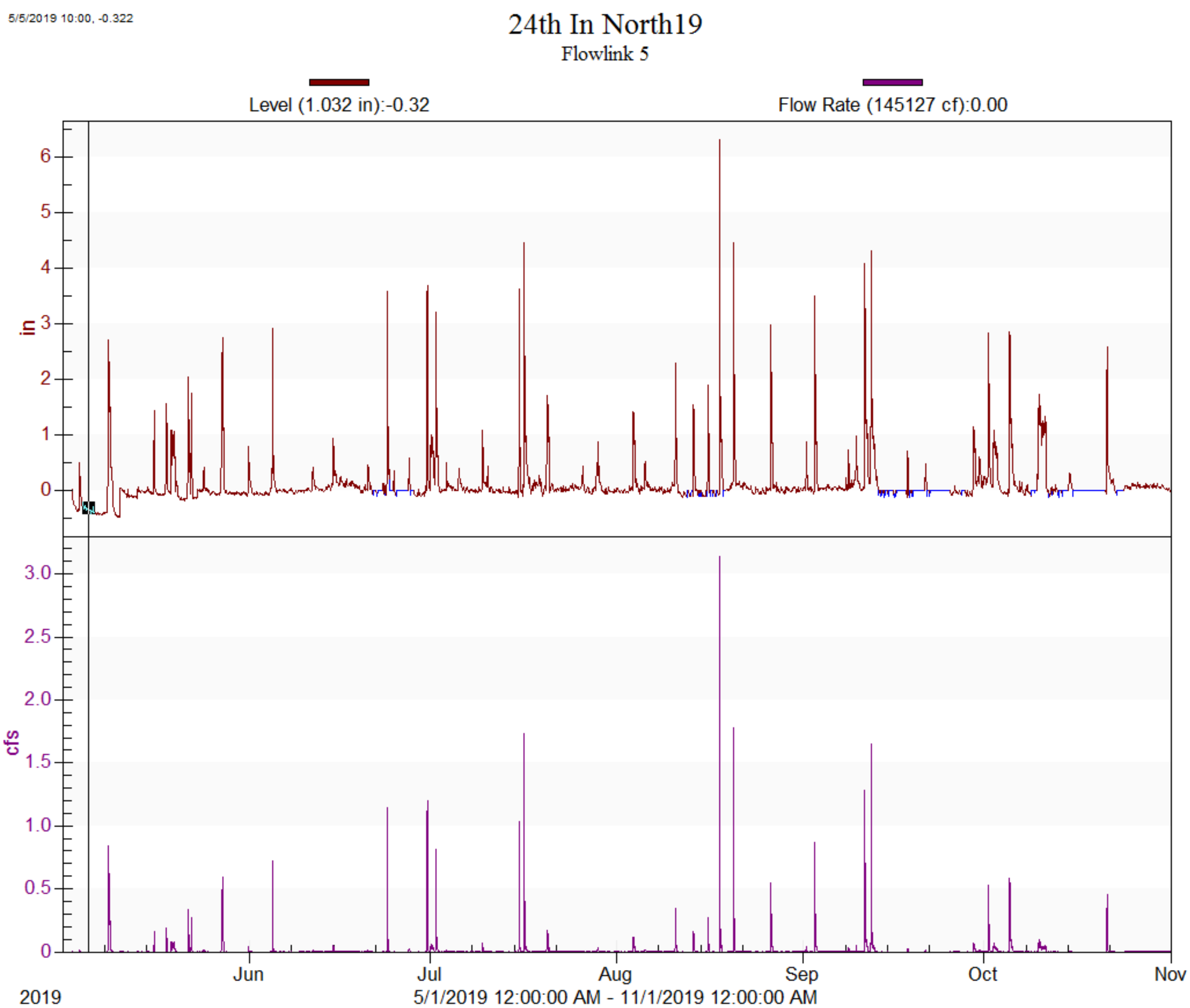


Figure 26-6. 2019 24th & Elm north inlet stage and discharge graphs from May 1 through November 11. The upper graph is stage in inches and the lower graph is discharge in cfs.

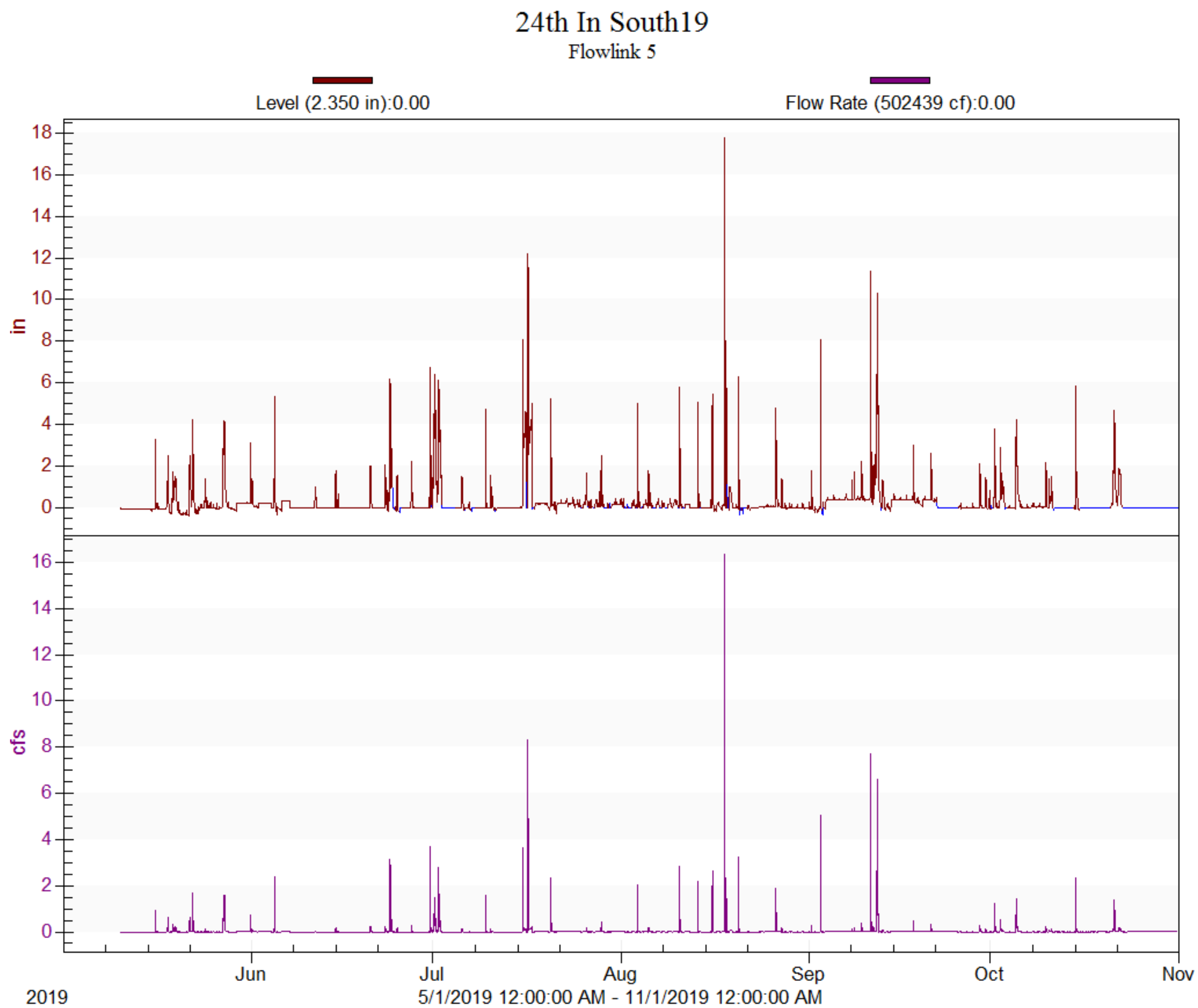


Figure 26-7. 2019 24th & Elm south inlet stage and discharge graphs from May 1 through November 1. The upper graph is stage in inches and the lower graph is discharge is in cfs.

