CITY OF BARABOO

STORMWATER MANAGEMENT PROGRAM

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Table of Contents

CHAPTER 1 - OVERVIEW..... 1
1.1 INTRODUCTION..... 1
1.2 BACKGROUND..... 1
1.3 PERMIT REQUIREMENTS..... 1
1.4 PROGRAM OVERVIEW 2

Attachments

ATTACHMENT A – PUBLIC EDUCATION & OUTREACH PROGRAM (2.1)

ATTACHMENT B – PUBLIC INVOLVEMENT AND PARTICIPATION (2.2)

ATTACHMENT C – ILLICIT DISCHARGE DETECTION AND ELIMINATION (2.3)

ATTACHMENT D – EROSION AND SEDIMENT CONTROL PERMITTING FOR SMALL SITES (2.4)

ATTACHMENT E – STORMWATER MANAGEMENT PERMITTING (2.5)

ATTACHMENT F – POLLUTION PREVENTION (2.6)

ATTACHMENT G – STORMWATER QUALITY MANAGEMENT (2.7)

ATTACHMENT H – STORM SEWER SYSTEM MAPS (2.8)

ATTACHMENT I – ANNUAL REPORTS (2.9)

ATTACHMENT J – WISCONSIN RIVER BASIN TMDL IMPLEMENTATION PLAN (C4)

Tables

Table 1. Compliance Schedule..... 2

CHAPTER 1 - OVERVIEW

Municipal Separate Storm Sewer System (MS4) Permit

Wisconsin Pollutant Discharge Elimination System (WPDES)

1.1 INTRODUCTION

The Federal Clean Water Act of 1972 made it unlawful to discharge any pollutant from a point source into navigable waters unless a permit was obtained. This permit program is called the National Pollutant Discharge Elimination System (NPDES). As part of the program, small cities are required to follow a Municipal Separate Storm Sewer System (MS4) General Permit which approves the discharge of stormwater to lakes, rivers, wetlands, and other receiving waters (EPA 2017). In Wisconsin, the MS4 Permit is administered by the WDNR.

1.2 BACKGROUND

Urban storm water runoff contains pollutants from roads, parking lots, construction sites, industrial storage yards and lawns. In 1987 Congress amended the federal Clean Water Act to control storm water pollution. Federal regulations thus required owners of storm water pollution sources, including many industries, municipalities and construction sites, to have National Pollutant Discharge Elimination System (NPDES) Stormwater Permits.

At the State level and to meet the requirements of the federal Clean Water Act, DNR developed the Wisconsin Pollutant Discharge Elimination System (WPDES) Storm Water Discharge Permit Program which is administered under the authority of ch. NR 216, Wis. Adm. Code.

A Municipal separate storm sewer system or MS4 means a conveyance or system of conveyances including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meet the following criteria: 1) Owned or operated by a municipality, 2) Designed or used for collecting or conveying storm water, 3) Is not a combined sewer conveying both sanitary and storm water, and 4) Is not part of a publicly owned wastewater treatment works that provides secondary or more stringent treatment.

A WPDES MS4 permit is required for a municipality that meet one of the following criteria:

1. It is located within a federally-designated Urbanized Area,
2. Its population equals 10,000 or more based on the latest decennial census; or
3. When the Department of Natural Resources designates the municipality for permit coverage in accordance with s. NR 216.025.

The MS4 permits are effective for a period of up to five years, at which point the permits are updated and re-issued.

About 220 municipalities in Wisconsin are currently required to have a WPDES MS4 permit.

1.3 PERMIT REQUIREMENTS

The current 2019 Wisconsin MS4 Permit, General Permit No. WI-S050075-3, has eight specific goals or Minimum Control Measures (MCM), within the permit's SWPPP, as listed below.

1. Public education and outreach
2. Public involvement and participation

3. Illicit discharge detection and elimination (IDDE)
4. Construction site pollutant control
5. Post-construction stormwater management
6. Pollution prevention/good housekeeping
7. Stormwater quality management
8. Storm sewer system map

This Program, and implementation of the Plan via the methodology described herein, satisfies the requirements of the General Permit.

1.4 PROGRAM OVERVIEW

The following provides information on the City of Baraboo's Storm Water Management Program and is intended to be a **living document** on how the city will meet its requirements of Wisconsin Administrative Rule NR 216 and its WPDES MS4 permit. This plan establishes activities and programs, and provides a schedule for implementation that aligns with the compliance and implementation schedule of the MS4 Permit (see Table 1).

Table 1. - Compliance Schedule WPDES Permit No. WI-S050075-3

PERMIT SECTION	ACTIVITY	COMPLIANCE DATE	COMMENTS
Section 1.5.1	Identify discharges to an impaired waterbody	By March 31 of each odd-numbered year thereafter	All permittees
Section 1.5.2 (C4.1 – C4.3)	Total maximum daily load implementation	Within 36 months of the approval date of the TMDL	Applies to a permittee with an MS4 discharge of a pollutant of concern to a waterbody subject to an USEPA approved TMDL that assigns the permittee a wasteload allocation.
Section 2.1	Public Education and Outreach – Submit public education and outreach program for the permit term with annual report	March 31, 2021	All permittees
Section 2.2	Public Involvement and Participation – Submit public involvement and participation program for the permit term with annual report	March 31, 2021	All permittees
Section 2.3.2 to 2.3.6	Illicit Discharge Detection and Elimination – Submit illicit discharge detection and elimination program for the permit term with annual report	March 31, 2021	All permittees
Section 2.4.2 to 2.4.4	Construction Site Pollutant Control – Submit construction site pollutant control program for the permit term with annual report	March 31, 2021	All permittees

Section 2.5.2 to 2.5.4	Post-Construction Storm Water Management – Submit post-construction storm water management program for the permit term with annual report	March 31, 2021	All permittees
Section 2.6	Pollution Prevention – Section 2.6.1, submit the municipal storm water management facility inventory with annual report	March 31, 2021, and annually thereafter (if updates)	All permittees
	Pollution Prevention – Section 2.6.2, submit the maintenance plan for municipal storm water management facilities with annual report	March 31, 2021	All permittees
	Pollution Prevention – Section 2.6.3, submit SWPPPs for municipally owned properties with annual report	March 31 of each year reporting on previous calendar year (if updates)	All permittees
Section 2.7	Storm Water Quality Management – Report TSS percent reduction	March 31 of each year reporting on previous calendar year	All permittees
Section 2.8	Storm sewer system map - Submit map with annual report	March 31 of each year reporting on previous calendar year (if updates)	All permittees
Section 2.9	Submit annual report	March 31 of each year reporting on previous calendar year	All permittees

After reviewing Table 1, one can sense that meeting permit requirements and maintaining compliance is a process. A living document allows for continued compliance, and provides opportunity for changes, amendments and updates as land use and land management activities change, as technology improves, and regulations change. Furthermore, this document provides the ability to identify deficiencies in any program or activity and allows for the opportunity to make modifications throughout the process.

This Storm Water Management Program plan cover serves as the skeleton document and provide placeholders for each respective required activity. Permit requirements, compliance activity and schedules are organized by attachments:

Attachment "A" **Public Education and Outreach (2.1)** – To increase the awareness of storm water pollution impacts on waters of the state and to encourage changes in public behavior to reduce such impacts.

Attachment "B" **Public Involvement and Participation (2.2)** – To notify the public of activities required by this permit and to encourage input and participation from the public regarding these activities.

Attachment "C" **Illicit Discharge Detection and Elimination (2.3)** – Continue to implement and enforce its program to detect and remove illicit connections and discharges to the MS4.

Attachment "D"	**Erosion and Sediment Control for Small Sites (2.4)** – Continue to implement and enforce its program to reduce the discharge of sediment and construction materials from construction sites.
Attachment "E"	**Stormwater Management Permitting (2.5)** – Continue to implement and enforce its program to require control of the quality of discharges from areas of new development, infill, and redevelopment, after construction is completed.
Attachment "F"	**Pollution Prevention (2.6)** – Continue to implement its pollution prevention program to prevent or reduce pollutant runoff from the MS4 to waters of the state.
Attachment "G"	**Stormwater Quality Management (2.7)** - The permittee shall implement its municipal storm water quality management program.
Attachment "H"	**Storm Sewer System Maps (2.8)** – The storm sewer system map shall be updated annually as needed for changes occurring in the permitted area boundaries.
Attachment "I"	**Annual Reports (2.9)** – An annual report on the status of permit requirements and a fiscal analysis on annual expenditures and proposed budget for program activities.
Attachment "J"	**Wisconsin River Basin TMDL Implementation (C4)** – TMDL implementation plan.

All attachments are hereby incorporated into this document by reference.

ATTACHMENT "A"

CITY OF BARABOO

PUBLIC EDUCATION AND OUTREACH (2.1)

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Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

Tables

TABLE 1 PUBLIC EDUCATION AND OUTREACH DELIVERY MECHANISMS 2

Appendices

APPENDIX A: PROGRAM ACTIVITIES A1
APPENDIX B: NCWSC STORMWATER MANAGEMENT EDUCATION AND OUTREACH PLAN 2021 ..... B1

CITY OF BARABOO
PUBLIC EDUCATION & OUTREACH PROGRAM (2.1)

Goal: To provide and maintain an enhanced public education & outreach program as a way to increase awareness of stormwater pollution and potential impacts to the City of Baraboo, the Baraboo River and other waters of the state. In doing so, we hope to encourage changes in public community behavior in order to improve the quality of and reduce the quantity of stormwater runoff.

Compliance Date: March 31, 2021 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

Develop and implement a public education and outreach program to increase the awareness of storm water pollution impacts on waters of the state to encourage changes in public behavior to reduce such impacts. The program shall establish measurable goals and, at a minimum, include the eight items listed under the work plan.

In the past, the City has relied on its partnership with the North Central Wisconsin Stormwater Coalition (NCWSC) to provide a portion of its needed education and outreach opportunities. The City will continue to rely on NCWSC to provide valuable educational opportunities into this area, through its website and partner coalition members.

The current permit requires that all eight of the previous topics be addressed by the City at least once during the permit term, May 1, 2019 – April 30, 2024, and at least 6 of them each year.

1. **Illicit Discharge Detection and Elimination (IDDE)** - Promote detection and elimination of illicit discharges and water quality impacts associated with such discharges from municipal separate storm sewer systems.
2. **Household Hazardous Waste Disposal/Pet Waste Management/Vehicle Washing** - Inform and educate the public about the proper management of materials that may cause storm water pollution from sources including automobiles, pet waste, household hazardous waste and household practices.
3. **Yard Waste Management/Pesticide and Fertilizer Application** - Promote beneficial onsite reuse of leaves and grass clippings and proper use of lawn and garden fertilizers and pesticides.
4. **Stream and Shoreline Management** - Promote the management of streambanks and shorelines by riparian landowners to minimize erosion and restore and enhance the ecological value of waterways.
5. **Residential Infiltration** - Promote infiltration of residential storm water runoff from rooftop downspouts, driveways and sidewalks.
6. **Construction Sites and Post-Construction Storm Water Management** - Inform and educate those responsible for the design, installation, and maintenance of construction site erosion control practices and storm water management facilities on how to design, install and maintain the practices.

7. **Pollution Prevention** - Identify businesses and activities that may pose a storm water contamination concern, and educate those specific audiences on methods of storm water pollution prevention.
8. **Green Infrastructure/Low Impact Development** - Promote environmentally sensitive land development designs by developers and designers, including green infrastructure and low impact development.

The permit also requires that the City of Baraboo use at least four different public education delivery mechanisms each year. From Table 1 below, at least two mechanisms shall be from the Active/Interactive method each year.

Table 1: Public Education and Outreach Delivery Mechanisms

Active/Interactive Mechanisms	Passive Mechanisms
• Educational activities (school presentations, summer camps) • Informational booth at event • Targeted group training (contractors, Consultants, etc.) • Government event (public hearing, council meeting) • Workshops • Tours • Other	• Passive print media (brochures at front desk, posters, etc.) • Distribution of print media (mailings, newsletters, etc.) via mail or email • Media offerings (radio and TV ads, press release, etc.) • Social media posts • Signage • Website • Other

WORK PLAN

This Public Education and Outreach Work Plan outlines how the City of Baraboo will implement a program to meet the objects indicated above. The following table identifies: 1) various educational activities, 2) defines the responsible party providing the activity, 3) lists the targeted audience, 4) provides an implementation timeframe, and 5) identifies measurable goals. Since the city is responsible for only educating people associated with properties owned and operated within the city the need for an extensive educational effort is minimal. The following are existing I & E activities geared at increasing awareness of storm water quality impacts for our citizens:

1. Daily one-on-one conversations with city residents providing information related to soil and water conservation issues.
2. Publish articles in biennial newsletter which reaches over 4,000 homes.
3. Facilitate storm drain stencil activities throughout the city to create awareness and help prevent illicit discharges.
4. Maintain a website.

City staff believe that our current education and outreach efforts already meet the minimum requirements of our MS4 general permit. Additional public education and outreach efforts will focus on targeted audiences identified in the following table. Our current coalition of local MS4 permitted communities will continue to help address permit requirements, assist with permit compliance and provide education and outreach program leadership.

This plan shall identify the target audience for each public education and outreach topic. Target audiences may include the general public, public employees, residents, businesses, contractors, developers, industries, and/or other appropriate audiences.

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Appendix A

Program Activities

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Program Activities
Public Education and Outreach for the City of Baraboo

2.1.1 Promote detection and elimination of illicit discharges and water quality impacts associated with such discharges from municipal separate storm sewer systems.				
Action	**Responsible Party**	**Target Audience**	**Implementation Timeline**	**Measurable Goals**
Presentation(s) to explain illicit discharges, regulatory requirements, and ordinance language.	Baraboo	Public Safety Committee & Common Council	2021	- One presentation given to Public Safety Committee. - One presentation given to Common Council.
Educational program and training for staff on field screening, identification, sampling, and enforcement.	Baraboo	Engineering Department	2021	- One educational/training for existing staff. - One-on-one training annually when needed and for new staff.
Distribute educational information.	Baraboo	General public	2021	Print one educational article for newspaper and/or newsletter annually.
Maintain website with related information.	Baraboo and NCWSC	General public	2021	Number of hits on web page
2.1.2 Inform and educate the public about the proper management of materials that may cause storm water pollution from sources including automobiles, pet waste, household hazardous waste and household practices.				
Action	**Responsible Party**	**Target Audience**	**Implementation Timeline**	**Measurable Goals**
Provide education material and presentations on sources of storm water pollution.	Baraboo	General Public	Summer 2021	- Develop educational materials, and update as needed. - Conduct one educational presentations at County Fair. - Print one educational article for newspaper or newsletter annually.
Maintain NCWSC website With related information.	NCWSC	All viewers	Ongoing	Number of hits on web page
Promote a storm drain stenciling program.	Baraboo	Local Governments, Civic Groups & Organizations	2022	Number of storm drains stenciled annually.

2.1.3 Promote beneficial onsite reuse of leaves and grass clippings and proper use of lawn and garden fertilizers and pesticides.				
Action	**Responsible Department**	**Target Audience**	**Implementation Timeline**	**Measurable Goals**
Provide education material and presentations on sources of storm water pollution related to goal.	Baraboo	General Public	2021	- Develop educational materials, and update as needed. - Conduct one educational presentations at County Fair. - Print one educational article for newspaper or newsletter annually.
Maintain NCWSC website with related information.	NCWSC	All viewers	Ongoing	http://www.ncwrpc.org/NCWSC/ website continues to serve as an effective source for educational information and material.
Continue to provide related products thru annual programs and website, e.g. rain barrels, compost bins, etc. Make products available annually.	Sauk County and Baraboo	General public	Ongoing	- Number and type of products sold. - Number of hits on web page - Promote program goal 1x per year through various tools, e.g. website, newsletters, social media, etc...
Educating people about available composting facilities.	Baraboo	General public	Ongoing	Continue to post availability of city compost site on city website.
2.1.4 Promote the management of streambanks and shorelines by riparian landowners to minimize erosion and restore and enhance the ecological value of waterways.				
Action	**Responsible Party**	**Target Audience**	**Implementation Timeline**	**Measurable Goals**
Develop educational materials relating to storm water & shoreland zoning ordinance.	Baraboo	General Public, Developers & Riparian landowners	2021	- Develop educational materials, and update as needed. - Print one educational article for newspaper or newsletter annually.
Hold public forum or tour to explain storm water impacts and benefits of riparian buffers.	Baraboo	Riparian landowners & developers	2022-2024	One event held annually, this may be combined with other programs due to similar goals.

2.1.5 Promote infiltration of residential storm water runoff from rooftop downspouts, driveways and sidewalks.				
Action	**Responsible Party**	**Target Audience**	**Implementation Timeline**	**Measurable Goals**
Develop educational materials relating to infiltration requirements in storm water ordinance.	Baraboo	Developers & General public	2021	- Develop educational materials, and update as needed. - Print one educational article for newspaper or newsletter annually. - Number of individuals advised annually.
Advertise existing sites successfully utilizing rain gardens and rain barrels.	Baraboo	General public	2021	Develop and maintain one rain garden educational material. Distribute rain garden educational materials. Hold an open house at one demonstration rain garden site.
Hold public forum or tour to explain storm water impacts and benefits of reducing storm water runoff.	Baraboo	Developers, Engineers, & Contractors	2021-2024	One event held annually, this may be combined with other programs due to similar goals, such as at County Fair.
Continue to provide related products thru annual programs and website, e.g. rain barrels, compost bins, etc.. Make products available annually.	Sauk County and Baraboo	General Public	Ongoing	- Number and type of products sold. - Promote program goal 1x per year through various tools, e.g. website, newsletters, social media, etc...
2.1.6 Inform and where appropriate educate those responsible for the design, installation, and maintenance of construction site erosion control practices and storm water management facilities on how to design, install and maintain the practices.				
Action	**Responsible Party**	**Target Audience**	**Implementation Timeline**	**Measurable Goals**
Develop educational materials relating to erosion control and storm water ordinance.	Baraboo	Developers, Engineers, Contractors & Public Officials	2021	- Develop educational materials, and update as needed. - Print one educational article for newspaper or newsletter annually.
Educate one-on-one	Baraboo	Developers, Engineers & Contractors	Ongoing	Number of individuals advised annually.

2.1.7 Identify businesses and activities that may pose a storm water contamination concern, and where appropriate, educate specific audiences on methods of storm water pollution prevention.				
Action	**Responsible Party**	**Target Audience**	**Implementation Timeline**	**Measurable Goals**
Utilizing existing models, inventory and evaluate adjacent sites (run-on) to determine potential contamination issues.	Baraboo	None	2022	Adapt and submit for print one educational item for newspaper articles and/or newsletter articles.
Based upon inventory above, develop plan, initiate discussions and provide educational opportunities that address concerns.	Baraboo	Specific identified sites	2022-23	- Report on number of sites identified from inventory. - Number of sites contacted and number of educational items provided.
2.1.8 Promote environmentally sensitive land development designs by developers and designers, including green infrastructure and low impact development.				
Action	**Responsible Party**	**Target Audience**	**Implementation Timeline**	**Measurable Goals**
Develop educational material relating to program goal.	Baraboo	Developers, Engineers & Contractors	2021	- Develop educational materials, and update as needed. - Print one educational article for newspaper or newsletter annually.
Encourage the use of low impact design for new developments in the City.	Baraboo	Developers, Engineers, Contractors & General public	Ongoing	Number of individuals advised annually.
Inventory, identify and advertise existing sites successfully utilizing green infrastructure or low impact development.	Baraboo	Developers, Engineers & Contractors	2022	Promote existing sites that have implemented program goal through various tools. Develop and distribute one educational material annually.

Appendix B

Northcentral Wisconsin Stormwater Management Education and Outreach Plan 2021

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Northcentral Wisconsin Stormwater Coalition

Stormwater Management Education and Outreach Plan

2021

Marathon County
City of Baraboo
City of Marshfield
City of Merrill
City of Mosinee
City of Schofield
City of Stevens Point
City of Wausau
City of Wisconsin Rapids
Village of Kronenwetter
Village of Rothschild
Village of Weston
Town of Rib Mountain

Northcentral Wisconsin Stormwater Coalition (NCWSC)

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March 2021

This plan was prepared under the direction of the Northcentral Wisconsin Stormwater Coalition (NCWSC) by the North Central Wisconsin Regional Planning Commission (NCWRPC).

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Introduction

A municipal stormwater management program is to reduce adverse impacts to waters of the state and to encourage changes in public behavior to reduce urban sources of stormwater runoff.

Urban storm water runoff is rain and melting snow that flows off building rooftops, driveways, lawns, streets, parking lots, construction sites, and industrial storage yards. Developed areas are covered by buildings and pavement, which do not allow water to soak into the ground.

Storm sewers may be pipes laid under streets or grass swales alongside roads to collect stormwater runoff from the road and parking lots. Storm sewers are used to collect large amounts of runoff from streets and parking lots and flows mostly untreated directly into lakes and rivers. Some stormwater is treated to varying degrees if it flows through the following: rain gardens, grass swales, infiltration practices, wet ponds, and bioretention systems.

About 245 municipalities in Wisconsin are currently required to have a Municipal Separate Storm Sewer System (MS4) permit under NR 216, Wis. Adm. Code. Members of the Northcentral Wisconsin Stormwater Coalition are all MS4 permit municipalities. An MS4 permit requires a municipality to reduce polluted stormwater runoff by implementing stormwater management programs with best management practices.

Public outreach and education are important features of a comprehensive and effective stormwater management program.

Statutory base for this plan

This document is the Public Outreach and Education program developed for Northcentral Wisconsin Stormwater Coalition members that are permitted under: WPDES Permit No. WI-S050075-3, for the term that began May 1, 2019 and expires on April 30, 2024.

All current Northcentral Wisconsin Stormwater Coalition members listed on this plan's cover are cooperating with each other via signed Cooperative Agreements and with Marathon County via signed Memorandum of Agreements to implement the Public Outreach and Education program for MS4 permitted communities.

All signed Cooperative Agreements and Memorandum of Agreements are on file with Marathon County.

Purpose

The primary purpose of this education and outreach plan is to provide continued direction toward reducing the adverse impacts of urban stormwater runoff to waters of the state.

Target Audiences

Each public education and outreach activity may be designed to reach a specific audience. Target audiences may include the general public, public employees, residents, businesses, contractors, developers, industries, and/or other appropriate audiences. The annual report to all NCWSC members will state the target audience for each activity.

Compliance

An annual report of the previous year's NCWSC sponsored activities will be provided to all NCWSC members for their annual reporting requirements in the WPDES permit.

Goals

The goals of this education and outreach plan are from the Table 1 requirements in the Wisconsin Pollutant Elimination Discharge System (WPDES) permit.

These goals will provide general direction to the Northcentral Wisconsin Stormwater Coalition over the next 3 years.

Goal 1 – Promote detection and elimination of illicit discharges and water quality impacts associated with such discharges from municipal separate storm sewer systems.

Goal 2 – Inform and educate the public about the proper management of materials that may cause stormwater pollution from sources including automobiles, pet waste, household hazardous waste and household practices.

Goal 3 – Promote beneficial onsite reuse of leaves and grass clippings and proper use of lawn and garden fertilizers and pesticides.

Goal 4 – Promote the management of streambanks and shorelines by riparian landowners to minimize erosion and restore and enhance the ecological value of waterways.

Goal 5 – Promote infiltration of residential stormwater runoff from rooftop downspouts, driveways, and sidewalks.

Goal 6 – Inform and educate those responsible for the design, installation, and maintenance of construction site erosion control practices and stormwater management facilities on how to design, install, and maintain the practices.

Goal 7 – Identify businesses and activities that may pose a stormwater contamination concern and educate those specific audiences on methods of stormwater pollution prevention.

Goal 8 – Promote environmentally sensitive land development designs by developers and designers, including green infrastructure and low impact development.

On an annual basis, at least six of the above goals will be addressed. During the term of this plan, all eight of the above goals will be addressed at least once.

Table A shows the active vs. passive ways to reach target audiences. On an annual basis at least four public education and outreach delivery mechanisms will be used; with at least two of those coming from the active/interactive column in **Table A**.