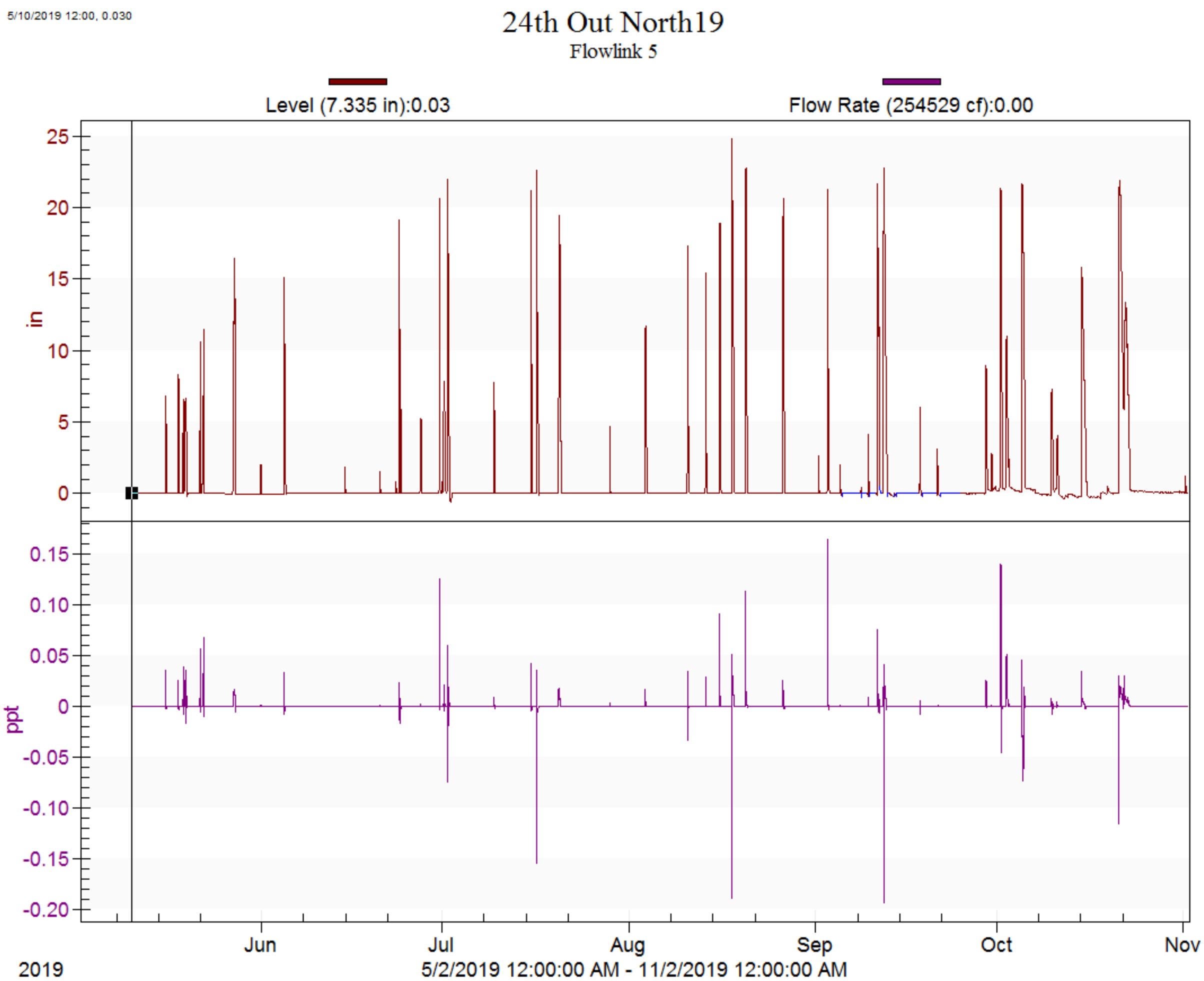


Figure 26-8. 2019 24th & Elm outlet stage and discharge graphs from May 1 through November 2. The upper graph is stage in inches and the lower graph is discharge is in cfs. Note the negative velocities.

Figure 26-9 shows the stage of both the outlet and north inlet for the same period of record (8/15/19 - 9/15/19). The significant stage difference between the two was unexpected since they are hydrologically connected with only a hydrodynamic separator between them. It appears that the head upstream of the hydrodynamic separator is significantly higher than the downstream head. In 2019, there was a significant amount of sand and very fine silt (3-4”) building up in the outlet pipe invert.

The most likely explanation of the head difference between the outlet and north inlet is that the hydrodynamic separator is partially plugged and causes stormwater to back-up the outlet pipe. This situation may cause water to bypass the hydrodynamic emergency overflow weir during large storms. When stormwater backs up the outlet pipe, it is temporarily impounded which allows suspended sediment to settle out in the outlet pipe. The impounded water in the outlet pipe then slowly drains through the partially plugged CDS, between storms, back toward the infiltration chamber. This theory could explain both the positive and negative velocities that were recorded, and why sediment has built up in the outlet pipe. Water likely drains down slow enough (<0.3 ft/sec) that negative velocities are not always picked up by the AV probe, complicating calculation and interpretation of the mass balance of both water and loading.

No water in the outlet pipe appears to have reached the backflow preventer and exited the EIC system. The outlet only sampled positive flows and likely sampled much of the fine sediment previously settled and/or resuspended in the invert, skewing the chemistry data, so a true picture of the outlet chemistry cannot be made. A mass balance should not be calculated using the outlet chemistry because no water left the site.

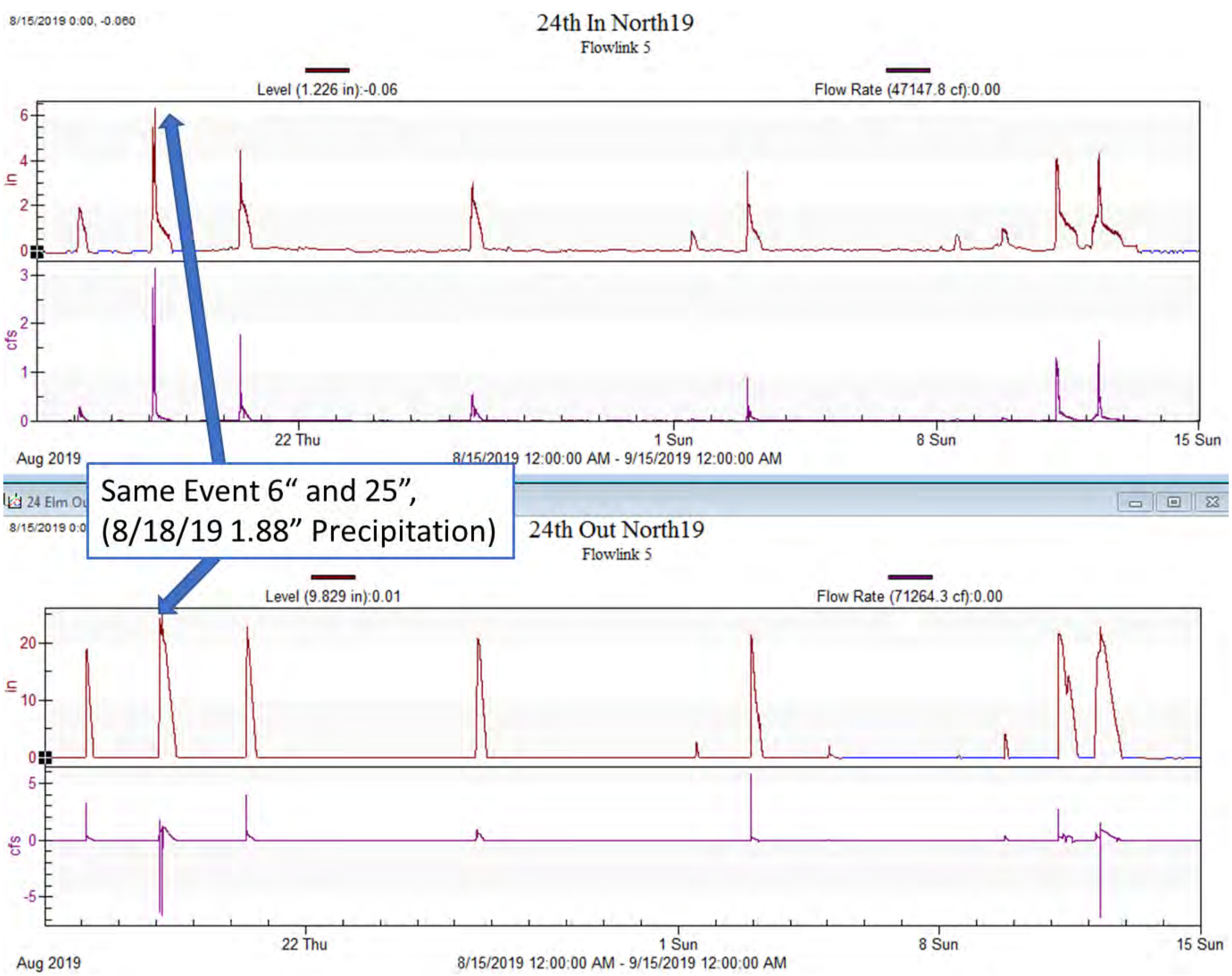


Figure 26-9. 2019, 24th & Elm outlet stage/discharge and north inlet stage/discharge graphs compared from 8/15- 9/15. The outlet is showing a higher stage than the north inlet for the same event(s).

Storm Event Data and Statistics

Table 26-2 shows the 2019, 24th & Elm Stormwater water chemistry data. Some of the stormwater samples collected were analyzed for limited parameters because of low volume or expired holding times.

The March TDP, TLN, TN, September TDP, and October data that are bold and red in **Table 26-**2 because these parameters failed MPRB's blind laboratory monthly performance standard for that month. It was deemed that the data can be used with caution, since performance standards were outside the 80-120% recovery standards for those samples.

Table 26-2. 2019 24th & Elm Stormwater chemistry data. Cells with less than values (<) indicate that the concentration of that parameter was below reporting limit. ND = no data is available due to expired holding time or low volume. NES = not enough sample. Data that are underlined and red had a blind performance standard failure for that month, for that parameter.

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP 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	pH std units	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
5/8/2019	13:35	24th & Elm In N	Grab	0.288	0.030	1.63	0.587	10	32	209	60	103	105	<5.00	8.1	118	24	26	145	9
6/4/2019	22:11	24th & Elm In N	Composite	0.186	0.018	1.59	0.484	7	28	82	23	70	69	ND	ND	ND	20	9	70	6
6/23/2019	22:42	24th & Elm In N	Composite	0.085	<0.010	0.759	0.183	19	18	38	11	80	36	ND	ND	ND	13	4	36	4
6/27/2019	11:00	24th & Elm In N	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	6.8	1126	ND	ND	ND	ND
7/15/2019	21:32	24th & Elm in N	Composite	0.134	0.017	1.19	0.299	5	28	76	15	50	36	ND	ND	ND	11	4	45	6
8/18/2019	3:59	24th & Elm in N	Composite	0.069	<0.010	0.542	0.156	<2.00	22	49	9	38	<20	ND	ND	ND	9	2	34	2
8/26/2019	13:20	24th & Elm in N	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND		<5.00		187	ND	ND	ND	ND
8/26/2019	20:05	24th & Elm in N	Composite	0.078	0.014	0.599	0.149	5	24	27	6	48	30	ND	ND	ND	21	4	38	5
9/3/2019	2:49	24th & Elm in N	Composite	0.077	0.009	0.728	0.229	4	24	29	6	58	16	ND	ND	ND	14	3	28	5
9/11/2019	14:53	24th & Elm in N	Composite	0.086	0.005	0.621	<0.030	5	28	32	10	58	23	ND	ND	ND	10	4	32	6
9/12/2019	8:35	24th & Elm in N	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.3	1576	ND	ND	ND	ND
9/12/2019	13:18	24th & Elm in N	Composite	0.055	0.006	<0.500	<0.030	4	22	34	11	38	<20	ND	ND	ND	7	3	23	2
10/10/2019	4:38	24th & Elm in N	Composite	0.119	0.013	1.11	0.182	3	34	58	14	90	102	ND	ND	ND	63	5	63	8
10/21/2019	13:27	24th & Elm in N	Composite	0.186	0.023	<0.500	<0.030	3	32	82	17	25	53	ND	ND	ND	17	7	54	4
5/8/2019	13:25	24th & Elm In S	Grab	0.284	0.074	1.35	0.157	9	24	95	36	93	88	<5.00	7.5	10	19	7	135	9
5/27/2019	13:08	24th & Elm In S	Composite	0.070	0.025	<0.500	0.103	<2.00	12	13	6	28	105	ND	ND	ND	10	1	<20	2
6/4/2019	21:35	24th & Elm In S	Composite	0.218	0.033	1.71	0.355	3	20	106	24	68	746	ND	ND	ND	18	6	78	6
6/20/2019	17:49	24th & Elm In S	Composite	0.681	0.231	2.60	0.044	14	48	40	21	170	106	ND	ND	ND	14	2	92	27
6/23/2019	23:09	24th & Elm In S	Composite	0.157	0.106	1.20	0.168	4	10	21	8	53	40	ND	ND	ND	9	2	29	6
6/27/2019	10:50	24th & Elm In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.0	1081	ND	ND	ND	ND
6/27/2019	13:05	24th & Elm In S	Composite	0.161	0.025	1.70	0.424	9	19	15	7	90	40	ND	ND	ND	13	1	32	9
8/10/2019	18:24	24th & Elm In S	Composite	0.118	0.039	0.716	0.167	5	16	31	10	45	133	ND	ND	ND	10	2	37	3
8/26/2019	13:20	24th & Elm In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.5	<10	ND	ND	ND	ND
8/26/2019	17:10	24th & Elm In S	Composite	0.075	0.017	<0.500	0.093	2	16	14	6	53	16	ND	ND	ND	8	2	23	3
9/1/2019	11:36	24th & Elm In S	Composite	0.164	0.016	1.026	0.239	22	42	16	8	120	47	ND	ND	ND	NES	NES	NES	NES
9/3/2019	0:43	24th & Elm In S	Composite	0.138	0.032	0.777	0.173	4	16	47	9	43	22	ND	ND	ND	8	3	29	3
9/11/2019	11:20	24th & Elm In S	Composite	0.061	0.009	<0.500	0.111	2	14	7	2	43	<20	ND	ND	ND	9	1	<20	2
9/12/2019	5:17	24th & Elm In S	Composite	0.068	0.019	0.742	0.142	6	14	10	4	55	<20	ND	ND	ND	10	1	<20	2
9/12/2019	8:30	24th & Elm In S	Grab	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<5.00	7.2	19863	ND	ND	ND	ND
10/10/2019	16:07	24th & Elm In S	Composite	0.387	0.268	0.812	0.310	4	22	11	6	70	36	ND	ND	ND	15	1	36	4
10/11/2019	3:07	24th & Elm In S	Composite	0.274	0.211	1.01	0.435	8	24	10	6	88	53	ND	ND	ND	17	1	31	NES
10/21/2019	11:11	24th & Elm In S	Composite	0.109	0.023	0.581	0.143	<2.00	14	20	8	35	26	ND	ND	ND	12	1	23	2
6/20/2019	17:41	24th & Elm Outlet	Composite	0.405	0.029	3.09	<0.030	130	168	59	28	535	102	ND	ND	ND	16	2	48	NES
6/23/2019	22:57	24th & Elm Outlet	Composite	0.198	0.012	1.49	0.440	15	40	76	19	130	70	ND	ND	ND	16	9	66	10
7/15/2019	19:49	24th & Elm Outlet	Composite	0.295	0.021	1.83	0.498	11	44	108	22	88	66	ND	ND	ND	20	9	81	12
8/10/2019	18:43	24th & Elm Outlet	Composite	0.220	0.015	1.04	0.319	3	36	126	22	63	48	ND	ND	ND	26	12	84	11
8/18/2019	5:08	24th & Elm Outlet	Composite	0.118	<0.010	0.753	0.239	<2.00	32	60	12	48	43	ND	ND	ND	14	5	47	6
8/26/2019	16:53	24th & Elm Outlet	Composite	0.092	0.010	0.643	0.220	2	24	39	8	55	33	ND	ND	ND	10	4	58	5
9/3/2019	3:01	24th & Elm Outlet	Composite	0.238	0.020	1.32	0.331	6	40	176	23	83	54	ND	ND	ND	18	12	93	7
9/11/2019	13:29	24th & Elm Outlet	Composite	0.148	0.009	0.799	<0.030	<2.00	28	53	14	55	36	ND	ND	ND	18	5	50	5
9/12/2019	6:07	24th & Elm Outlet	Composite	0.140	0.008	0.642	<0.030	<2.00	36	97	17	68	36	ND	ND	ND	13	6	54	NES
10/21/2019	12:15	24th & Elm Outlet	Composite	0.180	0.011	0.711	0.220	3	30	67	15	48	43	ND	ND	ND	16	5	43	4

Table 26-3 shows the statistics calculated from the 24th & Elm inlet and outlet samples. Statistics were only calculated for a chemical parameter if there were two or more measured values. When statistical analysis was performed on the data sets, and values below the reporting limit were present, half of the reporting limit was used in the calculations.

In **Table 26-3,** when comparing the geometric means of the inlets and outlet chemical concentrations, the outlet concentration was higher than the inlets for many parameters. The higher outlet pollutant concentration is likely due to large storms causing resuspension of sediment in the outlet pipe and/or the intake strainer collecting the fine sediment covering the invert. In 2019 no water left the site.

Table 26-4 shows the water balance and chemical load calculations for the 24th & Elm Infiltration Chamber. The load calculations used the geometric mean of the chemical parameter as the final concentration. Conversions were made to express the concentration in pounds.

Percent removal was not calculated because the outlet did not function as designed. It is likely that the north hydrodynamic separator was partially plugged which allowed water to back up and stagnate in the outlet pipe. This issue caused three problems: 1) sedimentation occurred in the outlet pipe, 2) resuspended sediment later mixed with water from subsequent storm events, and 3) positive velocities were recorded, but the low negative velocities of the impounded outlet pipe water slowly draining down were not. Velocity readings must be above 0.3 ft/sec to be recorded by the AV probe. Since the percent removal calculation would not have applied to the conditions of a particular storm, it was not calculated.

The backflow preventer is located approximately 36 inches off the outlet invert. Water in the outlet pipe never reached this stage to send water to Elm St. In 2019, all stormwater was infiltrated, so the EIC was 100% effective.

It appears that the hydrodynamic separators have not been cleaned since construction. The lack of maintenance is creating conditions where water in the north inlet does not drain properly. In the early winter 2019, the hydrodynamic separators were assigned grit chamber numbers, GPS coordinates, and added to the maintenance cleaning schedule. After the hydrodynamic separators are cleaned the outlet pipe should also be jetted and cleaned. Thorough cleaning should remove the sand and fine sediment, which will preserve the infiltration basin service life.

Table 26-3. 2019 24th & Elm stormwater data showing statistics of the inlets and outlet. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations. NC = not calculated.