Table A: Public Education and Outreach Delivery Mechanisms (Active and Passive)	
Active/Interactive Mechanisms	**Passive Mechanisms**
• Educational activities (school presentations, summer camps) • Informational booth at event • Targeted group training (contractors, consultants, etc.) • Government event (public hearing, council meeting) • Workshops • Tours • Other	• Passive print media (brochures at front desk, posters, etc.) • Distribution of print media (mailings, newsletters, etc.) via mail or email • Media offerings (radio and TV ads, press release, etc.) • Social media posts • Signage • Website • Other

See **Attachment A** for the various ways that the NCWSC may address the 8 goals and what mechanisms may be used by the NCWSC. The annual report to NCWSC members will show exactly what mechanisms were used.

Attachment A

The **Rubber Ducky ad** is designed to direct the public to a website for information on all 8 topic areas in Table 1.

Rubber Ducky website = a **passive** public outreach mechanism

Table 1: Public Education and Outreach Topic Areas and Descriptions			Options to satisfy requirement.
#	Topic Area	Description	
1	Illicit Discharge Detection and Elimination	Promote detection and elimination of illicit discharges and water quality impacts associated with such discharges from municipal separate storm sewer systems.	DNR Spill Hotline – a prominent note on **Rubber Ducky website**. - Staff from each community to document what they have done over the course of their permit, and report to their local governing body. **(Active)**
2	Household Hazardous Waste Disposal/Pet Waste Management/Vehicle Washing	Inform and educate the public about the proper management of materials that may cause storm water pollution from sources including automobiles, pet waste, household hazardous waste and household practices.	Rubber Ducky ad directing people to **Rubber Ducky website**. - Website to have a "where to put your waste" webpage. - Annual HHW drop-off event [1 per county] **(Active)**
3	Yard Waste Management/Pesticide and Fertilizer Application	Promote beneficial onsite reuse of leaves and grass clippings and proper use of lawn and garden fertilizers and pesticides.	**Rubber Ducky website** – specific section for lawn care and infiltration.
4	Stream and Shoreline Management	Promote the management of streambanks and shorelines by riparian landowners to minimize erosion and restore and enhance the ecological value of waterways.	**Rubber Ducky website** – specific section for shoreline management. Contact page for county conservationists.
5	Residential Infiltration	Promote infiltration of residential storm water runoff from rooftop downspouts, driveways and sidewalks.	**Rubber Ducky website** – specific section for residential infiltration. Add business infiltration ideas too.
6	Construction Sites and Post-Construction Storm Water Management	Inform and educate those responsible for the design, installation, and maintenance of construction site erosion control practices and storm water management facilities on how to design, install and maintain the practices.	**Rubber Ducky website** – specific section for controlling construction site erosion, and concrete wash-out. - Discuss the newest best practices with a contractor who comes in for becoming certified in that community. **(Active)**
7	Pollution Prevention	Identify businesses and activities that may pose a storm water contamination concern, and educate those specific audiences on methods of storm water pollution prevention.	Staff from each community to document what they have done over the course of their permit, and report to their local governing body. **(Active)**
8	Green Infrastructure/Low Impact Development	Promote environmentally sensitive land development designs by developers and designers, including green infrastructure and low impact development.	**Rubber Ducky website** – specific section on green infrastructure, with directions for rain garden development, lawn care, and infiltration.

ATTACHMENT "B"

CITY OF BARABOO

PUBLIC INVOLVEMENT AND PARTICIPATION (2.2)

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Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

Appendices

APPENDIX A: PROGRAM ACTIVITIES A1

CITY OF BARABOO
PUBLIC INVOLVEMENT AND PARTICIPATION (2.2)

Goal: To notify the public of activities required by this permit and to encourage input and participation from the public regarding these activities.

Compliance Date: March 31, 2021 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

Develop and implement a program to notify the public of activities required by this permit and to encourage input and participation from the public regarding these activities. This program shall include measurable goals for public involvement and participation and comply with applicable state and local public notice requirements.

The tools that will be utilized to educate and seek involvement will include: government events (council meetings, public hearings), displays, brochures, newsletters, press releases, website, presentations, workshops and tours, social marketing and personal contacts.

The city shall provide a minimum of one opportunity annually for the public to provide input on each of the following permit activities: annual report, storm water management program, and if applicable, the adoption or amendment of storm water related ordinances. The permittee shall also implement at a minimum one of the following volunteer activities per year: group best management practice (BMP) installation or maintenance, storm drain stenciling, planting community rain garden, clean up event, stream monitoring, citizen committee meeting, public workshop, presentation of storm water information, or other hands-on event.

The city shall identify the targeted participants for each permit activity and volunteer activity. Participants may include general public, public employees, residents, businesses, contractors, developers, industries, and/or other appropriate audience.

WORK PLAN

It is important that the public are provided an opportunity to provide input and play an active role in the development and implementation of a stormwater quality program. Experience has shown that an active and involved community determines the success of a stormwater management program. Informing the public and encouraging participation will utilize a variety of tools in order to reach a variety of audiences.

Examples of public involvement and volunteer opportunities planned for the permit term are listed in Appendix A.

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Appendix A

Program Activities

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Program Activities
Public Involvement and Participation for the City of Baraboo

2.2.1 and 2.2.2 Permit Activities and Delivery Mechanism				
Action	**Responsible Party**	**Target Participants**	**Implementation Timeline**	**Measurable Goals**
Presentation(s) for the public to provide input for annual report, storm water management program and ordinance amendments.	Baraboo	Public Safety Committee, Common Council and General Public	Winter 2020/2021 and then annually	- One presentation given to Public Safety Committee. - One presentation given to Common Council.
Presentation(s) for the public to provide input for updated storm water management plan.	Baraboo, MSA	Common Council and General Public	2021	
Update website with information regarding annual report, storm water management program and ordinance amendments.	Baraboo	General public	Fall 2020 and then annually	- Number of events advertised on website each year. - Number of hits on web page
2.2.3 Volunteer Activities				
Action	**Responsible Party**	**Target Participants**	**Implementation Timeline**	**Measurable Goals**
Hold group best management practice (BMP) installation or maintenance, storm drain stenciling, planting community rain garden, clean up event, stream monitoring, citizen committee meeting, public workshop, presentation of storm water information, or other hands-on event.	Baraboo	General Public	Annually	- Number of events and participants each year.

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ATTACHMENT "C"

CITY OF BARABOO

ILLICIT DISCHARGE DETECTION & ELIMINATION (2.3)

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Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

CHAPTER 1 - OVERVIEW 2

1.1 INTRODUCTION 2
1.2 PURPOSE 3

CHAPTER 2 – ILLICIT DETECTION & DISCHARGE (IDDE) 4

2.1 DEFINITIONS 4
2.2 ACRONYMS 5
2.3 WHAT IS AN ILLICIT DISCHARGE 5
2.4 COMMON SOURCES OF ILLICIT DISCHARGE 6
2.5 ALLOWABLE DISCHARGES 7
2.6 SIGNIFICANCE OF ILLICIT DISCHARGE 8
2.7 ILLICIT DISCHARGE DETECTION AND ELIMINATION PLAN OVERVIEW 8

CHAPTER 3 – STORMWATER SYSTEM MAPPING 9

3.1 SYSTEM MAPPING 9
3.2 OUTFALL INVENTORY 9

CHAPTER 4 – ASSESSMENT OF CATCHMENTS AND PRIORITY RANKING OF OUTFALLS 10

4.1 CATCHMENT DELINEATION 10
4.2 OUTFALL PRIORITIZATION AND RANKING 10
4.3 SUBMITTAL REQUIREMENTS 10

CHAPTER 5 – ON-GOING FIELD SCREENING PROGRAM 12

5.1 INSPECTION FREQUENCY OF OUTFALLS 12
5.2 ON-GOING FIELD SCREENING FOR THE REMAINDER OF THE PERMIT TERM (2021-2024) 12
5.3 SUPPLEMENTAL ANNUAL FIELD SCREENING 12
5.4 ON-GOING FIELD SCREENING PROTOCOLS 13
5.5 MEASURABLE GOALS 13

CHAPTER 6 – FIELD SCREENING PROCEDURES 14

6.1 FIELD SCREENING REQUIREMENTS 14
6.2 EQUIPMENT 14
6.3 SAFETY AND TRAINING 14
6.4 PROPOSED FIELD SCREENING PROCEDURES FOR ON-GOING SCREENING 15
6.5 SOURCE ISOLATION AND CONFIRMATION 18
6.6 MANHOLE INSPECTIONS 18
6.7 REMOVING SURCES OF ILLICIT DISCHARGES 19
6.8 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES 20

CHAPTER 7 – FOLLOW-UP FIELD SCREENING AND INVESTIGATION PROCEDURES 22

7.1 CONDITIONS TO TRIGGER ADDITIONAL IDDE INVESTIGATIONS 22
7.2 SUPPLEMENTAL PROCEDURES FOR IDDE INVESTIGATION 22

CHAPTER 8 – EMPLOYEE AND PUBLIC EDUCATION 25

8.1 EMPLOYEE EDUCATION 25
8.2 PUBLIC EDUCATION AND OUTREACH 25
8.3 FUTURE RECCOMENDATIONS 25

CHAPTER 9 – PROGRESS REPORTING..... 26

Tables

TABLE 6-1 VISUAL CHARACTERIZATION INTERPRETATION..... 16

Figures

FIGURE 2-1 ALLOWABLE DISCHARGES..... 7
FIGURE 5-1 OUTFALL DIELD SCREENING..... 12
FIGURE 6-1 INTERPRETING COLOR AND TURBIDITY..... 17
FIGURE 7-1 IDDE SCREENING PARAMETERS AND GUIDANCE THRESHOLDS..... 22

Appendices

APPENDIX A: OUTFALL TABLE AND MAPS A1

APPENDIX B: OUTFALL FIELD SCREENING FORM..... B1

APPENDIX C: SPILL AND ILLICIT DISCHARGE RESPONSE PROCEDURE MANUAL C1

APPENDIX D: EDUCATIONAL MATERIALS D1

APPENDIX E: CHAPTER 14, SUBCHAPTER V – ILLICIT STORMWATER DISCHARGE E1

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CITY OF BARABOO
ILLICIT DISCHARGE DETECTION AND ELIMIATION (2.3)

Goal: Develop a program to identify, prevent, and eliminate illicit discharges to storm sewer systems.

Compliance Date: March 31, 2021 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

Develop, implement and enforce a program to detect and remove illicit connections and discharges to the MS4. The program shall include measurable goals and include all of the following:

2.3.1 An ordinance or other regulatory mechanism to prevent and eliminate illicit discharges and connections to the MS4.

2.3.2 Initial field screening at all major outfalls during dry weather periods.

2.3.3 On-going dry weather field screening of outfalls during the term of the permit. Field screening shall be conducted at selected outfalls on an annual basis. Consideration shall be given to hydrological conditions, total drainage area of the site, population density of the site, traffic density, age of the structures or buildings in the area, history of the area and land use types when selecting outfalls for annual field screening.

2.3.4 Procedures for responding to known or suspected illicit discharges.

2.3.5 Take appropriate action to remove illicit discharges from its MS4 system as soon as possible. If it will take more than 30 days to remove an illicit connection, the Department shall be contacted to discuss an appropriate action and/or timeframe for removal.

2.3.6 In the case of interconnected MS4s, the permittee shall notify the appropriate municipality.

2.3.7 The name, title and phone number of the individual(s) responsible for responding to reports of illicit discharges and spills shall be included in the illicit discharge response procedure.

WORK PLAN

☒ Ordinance Adopted by Baraboo Common Council on 5/21/2008.
☒ Initial field screening started in 2009.
☒ The Illicit Discharge Detection and Elimination Program Manual completed by March 31, 2021.
☐ Update ordinance in 2021
☐ The City will implement items recognized in IDDE manual.

CHAPTER 1 - OVERVIEW

1.1 INTRODUCTION

The Federal Clean Water Act of 1972 made it unlawful to discharge any pollutant from a point source into navigable waters unless a permit was obtained. This permit program is called the National Pollutant Discharge Elimination System (NPDES). As part of the program, small cities are required to follow a Municipal Separate Storm Sewer System (MS4) General Permit which approves the discharge of stormwater to lakes, rivers, wetlands, and other receiving waters (EPA 2017). In Wisconsin, the MS4 Permit is administered by the WDNR.

Baraboo is an Urbanized Area, as defined by the Bureau of the Census, due to its population. The City is classified as an NPDES Phase II community, more commonly referred to as a small MS4 community, and has therefore been required to comply with the MS4 General Permit since 2006. Permit requirements were lastly revised in 2019 by the WDNR for small MS4 cities in Wisconsin. The current Wisconsin MS4 Permit has eight specific goals or Minimum Control Measures (MCM), within the permit's SWPPP, as listed below.

1. Public education and outreach
2. Public involvement and participation
3. **Illicit discharge detection and elimination (IDDE)**
4. Construction site pollutant control
5. Post-construction stormwater management
6. Pollution prevention/good housekeeping
7. Stormwater quality management
8. Storm sewer system map

This plan provides procedures and documents required to comply with the illicit discharge portions of the MS4 Permit, as described in Section 2.3 of the current WPDES Permit No. WI-S050075-3.

The specific goals of this IDDR Plan are to:

- Continue dry weather field screening of outfalls.
- Develop procedures for responding to known or suspected illicit discharges.
- Develop procedures for eliminating known illicit discharges from our MS4.
- Meet staff and public education objectives of the City's WPDES MS4 Permit.
- Provide effective tools for City staff to identify and respond to illicit discharges.

The City is committed to working internally and with state and federal environmental agencies to achieve water quality goals and protect public health. The City has established this Plan to outline procedures, goals, standard operating procedures (SOPs), and workflow processes for successful and efficient implementation of IDDE. It is a working document and will be revised as necessary. This Plan is based on current regulatory requirements formed by the 2019 MS4 General Permit and follows City Code, Chapter 14, Subchapter V, for Illicit Stormwater Discharge, which was last updated by the City of Baraboo in 2015 and can be found in Appendix E.

1.2 PURPOSE

The purpose of this plan is to outline a program to detect and eliminate illicit discharges to the City's MS4 and waterways to improve water quality and meet the Federal Phase II Stormwater requirements. Through this plan the City will identify procedures to:

- Prohibit illicit discharges into the MS4 through appropriate enforcement procedures and actions
- Establish a procedure for determining whether non-stormwater discharges are significant contributors of pollutants to Surface Waters of the State
- Detect and eliminate unauthorized non-stormwater discharges into the MS4
- Perform screening activities including dry weather sampling, wet weather sampling, and assessment of interconnections, and prioritize waterbodies shown through sampling activities to have impairments
- Educate City employees, businesses, and the general public about the hazards associated with illegal discharges and improper disposal of waste
- Utilize priority ranking of outfalls and sub-catchments in order to prioritize and pursue investigations of potential illicit discharges
- Identify illicit discharges, trace and remove these sources
- Confirm elimination and completion of investigations
- Develop standard operating procedures for spill response and enforcement
- Train staff who implement IDDE tasks

CHAPTER 2 – ILLICIT DETECTION AND DISCHARGE (IDDE)

2.1 DEFINITIONS

Dispatch – The City of Baraboo's Police, Fire, and Emergency Medical Services (EMS) emergency dispatch call center, available by dialing 911.

Drinking Water Supply Management Area (DWSMA) – Area surrounding a public water supply well, including the well head protection area, that must be managed by the entity identified in a Wellhead Protection Plan (WHPP).

Enforcement Response Procedures (ERPs) – A written requirement in the Municipal Separate Storm Sewer System (MS4) Stormwater Pollution Prevention Program (SWPPP) Permit (Part III) for Minimum Control Measures (MCM) 3, 4, and 5 for illicit discharge, construction site stormwater control, and post-construction stormwater management, respectively.

Environmental Coordinator – City Staff member in the Engineering Division within the Public Works Department who is responsible for the City's Stormwater Pollution Prevention Program (SWPPP) Permit, including documentation of the City's illicit discharge program.

Minimum Control Measure (MCM) – Goals within the Municipal Separate Storm Sewer System (MS4) General Permit that must be incorporated into stormwater management programs. There are a total of eight MCMs and when implemented together are expected to result in reductions of pollutants discharged through the MS4.

The National Pollutant Discharge Elimination System (NPDES) – EPA's permit program which controls water pollution by regulating sources that discharge pollutants into waters of the United States.

Navigable Waters – Waters that are presently used, or have been used in the past or may be susceptible for use, to transport interstate or foreign commerce. The Clean Water Act expands this definition to include tributaries and nearby wetlands when referring to the discharge of pollutants.

Receiving Water – Creeks, streams, rivers, lakes, estuaries, groundwater formations, or other bodies of water into which surface water, treated waste, or untreated waste are discharged.

Stormwater System – A Stormwater System includes any stormwater facility, drainage work or improvement that is designed to transport, convey or control the flow of stormwater or that improves or controls the water quality of stormwater. This shall include but is not limited to, outfalls, inlets, outlets, conduits, pipes, curbs, municipal streets, catch basins, gutters, ditches, pumping stations, manholes, structures, channels, retention or detention basins, infiltration areas, filtration systems and other structural components and equipment that are used for managing storm drainage or surface water. Stormwater Systems include both Public and Private Systems.

Surface water – All water which is open to the atmosphere and subject to surface runoff (Wisconsin Administrative Code NR 102.03).

Suspension Order – An official notice to a landowner of a violation of City Code, State Rules, or EPA statutes and regulations. The notice will describe the violations and instructions for coming into compliance.

Urbanized area – defined by the U.S. Census Bureau as contiguous census block groups with a population density of at least 1,000 per square mile. Urban areas are delineated without regard to political boundaries.

Wellhead Protection Area – Areas designated as public health importance due to its proximity to a drinking water well. Areas are determined based on the geology and potential of contamination into the drinking water source.

Wetlands – an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions. (Wisconsin Chapter NR 103).

Wisconsin Department of Natural Resources (WDNR) – Regulatory agency in Wisconsin and administrator of the State's NDPES permits including the MS4 General Permit.

2.2 ACRONYMS

BMP	Best Management Practice
EPA	Environmental Protection Agency
ERP	Enforcement Response Protocol
GIS	Geographic Information System
IDDR	Illicit Discharge Detection Response
MCM	Minimum Control Measure
WDH	Wisconsin Department of Health
WDNR	Wisconsin Department of Natural Resources
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
SSO	Sanitary Sewer Overflow
SWPPP	Stormwater Pollution Prevention Program/Plan

2.3 WHAT IS AN ILLICIT DISCHARGE?

The EPA defines an illicit discharge as "any discharge to an MS4 that is not composed entirely of stormwater", except discharges regulated by a separate NPDES (National Pollutant Discharge Elimination System) permit and/or allowable non-stormwater discharges that do not significantly contribute pollutants to the MS4. Illicit discharges to storm sewer systems are caused by a variety of situations and can be described by the path of entry and by the pattern of flow.

- Flow can *directly* enter into the storm sewer system via an illegal connection or even by an approved connection that exceeds the effluent standards set by the permit issued. They can also *indirectly* enter the storm sewer system due to accidental leakage into inlets or infiltration with groundwater through joints or cracks in the sewer.
- Illicit discharges could be *intermittent,* (only occurring a few hours per day or a few days per year), *continuous*, or *transitory* (occurring only once).

Illicit discharges are considered "illicit" because the water is not treated for water quality impairments before entering receiving waters. An illicit discharge may contain compounds that have the potential to be harmful to the health or welfare of citizens, to the environment, surface waters, or the storm sewer system. The receiving waters could be recreational areas or eventual drinking water sources. Even well maintained separate storm sewer systems can contribute to water pollution and deliver heavy metals, oil, grease, solvents, nutrients, toxics, bacteria to downstream water bodies.

2.4 COMMON SOURCES OF ILLICIT DISCHARGES

2.4.1 Construction Sites

Construction sites are a common source of illicit discharges to storm sewer systems. Runoff from these sites can transport sediment, automotive liquids, hazardous materials, higher than normal pH conditions, or abnormal temperatures (Herrera 2011). Construction sites that disturb more than one acre of soil or pose a risk to water resources require a "WPDES Construction Stormwater General Permit" issued by the Wisconsin Department of Natural Resources (WDNR). As a part of this permit, site owners and operators must develop an Erosion Control Plan for Construction Sites that specify the erosion control and pollution reduction measures that will be taken to ensure contaminated stormwater does not leave the construction site. Some of the BMPs that may be required by construction sites include items such as silt fence, inlet protection, and containment of runoff from erodible surfaces.

2.4.2 Illegal Dumping

Illegal dumping often occurs by persons that are unaware of the laws and rules about disposal of certain liquids or solid waste. Some individuals may assume that all sewer drainage is treated in the same manner as sanitary wastewater, while others may deliberately and knowingly dispose of waste into storm sewers. Common examples of items that are dumped into storm sewers include paint, trash, used motor oil, automotive liquids such as antifreeze, wash water from services (concrete contractors, carpet cleaning operations), cooking oils, and grease.

2.4.3 Sanitary Waste

Sanitary waste (sewage) can enter storm sewer systems through a variety of ways. Failed utility components or broken pipes can be one pathway. For example, a blocked or broken sanitary sewer pipe, septic system, or pump station near a storm sewer system could lead to overflow or infiltration of wastewater to the storm sewer pipe. Another common way wastewater enters the storm sewer is when a connection from a home or business is made directly to a storm sewer. Often storm and sanitary sewers appear similar from the outside and contractors may connect to the wrong pipe, either accidently or deliberately. While less common, recreational vehicle (RV) owners might dispose of sanitary waste into storm sewer systems.

2.4.4 Washing Activities and Improper Storage Containers

Commercial washing activities often result in a watery mix of detergents and solids that is called wash water. Wash water that drains directly to a stormwater system is considered an illicit discharge. Some examples include commercial vehicle washing and restaurant cleaning activities. Dumpsters or storage barrels that leak onto pavement are also illicit discharges. Storage containers should be covered and sealed to prevent or reduce rainwater from entering the container. Uncovered stockpiles of materials have potential to wash particles or other materials away from the stockpile and contribute to pollution in water bodies.

2.4.5 Car Accidents

Automotive fluids might enter storm drains after leaking from damaged vehicle parts or tanks. Liquids or materials in shipping containers also have the potential to leak or wash into the storm sewer system. Accidents taking place during rain events could make containment of these spills more difficult.

2.4.6 NPDES Permit Holders

Industrial, non-stormwater discharge to storm sewer is only allowed when the owner has an approved NPDES industrial permit which requires the site to meet water quality standards set by the WDNR before discharging to the storm sewer system. However, if the owner is exceeding the effluent limits set by the permit then they are illicitly discharging to the storm sewer. An example of exceeding NPDES industrial permit requirements could be an industrial facility that disposes of water with no chemical contaminants but at a very high temperature. Water quality standards typically set a required temperature limit that the facility is required to meet to discharge to the storm sewer. If the temperature limits are exceeded then it is considered illicit discharge.

2.5 ALLOWABLE DISCHARGES

Certain non-stormwater discharges are considered allowable and do not pose a threat of contamination to stormwater are outlined in Section 14.85 of the City Code and shown here in **Figure 2-1 Allowable Discharges:**

Figure 2-1 Allowable Discharges

Water line flushing
Landscape irrigation
Irrigation water, springs
Lawn watering
Dechlorinated swimming pool discharges

Diverted stream flow
Rising ground waters
Uncontaminated groundwater infiltration
Uncontaminated pumped groundwater
Flows from riparian habitats and wetlands

Foundation drains
Footing drains
Air conditioning condensation
Water from crawl space pumps

Discharge from potable water sources
Street wash water
Residential building wash water, without detergents

2.6 SIGNIFICANCE OF ILLICIT DISCHARGE

Illicit discharges contribute to elevated levels of pollutants to surface waterbodies and can potentially contaminate groundwater. When these pollutants enter waterbodies, they can contaminate drinking water supplies, create public safety concerns, hinder recreational activities, and harm wildlife habitats.

According to a survey implemented by the Center for Watershed Protection in 2003, the respondents indicated that the following are the most common sources of illicit discharges:

- Illegal dumping practices (95%)
- Broken sanitary sewer line (81%)
- Cross-connections (71%)
- Connection of floor drains to storm sewer (62%)
- Sanitary sewer overflows (52%)
- Inflow/infiltration (48%)
- Straight sewer pipe discharge (38%)

2.7 ILLICIT DISCHARGE DETECTION AND ELIMINATION PLAN OVERVIEW

This plan addresses three steps that will be used to eliminate illicit discharges:

- Assessment of and Initial Prioritization of Catchments
- Identification of Illicit Discharges
- Elimination of Illicit Discharges

Also included in this plan is Appendix C that deals with spill response procedures.