Site ID	Statistical Function	TP mg/L	TDP 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	pH std unit	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
24th & Elm in N	MEAN (geometric)	0.109	0.011	0.712	0.116	4	26	53	13	55	33	2.5	7.4	445	16	5	45	5
24th & Elm in N	MEAN (arithmetic)	0.124	0.013	0.843	0.210	6	27	65	17	60	45	2.5	7.4	752	19	6	52	5
24th & Elm in N	MAX	0.288	0.030	1.63	0.587	19	34	209	60	103	105	2.5	8.1	1576	63	26	145	9
24th & Elm in N	MIN	0.055	0.005	0.250	0.015	1	18	27	6	25	10	2.5	6.8	118	7	2	23	2
24th & Elm in N	MEDIAN	0.086	0.013	0.728	0.182	5	28	49	11	58	36	2.5	7.3	657	14	4	38	5
24th & Elm in N	STDEV	0.071	0.008	0.479	0.186	5	5	52	15	24	34	0	0.680	716	16	7	34	2
24th & Elm in N	NUMBER	11	11	11	11	11	11	11	11	11	11	4	3	4	11	11	11	11
24th & Elm in N	COV	0.569	0.629	0.568	0.886	0.866	0.188	0.802	0.926	0.401	0.765	0.000	0.092	0.953	0.827	1.06	0.663	0.418
24th & Elm In S	MEAN (geometric)	0.155	0.043	0.805	0.172	4	19	21	8	62	47	2.5	7.3	215	12	2	30	4
24th & Elm In S	MEAN (arithmetic)	0.198	0.075	0.998	0.204	6	21	30	11	70	99	2.5	7.3	5241	12	2	41	6
24th & Elm In S	MAX	0.681	0.268	2.60	0.435	22	48	106	36	170	746	2.5	7.5	19863	19	7	135	27
24th & Elm In S	MIN	0.061	0.009	0.250	0.044	1	10	7	2	28	10	2.5	7.0	10	8	1	10	2
24th & Elm In S	MEDIAN	0.157	0.032	0.81	0.167	4	16	16	8	55	40	2.5	7.3	546	11	1	30	3
24th & Elm In S	STDEV	0.163	0.088	0.644	0.122	6	11	31	9	38	183	0	0.24	9761	4	2	36	7
24th & Elm In S	NUMBER	15	15	15	15	15	15	15	15	15	15	4	4	4	14	14	14	13
24th & Elm In S	COV	0.825	1.17	0.645	0.596	0.931	0.518	1.02	0.863	0.536	1.86	0.000	0.03	1.86	0.301	0.914	0.878	1.10
24th & Elm Outlet	MEAN (geometric)	0.186	0.012	1.07	0.125	4	40	78	17	82	50	NC	NC	NC	16	6	60	7
24th & Elm Outlet	MEAN (arithmetic)	0.203	0.014	1.23	0.231	17	48	86	18	117	53	NC	NC	NC	17	7	62	7
24th & Elm Outlet	MAX	0.405	0.029	3.09	0.498	130	168	176	28	535	102	NC	NC	NC	26	12	93	12
24th & Elm Outlet	MIN	0.092	0.005	0.642	0.015	1	24	39	8	48	33	NC	NC	NC	10	2	43	4
24th & Elm Outlet	MEDIAN	0.189	0.012	0.92	0.230	3	36	72	18	65	46	NC	NC	NC	16	5	56	6
24th & Elm Outlet	STDEV	0.093	0.007	0.767	0.174	40	43	41	6	149	21	NC	NC	NC	4	3	18	3
24th & Elm Outlet	NUMBER	10	10	10	10	10	10	10	10	10	10	0	0	0	10	10	10	8
24th & Elm Outlet	COV	0.457	0.523	0.623	0.753	2.33	0.893	0.481	0.336	1.27	0.398	NC	NC	NC	0.265	0.501	0.283	0.405

Table 26-4. 2019 24th & Elm stormwater water balance, chemical load calculations in pounds. ND = no data.

Site	Vol Liters	TP lbs.	TDP lbs.	TN lbs.	NO_3NO_2 lbs.	Cl lbs.	Hardness lbs.	TSS lbs.	VSS lbs.	TDS lbs.	COD lbs.	FOG lbs.	Cu lbs.	Pb lbs.	Zn lbs.	DOC lbs.
24th & Elm in N	4,109,532	0.99	0.099	6.45	1.05	41	237	483	118	499	302	23	0.141	0.043	0.407	43
24th & Elm in S	14,227,465	4.86	1.34	25.3	5.41	132	590	662	258	1,955	1,481	78	0.371	0.051	0.950	140
24th & Elm Out	7,207,447	2.96	0.197	17.1	1.98	67	632	1,245	270	1,310	793	ND	0.257	0.097	0.959	109

CONCLUSION

In 2019 the 24th & Elm Infiltration Chamber infiltrated all the stormwater it received. No water reached the 36" stage required to flow out the backflow preventer and leave the site.

The cause of the negative velocities at the outlet was difficult to determine. The backflow preventer did not fail. It is theorized that observed negative velocities were caused by the north hydrodynamic CDS separator screens being plugged, which then caused water to back up in the outlet pipe. Impounded water then emptied slowly from the outlet pipe back into the infiltration chamber. Periodic settling and resuspension of sediment with water entering and exiting the same pipe made the outlet chemistry irrelevant to use. A mass balance could not be calculated.

Both the north and south inlet CDS separators had not been cleaned since construction in 2016 but will now be cleaned at least twice a year. Special attention should be given to cleaning and power washing the screens. Any accumulated sediment in the outlet invert should be jetted and removed. The outlet AV probe will be offset in future monitoring to reduce the possibility of being buried and causing signal reflection.

The infiltration chamber generally appears to be functioning as designed and is treating and infiltrating a large amount of stormwater. No stormwater appeared to have left the site in 2019, so it was 100% effective. Regular maintenance of the hydrodynamic separators should be continued to keep the EIC functioning for as long as possible.

Following cleaning, 2020 monitoring will likely show the EIC working better and allow for an accurate mass balance to be calculated by minimizing or eliminating the regular outflow backups of stormwater in the outlet pipe. Monitoring may determine if functionality is affected by cleaning the CDS unit and screens.

Minneapolis Sculpture Garden

BACKGROUND

The Minneapolis Park Board collected monthly grab samples from a large underground stormwater reuse cistern installed at the Minneapolis Sculpture Garden to compare the quality of the water collected in the cistern to Minnesota Pollution Control Agency (MPCA) water quality guidelines for stormwater harvesting and use for irrigation, **Table 25-1**.

In June 2017 the Minneapolis Sculpture Garden finished construction of an 80,000-gallon underground cistern. The purpose of the cistern is to collect overflow water from three areas: the Spoonbridge and Cherry sculpture, runoff from the southern 2/3rds of the garden paths, and runoff from a portion of Parade Field for reuse in irrigation at the Sculpture Garden. **Figure 25-1** shows construction plans for the Minneapolis Sculpture Garden and the location of the underground stormwater runoff storage cistern. **Figure 25-2** shows the underground cistern chambers during construction prior to their burial. **Figure 25-3** shows the north manhole used to sample the cistern.

The construction project was funded by the Mississippi Watershed Management Organization (MWMO). Water quality was monitored due to the interest of the City of Minneapolis and MWMO in this stormwater capture and reuse system.

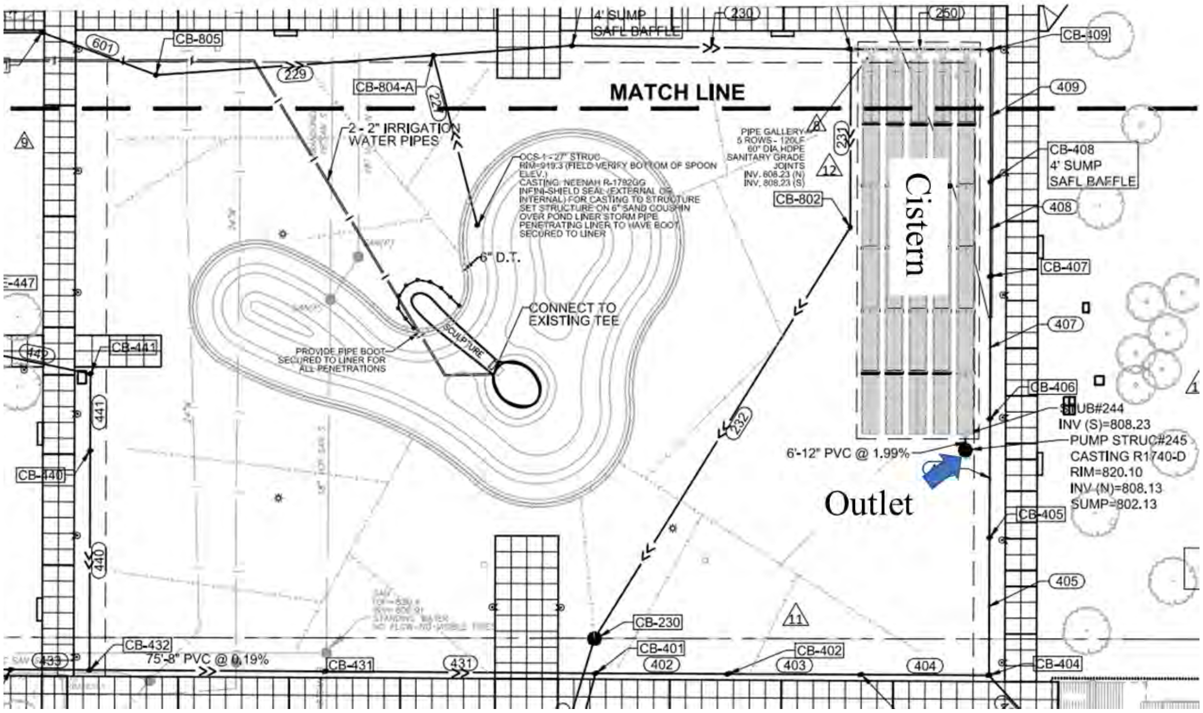


Figure 25-1. Drawing of the underground cistern and drainage system at the Minneapolis Sculpture Garden.

Figure 25-2. Photograph of the 80,000-gallon underground cistern under construction.

Figure 25-3. Photograph of the north manhole where sampling occurred at the underground cistern.

METHODS

Sample Collection

In 2018 and 2019, from spring through fall, monthly grab samples were collected from the Sculpture Garden underground cistern and analyzed for parameters referenced in the MPCA chemical guidelines, **Table 25-1**. The northwest manhole lid was removed, and a clean white bucket was lowered via rope. The bucket was rinsed with cistern water before taking a sample. Except for the *E. coli* sub sample, analyte containers were rinsed one time and then filled. The pH and temperatures were taken from the bucket after the aliquots were poured off.

Table 25-1. The MPCA summary of guidelines for stormwater reuse systems for irrigation.

Water Quality Parameter	Chloride	TSS	pH	*E. coli*	Copper	Zinc	Temperature	Turbidity
Impact of Parameter	Plant Health; Corrosion of Metals	Irrigation System Function	Plant Health	Public Health	Plant Health	Plant Health	Public Health	Irrigation System Function
Water Quality Guideline -Public Access Areas	500 mg/L	5 mg/L	6-9	126 *E. coli*/100mL	0.2 mg/L (longterm use); 5 mg/L (shortterm use)	2 mg/L (longterm use); 10 mg/L (shortterm use)	Guidance to be determined at a future date	2-3 NTU

RESULTS & DISCUSSION

In 2018 and 2019, from spring through fall, monthly grab samples were collected from the Sculpture Garden cistern and chemistry data are shown in **Table 25-2**. Except for TSS, all the chemical parameters measured were below the MPCA guidelines for water reuse irrigation purposes.

Many of the TSS values were above the 5 mg/L MPCA guidelines. The increased TSS values may be from dead grass clippings falling in the manhole when removing and reinstalling the cover for sampling. Replacing this non-standard manhole cover with a standard manhole cover should be considered, as it is extremely difficult to remove.

Table 25-2. The 2018 – 2019 chemistry data for grab samples collected at the Minneapolis Sculpture

Garden underground cistern. NC = Not Collected. TBD = to be decided. When a blind monthly laboratory performance standard failed, the data are underlined in red.

Date Sampled	Time	Site Location	Sample Type	TP mg/L	Cl mg/L	TSS mg/L	pH std units	E. Coli MPN	Cu ug/L	Zn ug/L	Temp °F	Turb NTU
5/1/2018	13:30	Sculpture Garden	Grab	NC	32	10	NC	<1	NC	NC	NC	NC
5/16/2018	12:45	Sculpture Garden	Grab	0.237	22	3	6.9	9	8	<20.0	45.4	<5.00
6/11/2018	14:45	Sculpture Garden	Grab	0.249	25	5	7.1	16	6	<20.0	66.7	<5.00
7/5/2018	13:30	Sculpture Garden	Grab	0.275	21	10	8.8	8	4	15	72.8	<5.00
8/7/2018	8:30	Sculpture Garden	Grab	0.374	23	30	8.7	<1	2	9	72.7	<5.00
9/17/2018	13:40	Sculpture Garden	Grab	0.669	27	63	8.5	13	8	10	71.5	<5.00
10/25/2018	9:05	Sculpture Garden	Grab	0.275	26	3	7.4	1	7	10	61.8	<5.00
4/25/2019	12:25	Sculpture Garden	Grab	0.337	38	6	7.0	16	11	19	42	NC
6/27/2019	14:25	Sculpture Garden	Grab	0.311	26	12	8.1	31	4	10	68	<5.00
7/10/2019	11:30	Sculpture Garden	Grab	0.305	25	4	7.9	52	5	6	70	<5.00
8/7/2019	10:00	Sculpture Garden	Grab	0.398	23	50	8.8	16	5	21	76	<5.00
9/5/2019	11:00	Sculpture Garden	Grab	0.281	23	16	8.1	3	3	6	72	<5.00
10/7/2019	13:30	Sculpture Garden	Grab	0.292	25	8	8.6	2	2	16	68	<5.00
		MPCA Guidelines		NA	500	5	6-9	126	200 longer use, 5,000 shorter use	2000 longer use, 10,000 shorter use	TBD	2-3

CONCLUSION

The water quality in the cistern at the Sculpture Garden met the MPCA water reuse irrigation guidelines, except for TSS. The higher TSS levels could be due to grass clippings falling into the manhole when removing or reinstalling the manhole cover to sample.

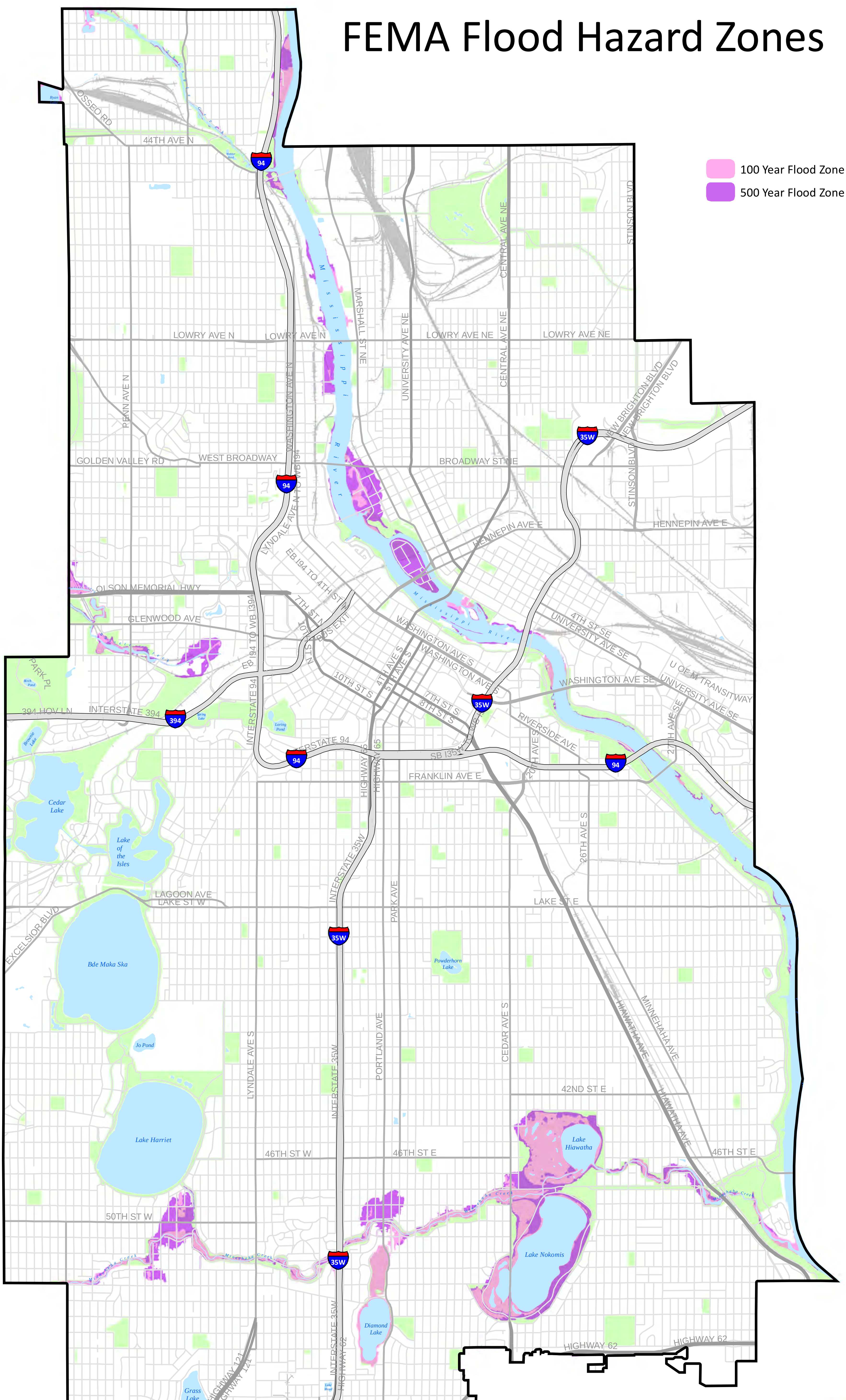
Further exploration will need to be done to definitively know the source of the TSS in the reuse cistern water. A different type of manhole cover, that is easier to remove, and additional sources of TSS should be investigated further. Additionally, water from the outlet should be sampled to see what is leaving the cistern.

An important consideration is that the collected stormwater was not used for irrigation in either 2018 or 2019. The reuse-water is planned to be used in 2020 for irrigation of the Sculpture Garden.

Once the system is able to be used normally, it could be monitored again to determine if the guidelines are still met when the system is used as it was designed.