CHAPTER 3 – STORMWATER SYSTEM MAPPING

3.1 SYSTEM MAPPING

A critical component of the City's IDDE program is the stormwater drainage system map. Maintaining an accurate map of the stormwater system allows the City to readily complete the tasks of tracing and locating the source of a suspected illicit discharge. Updated stormwater drainage system data is gathered by engineering staff during routine inspections of the system. Further investigation of suspected illicit discharges in addition to targeted mapping efforts complete the details of the stormwater sewer system infrastructure. This process includes the identification of key infrastructure and factors influencing proper system operation. The City of Baraboo has met previous MS4 SWPPP requirements and has mapped public storm sewer infrastructure, including constructed stormwater BMP's using Geographic Information System (GIS) software. The City's GIS data are regularly updated and verified through field inspections and information from as-built construction plans.

3.2 OUTFALL INVENTORY

As part of the overall mapping program, the City has mapped and inventoried all known outfalls within MS4 limits. As part of the outfall inventory, a unique identifier, latitude and longitude, receiving waterbody, and any listed impairments were recorded. Outfalls not previously mapped can be added according to the existing list of outfalls using the same labeling method. The Outfall Inventory Map is included in Appendix A.

A Stormwater System Inventory Form has been used by the City since 2009 for storm sewer inspections and can be found in Appendix B. This inspection form is used to collect information on the storm sewer system and includes a section on determination of the illicit discharge potential from the site.

CHAPTER 4 – ASSESSMENT OF CATCHMENTS AND PRIORITY RANKING OF OUTFALLS

4.1 CATCHMENT DELINEATION

Delineation of MS4 outfall catchments serves as a tool to define contributing areas for investigation of potential sources of any illicit discharges within the catchment. Thus, delineation serves as a planning tool to guide further investigation. A conservative approach will be utilized which will take into account land area, contributing overland flow, as well as piped stormwater, guided by topographic contours and known mapped drainage infrastructure. Including overland flow may help identify non-point sources of pollution to receiving waters.

4.2 OUTFALL PRIORITIZATION AND RANKING

The City's primary method for tracking and eliminating illicit discharges not immediately identified via opportunistic or private property inspection will be through outfall characterization and subsequent prioritized inspection.

Each outfall within the MS4 will be categorized and given a priority ranking based on determination of the potential for illicit discharges, SSOs, and related public health significance. This ranking determines the priority order for screening outfalls and interconnections, and catchment investigation procedures.

The City will delineate the catchment areas to each of its outfalls and classify each outfall into one of the following three categories:

High Priority Outfall	• Outfall within a catchment with high potential for illicit discharges based on size, location, history and field investigations
Medium Priority Outfall	• Outfall within a catchment determined to have a moderate risk of illicit discharge based on size, location, history and field investigations and should be monitored annually.
Low Priority Outfall	• Outfall within a catchment determined to be Low Priority based on field investigations and low probability of illicit discharge

The City's ranking process considers the following factors when ranking outfalls into the categories above:

- **History** – A history of past discharge, complaints or reports.
- **Direct Discharge to Waters of the State** – Outfalls/interconnections that discharge directly to the Baraboo River or tributary
- **Major Outfall** – An outfall that has been determined to be a "Major" outfall may have a higher illicit discharge potential.
- **Industrial Area** – Areas that have industrial lands contributing may have a higher potential for illicit discharge.

- **Drainage Area Size** – Storm sewer systems may have a higher illicit discharge potential as the size of the watershed increases.
- **Density of Generating Sites** – Density of potential sources including clusters of institutional, municipal or light commercial sites, with a potential to generate pollutants that could contribute to illicit discharges. Examples of these sites include, but are not limited to, car dealers; car washes; gas stations; garden centers; and schools.
- **Age of Development and Infrastructure** – Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old may be prone to higher rates of illicit discharge potential. Developments that are less than twenty years old may have a lower discharge potential.
- **Historic Combined Sewer System** – Catchments that were formerly served by a combined sewer system that has since been separated, have a higher illicit discharge potential.
- **Traffic Density** – Areas served by arterial and collector streets with higher traffic volume may have a higher potential for illicit discharge.
- **Population Density** - Areas served by larger population densities may have a higher potential for illicit discharge.

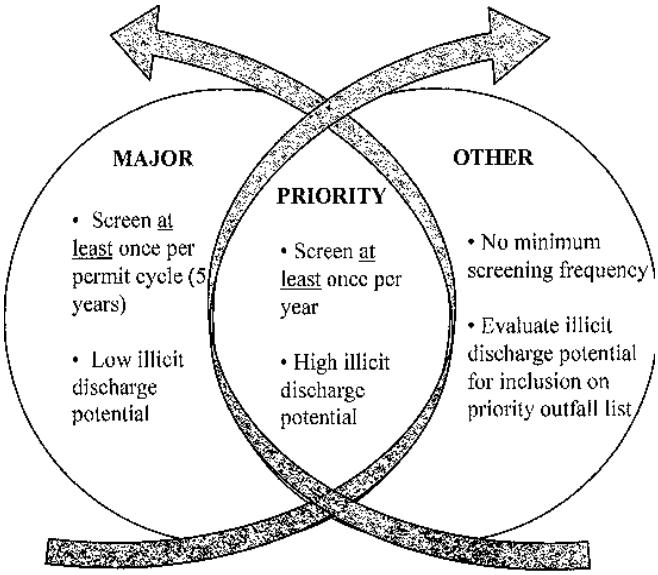
An outfall inventory and priority ranking matrix is provided in Appendix A.

CHAPTER 5 – ON-GOING FIELD SCREENING PROGRAM

5.1 INSPECTION FREQUENCY OF OUTFALLS

The recommended approach to outfall field screening frequency is depicted in Figure 5-1. All priority outfalls should be screened at least once per year. In some cases, it may be appropriate to conduct more than one field screening per year at a particular priority outfall depending on initial screening results or illicit discharge potential. All other major outfalls not identified as priority outfalls should be screened at least once during each MS4 permit cycle (i.e., 5 years). The priority outfall list should be reviewed and modified if necessary during an annual program evaluation.

Figure 5-1 – Outfall Field Screening



5.2 ON-GOING FIELD SCREENING FOR THE REMAINDER OF THE PERMIT TERM (2021-2024)

The Permit requires the City of Baraboo to conduct initial field screening at all major outfalls during dry weather periods within 36 months of the start date, to then develop an on-going field screening program within 36 months of the start date, and to implement that program within 48 months of the start date. This on-going field screening program shall be developed for the remaining term of the permit by March 31, 2021.

For the remainder of the current Permit cycle, the City has established an initial approach of screening the MS4 outfalls. The City has more detailed maps that show information such as outfalls and storm sewer systems for use in the field screening and follow-up processes. Outfall screening year/zone name and first year next future permit cycle is as follows:

- Year 1 (2021) – The remaining five major outfalls that have not been inspected in either 2019 or 2020 will be screened. Also, any outfall that showed any previous flow will be analyzed for chemicals. All minor outfalls will be inspected.
- Year 2 (2022) – All major outfalls inspected in 2019 will be inspected. All minor outfalls will be inspected.
- Year 3 (2023) - All major outfalls inspected in 2020 will be inspected. All minor outfalls will be inspected.

5.3 SUPPLEMENTAL ANNUAL FIELD SCREENING

In addition to the on-going field screening approaches identified above, the City will re-screen any outfalls that are placed on a "watch" list.

The purpose of the development of a "watch" list and the re-screening effort is to identify outfalls that are outliers to the conditions generally observed throughout the City based on the initial outfall screening. This will allow the City to document if the conditions observed at the subject outfall change over time and to determine if the conditions present warrant further follow-up screening and investigation even though they do not exceed the initial follow-up levels described in Section 3 of this report.

The City reserves the right to identify outfalls annually that they feel merit placement on the "watch" list. Where practicable, the City will develop and consistently apply criteria to placing outfalls on the "watch" list.

Example criteria may include:

- Visual/physical outlier characteristics such as unusual odor, color, turbidity or other parameters as listed on the Inspection Form
- Chemical outlier characteristics such as outfalls that had at least 50% of any one of the initial follow-up levels listed in Table 7-1 of Section 7.1 in this document for the Field Analysis (chemical tests for Total Chlorine, Detergents, Ammonia and Ph) or other visual or reported conditions the City feels warrants investigation.

5.4 ON-GOING FIELD SCREENING PROTOCOLS

- For all outfalls screened, the City will use a field screening form similar to the example field screening form in Appendix B.
- On-going field screening activities will generally follow the procedures in Section 6 of this document.
- Outfalls that meet one or more of the conditions listed in Table 6-1 of Section 6 in this document will be investigated following the general guidance in Section 6.4 of this document.

5.5 MEASURABLE GOALS

- Develop and submit the on-going field screening program to the WDNR by March 31, 2021.
- Document the on-going field screening program in annual reports to the WDNR.

CHAPTER 6 – FIELD SCREENING PROCEDURES

6.1 FIELD SCREENING REQUIREMENTS

At a minimum, field screening shall be documented and include:

- Visual observations in accordance with Permit Condition 2.3.2.1
  "Visual Observation - A narrative description of visual observations including color, odor, turbidity, oil sheen or surface scum, flow rate and any other relevant observations regarding the potential presence of non-storm water discharges or illicit dumping."
- Field Analysis in accordance with Permit Condition 2.3.2.2
  "Field Analysis - If flow is observed, a field analysis shall be conducted to determine the presence of illicit non-storm water discharges or illicit dumping. The field analysis shall include sampling for pH, total chlorine, total copper, total phenol and detergents, unless the permittee elects instead to use detergent, ammonia, potassium and fluoride as the indicator parameters. Other alternative indicator parameters may be authorized by the Department in writing."

6.2 EQUIPMENT

The field screening crew should have on hand the proper equipment to conduct safe, timely, and accurate investigations. The equipment required to conduct annual and follow-up investigations may vary slightly depending on screening location (outfall or other structure), weather conditions, and the screening kit being used.

The field screening crew should conduct an annual review of the current field screening equipment for condition and identify additional equipment needs based on experience in the field. Typical screening equipment includes, but is not limited to the following:

- System mapping
- Data collection forms, writing instruments and clipboard
- Watch
- Safety equipment (see Section 6.3 for typical list)
- Measuring tape (for outfall sizing)
- Digital camera
- Sample collection jar/device
- Waste disposal bottle/container
- Sample collection pole and bucket (in anticipation of hard to reach sample sites)
- Test kits (for portable/on-site field screening)
- Sampling instruments (such as pH meter for on-site screening)
- Sample jars (for samples identified for laboratory testing – if necessary)
- Cooler and ice (to transport samples for lab testing – if necessary)
- Manhole lid lifter/pick, sledge hammer, shovel, mirror/flash light if in manholes/structures
- Optional equipment may include a GPS device, electronic data collector or field laptop computer

6.3 SAFETY AND TRAINING

As with all public works activities, proper training on the use of equipment and general safety on the job is important. The field crew should review and be familiar with the field screening procedures, equipment, and situations present in the field. New staff should always be accompanied by experienced staff. Training needs should be reviewed annually for any changes or additions necessary to safely and efficiently conduct the field screening and follow-

up investigations.

Depending on screening methodology, testing materials, and screening location, safety equipment will vary. A project-specific safety plan is recommended including identification of hazards and location of medical facilities and should be reviewed annual with the field crew and other persons responsible for field safety. For normal outfall reconnaissance and screening, safety equipment generally includes, but is not limited to the following:

- first aid kit (bandages, gauze, disinfectant, scissors, tape, etc.)
- insect repellant (if needed)
- cell phone(s) (and/or radios)
- rubber gloves
- rubber boots/waders
- steel toe boots
- safety glasses
- safety vests
- hard hats
- floatation device(s) (if working from a canoe, wading streams, or working near fast flowing waters)
- traffic cones and vehicle safety light for working in or near streets

If confined space entry is required during routine of follow-up investigations, additional training, equipment (including gas detector, tripod, and other identified devices), and personnel will be required as directed by the City's confined space standard operating procedure.

6.4 PROPOSED FIELD SCREENING PROCEDURES FOR ON-GOING SCREENING

The field screening analysis will follow the guidelines of NR 216.07(3)(i) and the Permit (Visual Observation and Field Analysis (if flow is present)). Field screening will be conducted during dry weather periods (typically at least 72 hours after a rainfall event totaling 0.10 inches or greater). An Outfall Inspection Form will be used to document the field screening (a sample form is attached in Appendix B).

Field screening points shall, where possible, be located downstream of any source of suspected illicit activity. Field screening points shall be located where practicable at the outfall, farthest downstream manhole, or other accessible location downstream in the system. Safety of personnel and accessibility of the location shall be considered in making this determination.

Field screening shall include a Visual Observation of color, odor, turbidity, floatable matter (including oil sheen or surface scum), deposits and stains, vegetation, damage to outfall structures, flow rate and other relative observations regarding the potential presence of non-storm water discharges or illicit dumping. Table 6-1 and Figure 6-1 provides some visual characterization interpretation guidance.

If sufficient flow is observed, the City will conduct a Field Analysis to determine the potential presence of illicit non-storm water discharges or illicit dumping. The field analysis will consist of testing a grab sample using a field test kit. The samples will not be taken from submerged outlets or structures. If submerged outlets/structures are encountered, sampling will be conducted at the nearest un-submerged upstream point. The test kit will provide approximate readings for pH, total chlorine, ammonia and detergents (surfactants). The City can instead elect to use total copper, total phenol, potassium, fluoride, E. coli and human bateriodes as the indicator parameters as allowed in the Permit. Other alternative indicator parameters may be authorized by the WDNR in writing.

Table 6-1

Visual Characterization Interpretation (1)

PARAMETER	INTERPRETATION
Odor	***sewage:*** smell associated with stale sanitary wastewater, especially in pools near outfall. ***sulfur ("rotten eggs"):*** industries that discharge sulfide compounds or organics (meat packers, canneries, dairies, etc.). ***oil and gas:*** petroleum refineries or many facilities associated with vehicle maintenance or petroleum product storage ***rancid-sour:*** food preparation facilities (restaurants, hotels, etc.).
Color	***cloudy:*** sanitary wastewater, concrete or stone operations, fertilizer facilities, automotive dealers. ***opaque:*** food processors, lumber mills, metal operations, pigment plants.
Turbidity	***cloudy:*** sanitary wastewater, concrete or stone operations, fertilizer facilities, automotive dealers. ***opaque:*** food processors, lumber mills, metal operations, pigments plants.
Floatable Matter	***oil sheen:*** petroleum refineries or storage facilities and vehicle service facilities. (2) ***sewage:*** sanitary wastewater.
Deposits and Stains	***sediment:*** construction site erosion. ***oily:*** petroleum refineries or storage facilities and vehicle service facilities.
Vegetation	***excessive growth:*** food product facilities ***inhibited growth:*** high stormwater flows, beverage facilities, printing plants, metal product facilities, drug manufacturing, petroleum facilities, vehicle facilities and automobile dealers.
Damage to Outfall Structures	***concrete cracking, concrete spalling, industrial flows, metal corrosion:*** industrial flows

(1) Adapted from "Table 3: Physical Observation Parameters and Likely Associated Flow Sources (Pitt, 2001)" of "Techniques for Identifying and Correcting Illicit and Inappropriate Discharges Task #2 Technical Memorandum".

(2) Some naturally occurring phenomenon can be mistaken for the presence of oil. A quick way to distinguish between oil-related materials and natural residue is to disturb the area in question. If it breaks up into ˝platelets˝ it is a natural material. If it returns to cover the area of disturbance without breaking up, it is probably an oil related product.

Color: Brown; Severity: 2
Turbidity Severity: 2

Color: Blue-green; Severity: 3
Turbidity Severity: 2

Highly Turbid Discharge
Color: Brown; Severity: 3
Turbidity Severity: 3

Sewage Discharge
Color: 3
Turbidity: 3

Paint
Color: White; Severity: 3
Turbidity: 3

Industrial Discharge
Color: Green; Severity: 3
Turbidity Severity: 3

Blood
Color: Red; Severity: 3
Turbidity Severity: None

Failing Septic System:
Turbidity Severity: 3

Turbidity in Downstream Plume
Turbidity Severity: 2
(also confirm with sample bottle)

High Turbidity in Pool
Turbidity Severity: 2
(Confirm with sample bottle)

Iron Floc
Color: Reddish Orange; Severity: 3
(Often associated with a natural source)

Slight Turbidity
Turbidity Severity: 1
(Difficult to interpret this observation; May be natural or an illicit discharge)

Construction Site Discharge
Turbidity Severity: 3

Discharge of Rinse from Floor Sanding
(Found during wet weather)
Turbidity Severity: 3

Figure 6-1: Interpreting Color and Turbidity

6.5 SOURCE ISOLATION AND CONFIRMATION

Once an illicit discharge is identified at an outfall or within the catchment, further investigation is necessary to identify the specific point where the illicit discharge enters the system (the source). The objective of a source investigation is to trace the path of an illicit discharge from the outfall or manhole to the upstream source.

An important first step is to identify the drainage network and catchment area contributing to an outfall before evaluating the source. The sampling results may give an indication of a possible source and help narrow the search. The procedures used for source investigation will vary depending on field conditions; however, typical procedures should at least begin with historic record evaluations and field surveys before progressing through additional tests or procedures, as outlined below:

- **Field Reviews** – The quickest and possibly most straightforward method for identifying the sources of illicit discharges is a survey of the drainage system and land area that contribute to an outfall. Field crews may be able to gauge obvious sources of an illicit discharge through observation of land use and activities surrounding the outfall. This can be followed by tracing the drainage system by inspecting manholes and connecting drainage pipes, in particular if a non-stormwater discharge is flowing. However, some cases may require additional methods if a flow cannot be traced due to blind connections or complicated drainage networks.
- **Dye Tracer Testing** – Fluorometric dye can be used to trace flows from unknown pipes to identify illicit connections to the drainage system. This involves flushing a non-toxic dye into plumbing fixtures or other points of entry to the stormwater system, and observing nearby storm drains and sewer manholes as well as outfalls for the presence of the dye. If dye testing is to be used, DNR must be notified ahead of time of location and time of testing.
- **Smoke Testing** – The injection under pressure of non-toxic smoke into isolated sections of the storm sewer system, such as drain lines or individual unknown connections to the drainage system can be used to discover and investigate illicit connections. By plugging manholes and/or catch basins, the smoke will seek the path of least resistance to exit the system. By placing test personnel in place in areas where there are suspected illegal connections or cracks/leaks and noting the escape of smoke, illicit connections or damaged storm drain infrastructure can be identified. It is important to notify the public prior to conducting smoke testing to inform them of the activity and that the smoke is non-toxic and will not affect their building. This can also provide the public with an opportunity to participate in the ID investigation and promote IDDE efforts in the Town.

Television Inspection – Mobile video cameras can be guided remotely through stormwater drain lines to observe possible illicit discharges. Video can identify blind connections (i.e. a lateral connection that does not have a manhole), and structural deficiencies to the system allowing visible infiltration of a potential illicit discharge. Any connections identified that are not shown on the existing City storm map need to be investigated to determine the source.

6.6 MANHOLE INSPECTIONS

The source of some illicit connections or discharges can be located by systematically isolating the area from which the polluted discharge originates. This process involves progressive investigation at manholes and catch basins in the storm drain network to narrow down the location where the illegal discharge is entering the drainage system. This method is best used

to identify constant or frequent discharge sources such as an illicit connection with the sanitary sewer system. Field crews should work progressively upstream from the outfall and inspect stormwater structures (e.g., manholes, catch basins, junctions) looking for the presence of flow during dry weather and indicators such as foul odors, colors or stained deposits, oily sheen, floatable materials, and/or other indicators of an illicit discharge. The observations are continued at each upstream structure until a structure is found with no evidence of discharge. This indicates the discharge source is likely located between the structure with no evidence of discharge and the next downstream structure. To facilitate subsequent investigations, junction manholes should be identified during this process.

Field crews strategically inspect manholes within the storm drain network system to identify chemical or physical indicators that can isolate discharges to a specific segment of the network. Once the pipe segment has been identified, onsite investigations are used to find the specific discharge or improper connection. This method involves progressive sampling at manholes in the storm drain network to narrow the discharge to an isolated pipe segment between two manholes. Field crews need to make two key decisions when conducting a storm drain network investigation— where to start sampling in the network and what indicators will be used to determine whether there are indications of an illicit flow or whether to confirm there is none. The field crew can sample the key junction manholes in one of two ways:

- By working progressively up from the outfall and inspecting key junction manholes along the way, or
- By working progressively down from the upper parts of the catchment toward the outfall

Where flow is observed, and determined to be contaminated through visual observation (e.g., excrement or toilet paper present), the tributary storm sewer alignment is isolated for further investigation (Section 6.6). No additional downstream manhole inspections are performed unless the observed flow is determined to be uncontaminated or until all upstream illicit connections are identified and removed. Where flow is not observed, testing and observation continue with the chosen methodology.

Inspection of key junction manholes will proceed as follows:

1. Manholes will be opened and inspected for visual and olfactory evidence of an illicit connection.
2. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants. Sampling procedures will be done in accordance with those outlined in Section 6.4.
3. Where sampling results indicate a potential illicit discharge, investigations will continue upstream in order to further isolate and confirm the source.
4. Subsequent key junction manhole inspections will proceed until the location of the suspected illicit discharge or SSO can be isolated to a pipe segment between two manholes.
5. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.

6.7 REMOVING SOURCES OF ILLICIT DISCHARGES

After identifying the source of an illicit discharge, the City will exercise its authority as necessary to require abatement including notification in writing to require immediate cessation. If the

Responsible Party is identified, they will be notified and directed to correct the problem. The Responsible Party is required to provide adequate cleanup for a spill or illicit discharge.

The City of Baraboo will follow the enforcement procedures as outlined in the Illicit Discharge Ordinance. The City of Baraboo will notify WDNR if an illicit discharge is not cleaned up and removed within 30 days to discuss further options.

If the Responsible Party cannot be identified, the City of Baraboo will work with WDNR to ensure that the necessary steps are taken to clean up the spill or illicit discharge. The WDNR may be contacted to discuss any funding opportunities that may be available. WDNR may be contacted for assistance in hiring a qualified contractor and will be kept informed of the progress of a cleanup.

The Annual Report will include the status of IDDE investigation and removal activities and will include all aspects of the IDDE Program, as required by the Permit. Documentation of illicit discharge investigations will include:

- Location and source of discharge
- Description of the discharge
- Method and date of discovery
- Date of removal, repair or enforcement or planned corrective measures including a schedule for completion of removal
- Date and estimated volume of flow removed

6.7.1 Confirmatory Outfall Screening

Within one year of removal of an identified illicit discharge or SSO source within a given catchment area, confirmatory outfall or interconnection screening will be conducted. The confirmatory screening will be conducted in dry weather unless System Vulnerability Factors (SVFs) have been identified, in which case both dry weather and wet weather confirmatory screening will be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment will be scheduled for additional investigation. Confirmatory screening is not required in catchments where no illicit discharges or SVFs have been identified and no previous screening indicates suspicious flows. This iterative approach will continue until sampling and observation do not indicate an illicit discharge. Once investigation of a sub-catchment is completed and all known illicit discharges removed, the City will conduct confirmatory, routine screening, as outlined in 6.7.2 below.

6.7.2 Follow-up Screening

Upon completion of the catchment investigation and illicit discharge removal and confirmation (if necessary), each outfall or interconnection will be scheduled for follow-up screening within five (5) years or sooner based on the catchment's illicit discharge priority. Ongoing screening will consist of dry weather screening and sampling consistent with the procedures described in Section 6.4 of this document. The City may elect to conduct follow-up screening sooner based on the catchment's illicit discharge priority. All sampling results will be reported in the Annual report.