Appendix B

FEMA Flood Hazard Zones



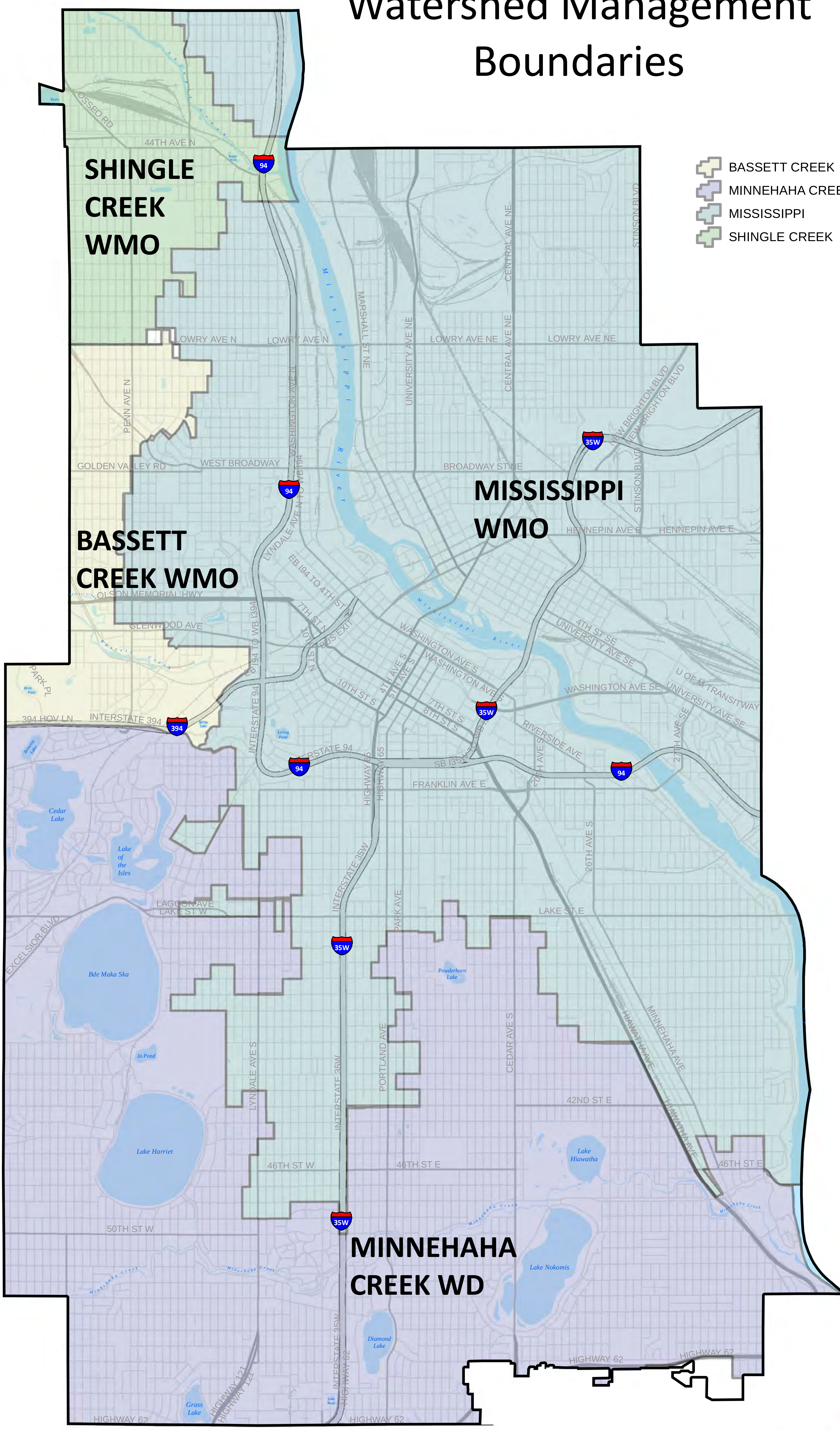
Date: 5/11/2020

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



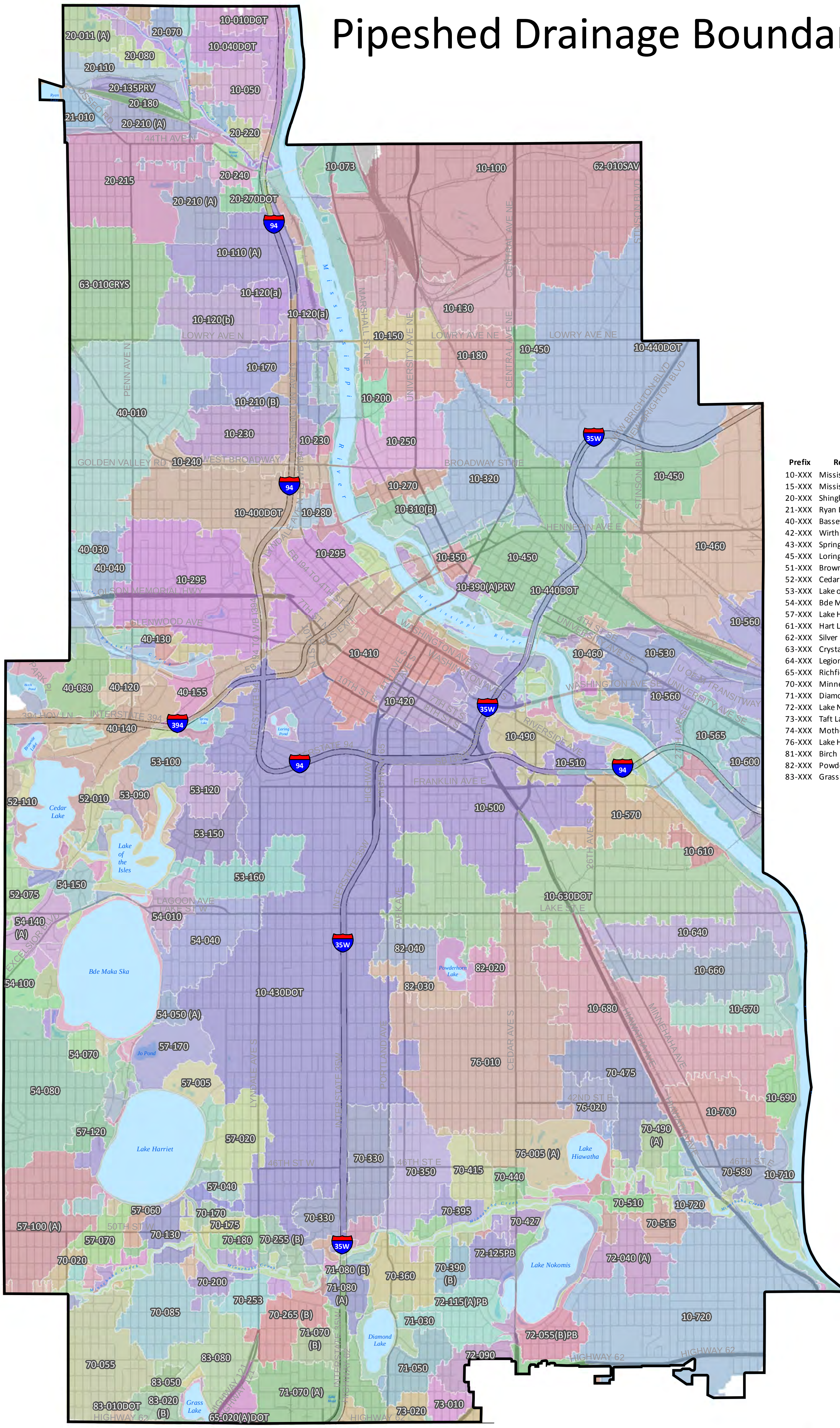
Date: 5/11/2020

Source: Board of Water and Soil Resources
Effective Date : 02-12-2020
Accessed : 05-06-2020

Appendix B2

Minneapolis
Public Works

Pipeshed Drainage Boundaries



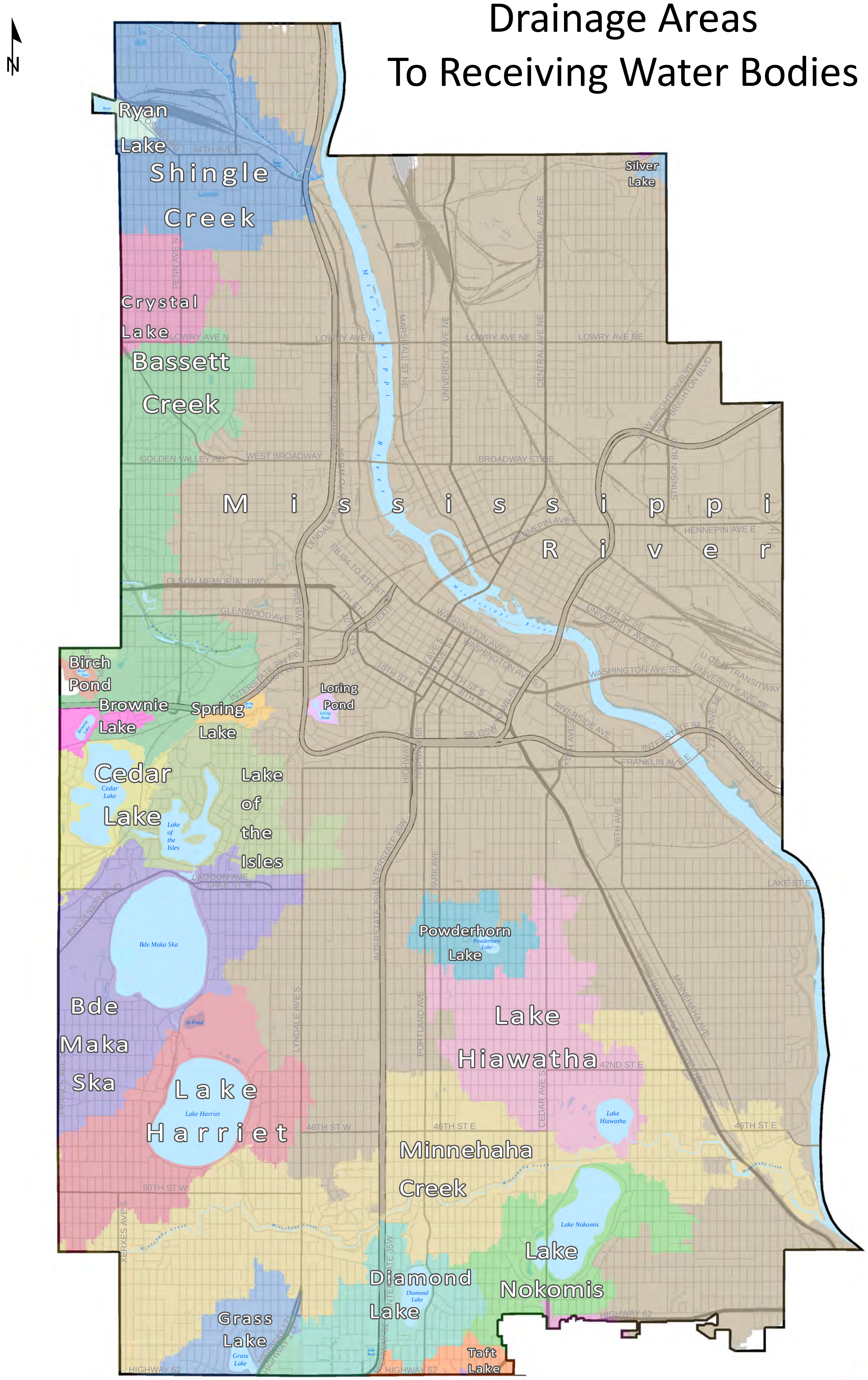
Prefix	Receiving Water
10-XXX	Mississippi River (Mpls)
15-XXX	Mississippi River (UofM)
20-XXX	Shingle Creek
21-XXX	Ryan Lake
40-XXX	Bassett Creek
42-XXX	Wirth Lake
43-XXX	Spring Lake
45-XXX	Loring Pond
51-XXX	Brownie Lake
52-XXX	Cedar Lake
53-XXX	Lake of the Isles
54-XXX	Bde Maka Ska
57-XXX	Lake Harriet
61-XXX	Hart Lake
62-XXX	Silver Lake
63-XXX	Crystal Lake
64-XXX	Legion Lake
65-XXX	Richfield Lake
70-XXX	Minnehaha Creek
71-XXX	Diamond Lake
72-XXX	Lake Nokomis
73-XXX	Taft Lake
74-XXX	Mother Lake
76-XXX	Lake Hiawatha
81-XXX	Birch Pond
82-XXX	Powderhorn Lake
83-XXX	Grass Lake

Date: 5/11/2020
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 05-07-2020; Accessed : 05-07-2020

Appendix B3

Minneapolis
Public Works

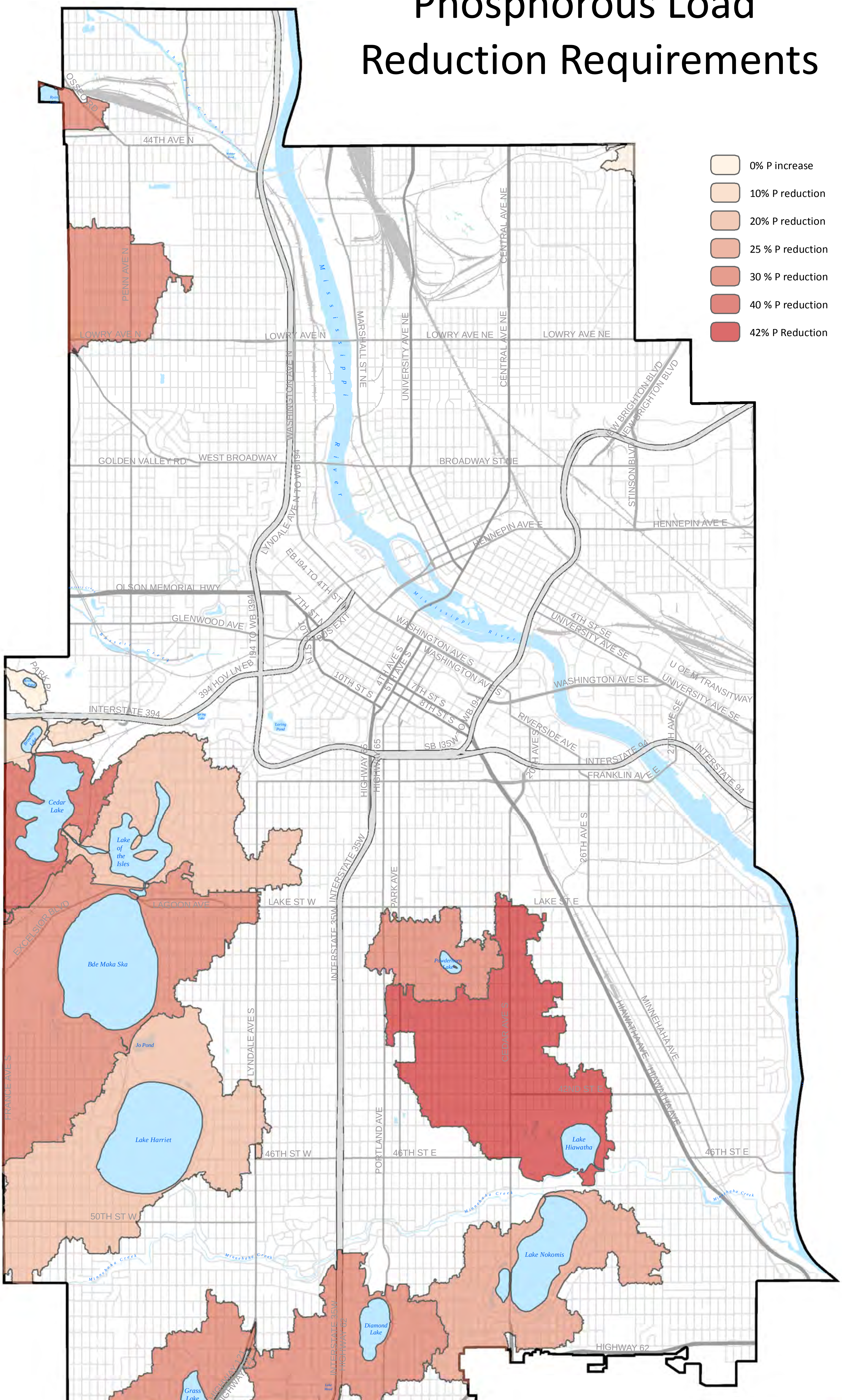
Drainage Areas To Receiving Water Bodies



Date: 5/12/2020
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 05-07-2020; Accessed : 05-07-2020