6.7.3 Illicit Discharge Prevention Procedures

The City of Baraboo will implement the following mechanisms and procedures to assist in the prevention of illicit discharges and SSOs:

- Spill response and prevention procedures including identification of spills, reporting procedure, containment procedures, and documentation
- Public awareness
- Reporting hotlines and training of public employees involved in the IDDE program on ways to identify potential illicit discharges and SSOs

6.8 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES

When it comes to quality assurance and quality control, there is no substitute for field staff with proper training and experience. Taking care to follow the test kit procedures, not scrape the outfall pipe or structures are all details that can aid in obtaining reliable results. Additional QA/QC components include the following:

- Keep checklists of equipment and conduct calibration of field equipment as required
- Maintain field data collection forms, maps, and equipment in a centralized location
- Repeating screening/test results after recorded to confirm values
- If an unusually high test results are obtained, take an immediate second confirmation test
- If field notes are transcribed into an electronic database or table, have a second person (if possible one of the original field persons) review the transcription
- If follow-up investigations result in the isolation of one or more contaminants that are expected to result in action against a property owner, consideration should be given to utilizing a laboratory and standard chain of custody procedures

CHAPTER 7 – FOLLOW-UP FIELD SCREENING AND INVESTIGATION PROCEDURES

The following represents supplemental procedures for conducting follow-up field screening and investigation of potential illicit discharges.

7.1 CONDITIONS TO TRIGGER ADDITIONAL IDDE INVESTIGATIONS

The City will investigate portions of the MS4 that, based on field screening or other information, indicate a reasonable potential for containing illicit discharges or other sources of non-storm water discharges. Comparison with other outfall results and historical findings will be used in follow-up investigation decision making.

A potential trigger for follow-up investigations may include chemical analysis results or other indicators outside of the expected ranges. A list of chemical test parameters and initial follow-up levels or conditions is presented in Table 7-1.

Positive chemical test results do not necessarily indicate the presence of an illicit discharge. Permitted industrial storm water discharges or other permitted non-storm water discharges may be present or illicit discharges may be masked by excessive clear water flows. They are, however, used to compare one outfall level to another, used to develop history on an outfall (i.e. establish baseline levels) and serve as potential indicators of illicit discharges.

Table 7-1

IDDE Screening Parameters and Guidance Thresholds

Primary Sampling Parameters	Action Level	Additional Parameters	Action Level
Ammonia	0.1 mg/l	Total Copper	0.1 mg/l
Detergents	0.5 mg/l	Phenol	Detection or positive test
pH	< 6 or > 9	Fluoride	Detection above background
Total Chlorine	Detection or positive test	Potassium	10 mg/l
		E. coli	10,000 MPN/100mL
		Human Bacteriodes	Detection or positive test

7.2 SUPPLEMENTAL PROCEDURES FOR IDDE INVESTIGATION

For those outfalls identified in the field chemical analysis or identified by other information as having a reasonable potential for containing illicit discharges or other sources of unallowable non-storm water discharges, the City will attempt to locate the source of the potential illicit discharge. The following procedure will generally be followed:

The suspect outfall will be re-screened for the parameter(s) of concern to verify the continued presence of the suspect parameter(s). Typically, only the parameter(s) of concern will be screened for.

The field screening crew will follow the storm drainage system upstream to the next accessible upstream manhole or storm sewer junction to confirm the presence of flow and parameter(s) of interest. This procedure will be continued using storm sewer system mapping until the suspect parameter(s) is isolated to the extent practicable. The field screening crew may skip to MS4 junctions of other areas of interest such as permitted industrial sites or suspected areas of the system to expedite the follow-up investigation. The field crew will take note of surface

conditions that may aid in the identification of suspect sources (wet gutters, streets or other surfaces).

Once the location is isolated (if possible), the crew will search for obvious visual signs of illicit connections and discharges by conducting a “windshield survey”. The survey includes photographing the surrounding area including buildings, observing business types, and other items of interest. Other items of interest can include, but are not limited to outdoor storage areas, staining, or other potential signs of illicit discharges or dumping. Inlets and catch basins, if present, may be inspected for the presence of discolored water, staining, or other indications of non-storm water discharges and may include direct chemical testing of sumps. No internal entry of any business is included in this effort. The results of the survey will be shared with City staff at a meeting for discussion of potential sources and recommended next steps.

Following the “windshield survey”, building records may be researched to identify potential cross connections. Letters may be sent to property owners in the area notifying them of the findings and investigation, requesting their assistance, and/or notifying them of further potential actions including discussions with the property owners and other investigative methods which may or may not require access to the property.

If no immediate source is apparent after visual and desktop review, the City will consider other methods to identify the discharge such as leak detection, sewer system televising, dye water testing (the WDNR shall be notified in advance of the time and location of any dye water testing), or smoke testing (neighboring property owners will be notified prior to smoke testing). The method selected will depend on various factors such as building and land uses in the area (including proximity to industrial activity), location of water mains, location of sanitary sewers, past history with property owners, ease of access, and potential disruption to property owners.

The City will assess whether or not an identified source facility is appropriately permitted to discharge into the MS4 by requesting permit information from the WDNR as needed.

When an illicit connection/discharge is located, the City will begin procedures to work with the subject property owner or person/entity in responsible charge to eliminate the connection as expediently as possible.

In the case of an illicit discharge that originates within the City and that discharges directly to a neighboring municipality, the City will notify the affected municipality within one working day of confirming the illicit discharge.

In the case of a potential illicit discharge that appears to originate from a neighboring municipality, the City will notify that municipality as soon as practicable, but generally within one working day.

Prior to the actual disconnection, the City will require the owner/operator of the illicit connection/discharge to take all reasonable measures to minimize the discharge of pollutants to the MS4.

Each illicit connection/discharge discovery will be handled on a case-by-case basis. The City has not prepared an exact remedy or timeframe for illicit discharge correction because of the wide variability of potential discharge situations, however each case will be removed as quickly as possible. More complicated or costly remedies may take a longer period of time to correct. If it appears that more than 30 days are required to remove an illicit connection, the WDNR will be contacted and provided with additional details regarding the problem and discuss an appropriate action including but not limited to interim measures to eliminate or reduce pollutant exposure and an estimated timeline for complete elimination.

Included in the City’s Code Chapter 14, Building, Construction Site and Housing Codes is Subchapter V that addresses Illicit Storm Water Discharge and is the regulator mechanism for such discharges into the storm drainage system and waters of the state. This ordinance

develops the local regulatory authority to prohibit discharges, conduct monitoring, and identifies notification, violation, and enforcement procedures.

Notifications regarding spills and illicit discharges should follow the procedures and information located in Chapter 14 and **the "City of Baraboo Spill and Illicit Discharge Response Procedure Manual"**.

CHAPTER 8 – EMPLOYEE AND PUBLIC EDUCATION

8.1 EMPLOYEE EDUCATION

Field staff will be trained on illicit discharge by means of an in-person training or an employee training video that will be created in conjunction with this plan. City procedures will be reviewed with employees, as well as the locations of reference materials and contact information. Additional reminders will be posted on the City's Intranet site and/or via email newsletters as needed.

8.2 PUBLIC EDUCATION AND OUTREACH

The City will continue public education through the use of a variety of media; the type and nature of future distribution will be determined annually. Illicit discharge and other MS4 concerns will be communicated at public events as appropriate. An educational pamphlet has been developed for residents and businesses regarding illicit discharge (Appendix D-2). Three additional pamphlets addressing related stormwater issues, "Pet Waste and Water Pollution", "Stormwater Management," and "Working Together to Protect Stormwater Ponds" can be distributed as needed (Appendices D-3, D-4, and D-5).

City staff have actively promoted educational opportunities to staff and citizens regarding stormwater issues. They have used and continue to use mediums such as newsletters, newspaper articles, cable access channel, workshops, and social media messages. The City is also a member of the Northcentral Wisconsin Stormwater Coalition(NCWSC), whose members include villages, cities, a town and a county, all located in the upper Wisconsin River watershed. The mission of NCWSC is to coordinate and collaborate on education and outreach activities, and recommend policy and operational changes for cooperating local governments in order to comply with regulations and reduce stormwater pollution in a cost effective manner so that residents of Central Wisconsin benefit from rivers, lakes and streams that remain swimmable and fishable.

8.3 FUTURE RECOMENDATIONS

The Engineering Department will review the illicit discharge inspection schedule and update records as needed. The IDDR Plan should also be updated annually or as contact information changes and procedures are revised. Annually, the program will be revisited to determine if strategies and procedures defined in this plan are being used and to see if measurable progress is being made in the City in regards to illicit discharge elimination.

CHAPTER 9 – PROGRESS REPORTING

The Annual Report will include an evaluation of the progress and success of the IDDE program. The following elements will be included, at a minimum, as indicators of program progress:

- Measures that demonstrate efforts to locate illicit discharges
- Number of SSOs and illicit discharges identified and removed
- Number and percent of total outfall catchments served by the MS4 evaluated using the catchment investigation procedure
- Number of dry weather outfall inspections
- Number of wet weather outfall inspections
- Number of enforcement notices issued
- Number of illicit discharges eliminated and time from confirmation to elimination
- Number of employees trained annually

The success of the IDDE program will be measured by the IDDE activities completed within the required permit timelines, including all illicit discharge and prioritized catchment investigation actions taken per required timelines.

Appendix A

Outfall Map and Table

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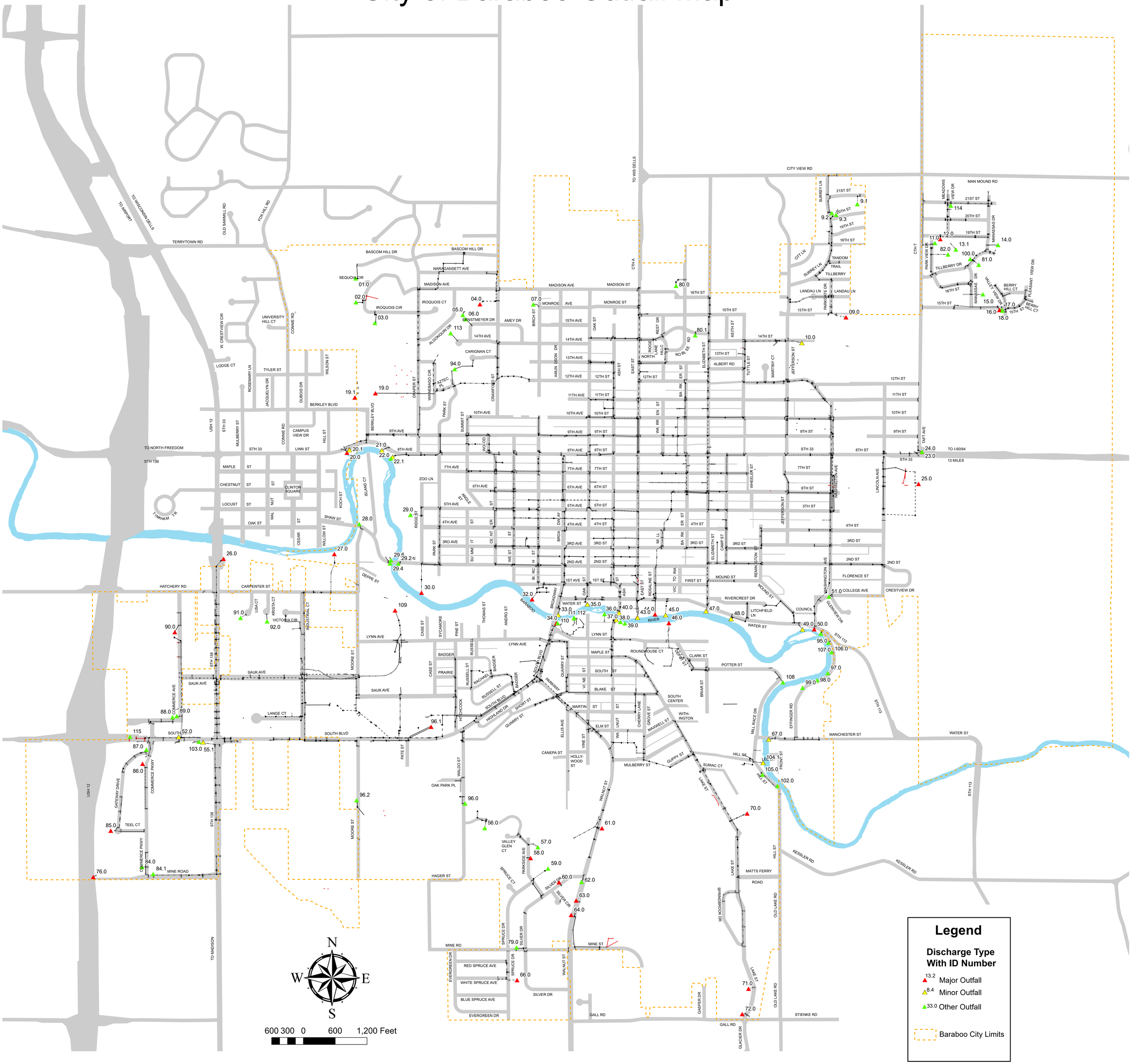
City of Baraboo Outfall Map



APPENDIX A. CITY OF BARABOO OUTFALL RANKINGS

Outfall ID	Previous Screening Results Indicate Possible IDDE? [1]	Direct Discharge to Waters of the State? [2]	Major Outfall? [3]	Industrial area? [4]	Drainage Area Size	Density of Generating Sites [5]	Age of Development/ Infrastructure [6]	Historic Combined Sewers or Septic? [7]	Traffic Denisty	Population Density	Score	Priority Ranking	Major?	Minor?
Information Source	Outfall inspections and sample results	GIS Maps	City Staff		GIS Maps	Land Use/GIS Maps, Aerial Photography	Land Use Information, Visual Observation	City Staff, GIS Maps	Land Use, City Staff	GIS and Storm System Maps				
Scoring Criteria	Yes = 3 (Problem Outfall) No = 0	Yes = 3 No = 0	Yes = 3 No = 0	Yes = 3 No = 0	>50 Ac = 3 >20 , < 50=2 <20 Ac = 1	High = 3 Medium = 2 Low = 1	>40 = 3 >20,<40 = 2 <20 = 1	Yes = 3 No = 0	High = 3 Medium = 2 Low = 1	High = 3 Medium = 2 Low = 1				
034.0	3	3	3	3	3	3	2	3	3	2	28	High Priority	Major	
032.0	3	3	3		2	3	3	3	2	3	25	High Priority	Major	
027.0	3	3	3	3	3	3	2		3	1	24	High Priority	Major	
044.0	3	3	3		3	1	3	3	2	3	24	High Priority	Major	
043.0	3	3	3		2	1	3	3	2	3	23	High Priority	Major	
096.1	3		3	3	3	3	2		3	2	22	High Priority	Major	
026.0		3	3	3	3	3	2		3	1	21	High Priority	Major	
046.0	3	3	3		2	1	3	3	2	1	21	High Priority	Major	
050.0		3	3		3	2	3		3	3	20	High Priority	Major	
040.0	3	3			1	1	3	3	3	2	19	High Priority		Minor
070.0		3	3	3	3	1	2		3	1	19	High Priority	Major	
030.0		3	3		1		3	3	2	3	18	High Priority	Major	
020.0		3	3		3	1	2		3	2	17	High Priority	Major	
025.0		3	3		1	2	3		3	2	17	High Priority	Major	
038.0		3			2	1	3	3	2	3	17	High Priority		Minor
047.0		3			2	1	3	3	3	2	17	High Priority		Minor
033.0		3			1	3	3	3	3		16	High Priority		Minor
048.0		3			1		3	3	3	2	15	High Priority		Minor
035.0		3			1	1	3	3	3		14	Med Priority		Minor
049.0		3			1		3	3	3	1	14	Med Priority		Minor
109.0			3	3	1	3	2		2		14	Med Priority	Major	
064.0			3	3	2	1	1		3		13	Med Priority	Major	
088.0			3	3	2	2	1		2		13	Med Priority	Major	
019.0			3		3	1	2		1	2	12	Med Priority	Major	
022.0		3			1	1	2		3	2	12	Med Priority		Minor
023.0			3		1	1	2		2	3	12	Med Priority	Major	
043.1		3			1	3	1	3	1		12	Med Priority		Minor
058.0			3		3		1		2	3	12	Med Priority	Major	
061.0			3		3		1		2	3	12	Med Priority	Major	
076.0			3	3	2	2	1		1		12	Med Priority	Major	
004.0			3		2		2		2	2	11	Med Priority	Major	
009.0			3		3		1		1	3	11	Med Priority	Major	
012.0			3		2		1		2	3	11	Med Priority	Major	
021.0		3			1	1	3		3		11	Med Priority		Minor

066.0			3		2		1		2	3	11	Med Priority	Major	
071.0			3	3	1	1	1		1	1	11	Med Priority	Major	
072.0			3	3	1	1	1		1	1	11	Med Priority	Major	
090.0			3	3	1	2	1		1		11	Med Priority	Major	
016.0			3		2		1		1	3	10	Med Priority	Major	
020.1		3			1	1	2		3		10	Med Priority		Minor
045.0		3			1	1		3	2		10	Med Priority		Minor
060.0			3		1		1		2	3	10	Med Priority	Major	
085.0			3	3	1		1		2		10	Med Priority	Major	
052.0					2	3	1		3		9	Med Priority		Minor
063.0			3		1	1	1		3		9	Med Priority	Major	
067.0		3			1		3		1	1	9	Med Priority		Minor
104.1		3			1		1	3	1		9	Med Priority		Minor
010.0				3	1		2		2	1	9	Med Priority		Minor
019.1			3		3	1	1				8	Med Priority	Major	
055.1					1	3	1		3		8	Med Priority		Minor
009.2					1		1		2	3	7	Low Priority		
011.0					1		1		3	2	7	Low Priority		
013.1					2		1		2	2	7	Low Priority		
015.0					1		1		2	3	7	Low Priority		
024.0					1		1		3	2	7	Low Priority		
028.0		3			1		1		2		7	Low Priority		
029.0					1		3		1	2	7	Low Priority		
029.2		3			1		1		2		7	Low Priority		
029.4		3			1		1		2		7	Low Priority		
036.0		3			1	1			1	1	7	Low Priority		
051.0					1		2		2	2	7	Low Priority		
056.0					1	1	1		2	2	7	Low Priority		
057.0					1		1		2	3	7	Low Priority		
059.0					1		1		2	3	7	Low Priority		
079.0					1		1		2	3	7	Low Priority		
084.1					2	1	1		3		7	Low Priority		
095.0		3			1				3		7	Low Priority		
096.0					1	1	1		2	2	7	Low Priority		
096.2					1		1		2	3	7	Low Priority		
110.0		3			1	1	1		1		7	Low Priority		
111.0		3			1	1	1		1		7	Low Priority		
115.0					1	2	1		3		7	Low Priority		
001.0					1		1		1	3	6	Low Priority		
002.0					1	1	1		1	2	6	Low Priority		
006.0					1		1		1	3	6	Low Priority		
007.0					1		1		1	3	6	Low Priority		
009.1					1		1		1	3	6	Low Priority		
009.3					1		1		1	3	6	Low Priority		
014.0					1		1		1	3	6	Low Priority		
017.0					1		1		1	3	6	Low Priority		

018.0					1		1		1	3	6	Low Priority		
037.0		3			1	1			1		6	Low Priority		
080.0					2	1	1		1	1	6	Low Priority		
080.1					1		1		1	3	6	Low Priority		
081.0					1		1		1	3	6	Low Priority		
082.0					1		1		1	3	6	Low Priority		
091.0					1		1		1	3	6	Low Priority		
092.0					1		1		1	3	6	Low Priority		
094.0					1		1		1	3	6	Low Priority		
102.0		3			1				2		6	Low Priority		
108.0		3			1				1	1	6	Low Priority		
113.0					1		1		1	3	6	Low Priority		
114.0					1		1		1	3	6	Low Priority		
003.0					1		1		1	2	5	Low Priority		
005.0					1		1		2	1	5	Low Priority		
029.6		3			1	1					5	Low Priority		
039.0		3			1	1					5	Low Priority		
062.0					1		1		3		5	Low Priority		
084.0					1	1	1		2		5	Low Priority		
087.0					1	1	1		2		5	Low Priority		
089.0					1	1	1		2		5	Low Priority		
097.0		3			1				1		5	Low Priority		
098.0		3			1				1		5	Low Priority		
099.0		3			1				1		5	Low Priority		
103.0					1		1		3		5	Low Priority		
105.1		3			1				1		5	Low Priority		
106.0		3			1				1		5	Low Priority		
107.0		3			1				1		5	Low Priority		
112.0		3			1	1					5	Low Priority		
086.0					1		1		2		4	Low Priority		

Scoring Criteria:

[1] Previous screening results indicate likely sewer input if any of the following are true:

- Olfactory or visual evidence of sewage,
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water, or
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine

[2] Outfalls/interconnections that discharge directly to the Baraboo River or tributary

[3] Has the outfall been classified as "Major"?

[4] Does the drainage area contain lnads that are predominately Industrial or Heavy Commercial?

[5] Generating sites are institutional, municipal or light commercial with a potential to contribute to illicit discharges (e.g., car dealers, car washes, gas stations, garden centers, schools, etc.)

[6] Age of development and infrastructure:

- High = Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old
- Medium = Developments 20-40 years old
- Low = Developments less than 20 years old

[7] Areas once served by combined sewers and but have been separated, or areas once served by septic systems but have been converted to sanitary sewers.