Minneapolis
Public Works

Phosphorous Load Reduction Requirements

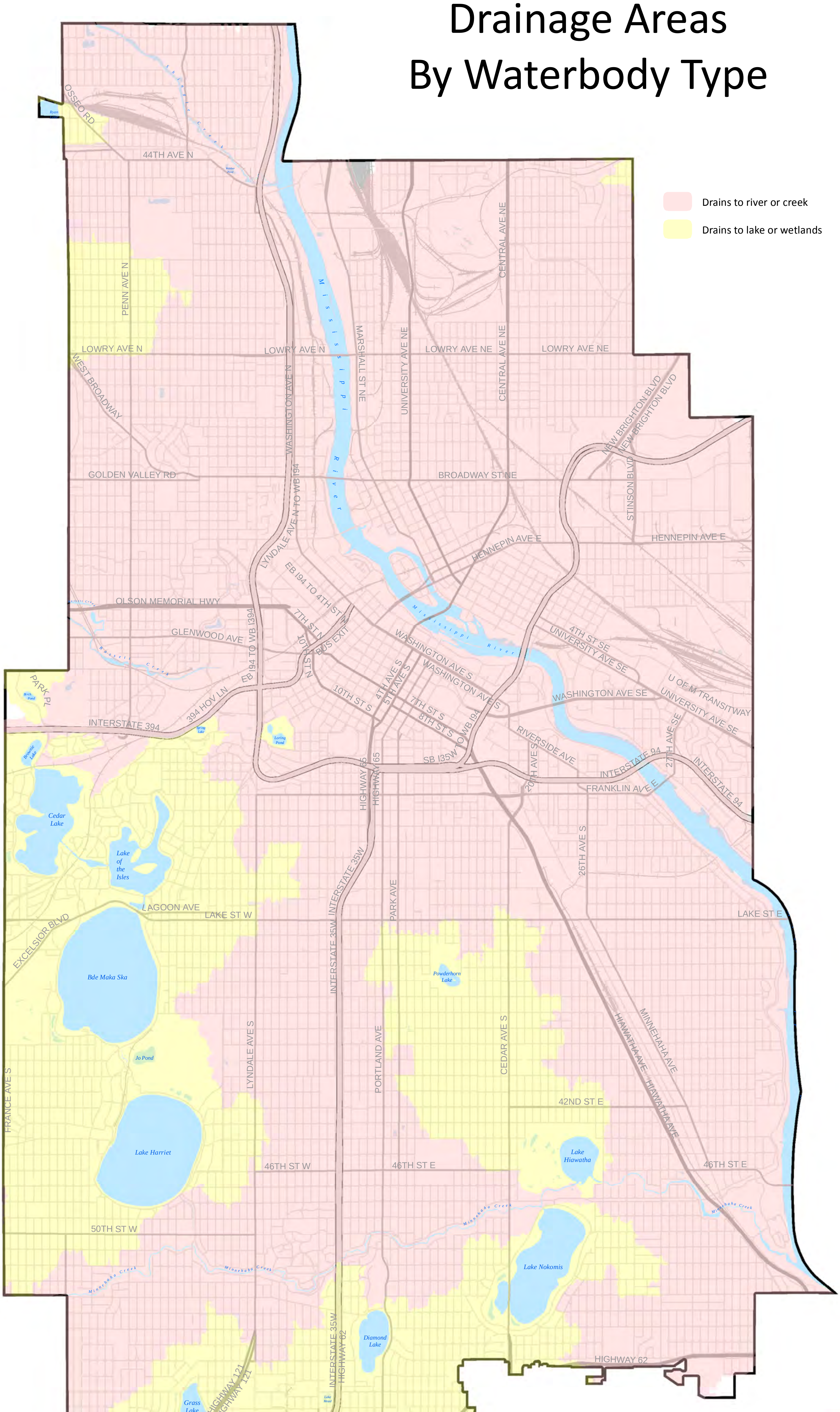


Date: 5/11/2020
Source: Minneapolis Public Works - Surface Water & Sewers

Appendix B5

Minneapolis
Public Works

Drainage Areas By Waterbody Type

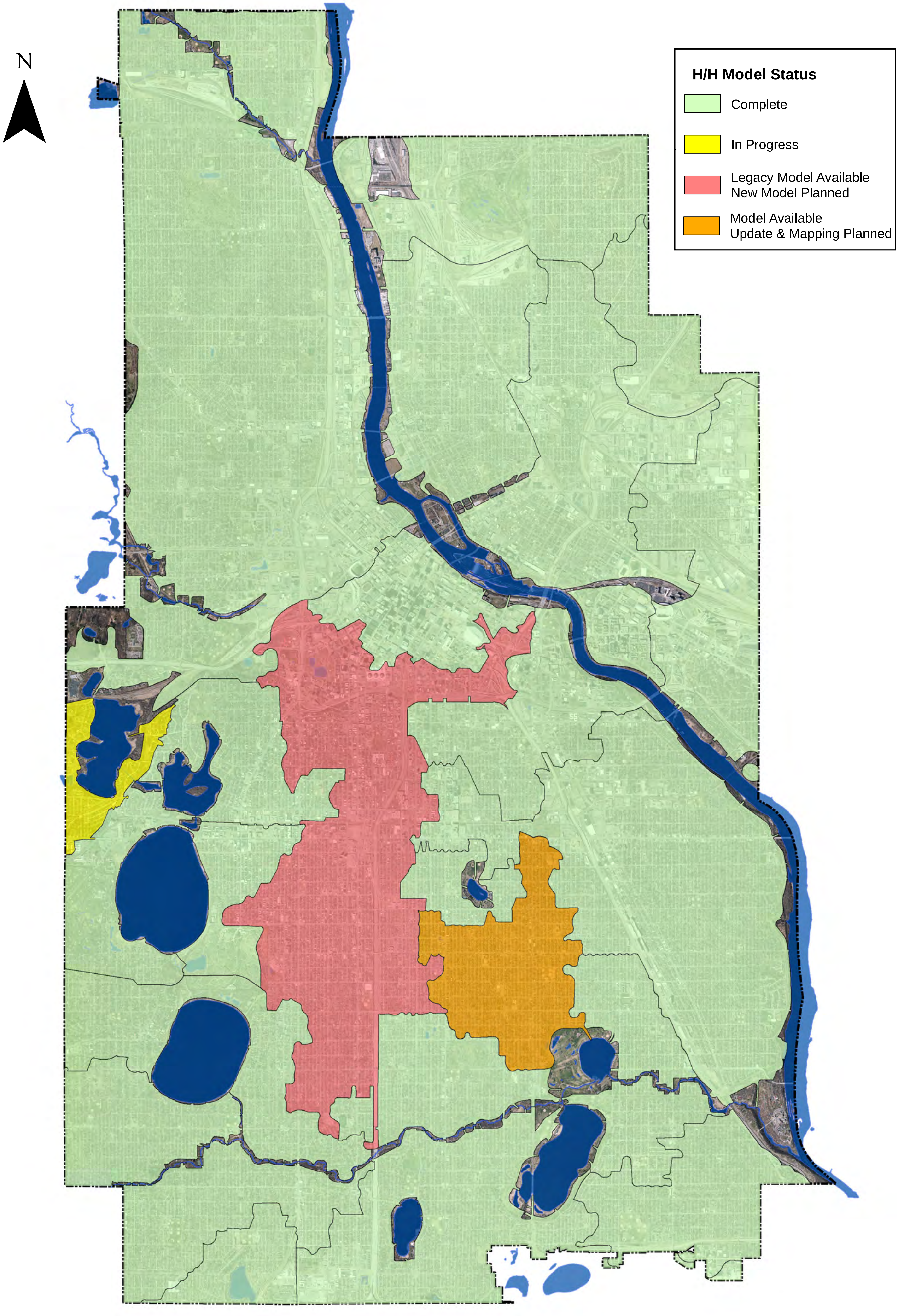


Date: 5/11/2020
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 05-07-2020; Accessed : 05-07-2020

Appendix B6

Minneapolis
Public Works

Hydrologic / Hydraulic Storm Modeling Status



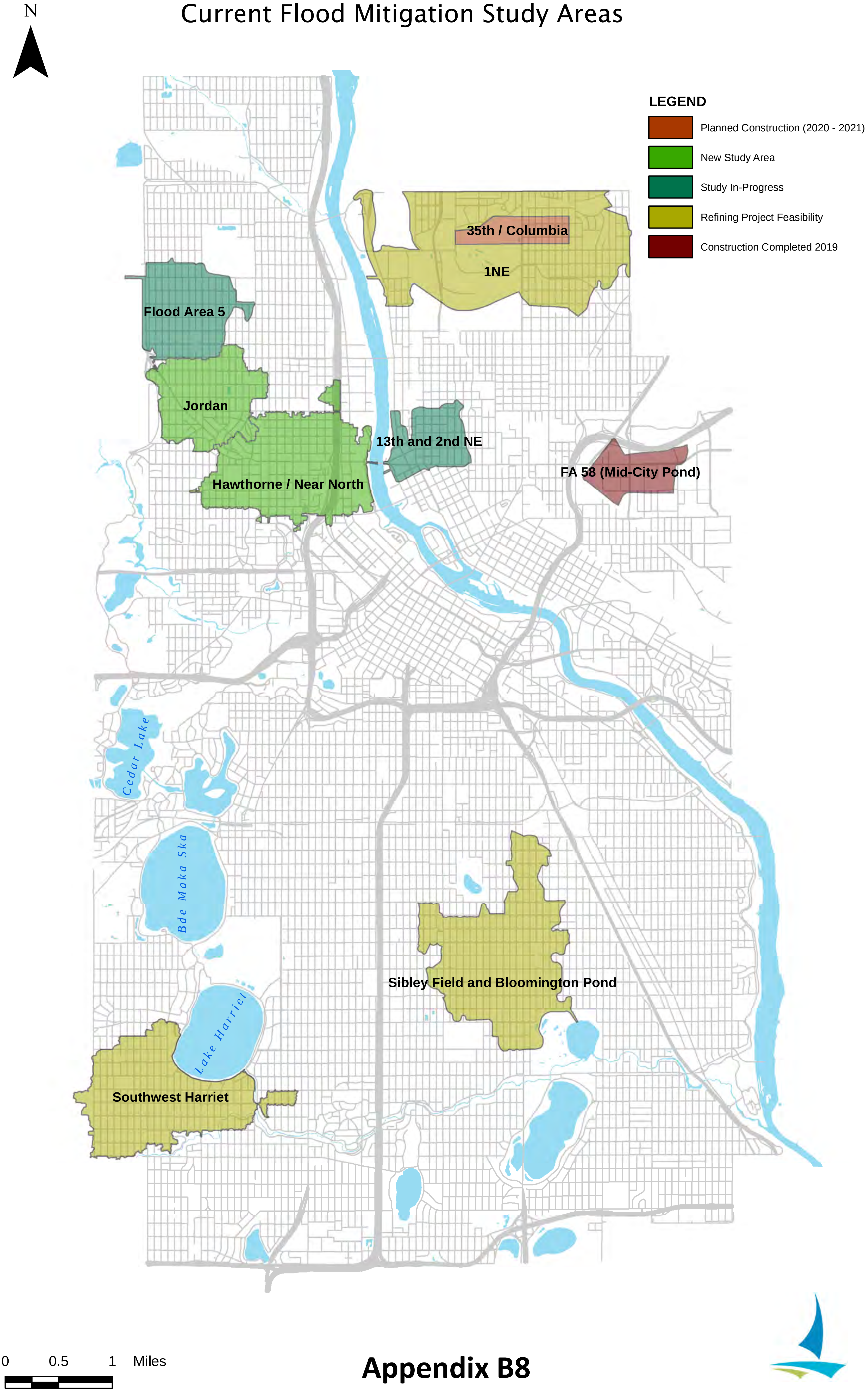
Document Path: M:\PWSWS\MODELS\RESOURCES\Hydraulic Modeling Status\2020_June_Model Status.mxd

Appendix B7

Minneapolis
City of Lakes

Surface Water & Sewers Division
Regional Hydrologic / Hydraulic Model
June 2020 Project Status

Current Flood Mitigation Study Areas



Appendix B8