Appendix B

Outfall Field Screening Form

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Appendix B - Outfall Field Screening Form

City of Baraboo, Wisconsin
Outfall Field Screening

Section 1: Background Data

Facility ID:	Outfall Location:
Watershed / HUC:	Local Subwatershed:
Today's date:	Military Time:
Screening performed by:	Photo #(s):
Weather, Temp.(°F):	Date of last precipitation: Amount:
Local Land Use (Check all that apply): ☐ Ultra/Urban Residential ☐ Commercial ☐ Industrial ☐ Suburban Residential ☐ Open Space / Park	

Section 2: Outfall Description

MATERIAL	OUTFALL SHAPE	NUMBER PIPES	OUTFALL DIAMETER	SUBMERGED
☐ RCP ☐ CMP ☐ DIP ☐ PVC ☐ Steel ☐ Clay Tile ☐ Brick ☐ Concrete ☐ Other _____	☐ Circular ☐ Elliptical ☐ Box ☐ Flared End	☐ Single ☐ Double ☐ Triple	☐ 12" ☐ 50" ☐ 15" ☐ 54" ☐ 18" ☐ 60" ☐ 20" ☐ 72" ☐ 24" ☐ Other ☐ 36" ☐ 40" ☐ 42" ☐ 48"	In Water: ☐ No ☐ Partially ☐ Fully In Sediment: ☐ No ☐ Partially ☐ Half Full ☐ Over Half ☐ Fully

Observed Dry Weather Flow	☐ Yes	☐ No	***(If No, Skip to Section 5)***
Flow Description (If present)	☐ Trickle	☐ Moderate	☐ Substantial

Section 3: Quantitative Indicators for Flowing Outfalls: Field measurements? ☐ **YES** ☐ **NO** ***(If No, Skip to Section 4)***

Estimated Discharge Rate				
A: Width of Flow	**B: Approx. Avg. Depth**	**A x B = C: Area**	**Length of flow/ Time = D**	**C x D = E Est. Flow Rate**

Parameter	Result (Unit)	Equip. Used	ACTION LEVEL	ACTION NEEDED
Temperature	°F			
pH	Unitless		< 6.0 or > 9.0	☐ Yes ☐ No
Detergents	mg/l		> 0.5 mg/l	☐ Yes ☐ No
Ammonia	ppm		> 0.1 mg/l	☐ Yes ☐ No
Chlorine	ppm		Detection	☐ Yes ☐ No

Section 4: Physical Indicators for Flowing Outfalls Only

Are Physical Indicators Present in the flow? ☐ Yes ☐ No ***(If No, Skip to Section 5)***

PHYSICAL INDICATOR	FLOW INDICATOR DESCRIPTION	FLOW INDICATOR RELATIVE SEVERITY INDEX (1-3)		
Odor	☐ Sewage ☐ Rancid ☐ Petroleum ☐ Sulfide/rotten Egg	☐ 1 – Faint	☐ 2 – Easily detected	☐ 3 – Noticeable from a distance
Color	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ White/Cloudy	☐ 1 – Faint	☐ 2 – Clearly visible	☐ 3 – Clearly visible in outfall flow
Surface/Floatables	☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum / Oil Sheen ☐ Other	☐ 1 – Few/slight; origin not obvious	☐ 2 – Some; indication of origin	☐ 3 – Some; origin clear / obvious

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls

Are physical indicators that are not related to flow present? ☐ Yes ☐ No ***(If No, Skip to Section 6)***

INDICATOR	DESCRIPTION	INDICATOR	DESCRIPTION
Outfall Damage	☐ Spalling, Cracking or Chipping ☐ Corrosion ☐ Erosion	Pipe benthic growth	☐ Brown ☐ Orange ☐ Green ☐ Black ☐ Other_____
Deposits/Stains	☐ Oily ☐ Flow Line ☐ Paint		

Section 6: Overall Outfall Illicit Discharge Characterization

☐ None ☐ Unlikely ☐ Potential (presence of two or more indicators)
☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

Section 7: Follow Up Needed? ☐ Yes ☐ No

1.Return for In-depth sampling?	☐ Yes	☐ No	
2.Return to Re-inspect for Flow?	☐ Yes	☐ No	
3.Grab sample collected?	☐ Yes	☐ No	***If yes*, Sample ID:**
4.If yes, collected from:	☐ Flow	☐ Pool	

Section 8: Photos

Appendix C

Spill and Illicit Discharge Response Procedure Manual

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APPENDIX C TO ATTACHMENT "C"

CITY OF BARABOO

SPILL AND ILLICIT DISCHARGE RESPONSE PROCEDURE MANUAL

Prepared by:
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Table of Contents

CHAPTER 1 - OVERVIEW **1**
1.1 INTRODUCTION 1
1.2 DEFINITIONS 1

CHAPTER 2 - DISCOVERY AND NOTIFICATION **4**
2.1 TYPES OF DISCOVERY 4
2.2 GATHERING INFORMATION 4
2.3 ILLICIT DISCHARGE COORDINATOR 4
2.4 EXAMPLE SCENARIOS 4
2.5 SCENARIOS 5

CHAPTER 3 - COORDINATION AND CONTAINMENT **7**
3.1 GENERAL 7
3.2 COORDINATION EFFORTS 7
3.3 CONTAINMENT 8
3.4 LOCATING AN UNKNOWN SOURCE AND RESPONSIBLE PARTY 8

CHAPTER 4 - CLEANUP, EVIDENCE, COLLECTION AND DOCUMENTATION **10**
4.1 GENERAL PROCEDURE 10
4.2 EVIDENCE COLLECTION 10
4.3 DOCUMENT PROCESS 12
4.4 CLEAN-UP THE SPILL OR ILLICIT DISCHARGE 13
4.5 WORK TOWARD COST RECOVERY 14

CHAPTER 5 - EVALUATION AND REPORTING **15**
5.1 EVALUATE THE PROCESS AND PROCEDURES 15
5.2 REPORT CLEAN-UP EFFORTS 15

Tables

TABLE 2.1 EXAMPLE SCENARIOS 4

Subappendices

SUBAPPENDIX A: SPILLS/ILLICIT DISCHARGE — INCIDENT TRACKING FORM A1
SUBAPPENDIX B: SPILLS/ILLICIT DISCHARGE — CONTACT LIST B1
SUBAPPENDIX C: EMPLOYEE AND 3RD PARTY ILLICIT DISCHARGE FLOW CHART C1
SUBAPPENDIX D: MAP/LOCATION LIST OF ADJOINING MUNICIPALITIES D1
SUBAPPENDIX E: WDNR FORM #4400-225 NOTIFICATION OF HAZARDOUS SUBSTANCE DISCHARGE E1
SUBAPPENDIX F: WDNR PUBLICATION RR558 ..... F1
SUBAPPENDIX G: WNDR PUBLICATION RR560 AND RR604 ..... G1
SUBAPPENDIX H: SAMPLE CHAIN OF CUSTODY FORM H1

CHAPTER 1 - OVERVIEW

1.1 INTRODUCTION:

The purpose of this Spill and Illicit Discharge Response Procedure Manual is to provide a framework for spill and illicit discharge response procedures in the City of Baraboo and to comply with the Wisconsin Department of Natural Resources WPDES Permit No. WI-S050075-3 requirements. All employees are expected to work cooperatively with state and local agencies to define, contain, and clean up spills and illicit discharges.

This manual is designed to provide general response procedures to City of Baraboo employees. It includes phone numbers for help at all levels, safety information, response guidance for some specific spills, authority, references, and forms. However, each situation is unique and field conditions may determine different procedures. Home and mobile telephone numbers are not to be released to the public.

Each employee that may be involved in spill or illicit discharge response should take the time to become familiar with the information in this Manual. If you know of revisions that should be made or have suggestions to improve this manual, send your comments to Dennis Biddick in the City of Baraboo Engineering Department.

For the City of Baraboo, Dennis Biddick in the Engineering Department at office: (608)355-7324 or cell: (608)963-6159 is the designated Illicit Discharge Coordinator. If Dennis Biddick is not available, contact the following people in the following order to act as Illicit Discharge Coordinator in his absence:

During normal work hours, Monday thru Friday:

> Tom Pinion, Director of Public Works/City Engineer, Office: (608)355-7325 or Cell: (608)393-9945
>
> Tony Gilman, Street Department Supervisor, Office: (608)355-7383 or Cell: (715)437-0999
>
> Engineering Department general number: (608)355-2730

SAFETY FIRST — Follow all appropriate safety procedures when dealing with any spill or illicit discharge.

Staff will maintain their personal safety and the safety of others as their first objective. It is also critical that complete and accurate information of the incident and all parties' involvement is documented.

This document describes the stages of spill and illicit discharge cleanup and provides examples for the various sections of the Manual. The stages involved in spill and illicit discharge response and cleanup are:

A. Discovery and Notification
B. Coordination and Containment
C. Cleanup, Evidence Collection and Documentation
D. Evaluation and Reporting

1.2 DEFINITIONS

WDNR Reportable Spill - ALL discharges of hazardous substances that adversely impact, or threaten to adversely impact public health, welfare or the environment must be IMMEDIATELY reported to the WDNR. (Source: WDNR PUB-RR-560 "Wisconsin Spill Reporting Requirements — Condensed Version" http:MDNR.wi.gov/org/aw/rr/archives/pubs/RR560.pdf) and can be found in Subappendix F.

Hazardous Substance - Chapter 292.01(5), Wis. Stats., defines a hazardous substance as "any substance or combination of substances including any waste of a solid, semisolid, liquid or gaseous form which may cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illnesses or which may pose a substantial present or potential hazard to human health or the environment because of its quantity, concentration or physical, chemical or infectious characteristics. This term includes, but is not limited to, substances which are toxic, corrosive, flammable, irritants, strong sensitizers or explosives as determined by the department."

This definition suggests that a hazardous substance can be anything, depending on the nature of the release. The question to ask is "How much was released and into what environment?" The rule of thumb is that if you have to think about whether a spill or illicit discharge needs to be reported, it probably does. Whether the spilled hazardous substance is heating oil or gasoline, or something unusual like corn, butter and/or manure that flows towards a stream, pickle juice spilled on the ground, or even mercury spilled in a classroom, WDNR staff will tell you if your specific incident does not meet the criteria of a reportable spill at the time that it is reported. To help clarify what spills are reportable, statutory exemptions as well as "de-minimis" exemptions have been established. (Source: WDNR PUB-RR-558 "Hazardous Substance Spills Reporting Requirements" http:/ANDNR.wi.gov/org/aw/rr/archives/pubs/RR558.pdf) and can be found in Subappendix F.

Illicit Discharge - Any discharge to a municipal separate storm sewer system that is not composed entirely of storm water except discharges authorized by a WPDES permit or other discharge not requiring a WPDES permit such as landscape irrigation, individual residential car washing, firefighting, diverted stream flows, uncontaminated groundwater infiltration, uncontaminated pumped groundwater, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, lawn watering, flows from riparian habitats and wetlands, and similar discharges. (Source: Subchapter V of Chapter 14 Ordinance)

Municipal Separate Storm Sewer System (MS4) - As defined in Wisconsin Administrative Code NR 216, means a conveyance or system of conveyances including roads with drainage systems, municipal streets, catch basins, inlets, curbs, gutters, ditches, constructed channels or storm drains, which meets all the following criteria:

1. Owned or operated by a municipality.
2. Designed or used for collecting or conveying storm water.
3. Which is not a combined sewer conveying both sanitary and storm water.

4. Which is not part of a publicly owned wastewater treatment works that provides secondary or more stringent treatment.

(Source: Subchapter V of Chapter 14 Ordinance)

Outfall - The point at which storm water is discharged to waters of the state or to a storm sewer.
(Source: Subchapter V of Chapter 14 Ordinance)

Spill - The spill law, Chapter 292.11, Wis. Stats., requires that a person who possesses or controls a hazardous substance or who causes the discharge of a hazardous substance shall notify the department immediately of any discharge not exempted by the statute. In order to determine whether you have a hazardous substance spill that requires immediate notification, you must ask yourself the following three questions: 1) Is the substance spilled a hazardous substance?; 2) Has it been released to the environment?; and 3) Are there statutory or rule exemptions that apply to this situation?
(Source: WWDNR PUB-RR-558 "Hazardous Substance Spills Reporting Requirements" http://WDNR.wi.gov/org/aw/rr/archives/pubs/RR558.pdf) and can be found in Subappendix F.

CHAPTER 2 – DISCOVERY AND NOTIFICATION

2.1 TYPES OF DISCOVERY

- **3rd Party Reporting:** Incidents that have been reported to the municipality by members of the general public.
- **Illicit Substances Detected due to Field Screening:** Incidents of spills and illicit discharges that are discovered during planned field screening of outfalls.
- **Employee Discovery:** Incidents where a municipal employee comes across a spill or illicit discharge during regular work activities.

2.2 GATHERING INFORMATION

Upon discovering or being notified of a spill or illicit discharge, obtain as much information about the incident as possible. This information will assist in establishing the severity of the incident and how to proceed with the cleanup efforts.

Use the Spills/Illicit Discharge Initial Contact Form in Subappendix A to get as much information as possible regarding: date and time of the discharge, location of discharge, street address, municipality, property owner name and address, name and phone number of person reporting the incident, name and address of possible responsible party, type or description of substance, approximate amount of substance, and any actions taken by the person reporting the incident.

2.3 ILLICIT DISCHARGE COORDINATOR

Regardless of who reports the incident, the first priority is to determine if there is any fire, explosion or safety hazard to life, health or the environment or a need to evacuate. If this is not clearly obvious to the person taking the call, the Illicit Discharge Coordinator will make that determination. It is also the responsibility of the Illicit Discharge Coordinator to identify all persons who will be involved in the cleanup effort.

2.4 EXAMPLE SCENARIOS

The following example scenarios are intended to provide general guidelines on how to proceed in different situations. Each incident is unique and will need to be addressed per its particular circumstances. Keep in mind that whenever safety to people or the environment is in question, it should be reported to the appropriate call center or notification system (such as 911) immediately.

Table 2.1 Example Scenarios

Type of incident	911	Illicit Discharge Coordinator
Public report of grass clippings in storm sewer	N	Y
Public report of pet waste in storm sewer	N	Y
Public report of a sheen along the river	Y	Y
Public report of gasoline or other petroleum product entering storm sewer	Y	Y
Public report of an unknown chemical substance entering the storm sewer	Y	Y
Public report of chlorinated swimming pool water being discharged into the storm sewer	N	Y

Public or employee report of carpet cleaning company discharging dirty water into storm sewer	N	Y
Employee notices grease and/or cooking oil going into storm drain during restaurant inspection	N	Y
Employee spills less than one gallon of gasoline while fueling a municipal vehicle — it does not enter the storm sewer; is contained and cleaned up	N	Written record shall be submitted
Employee spills less than one gallon of gasoline while fueling a municipal vehicle — it does enter storm sewer	N	Y
Employee notices large amount of unidentified substance on the river while in the field for another purpose	Y	Y
Employee notices an unidentified substance discharging from an outfall to a waterway while performing other work related activities	Y	Y
During Illicit Discharge field screening, employee notices small quantity of an unknown material / substance at the outfall.	N	Y
During Illicit Discharge field screening, employee notices large quantity of a material with unusual color and odor	Y	Y

2.5 SCENARIOS

A. 3RD PARTY REPORTING

1. Phone call received from the general public that he saw someone putting pet waste or grass clippings into the storm sewer

Recommended Action: Complete the Spills/Illicit Discharge — Initial Contact Form and route to the Illicit Discharge Coordinator

2. Phone call received from the general public that she noticed a sheen and gasoline smell along the river

Recommended Action: Complete the Spills/Illicit Discharge - Initial Contact Form and contact 911 immediately. Notify the Illicit Discharge Coordinator by giving them a copy of the Spills/Illicit Discharge - Initial Contact Form.

B. EMPLOYEE DISCOVERY

1. During routine maintenance an employee spilled a small quality of oil.

Recommended Action: The employee should follow the municipality's standard policy and procedure on containment, clean up and disposal of material (e.g. using oil dry and sweeping up)

2. During a restaurant inspection an employee notices that grease is being poured into the storm sewer drain.

Recommended Action: Employee should contact their supervisor and/or the Illicit Discharge Coordinator immediately to report their observation. The Spills/Illicit Discharge Observation Form should be completed and routed to the Illicit Discharge Coordinator. The Illicit Discharge Coordinator will then work to get the restaurant to cease its actions.

3. While out on an inspection an employee notices a large quantity of an unidentified substance along the river.

Recommended Action: The Employee should call 911 immediately or, if they do not have a cell phone, contact their supervisor and/or the Illicit Discharge Coordinator to call 911 immediately. The Spills/Illicit Discharge - Observation Form should be completed and routed to the Illicit Discharge Coordinator.

C. ILLICIT SUBSTANCES DETECTED DUE TO FIELD SCREENING

1. While doing a field inspection for illicit discharge the employee comes across a small quantity of an unknown material/substance at the outfall

Recommended Action: The employee should contact the Illicit Discharge Coordinator. The Spills/Illicit Discharge - Observation Form and Outfall Inspection form should be completed. Follow procedure in IDDE Program Plan.

2. While doing a field inspection for illicit discharge the employee comes across a large quantity of a material with unusual color and odor

Recommended Action: The Employee should contact 911 immediately and then contact the Illicit Discharge Coordinator relaying as much information as possible. The Spills/Illicit Discharge - Observation Form should be completed.

CHAPTER 3 – COORDINATION AND CONTAINMENT

3.1 GENERAL

The following is the general procedure for contacts and notifications.

A. Coordinate efforts of those people involved in managing the incident.

B. Locate the source of the spill or illicit discharge.

C. Attempt to locate the responsible party.

The City of Baraboo will use any or any combination of the following strategies to locate the source and responsible party of a spill or illicit discharge:

- Visual and smell indicators
- Field test kit
- Uncover manholes upstream to identify where flow may be coming from and use additional samples and tests as needed to isolate potential source areas
- Utilize available MS4 mapping to assist in tracking upstream of the incident
- Dye-test storm and sanitary sewers
- Smoke test sanitary and/or storm sewers
- Televise sanitary and/or storm sewers
- Obtain access to private property to obtain samples and perform tests

3.2 COORDINATION EFFORTS

A. Identify persons and agencies that need to be notified and involved in the situation.

B. For the City of Baraboo, parties that may be requested to assist in a situation may include, but are not limited to:

- Baraboo Fire Department - emergency dial 911, non-emergency dial (608)355-2710
- Baraboo Police Department - emergency dial 911, non-emergency (608)355-2720
- Baraboo Emergency Management Director – Kevin Steive (608)355-2710
- Sauk County Emergency Management Director – Jeff Jelinek, (608)355-4410
- Sauk County Environmental Health Manager – Steve Lisser, (608)355-3290 and after hours, (800)533-5692
- Baraboo Public Works Department (608)355-2735

C. Current contact information for some of these people can be found on the Flowcharts in Subappendix C. In circumstances when a spill or illicit discharge originating in the City of Baraboo discharges directly to a property under the jurisdiction or another municipality, that jurisdiction or municipality shall be notified of the incident as soon as possible but at least within one working day. These surrounding areas can be seen on the map found in Subappendix D.

D. Notify persons and agencies, providing as much information about the incident as soon as possible.

E. Contain the spill or illicit discharge safely and legally through necessary means.

F. Determine if the spill is "reportable" to the WDNR (using standards found in http://WDNR.wi.gov/org/aw/rr/archives/pubs/RR558.pdf). If reportable, contact the WDNR through the spill hotline (1-800-943-0003).

G. If the spill is not "reportable", contact the SC Region WDNR Spills Coordinator, at 1-608-275-3303.

H. If a responsible party has been identified, they are to take control of the situation as soon as practical and shall continue containment, cleanup and disposal of the substance as required by local and state agencies.

3.3 CONTAINMENT

3.1.1 SPILL CONTAINMENT PROCEDURES:

A. Stop the flow of the spill.

1. Build a berm or sand bag to prevent the flow on pavement and in ditches.
2. Sand bag inlets to prevent flow into inlets.
3. Insert plugs in pipes to prevent flow within sewers.
4. Divert flow to containment site or sanitary sewer, pump or vacuum if applicable.

B. Prevent Runoff during Rain.

1. Cover with plastic or tarps, divert water flow on pavement or ditch area.

C. Prevent Tracking

1. Barricade off area.

D. Recover Discharged Material.

1. Absorb liquids. Cover with sand, oil dry.
2. Vacuum liquid, sweep street.

E. Contain Liquids on Bodies of Water.

1. City of Baraboo Fire Department 608-355-2710 or 911.
2. Containment and Clean up by Sauk County Hazmat Team.

F. Remove Solids.

1. Loader and dump truck, street sweeper, hand shovels and broom.

G. Dispose of recovered material to proper approved location or site.

3.4 LOCATING AN UNKNOWN SOURCE AND RESPONSIBLE PARTY

3.4.1 LOCATING SOURCE

A. Once a spill or discharge is found, additional efforts usually are necessary to determine the source and responsible party. There are many methods that can be used to find the source of a spill or illicit discharge, including:

- Tracing the discharge upstream through the MS4 using available maps
- Field test kits
- Chemical analysis
- A certification program that shows that buildings have been checked for illicit connections
- An incentive program
- An inspection program of septic systems

- Televising the storm and/or sanitary sewers
- Dye-testing buildings in problem areas. The WDNR and/or the local wastewater treatment facility should be contacted prior to dye testing.
- Visual and smell indicators
- Uncovering manholes upstream to identify where flow may be coming and use additional samples and tests as needed to isolate potential source areas.
- Utilizing available MS4 mapping to assist in tracking the incident upstream.
- Checking for amount of flow in discharge
  - Sanitary blockages (usually higher flows)
  - Cross-connects (usually much lower flows)
- Dye testing sanitary and storm sewers and connections
- Smoke testing sanitary sewers
- Obtaining access to perform tests and obtain samples
- Tracing the spill or illicit discharge upstream - beginning at the outfall

B. A combination of tactics may be required to aid in the discovery of the source and responsible party of a spill or illicit discharge.

C. When locating an illicit discharge, remember illicit discharges generally originate from one of the following sources:

- An internal plumbing connection (e.g., the discharge from a washing machine is directed to the building's storm lateral; the floor drain in a garage is connected to the building's storm lateral)
- A service lateral cross-connection (e.g., the sanitary lateral from a building is connected to the MS4)
- An infrastructure failure within the sanitary sewer or MS4 (e.g., a collapsed sanitary line is discharging into the MS4)
- An indirect transitory discharge resulting from leaks, spills, or overflows.

CHAPTER 4 – CLEANUP, EVIDENCE COLLECTION AND DOCUMENTATION

4.1 GENERAL PROCEDURE

The following general procedure shall be used for cleanup, evidence collection and documentation:

A. Collect evidence

B. Document the entire process

C. Clean up the spill

D. Work toward cost recovery

4.2 EVIDENCE COLLECTION

It is important to gain evidence of the spill or illicit discharge before the site has changed, during the cleanup, and after the work has been completed. Samples and photographs should be obtained prior to the evidence being changed or destroyed by weather or cleanup crews. The level of effort and quantity of evidence collected will need to be based upon experience and the severity of the incident or as directed by the City of Baraboo legal authority. If there are multiple agencies working on a single incident, sharing of information is imperative so that duplication of efforts is minimized.

Evidence will be used to hold the responsible party accountable, for successful enforcement of civil/criminal statutes, and to recover cleanup costs. Uniform procedures should be followed when documenting an incident through sampling, photographs, and collecting other information. This includes maintaining a "chain of custody" on all samples, photographs, and other evidence.

4.2.1 KEEP AN ON-GOING WRITTEN LOG

A. Statements should be taken while eyewitnesses are still readily available. Written documentation should include notes or a log of your observations, conversations, statements of witnesses, decisions, actions, sampling activity, and photographs. Include names, addresses, dates, and times in your notes. Also, obtain copies of any shipping papers, material safety data sheets (SDS), and statements from responsible parties regarding product, vehicle numbers, etc. Make certain you have the correct spelling of each chemical name (common and scientific).

4.2.2 TAKE PICTURES

A. Take pictures before the spill site has changed, during the cleanup, and after the work has been completed. Color photographs are preferred. Do not be afraid to use film when you are at a spill incident. The more pictures you take, the better the documentation. Carry your camera with you during the entire incident. Always have spare batteries and film readily available.

B. Pictures should show the source or possible sources, path of discharge, the extent of the discharge, damage to the environment, and any other object or scene which will make the case clearer for other Municipal Staff, WDNR

staff, prosecutors, and the courts. Be sure to maintain the chain of custody of both the original photographs and negatives.

C. Document the following information on each photo and in your reports:

- Date and time of the photo
- Name of the responsible party
- Exact location and site description
- The photographer's name

4.2.3 DIGITAL PHOTOS

A. The use of a digital image as evidence requires additional care because, unlike a negative, the original image can be easily manipulated. Digital images can be easily and quickly manipulated by virtually anyone who possesses a computer. Digital images can also be intentionally or unintentionally deleted or lost. The following digital image management steps are recommended:

- Be familiar with the operation of the digital camera.
- Take extra batteries and floppy disks or memory cards/sticks.
- Label disks used at the scene with all pertinent information, as listed above.
- Upon returning to the office, a back-up file of the digital image should also be made. Any disks containing the original digital image should have a file name that includes the word 'original", and should be preserved as evidence.
- Digital images should be promptly viewed on a computer monitor to become familiar with the digital images and ensure the digital image accurately depicts the scene at the time it was photographed.
- Any enhancements, including simple cropping, should be made to duplicate digital image and saved with a different file name. Manipulation should not be performed on any original digital images that may be used as evidence.
- Consider using password protection, "write protect" features, or writeable CDs for storing digital images.
- A brief report documenting how the digital images were handled, enhanced, and archived should be prepared and placed in the case file.

4.2.4 COLLECT SAMPLES

A. Do not collect samples of unknown substances. Only authorized and properly trained persons should be permitted to collect samples. Those who are authorized to collect samples must be properly protected prior to sample collection.

B. Those collecting samples should understand and have available the following before beginning sample collection:

- Appropriate PPE (Personal Protection Equipment) for the situation
- Sample collection jars
- Sample preservation
- Sample analytical parameters
- Chain of Custody
- Sample packaging for shipping

C. Any other questions relating to sample collection and analysis should be addressed to Dennis Biddick in Engineering. WDNR environmental staff may be able to offer some general assistance. A sample Chain of Custody form can be found in Subappendix H.

D. Document the following information on each sample and in your reports:

- Date and time collected
- Name of the responsible party
- Exact location and site description
- Name of person collecting the sample

E. Sampling is critical to identification of the spilled material and may aid in determining the responsible party or parties. Supporting sample documentation includes maintaining a chain of custody, pictures of sample locations, sampling parameters, sample results, etc.

4.2.5 CREATE SKETCHES OR MAPS

A. Sketches and maps should show the extent of the environmental impacts, discharge point, location of vehicles, permanent reference points, sampling locations etc. because this information is valuable in explaining and understanding the spill incident.

B. Add the following information on each map or sketch:

- Date and time of the sketch
- Name of the responsible party
- Location and site description
- The name of person completing sketch
- Location of permanent reference points such as street intersection, building corner, fire hydrant, trees, etc.
- Scale measurements used

4.2.6 OTHER DATA

A. Check container shapes, markings, colors, placards, identification number and labels that may indicate the presence of a hazardous material. Talk with the drivers; check shipping paper information (most reliable), vehicle ID numbers and/or initials to identify hazardous material cargo.

4.3 DOCUMENT PROCESS

The following documentation will be kept to the maximum extent possible during a spill or illicit discharge event:

- An on-going written log
- Pictures
- Sketches or Maps
- A list of the names of those who have been involved, their agency and contact information.
- Other data as may be deemed appropriate by those involved in managing the incident
- Samples - Samples will be collected from the following locations as long as they are accessible and conditions are safe:

- The suspected source of the spill or discharge (discharge substance and/or site soil)
- Down-gradient of the suspected source
- Up-gradient of the suspected source

4.4 CLEAN-UP THE SPILL OR ILLICIT DISCHARGE

A. Parties responding to the incident will work downstream to determine the extent of cleanup required.

B. If the Responsible Party is identified, they will be notified and directed to correct the problem. The Responsible Party is required to provide adequate cleanup for a spill or illicit discharge.

C. The City of Baraboo will follow the enforcement procedures as outlined in Subchapter V: Illicit Stormwater Discharge of Chapter 14 of ordinances. The City of Baraboo will notify WDNR if an illicit discharge is not cleaned up and removed after 30 days to discuss further options.

D. If the Responsible Party cannot be identified, the City of Baraboo will work with WDNR to ensure that the necessary steps are taken to clean up the spill or illicit discharge. The WDNR may be contacted to discuss any funding opportunities that may be available. WDNR may be contacted for assistance in hiring a qualified contractor and will be kept informed of the progress of a cleanup.

4.4.1 CLEANUP EFFORTS

A. Cleanup includes transportation and disposal of the spill or illicit discharge substance. Efforts should be coordinated with other agencies with a notable interest in the cleanup. If a contractor is needed for cleanup, contact the WDNR and ask for assistance in hiring a qualified contractor. For hazardous spills, the WDNR will use their Zone Contractor procedure.

B. Documentation from the process of identifying, containing and cleaning up spills and illicit discharges should be collected. Documented actions should be provided to the City of Baraboo Stormwater Coordinator, Dennis Biddick in the Engineering Department, to be tracked for the annual report. These actions should be included in annual reports and include information such as: the number of outfalls screened; any complaints received and corrected; the number of discharges and quantities of flow eliminated; the number of dye or smoke tests conducted, etc. This illustrates that progress is being made to eliminate illicit connections. The County Emergency Management Director shall be notified of any spills that were determined to be a fire, explosion or safety hazard to life and health, threat to the environment or a need to evacuate.

C. The Responsible Party shall provide adequate cleanup for a spill or illicit discharge. If the Responsible Party has been identified, every effort should be made to receive cost recovery for funds expended by City of Baraboo. The WDNR should be kept informed of the progress on cleanups and to verify if any funding opportunities are available.

D. If a spill or illicit discharge is not cleaned up immediately it will require routine inspections to ensure that steps are being taken toward completing the cleanup. It is necessary to document these inspections in case further enforcement actions are necessary.

E. The Responsible Party shall provide documentation that the spill or illicit discharge has been cleaned up. The Illicit Discharge Coordinator has the authority to determine that the spill or illicit discharge has been adequately addressed. If the WDNR was involved in the cleanup, City of Baraboo may contact the WDNR to discuss the status.

4.5 WORK TOWARD COST RECOVERY

A. Once the responsible party has been identified every effort will be made to receive cost recovery of funds expended by the City of Baraboo. The WDNR may be contacted to discuss any funding opportunities that may be available.

CHAPTER 5 - EVALUATION AND REPORTING

5.1 EVALUATE THE PROCESS AND PROCEDURES

The Illicit Discharge Coordinator will contact the parties involved in the event to discuss what went right, what went wrong, and any suggested improvements to the process and procedures. This information will be kept in the City of Baraboo Engineering Department.

5.2 REPORT CLEANUP EFFORTS

All files regarding spill events created by the Fire Department will be kept electronically at the Fire Department and copies will be submitted to the Illicit Discharge Coordinator. All files regarding spills and illicit discharges created by the Illicit Discharge Coordinator shall be kept at the City of Baraboo Engineering Department. Reports will be made to the following agencies as appropriate for each incident:

- WDNR

All files will be made available to the City of Baraboo Stormwater Coordinator for the Annual Report.

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Subappendix A

Spills/Illicit Discharge Incident Tracking Form

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CITY OF BARABOO - ILLICIT DISCHARGE INCIDENT TRACKING FORM

1. INCIDENT LOCATION

Storm Sewer System Feature where Illicit Discharge was observed: ☐Outfall ☐ Ditch ☐ Catch Basin/Inlet ☐ Curb ☐ Wetland/Storm Pond ☐ Street ☐ Parking Lot ☐ Other:	
Closest street address:	Business/Landowner name:
Brief description of incident/complaint:	Receiving Water (if known):

2. CITY PUBLIC WORKS RESPONDER INFORMATION

Call taken by:	Precipitation (inches) in past 24 – 48 hours;
Call time:	Outfall ID (if applicable):

3. REPORTER INFORMATION

Incident time:	Incident date:
Caller name & contact information:	

4. INVESTIGATION NOTES

Initial investigation date:	Investigators:
Methods Used: ☐ Tracking ☐ CCTV ☐Sampling ☐ Thermal Imaging ☐ Smoke/Dye testing ☐Other	
Notes:	

5. SOURCE INFORMATION

Is illicit discharge confirmed?
Is the dumped material known? If not, describe discharge: Suspected violator (Name, personal or vehicle description, etc):
Enforcement action taken:

6. ENTITY RESPONSIBLE FOR CLEANUP AND/OR ELIMINATION

Business Name (If Applicable)	Contact Person:
Telephone:	Email Address:

7. FOLLOW UP INSPECTION NEEDED? ☐YES ☐NO

Email this form to the Environmental Coordinator and Utilities Supervisor.
As needed, attached an Outfall Inspection Form and supporting documentation for filing.
File Location:

Baraboo Police Department Procedure

Category: Polluting	
Subject: "Illicit Discharge" i.e. Polluting or Dumping into Storm Sewer System	
Date: 03/05/2021	**Submitted by**: Engineering Department
Reference:	**Authorization:**

Key Questions/Actions:

1. Name, address and phone number of caller.
2. Where is the discharge occurring?
3. Description of the Illicit Discharge.
   - Does the caller see the discharge going into or coming out of the storm sewer system? Is it a grate, pipe, curb, or ditch?
   - Does it have a color or odor? Please describe it.
   - Do they know who is dumping? Please describe the person/business.
4. Were you able to take a photo? If City staff, ask that they take a photo.

Dispatching the call:

1. Assign a Patrol Officer.
2. If during business hours call the Engineering Department (x7324). If outside business hours assign the Street On-Call staff member.
3. Give out type of call, location and all pertinent information.
4. Perform status checks.

Pre-Arrival Instructions / Follow-Up Questions:

Information gathered should be shared with the Environmental Coordinator or Engineering Department staff and the Street Department Supervisor for proper documentation and follow-up as needed for confirmed illicit discharges.

Subappendix B

Spills/Illicit Discharge Contact Information

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Illicit Discharge Detection Response Plan
Contact Information

Title	Agency	Name	Phone Number	Email
Dispatch, Emergency (24 hours)	City of Baraboo - Police		911	
Dispatch, Non-Emergency (24 hours)	City of Baraboo - Police		(608) 355-2720	
Engineering Department	City of Baraboo		(608) 355-2730	
Environmental Coordinator	City of Baraboo	Dennis Biddick	(608) 355-7324	dbiddick@cityofbaraboo.com
City Engineer	City of Baraboo	Tom Pinion	(608) 355-7325	tpinion@cityofbaraboo.com
Utility Department			(608) 355-7380	
Utility Supervisor	City of Baraboo	Wade Peterson	(608) 355-7382	wpeterson@cityofbaraboo.com
On-Call Utility Staff (24 hours)	City of Baraboo		Call 911 to be Transferred	
Fire Department			(608) 355-2710	
Chief – HazMat and Emergency Preparedness	City of Baraboo	Kevin Stieve	(608) 355-7302	ksteive@cityofbaraboo.com
Buildings Inspector, Erosion Control	City of Baraboo	Megan Krautkramer	(608) 355-7411	mkrautkramer@cityofbaraboo.com
DNR Spill Hotline (24 hours)	WDNR		(800) 943-0003	

02/16/2021

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Subappendix C

Employee and 3rd Party Spill or Illicit Discharge Flow Chart

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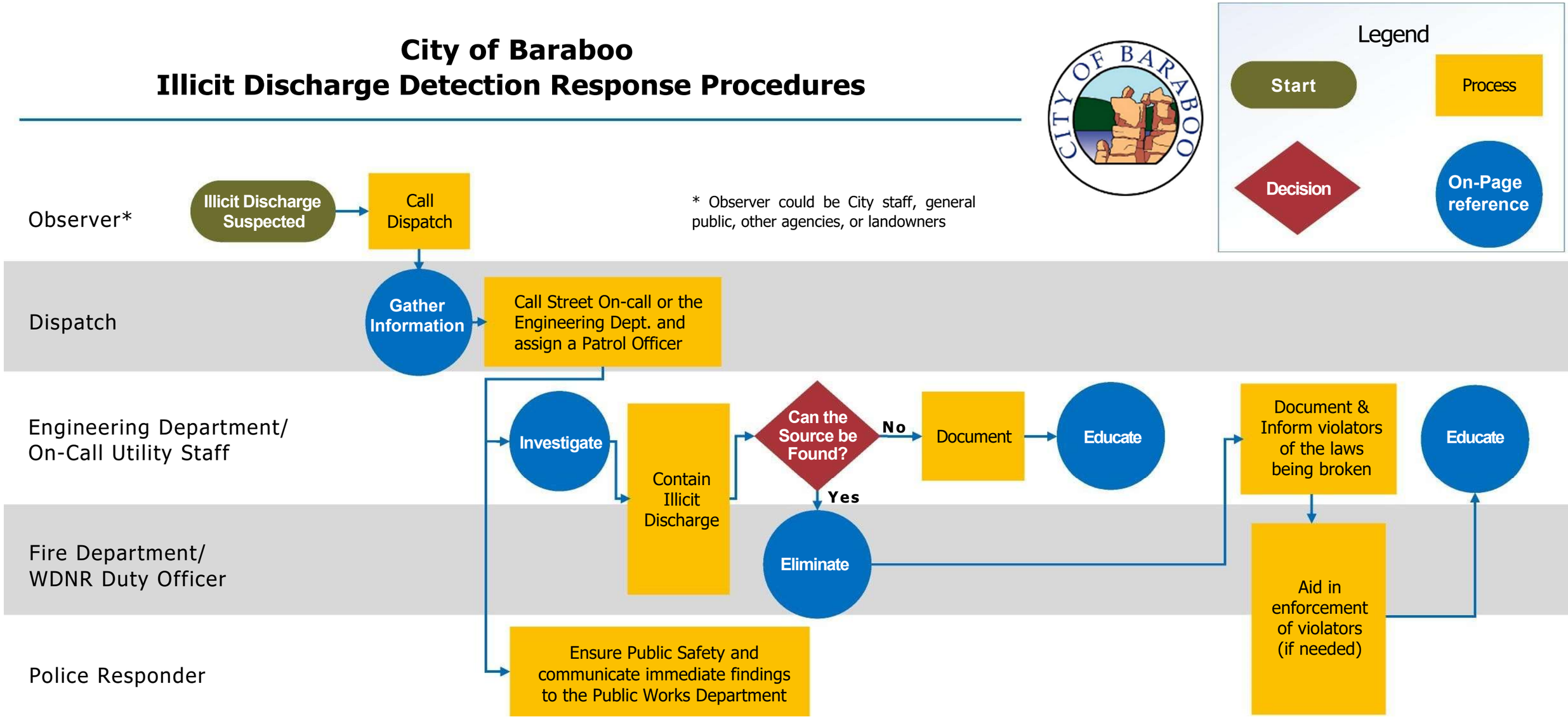
City of Baraboo
Illicit Discharge Detection Response Procedures



Gather Information
- -Name of Observer
- -Contact Information
- -Date
- -Location
- -Description of Illicit Discharge
  - -In/Out of Grate/Pipe/Curb/ Ditch?
  - -Color/Odor
  - -Quantity?

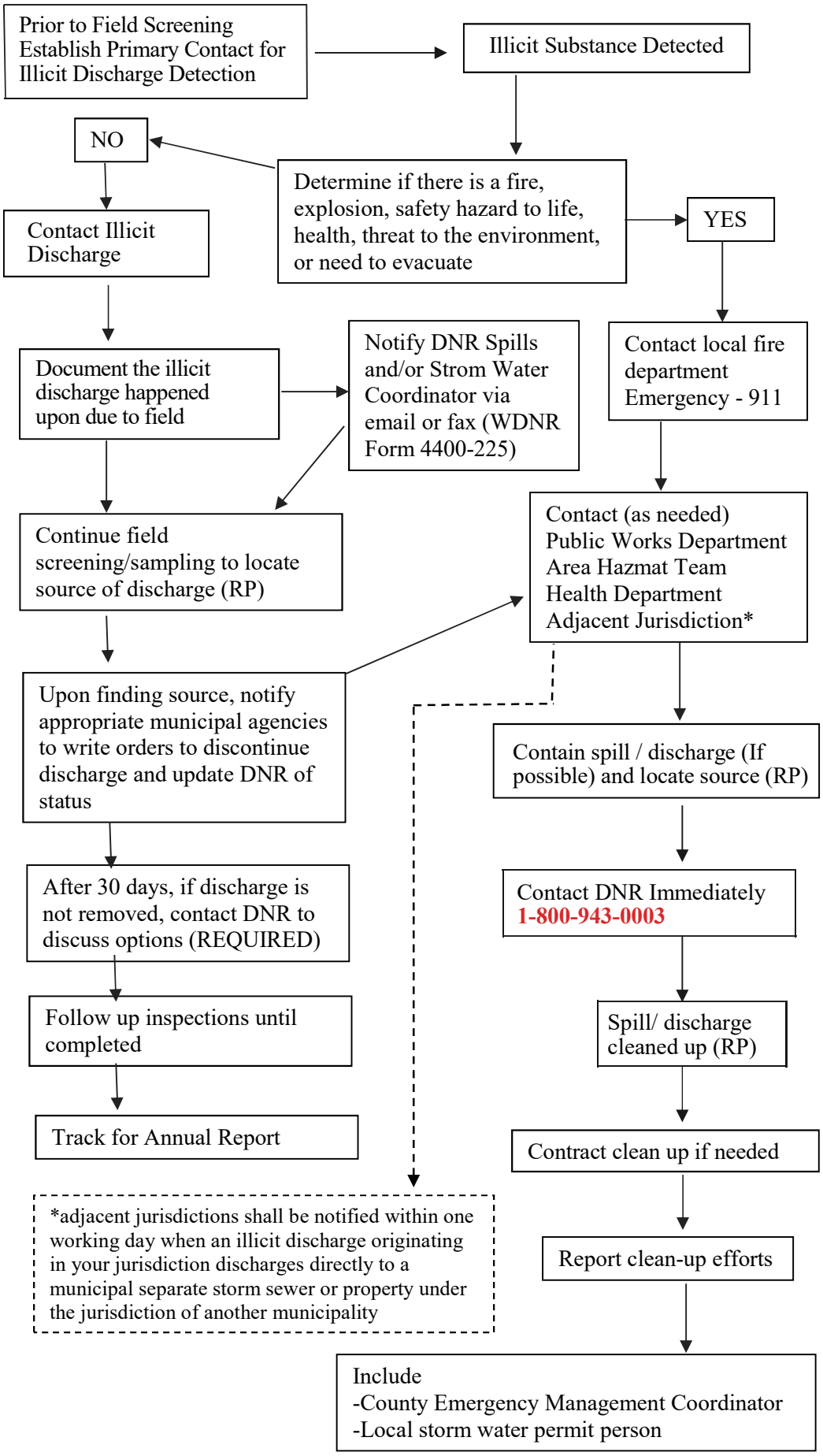
Investigate
- -Confirm Gathered Information
- -Collect any additional info
- -Investigate possible sources
  - -Follow Upstream
  - -Inspect Inlets
  - -Take Samples of Discharge/Field Test kits
  - -Dye testing

Eliminate
- -See Plan for Scenarios and Procedures

Enforce
- -See Plan for Scenarios and Procedures

Educate
- -Distribute Pamphlet
- -Talk to nearby land or business owners

02/16/2021



Update the flow chart at a minimum annually and when there are changes in management or personnel

Local Contacts
(Name, Title, Phone #)

Emergency — 911
Fire (non-emergency) — 355-2710
Police (non-emergency) — 355-2720
Public Works — 355-2736
Sauk Emer. Man. — 355-4410
24 Hour Contact —
Work Hours —

After Hours — Duty Schedule

South Central Region Spills Coordinator
James Amrhein
608-275-380 (office)
Dept. of Natural Resources
3911 Fish Hatchery Road
Fitchburg, WI 53711-5367

Spill Hotline - 1-800-943-0003
http://dnr.wi.gov/org/aw/rr/spills/

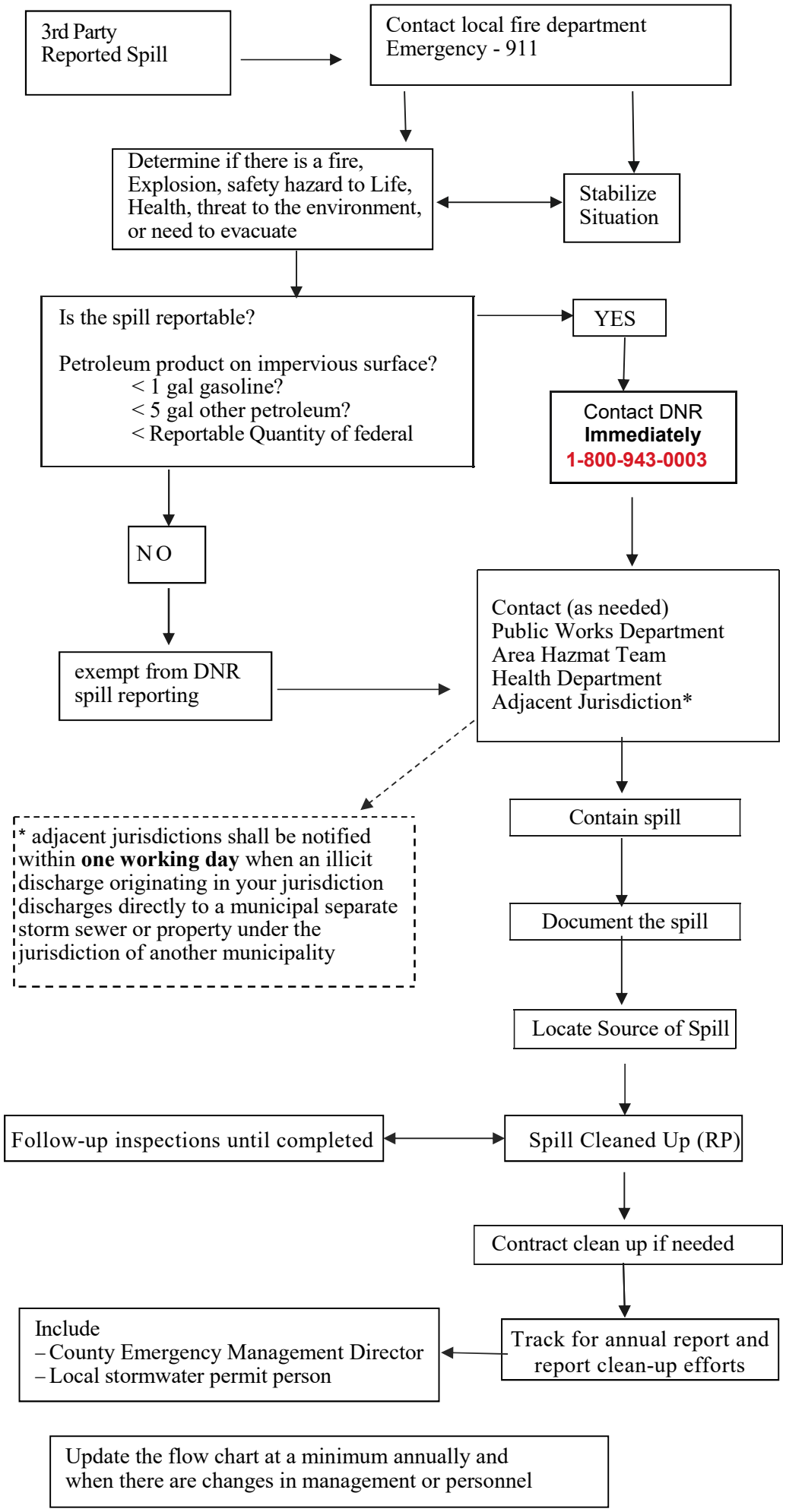
Safety First

- personal protection equipment
- establish site security
- identify material spilled
- contain the spill
- protect environmentally sensitive areas
- protect spilled material from weather conditions
- dispose of material properly

Documenting your response

- date and time of the discharge
- location of discharge
- street address, municipality, quarter section, and legal description
- property owner name and address
- type and amount of substance
- type and amount recovered
- actions taken to stop discharge
- sketch of site
- obtain samples
- treatment and disposal documentation
- photo documentation
- estimate flow volume
- identify responsible party
- work toward cost recovery

Dated: October 13, 2020



Local Contacts
(Name, Title, Phone #)

Emergency — 911
Fire (non-emergency) — 355-2710
Police (non-emergency) — 355-2720
Public Works — 355-2736
Sauk Emer. Man. — 355-4410
24 Hour Contact —
Work Hours —
After Hours — Duty Schedule

South Central Region Spills Coordinator
James Amrhein
608-275-380 (office)
Dept. of Natural Resources
3911 Fish Hatchery Road
Fitchburg, WI 53711-5367

Spill Hotline - 1-800-943-0003
http://dnr.wi.gov/org/aw/rdspills/

Safety First

- personal protection equipment
- establish site security
- identify material spilled
- contain the spill
- protect environmentally sensitive areas
- protect spilled material from weather conditions
- dispose of material properly

Documenting your response

- date and time of the discharge
- location of discharge
- street address, municipality, quarter section, and legal description
- property owner name and address
- type and amount of substance
- type and amount recovered
- actions taken to stop discharge
- sketch of site
- obtain samples
- treatment and disposal documentation
- photo documentation
- estimate flow volume
- identify responsible party
- work toward cost recovery

Dated: October 13, 2020

Subappendix D

Map/Location List of Adjoining Municipalities

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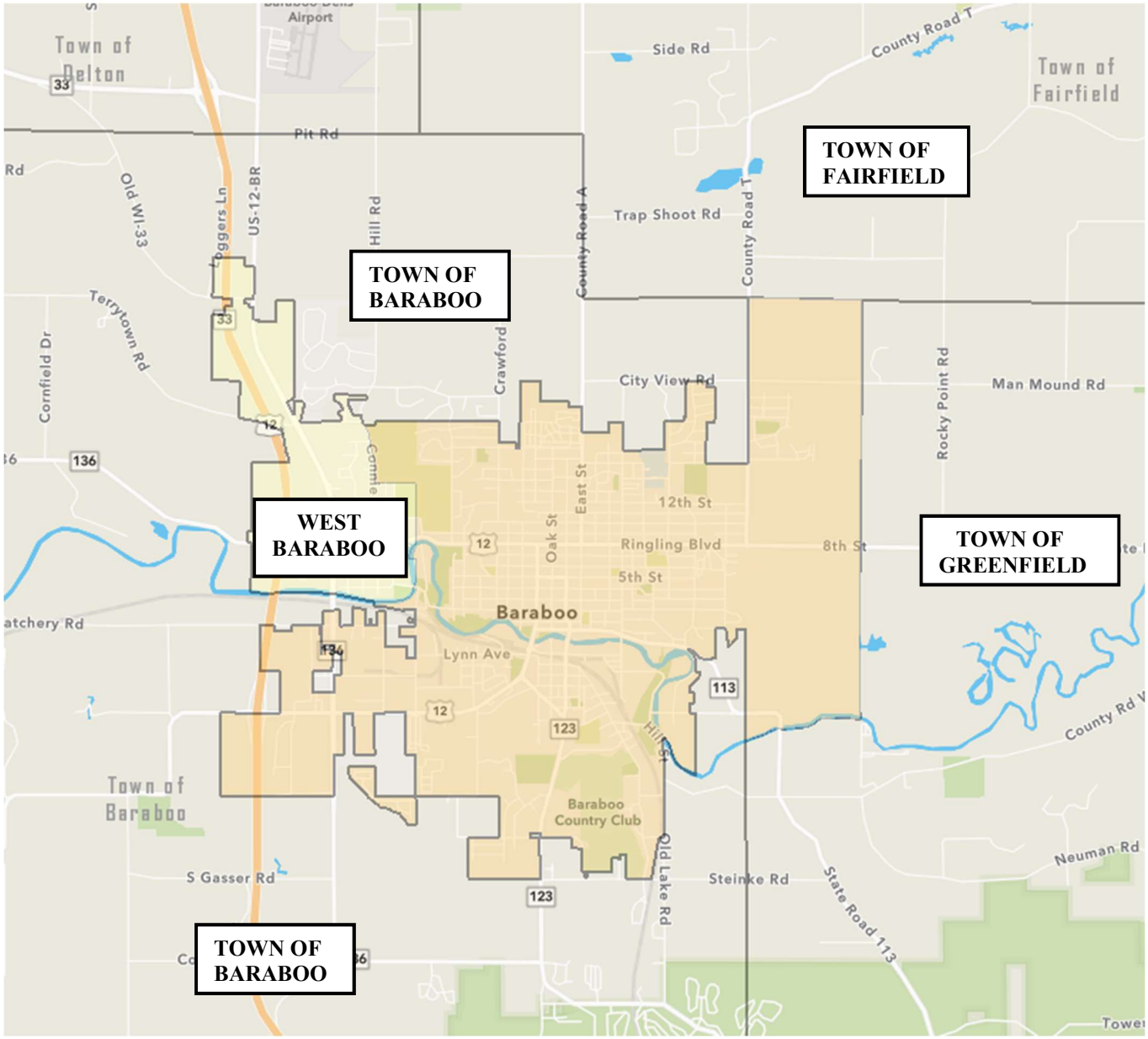

Village of West Baraboo
500 Cedar St.
West Baraboo, WI 53913
(608)356-2516
Business Hours:
DPW – Jerry Conley
Office (608)356-2516
Cell (608)963-650

Town of Baraboo
101 Cedar St.
Baraboo, WI 53913
(608)356-5170
Business Hours: Mon & Wed, 4pm – 6pm
Tues & Thurs, 9am – Noon

Town of Greenfield
E13098 County Road W
Baraboo, WI 53913
(608)356-0054
Business Hours: Mon – Fri

Town of Fairfield
E12891 County Road U
Baraboo, WI 53913
(608)355-0406
Business Hours: Mon – Fri

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Subappendix E

WDNR Form #4400-225
Notification of Hazardous Substance Discharge

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State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Notification For Hazardous Substance Discharge (Non-Emergency Only)

Form 4400-225 (R 02/20)

Emergency Discharges / Spills should be reported via the 24-Hour Hotline: 1-800-943-0003

Notice: Hazardous substance discharges must be reported immediately according to s. 292.11 Wis. Stats. Non-emergency hazardous substance discharges may be reported by telefaxing or e-mailing a completed report to the Department, or calling or visiting a Department office in person. If you choose to notify the Department by telefax or by email, you should use this form to be sure that all necessary information is included. However, use of this form is not mandatory. Under s. 292.99, Wis. Stats., the penalty for violating the reporting requirements of ch. 292 Wis. Stats., shall be no less than $10 nor more than $5000 for each violation. Each day of continued violation is a separate offense. It is not the Department's intention to use any personally identifiable information from this form for any purpose other than program administration. However, information submitted on this form may also be made available to requesters under Wisconsin's Open Records Law (ss. 19.31 – 19.39, Wis. Stats.).

Confirmatory laboratory data should be included with this form, to assist the DNR in processing this Hazardous Substance Release Notification.

Complete this form. TYPE or PRINT LEGIBLY. NOTIFY appropriate DNR region (see next page) IMMEDIATELY upon discovery of a potential release from **(check one)**:

- ◯ Underground Petroleum Storage Tank System (additional information may be required for Item 6 below)
- ◯ Aboveground Petroleum Storage Tank System
- ◯ Dry Cleaner Facility
- ◯ Other - Describe: _____

ATTN DNR: **R & R Program Associate** Date DNR Notified:

1. Discharge Reported By

Name	Firm	Phone Number (include area code)

Mailing Address	Email

2. Site Information

Name of site at which discharge occurred. Include local name of site/business, not responsible party name, unless a residence/vacant property.

Location: Include street address, not PO Box. If no street address, describe as precisely as possible, i.e., 1/4 mile NW of CTHs 60 & 123 on E side of CTH 60.

Municipality: (City, Village, Township) Specify municipality in which the site is located, not mailing address/city.

County	Legal Description:	WTM:
	____ ¼ of ____ ¼ Section ____, Town ____ N, Range ____ ◯ E ◯ W	X Y

3. Responsible Party (RP) and/or RP Representative

Responsible Party Name: Business or owner name that is responsible for cleanup. If more than one, list all. Attach additional pages as necessary.

☐ A local governmental unit claiming an exemption from state Spill Law and Solid Waste Management responsibilities for the discharge being reported, per Wis. Stat. §§ 292.11(9)(e) and 292.23, should: 1) check this box; 2) review DNR publication RR-055; and 3) provide documentation to DNR that demonstrates compliance with the statutory requirements of the liability exemptions. Local governmental units may also request a fee-based liability clarification letter from DNR by using DNR Form 4400-237.

Contact Person Name (if different)	Phone Number	Email		
Mailing Address		City	State	ZIP Code

Responsible Party Name: Business or owner name that is responsible for cleanup. If more than one, list all. Attach additional pages as necessary.

Contact Person Name (if different)	Phone Number	Email		
Mailing Address		City	State	ZIP Code

(continued)

Notification For Hazardous Substance Discharge (Non-Emergency Only)

4. Hazardous Substance Information

Identify hazardous substance discharged (check all that apply):

- ☐ VOCs
  - ☐ PCE
  - ☐ TCE
  - ☐ Other Chlorinated
  - ☐ Diesel
  - ☐ Fuel Oil
  - ☐ Gasoline
  - ☐ Hydraulic Oil
  - ☐ Jet Fuel

(VOCs continued)

- ☐ Mineral Oil
- ☐ Waste Oil
- ☐ Petroleum-Unknown Type
- ☐ PAHs
- ☐ PCBs
- ☐ Cyanide
- ☐ Leachate
- ☐ Manure

- ☐ Metals
  - ☐ Arsenic
  - ☐ Chromium
  - ☐ Lead
  - ☐ Other: _____
- ☐ Pesticides: _____
- ☐ Fertilizer: _____
- ☐ RCRA Hazardous Waste: _____
- ☐ Other: _____
- ☐ Unknown

5. Impacts to the Environment Information

Enter "K" for known/confirmed or "P" for potential for all that apply.

____ Air Contamination
____ Co-mingled (Petroleum & Non-Petroleum)
____ Contamination in Fractured Bedrock
____ Contamination Within 1 Meter of Bedrock
____ Contaminated Private Well
____ Contaminated Public Well
____ Contamination in Right of Way

____ Fire Explosion Threat
____ Free Product
____ Groundwater Contamination
____ Off-Site Contamination
____ Sanitary Sewer Contamination
____ Storm Sewer Contamination
____ Sediment Contamination

____ Soil Contamination
____ Soil Gas Contamination
____ Sub-slab Vapor Contamination
____ Surface Water Contamination
____ Within 100 ft of Private Well
____ Within 1000 ft of Public Well

Other (specify): _____

Contamination was discovered as a result of:

☐ Tank closure assessment Date [ ]
☐ Site assessment Date [ ]
☐ Other - Describe: _____ Date [ ]

Lab results: ☐ Lab results will be faxed upon receipt ☐ Lab results are attached

Additional Comments: Include a brief description of immediate actions taken to halt the release and contain or cleanup hazardous substances that have been discharged.

6. Federal Energy Act Requirements (Section 9002(d) of the Solid Waste Disposal Act (SWDA))

For all confirmed releases from USTs occurring after 9/30/2007 please provide the following information:

Source

- ☐ Tank
- ☐ Piping
- ☐ Dispenser
- ☐ Submersible Turbine Pump
- ☐ Delivery Problem
- ☐ Other (specify): _____

Cause

- ☐ Spill
- ☐ Overfill
- ☐ Corrosion
- ☐ Physical or Mechanical Damage
- ☐ Installation Problem
- ☐ Other (does not fit any of above)
- ☐ Unknown

☐ Does not apply.

Submit this completed form along with any associate lab results using the RR Program Submittal Portal, found on the DNR website at https://dnr.wi.gov/topic/Brownfields/Submittal.html.

If you have any questions, please contact the appropriate regional Environmental Program Associate (EPA) listed under the "EPAs" tab at https://dnr.wi.gov/topic/Brownfields/Contact.html.

Subappendix F

WDNR Publication RR558

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Hazardous Substance Spills Reporting Requirements

PUB-RR-558 February, 2010

Chapter 292.11 – Wisconsin Spill Law

The spill law, Chapter 292.11, Wis. Stats., requires that **a person who possesses or controls a hazardous substance or who causes the discharge of a hazardous substance shall notify the department *immediately* of any discharge not exempted by the statute.** The Department has a 24-hour toll free number for reporting spills: 1-800-943-0003.

In order to determine whether you have a hazardous substance spill that requires immediate notification, you must ask yourself the following three questions: 1) Is the substance spilled a hazardous substance; 2) Has it been released to the environment; and 3) Are there statutory or rule exemptions that apply to this situation. The following text should help you answer those questions, and provides you with insights into unusual spills that did require notification.

Hazardous Substance Definition

Chapter 292.01(5), Wis. Stats., defines a **hazardous substance** as "any substance or combination of substances including any waste of a solid, semisolid, liquid or gaseous form which may cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illnesses or which may pose a substantial present or potential hazard to human health or the environment because of its quantity, concentration or physical, chemical or infectious characteristics. This term includes, but is not limited to, substances which are toxic, corrosive, flammable, irritants, strong sensitizers or explosives as determined by the department."

This definition suggests that a hazardous substance can be anything, depending on the nature of the release. The question you really need to ask yourself is how much was released and into what environment. The rule of thumb used by many is if you have to think about whether it needs to be reported, it probably does. Remember, reporting spills never gets you into trouble, only failure to report does. Whether the spilled hazardous substance is heating oil or gasoline, or something unusual like corn, butter and/or manure that flows towards a stream, pickle juice spilled on the ground, or even mercury spilled in a classroom, DNR staff will tell you if your specific incident does not meet the criteria of a reportable spill at the time that you report it. To help clarify what spills are reportable, statutory exemptions as well as "de-minimis" exemptions have been established and are explained on the back page of this document.

A hazardous substance that is released into a secondary containment structure, completely contained and can be recovered with no discharge to the environment, is not "discharged" as that term is used in s. 292.11, Wis. Stats. **Only discharges to the environment require notification to the DNR.**

The 24-hour Toll Free Hotline for Reporting Spills is:
1-800-943-0003

Wisconsin Department of Natural Resources
P.O. Box 7921, Madison, WI 53707
dnr.wi.gov/org/aw/rr

Are these hazardous substance spills?

Knee High by the Fourth of July!

We don't think of corn as hazardous – fields of corn dominate the landscape in the summer. Sweet corn stands at the farmers' market and ground corn for cattle or hogs are the images that come to mind. However, a stream filled with dried shell corn from a derailed train is quite a different picture. As organic materials decompose in water, they increase the biological oxygen demand, or BOD, of the water. Their degradation reduces the amount of oxygen available to the organisms living in that water body, including fish. If the BOD gets too high, the water will not contain sufficient oxygen for organisms to survive – in this case, the corn created an anaerobic environment. The substance can be corn, milk, manure, or any other organic material. The quantity and size of the spill, the biological oxygen demand of the spilled material, and the size of the water body will determine whether the environment is at risk. The company associated with this spill did not report it to the department, and was subject to enforcement action.

If there's corn, there must be butter…

In May of 1991, a fire broke out in a refrigerated warehouse that stored 50 million pounds of food products, including butter, lard and cheese. This warehouse was in close proximity to a creek that flowed into Lake Monona, a large urban lake. The heat from the fire caused the food products to melt, which in turn, contributed to the intensity and duration of the fire. It took 8 days for the fire department to put out the fire. The warehouse buildings were destroyed, and the water from the fire suppression activities mixed with the melted food products and flowed toward the creek and nearby storm sewers – all leading to the lake. The fire department realized quickly that this was a reportable spill, and a potential environmental disaster and reported the release to the DNR. The department acted to prevent the mixture from reaching the waterbodies, and the total environmental cleanup costs to the warehouse company were over $1 million.

What's that smell?

Driving through the beautiful Wisconsin countryside with the windows open – fresh air filling your car – until you pass an area that has recently been spread with animal manure. Yes, you explain to your children, waste from animals can be used to fertilize the land, making it a recyclable product benefiting the environment. Until, however, that manure is applied too heavily or washed into a stream where the organic material removes the oxygen from the stream resulting in a major fish kill stretching for miles downstream. Again, manure is not often thought of as a hazardous substance – it's a natural by-product of animal husbandry – but it needs to be properly managed or hazardous conditions may result. For more information on agricultural spills, see DNR publication # RR-687 "Agricultural Spills and How to Handle Them".

In a pickle!

This truck driver was in quite a pickle after his truck carrying pickle juice was in a major collision. Pickle juice leaked from the truck bed, along with diesel fuel from the truck itself. This caused soil contamination due to the hazardous characteristics of the diesel fuel along with the low pH of the pickle juice. The trucking company hired a clean up company to excavate the contaminated soil and properly dispose of it. If left in place, this contamination could have migrated to the groundwater, causing impacts to nearby private drinking water wells.

"F" in Science Class…

Recently, a high school science teacher was using elemental mercury in his science class while talking about elements and compounds. Despite warnings about the hazards of mercury, it was simply too tempting for one student, who stole the small bottle containing approximately 4 ounces of mercury after class.

The student and friends began playing with the mercury, spreading it to various classrooms, stairwells, steps and sidewalks. Later in the morning, the student went bowling at a nearby bowling alley. On the bus to the bowling alley, the container of mercury was passed around, spilling on more students and the bus. At the bowling alley, students continued to play with the mercury, putting it in the finger holes of bowling balls and rolling them down the lanes. During lunch, the student took the mercury to a friend's house, transferring it to zip lock bags to be sold for $1 per bag. Before classes ended that day, the student was called out of her classroom, the mercury was confiscated and police, fire departments, and the DNR were notified.

After sampling, the high school, several students, one home, a school bus, the bowling alley, and a sidewalk tested positive for mercury contamination. A contractor was called into assist with the mercury cleanup. In order to gain control of the scene and begin to control the spread of the mercury students were locked in the building and put into separate rooms, depending on whether they were contaminated or not. Students that were exposed to the mercury were required to go to the school locker rooms, remove their clothes, shower, and dress in new clothes. Several students were taken to a local hospital for additional mercury testing. Total costs for the entire cleanup were more than $250,000.

When in doubt, call the number!

If you're not sure whether you have a spill that needs to be reported, call the 24-hour toll free hotline, **1-800-943-0003**, and you will be provided with guidance on reporting. In many situations, spill report forms are not completed if the incident is not considered a hazardous substance spill to the environment. You will need to provide information such as

- √ your name, address, location of the discharge;
- √ physical state, quantity, chemical characteristics of the discharged substance;
- √ cause of the discharge;
- √ destination of the discharged substance;
- √ actions taken to stop the release/minimize the impact to the environment
- √ actual or potential impacts to human health or the environment

***DNR Regional Spill Coordinators*:**
***Northeast:* Jason Moeller (920) 662-5492**
***Northern*: John Sager (715) 365-8959**
***Southeast*: Scott Ferguson (414) 263-8685**
***South Central*: Mike Schmoller (608) 275-3303**
***West Central*: Tom Kendzierski (715) 839-1604**

See the back page for further explanation of reporting exemptions.

Remember, reporting a spill is always in your best interest – it can minimize potential legal consequences, protect you from future false accusations, and establish a record on your follow-up activities cleaning up the spill. Not reporting spills is where problems start. If you have general questions about spill reporting, call your regional DNR office and ask for the spill coordinator. They can assist you in your spill-related questions.

This document may contain some information about certain state statutes and rules but does not necessarily include all of the details found in the statutes/rules. Readers should consult the actual language of the statutes/rules to answer specific questions.

The Wisconsin Department of Natural Resources provides equal opportunity in its employment, programs, services, and functions under an Affirmative Action Plan. If you have any questions, please write to Equal Opportunity Office, Department of Interior, Washington, D.C. 20240

This publication is available in alternative format upon request.
Please call 608-267-3543 for more information.

Wisconsin Spill Reporting Exemptions

Statutory Exemptions

The following exemptions to spill reporting are included in s. 292.11, Wis. Stats.:

- discharges within the limits authorized by a valid permit or program approved under Chs. 281, 285, or 289 - 299 (e.g. WPDES discharge permit);
- law enforcement agencies/fire departments using hazardous substances in protecting human health, safety, or welfare;
- applications of a registered pesticide according to label instructions, or application of a fertilizer at or below normal and beneficial agronomic rates

De Minimis Exemptions:

Besides the statutory exemptions identified above, Ch. NR 706, Wis. Adm. Code establishes exemptions for small quantity spills of agricultural and petroleum related compounds, as well as substances that have a federal reportable quantity established. These quantities are termed "de minimis" in that below these levels, under the following conditions, state notification of a discharge is not required. While reporting requirements may be exempted, **cleanup requirements remain**.

De Minimis Exemptions *do not apply* if the spill:

√ ***has not evaporated or been cleaned up*** in accordance with NR 700 - 726;

√ ***adversely impacts or threatens to adversely impact*** the air, lands, waters of the state as a single discharge, or when accumulated with past discharges;

√ ***causes or threatens to cause*** chronic/acute human health impacts; or

√ ***presents or threatens to present*** a fire or explosion or other safety hazard (*including evacuations*).

If you have a discharge that meets one of the following de-minimis exemptions,
but has not been cleaned up,
adversely impacts or *threatens* to adversely impact the environment,
causes or *threatens* to cause human health impacts, or
presents or *threatens* to present a fire or explosion hazard (including all evacuations),
you still need to report your spill!

De Minimis Exemptions are as follows:

Discharges of Petroleum compounds if you spill:

- gasoline or another petroleum product is completely contained on an impervious surface.
- less than one gallon of gasoline on a pervious surface or runs off an impervious surface.
- less than five gallons of other petroleum products on a pervious surface or runs off an impervious surface.

Discharges of Agrichemical compounds if:

- the amount is less than 250 pounds of a dry fertilizer.
- the amount is less than 25 gallons of a liquid fertilizer.
- the amount discharged when diluted as indicated on the pesticide label would cover less than one acre of land if applied according to label instructions for pesticides registered for use in Wisconsin.

Federal reportable quantities:

- if the amount discharged is less than the federal reportable quantity.

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Subappendix G

WNDR Publication RR560
WDNR Publication RR604

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Immediate Reporting Required for Hazardous Substance Spills

If you are aware of a hazardous substance spill notify the Department of Natural Resources (DNR). State law requires the IMMEDIATE reporting of hazardous substance spills and other discharges to the environment.

CALL 800-943-0003 TO REPORT SPILLS

Use DNR Form 4400-225 to report other hazardous substance discharges

Other hazardous substance discharges, including historical contamination and contamination caused by an ongoing long-term release, discovered during an environmental assessment or laboratory analysis of soil, sediment, groundwater or vapor samples, should be reported to the DNR by filling out and submitting DNR Form 4400-225, "Notification for Hazardous Substance Discharge (Non-Emergency Only)," which is is available at dnr.wi.gov.

- ✓ **Report hazardous substance discharges as soon as visual or olfactory evidence confirms a discharge or laboratory data is available to document a discharge. Do not wait to complete a Phase II environmental assessment, or other similar report, to notify the DNR.**

Reporting is everyone's responsibility

Individuals and entities that cause a hazardous substance spill or discharge to the environment are required by state law to notify the DNR immediately - as soon as the spill or discharge is identified. Individuals and entities that own or control property where the spill or discharge occurred must report the discharge immediately if it is not reported by the person or entity that caused the discharge.

For public health and safety, the DNR encourages everyone to report known hazardous substance discharges. Reporting a spill or other discharge, in itself, does not make a person or entity liable for the contamination.

Proper spill containment, cleanup, and disposal is always required

Every person/entity (including lenders and local governments) that causes a hazardous substance discharge, or owns or controls property at which a discharge occurred, must comply with the response action requirements in Wis. Admin. Chs. NR 700 to 754. No spill or discharge is exempt from the duty to properly contain, clean up and dispose of the substance and associated contaminated media, such as soil, water and other affected materials.

Spill reporting exemptions

All spills must be cleaned up, but it is generally not necessary to report recent spills that are:

- less than 1 gallon of gasoline
- less than 5 gallons of any petroleum product other than gasoline
- any amount of gasoline or other petroleum product that is completely contained on an impervious surface
- individual discharges authorized by a permit or program approved under Wis. Stats. Chs. 289 - 299
- less than 25 gallons of liquid fertilizer
- less than 250 pounds of dry fertilizer
- pesticides that would cover less than 1 acre of land if applied according to label instructions
  - NOTE: Reporting is required if the ongoing, long-term release or application of a permitted pesticide, fertilizer or other substance accumulates to levels that exceed current health or safety standards.
- less than the federal reportable quantities listed in 40 C.F.R. §§ 117 or 302
  - NOTE: U.S. EPA (federal) spill reporting requirements are outlined on the internet at https://www.epa.gov/emergency-response/when-are-you-required-report-oil-spill-and-hazardous-substance-release.

Spill reporting exemptions do not apply (and reporting is required) when:

- the spilled substance has not evaporated or been cleaned up in accordance with Wis. Admin. chs. NR 700 - 754
- the spilled substance is a potential fire, explosion or safety hazard
- the spilled substance causes, or threatens to cause, chronic or acute human health concerns
  - NOTE: If you are unsure about potential human health effects, consult with local or state health officials.
- the spilled substance adversely impacts, or threatens to impact, the air, lands or waters of the state (as either a single discharge or when accumulated with past discharges) - even if the degree of the impact has not yet been thoroughly evaluated
  - NOTE: If the substance causes sheen on surface water, has entered or is on the verge of entering the waters of the state, DNR will consider the spilled substance a threat to impact, or to have adversely impacted, waters of the state and reporting is required.

Terms, definitions, statutes and rules

Hazardous substance —Any substance that can cause harm to human health and safety, or the environment, because of where it is spilled, the amount spilled, its toxicity or its concentration. Even common products such as milk, butter, pickle juice, corn, beer, etc., may be considered a hazardous substance if discharged to a sensitive area.

Discharge — Spilling, leaking, pumping, pouring, emitting, emptying, dumping, etc., to land, air or water.

Spill — A discharge that is typically a one-time event or occurrence, and usually inadvertent.

Wis. Stat. § 292.11(2) and Wis. Admin. § NR 706.05 — Require individuals and entities that possess or control a hazardous substance, or that cause the discharge of a hazardous substance to the environment, to notify the DNR immediately about the discharge.

Wis. Stat. § 292.99 — Authorizes penalties up to $5,000 for each violation of the notification requirement.

Consult Wis. Stat. Ch. 292 and Wis. Admin. §§ 700 – 754, and dnr.wi.gov for further information on hazardous substance spill and discharge reporting, investigation and cleanup.

DNR contact information

To report a discharge call 1-800-943-0003. For more information on the spills program, including contact information, visit dnr.wi.gov, search "Spills".

This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Remediation and Redevelopment Program

Hazardous Substance Spills in Wisconsin

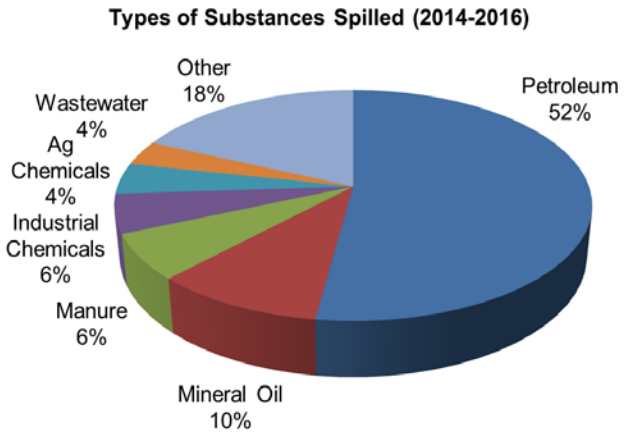
Hazardous substances play important roles in our everyday quality of life – from the natural gas that heats our home, to the fertilizer that keeps our lawn green. When a discharge or spill of a hazardous substance occurs, there is a potential danger to the public and the environment. In most instances, hazardous substance spills must be reported immediately to the Wisconsin Department of Natural Resources (DNR) using the DNR's 24-hour toll-free hotline (1-800-943-0003). Most of these spills require cleanup to protect public health and the environment. For more information on the spills program, visit the DNR Remediation and Redevelopment (RR) Program website dnr.wi.gov, search "Spills."

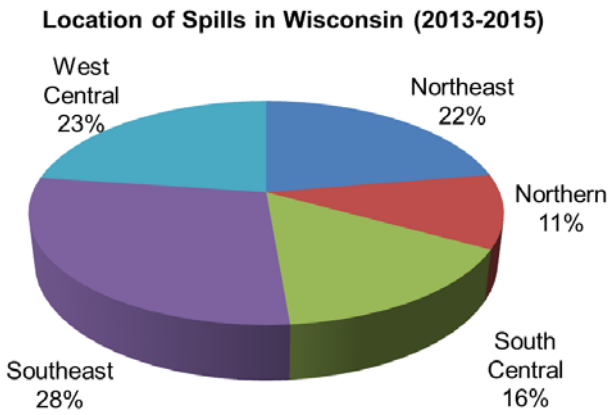
Where Are The Most Spills In Wisconsin?

Wisconsin averages almost 1,000 spills of hazardous substances every year. The majority of these spills occur in the most populated areas of the state. Twenty-eight percent of all spills occur in the southeast part of Wisconsin where the population is highest, while only 11 % of all spills occur in the less-populated northern part of the state.

What Substances Are Spilled Most Often?

The most commonly transported materials are petroleum-based substances used to fuel vehicles or heat homes; therefore they have the most potential to be spilled. Petroleum-related spills (including mineral oil) account for approximately 44% of all spills in Wisconsin annually. Other substances spilled include agricultural and industrial chemicals, manure, and wastewater.





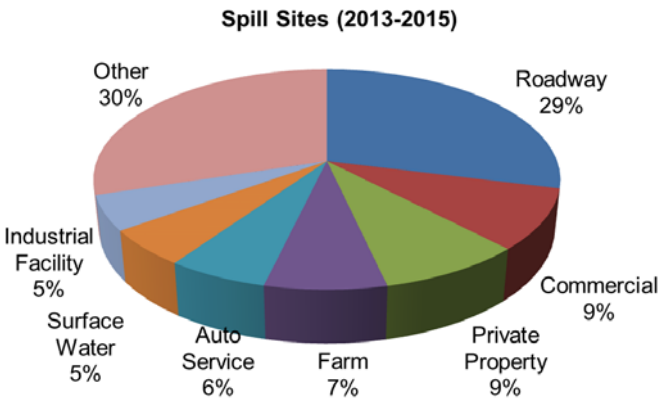
Where Do Most Spills Occur?

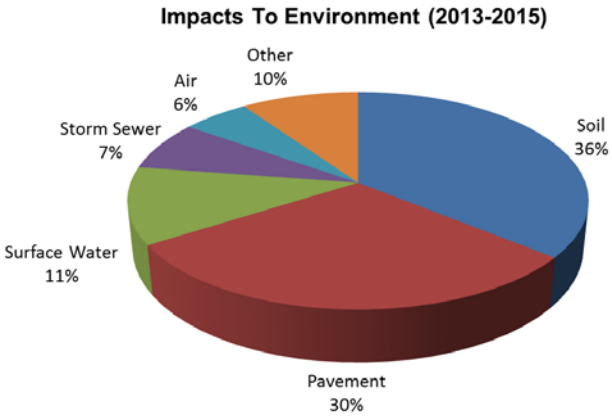
Spills can happen anywhere. The most spills occur on roadways (29%), commercial properties (12%), private properties (12%), and farms (7%)

How Do Spills Impact The Environment?

Approximately 30% of spills each year in Wisconsin are contained and/or recovered before they impact the environment. The remaining spills can impact the environment or become a public health concern through the contamination of air, soil, and water.

Spills to soil account for approximately 36%, while spills to surface water or storm sewers occur approximately 18% of the time. Spills that could contaminate groundwater are investigated further and cleaned up as necessary.





Wisconsin DNR Spill Coordinators

Wisconsin DNR spill coordinators respond to a wide variety of hazardous substance releases, from agricultural manure spills to train car accidents and chemical fires. Spill coordinators work with local fire departments and hazardous materials teams to coordinate response and clean-up activities. The general public is also encouraged to contact a DNR spill coordinator if they have any questions about a release or potential release in their communities.

This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.. This publication is available in alternative format upon request. Please call 608-267-3543 for more information.

Subappendix H

Sample Chain of Custody Form

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Subappendix H
City of Baraboo Illicit Discharge Chain of Custody

Sampled By_____ Temperature_____

Sample Date _____ Weather _____

# of Samples Taken _____

Sample Material Liquid ☐ Powder ☐

Sample Description and I.D. Number _____

_____

_____

Sample Location: _____

_____

_____

_____

_____

Testing Lab: _____

_____

_____

Composition of Material tested _____

_____

_____

Tested By: _____

Date of Test: _____

Contact Person: Dennis Biddick (608)-355-7324 mailto:dbiddick@cityofbaraboo.com
101 South Blvd, Baraboo, WI 53913

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Appendix D

Educational Materials

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ILLICIT DISCHARGE

Detection and Elimination

As a part of the Municipal Separate Storm Sewer System (MS4) Permit, the City of Baraboo must meet requirements set by the Wisconsin Department of Natural Resources (WDNR) to discharge stormwater into Wisconsin's streams, lakes or wetlands.

One of the requirements is the detection and elimination of pollutants entering the storm sewer system. Wisconsin's public waters are sources of drinking water and provide recreational opportunities like swimming, boating and fishing, which can all be negatively impacted if pollutants travel here by stormwater

Illicit Discharge

Illicit discharge is any discharge to the storm sewer system that is harmful to the health or welfare of citizens, the environment, surface waters or storm sewer system. Illicit discharges would include items such as:

- Sewage from broken sewer lines or overflow from private septic systems
- Pesticides, herbicides, wash water from cleaning up paint, household cleaners or others
- Sediment washing from construction sites
- Chemical or oil spills

Illicit discharges could be ***intermittent***, only occurring a few minutes per day or a few days per year, ***continuous***, occurring almost daily, or ***transitory***, only occurring once.

What incidences are not considered illicit discharges? Items like water line flushing, residential car washing or draining swimming pools that are de-chlorinated (left to rest for 7 or more days after treatment) are not classified as illicit.

What Do I Do if I Suspect an Illicit Discharge is Present?

All City employees can help. Although illicit discharge detection is incorporated into all inspection and maintenance activities, employees may not be present at a certain time. If you notice storm sewer discharges with unusual ***odors, floatables, oil film*** or ***atypical coloring*** you should:

- Estimate the volume or area impacted, as well as the location
- Take photos
- Contact the Engineering Department to report the problem or call 911 if you suspect the issue needs immediate attention

City staff can then evaluate the situation and determine if testing is needed to see if pollutants are present.

The City Engineering Dept. is currently working on developing an Illicit Discharge Detection and Response Plan. For questions regarding the City of Baraboo's responsibilities, or if you are interested in being a part of the planning process, please contact your supervisor or **Dennis Biddick** at dbiddick@cityofbaraboo.com or **608-355-2730**.

ILLICIT DISCHARGE

Detection and Elimination

The City of Baraboo is working to eliminate illegal dumping into its storm sewer system. Wisconsin's public waters are sources of drinking water and provide recreational opportunities such as swimming, boating and fishing, which can all be negatively affected by the pollutants stormwater carries.

Damage to a stream after rinsing blue paint into a storm drain.

NEED MORE INFORMATION?

To learn about proper disposal methods for liquids such as paint, visit co.sauk.wi.us/landconservation/sauk-county-clean-sweep-and-alternative-disposal-options-clean-

Illicit Discharge

Illicit discharge is any discharge to the storm sewer system that is harmful to the health or welfare of people, the environment, wildlife or surface waters. Illicit discharges include items such as:

- Sediment washing from construction site
- Chemical or oil spills
- Sewage from broken sewer lines or over from private septic systems
- Pesticides, herbicides, wash water from cleaning up paint and household cleaners

Illicit discharges could be ***intermittent*** — only occurring a few minutes per day or a few days per year, ***continuous*** — occurring almost daily or ***transitory*** — only occurring once.

Which activities are not considered illicit discharges? Water line flushing, residential car washing or draining swimming pools that are dechlorinated (left to rest for seven or more days after treatment), firefighting and lawn watering are not considered illicit.

How Does a Small Amount Affect the Environment?

It only takes a very small amount of many types of chemicals to harm fish, plants and other aquatic organisms. For example, just 1 teaspoon of mercury is enough to contaminate more than 13 Olympic-sized swimming pools of drinking water. And most contractors know that rinsing concrete equipment into a lake or stream can kill fish. This is because the liquid can dramatically change the pH of water, making it very alkaline.

Most of these chemicals enter our water systems through improper or accidental disposal outside.

What Do I Do if I Suspect an Illicit Discharge is Present?

If you notice illegal or suspicious dumping into a storm sewer inlet or curb ditch, you should report the problem in one of the following ways:

- Call the City's Engineering Division at **608-355-2730**
- Call **911** if you suspect the issue requires immediate attention
-

PET WASTE AND WATER POLLUTION

Dogs in Baraboo produce up to a ton of waste each day. Unfortunately, pet waste left on the ground washes into storm drains and waterways, exposing humans, pets and wildlife to harmful bacteria and other contaminants.

NEED MORE INFORMATION ON MANAGING PET WASTE?

There is always pet waste information available online.

Or for more information, call the City's Engineering Division at **608-355-2730.**

What is the City's policy on pet waste?

Baraboo's City Code states that pet owners cannot leave waste on public or private property without permission from the owner. While it is not illegal to leave pet waste in your own yard, the City asks that you pick up after your pooch to reduce the movement of bacteria into water or into areas where it can be stepped on.

How does pet waste in my yard pollute water?

When pet waste is left on a lawn and is later rained on, it leaches bacteria, viruses and parasites (such as worms and giardia) into storm water, which can threaten the health of humans and animals. Pet waste also contains nutrients that promote weed and algae growth in lakes and rivers. This is the same as when too much fertilizer is used – it turns waterbodies into a mucky, green color. Picking up dog waste helps keep our recreation areas clean, safe and beautiful.

What about all the other animals?

It is true that squirrels, geese and other wildlife also contribute to water pollution. However, these animals tend to spread out waste across the landscape, whereas dog waste tends to be concentrated in yards, pens and along sidewalks or paths. Cats usually bury their waste, so it does not get into waterways as easily.

How do I properly dispose of pet waste?

When nature calls, the best option is to flush pet waste down the toilet where it will be treated at the sewage treatment plant just like human waste. You can always just pick it up in a plastic bag and throw it in the garbage.

STORMWATER MANAGEMENT

The City of Baraboo encourages residents to help the City and local watershed districts manage stormwater and protect our waterways.

Over time, more impervious surfaces, such as roads, rooftops and parking lots, have been built around the City. These surfaces do not allow rain to absorb into the ground, resulting in larger amounts of water flowing more quickly to a downstream creek, wetland, pond or lake than it would in a natural prairie or wooded landscape.

Large rainstorms can lead to flooding and erosion in downstream channels. Stormwater is also a leading transporter of pollutants from our streets. Homeowners can help protect valuable property and enhance water quality at the same time by using the methods listed below.

Best Management Practices (BMP)	Downstream Benefits	Water Quality Benefits	Groundwater Benefits	
Rain gardens or vegetated ditches	Reduces the amount and speed of runoff	Filters the runoff and allows plants to consume excess fertilizers	Recharges groundwater, if infiltrated	
Rain barrels	Reduces amount of runoff	Reuse of stormwater	Conserves water	
Redirecting downspouts from impervious surfaces to vegetated areas	Allows infiltration and reduces the speed of runoff	Allows filtering of runoff to remove pollutants	Cleans surface water before it infiltrates to groundwater	
Pervious pavements or pavers in place of asphalt or concrete	Allows infiltration and reduces the speed of runoff	Allows filtering of runoff to remove pollutants	Cleans surface water before it infiltrates to groundwater	

If local stormwater rules require you to design and implement a **Stormwater Best Management Practice** (BMP) on your property, contact the City Engineering Department for more information regarding which BMPs meet that requirement. To protect drinking water, there may be restrictions on the types of BMPs that can be used to recharge groundwater.

Contact the Engineering Division at **608-355-2730** before designing a rain garden or other infiltrating BMP. The **Wisconsin Department of Natural Resources** (https://dnr.wisconsin.gov/topic/Stormwater/standards) is also a great resource and has more information on design standards and additional BMPs.

For more useful stormwater management information, visit **cityofbaraboo.com/**

Working Together

TO PROTECT STORMWATER PONDS

Stormwater ponds and wetlands are designed to intercept and treat stormwater.

Algae blooms or aquatic plants in ponds and lakes need nutrients to grow. Pollutants or nutrients entering a pond through stormwater runoff can lead to large algae blooms, excess plant growth or even hurt wildlife.

Pollutants that should not be washed into our ponds include:

- Lawn-care products such as fertilizers or pesticides
- Animal debris or waste
- Lawn clippings
- Oils, greases and automotive additives
- Dust and dirt from construction, streets or rainfall
- Wind-blown chemicals

An overabundance of plant and algae growth may inhibit a stormwater pond's function and degrade the pond's water quality. More importantly, however, the degradation of a stormwater pond results in polluting the watershed, or drainage area, around a lake, creek, wetland or pond. This negatively affects water quality, which has an adverse effect on plant and animal life, and decreases the recreational potential for lakes and creeks.

Property Owner Responsibility

- Pick up or rake up trash, leaves and grass from yards, streets and curbs.
- Never dispose of yard waste (or anything else) into ponds and storm drains – the waste contains phosphorus, which causes plants and algae to grow.
- Use biodegradable soaps for outdoor cleaning or car washing
- Sweep driveways and sidewalks instead of hosing them off.
- Pick up pet waste and dispose of it in the trash.
- Maintain healthy sod and grass to limit erosion. Re-seed or re-sod all bare areas to keep stormwater from washing soil particles, which also contain phosphorus, into a storm sewer or pond.

City Responsibility

The City does not treat stormwater ponds or wetlands for algae, weeds, odors or other aesthetic problems, however the City is responsible for the following tasks:

- Maintenance of the "hydraulic and treatment function" of water resources that are located within City-owned property, drainage or utility easements.
- Removal of sediment accumulation, obstructions and debris that impede the flow of water, and clearing clogged stormwater pipe.

CITY RESOURCES

Public Works
Assistance with repairs
608-355-7383

Engineering Division
Drainage concerns
Boundary locations
608-355-2730

Environmental Coordinator
Vegetation management permit application
Report dumping of pollutants such as motor oil or paint
608-355-7324

WEB-BASED RESOURCES

Department of Natural Resources
https://dnr.wisconsin.gov/topic/Stormwater/standards

University of Wisconsin Extension
extension.wisc.edu

Blue Thumb
bluethumb.org

Appendix E

Ordinance Chapter 14
Subchapter V

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ATTACHMENT "D"

CITY OF BARABOO

EROSION AND SEDIMENT CONTROL PERMITTING FOR SMALL SITES (2.4)

Prepared by:
ENGINEERING DEPARTMENT
101 South Boulevard
Baraboo, WI 53913
Ph: (608)355-2730 Fax: (608)355-2719
www.cityofbaraboo.com

Origination Date: 03/05/2021
Revision Dates:

Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

CHAPTER 1 - OVERVIEW 2

1.1 INTRODUCTION 2
1.2 PURPOSE 2
1.3 OBJECTIVES 3

CHAPTER 2 - DOCUMENT USE 4

2.1 GENERAL 4
2.2 DEFINITIONS 4
2.2 APPLICABILITY 4
2.3 LIMITATIONS 4

CHAPTER 3 - ADMINISTRATIVE 5

3.1 GENERAL 5
3.2 PERMITTING REQUIREMENTS, PROCEDURES AND FEES. 5
3.3 ESC PLAN AND AMENDMENTS. 7
3.4 INSPECTIONS. 9
3.5 ENFORCEMENT. 9

Appendices

APPENDIX A: STANDARD EROSION CONTROL PLAN FOR 1 & 2 FAMILY DWELLING CONSTRUCTION SITES A1

APPENDIX B: PUB-GWQ001, EROSION CONTROL FOR HOME BUILDERS B1

APPENDIX C: CHAPTER 14, SUBCHAPTER II: CONSTRUCTION SITE EROSION CONTROL CODE C1

CITY OF BARABOO
CONSTRUCTION SITE POLLUTANT CONTROL (2.4)

Goal: Maintain a soil erosion control ordinance and enforce it on construction sites.

Compliance Date: March 31, 2021 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

Develop, implement and enforce a program to reduce the discharge of sediment and construction materials from construction sites. The program shall implement the following measurable goals:

2.4.1 Construction site ordinance. An ordinance or other regulatory mechanism to require erosion and sediment control at construction sites and establish sanctions to ensure compliance.

2.4.2 Erosion and sediment control plan review. Written procedures for construction site plan review which incorporate consideration of potential water quality impacts. Preconstruction erosion control plan reviews shall be conducted for all construction sites with greater than one acre of land disturbance.

2.4.3 Administrative procedures. Written procedures for the administration of the construction site pollutant control program including the process for obtaining local approval, managing and responding to complaints, tracking regulated construction sites, and construction site plan receipt and consideration of information submitted by the public.

2.4.4 Construction site inspections and enforcements. Written procedures for construction site inspection and enforcement of erosion and sediment control measures.

WORK PLAN

☒ Ordinance last modified and adopted by Baraboo Common Council on 9-08-2015.
https://www.cityofbaraboo.com/vertical/Sites/%7BD06131C5-F452-44C7-954E-97BD998BCA20%7D/uploads/CHAPTER_14.pdf

☒ The City of Baraboo Erosion and Sediment Control Permitting Program Manual for Small Sites completed by March 31, 2021.
☐ Update ordinance in 2021
☐ The City will implement items recognized in erosion control manual.

CHAPTER 1 - OVERVIEW

1.1 INTRODUCTION

The Federal Clean Water Act of 1972 made it unlawful to discharge any pollutant from a point source into navigable waters unless a permit was obtained. This permit program is called the National Pollutant Discharge Elimination System (NPDES). As part of the program, small cities are required to follow a Municipal Separate Storm Sewer System (MS4) General Permit which approves the discharge of stormwater to lakes, rivers, wetlands, and other receiving waters (EPA 2017). In Wisconsin, the MS4 Permit is administered by the WDNR.

Baraboo is an Urbanized Area, as defined by the Bureau of the Census, due to its population. The City is classified as an NPDES Phase II community, more commonly referred to as a small MS4 community, and has therefore been required to comply with the MS4 General Permit since 2006. Permit requirements were lastly revised in 2019 by the WDNR for small MS4 cities in Wisconsin. The current Wisconsin MS4 Permit has eight specific goals or Minimum Control Measures (MCM), within the permit's SWPPP, as listed below.

1. Public education and outreach
2. Public involvement and participation
3. Illicit discharge detection and elimination (IDDE)
4. **Construction site pollutant control**
5. Post-construction stormwater management
6. Pollution prevention/good housekeeping
7. Stormwater quality management
8. Storm sewer system map

This plan provides procedures and documents required to comply with the construction site pollutant control portions of the MS4 Permit, as described in Section 2.4 of the current WPDES Permit No. WI-S050075-3.

The specific goals of the Erosion and Sediment Control Program are to:

- Develop and update construction site ordinance.
- Develop procedures for erosion and sediment control plan review.
- Develop procedures for the administration of the erosion control program.
- Develop procedures for erosion control site inspections and enforcement.

The City is committed to working internally and with state and federal environmental agencies to achieve water quality goals and protect public health. The City has established this Plan to outline procedures, goals, standard operating procedures (SOPs), and workflow processes for successful and efficient implementation of the construction site erosion control program. It is a working document and will be revised as necessary. This Plan is based on current regulatory requirements formed by the 2019 MS4 General Permit and follows City Code, Chapter 14, Subchapter II for Construction Site Erosion Control, which was last updated by the City of Baraboo in 2015 and can be found in Appendix B.

1.2 PURPOSE

1.2.1 The following policies and procedures have been compiled to assist homeowners, developers, builders and engineers in the development of plans and specifications in the City of Baraboo.

1.2.2 Design and construction work shall conform to the most recent editions of the following

A. City of Baraboo Standard Specifications

B. City of Baraboo Ordinances

C. Standard Specifications for Sewer and Water Construction in Wisconsin

D. Uniform Dwelling Code

E. WISDOT Standard Specifications for Construction

1.2.3 Prior to beginning of construction, all regulatory agency permits and approvals shall be obtained including but not limited to:

A. City of Baraboo

B. Army Corps of Engineers

C. Wisconsin Department of Natural Resources

D. Wisconsin Department of Transportation

E. Sauk County Zoning

1.2.4 This document does not take the place of or supersede Wisconsin State Administrative Code requirements. It is the responsibility of the property owner and/or applicant to provide accurate and reliable information concerning the project in accordance with all applicable codes.

1.3 OBJECTIVES

- To clarify when the City of Baraboo's Erosion and Sediment Control Program and related permitting is required.
- To describe the required submittals for permit application.
- To explain what is needed on a site plan.
- To specify the requirements for complying with the Site Erosion Control Ordinance.

CHAPTER 2 – DOCUMENT USE

2.1 GENERAL

This document houses all information on processes and procedures related to obtaining and following the City of Baraboo's Erosion and Sediment Control permit and permit requirements for Small Sites.

A. The permit and permit requirements satisfy the Erosion Control requirements, on a per project basis, as required through the City of Baraboo's Code of Ordinances.

Different components of the process will be covered in individual chapters. For an overview of the permit application requirements, see Chapter 4.

2.2 DEFINITIONS

2.1.1 With the exception of the following defined terms, all definitions found in NR 216, NR 151, and SPS 360 are applicable to this document and referenced documents:

A. *Business day* means a day the City of Baraboo offices are open for business.

B. *Cease and Desist Order* means a court-issued order to halt land disturbing construction activity that is being conducted without the required permit or in violation of a permit issued by the City of Baraboo.

C. *Redevelopment* means areas where development is replacing older existing development.

D. *Stop Work Order* means an order issued by the Building Inspector or City Engineer which requires that all construction activity on the site be stopped.

2.3 APPLICABLITIY

2.2.1 This program applies to residential construction sites with land disturbing activity totaling less than one acre and commercial and industrial sites that disturb less than 0.5 acres. Residential sites with one or more acres of land disturbing activity, or commercial and industrial sites with 0.5 acres or more of land disturbing activity are regulated under the City of Baraboo's Stormwater Management Permitting Program.

2.4 LIMITATIONS

This document only includes references and suggestions related to other potential permits or approvals which may be necessary for the development of a property. It is the responsibility of the landowner to ensure all necessary federal, state, and local permits and approvals are obtained prior to the start of construction

CHAPTER 3 - ADMINISTRATIVE

3.1 GENERAL

3.1.1 Administrative Duties

A. Keep an accurate record of all plan data received, plans approved, permits issued, inspections made and other official actions.

B. Review all plans and permit applications received when accompanied with the necessary information and the appropriate fee and issue the permits.

C. Investigate all complaints made related to erosion control.

1. Complaints received by the City shall be forwarded to the permitting office to be documented by the inspector.
2. The inspector assigned to the case shall perform a site inspection within 24 hours of logging the complaint.
3. If deficiencies in a planned sediment control BMP is found, the permittee shall be given 24 hours to correct.
4. If the overall site control appears to be inadequate, the permittee shall submit a plan amendment.

D. Perform required site inspections and enforcement duties.

3.2 PERMITTING REQUIREMENTS, PROCEDURES AND FEES

3.2.1 Review and Approval of Permit Application. The following approval procedure shall be used:

A. Within 10 business days of the receipt of a complete permit application, as required, the Public Works Department shall inform the applicant whether the application and plan are approved or disapproved based on the requirements of this ordinance.

B. If the permit application and plan are approved, the Public Works Department shall issue the permit.

C. If the permit application or plan is disapproved, the Public Works Department shall state in writing the reasons for disapproval.

D. The Public Works Department may request additional information from the applicant. If additional information is submitted, the Public Works Department shall have 10 business days from the date the additional information is received to inform the applicant that the plan is either approved or disapproved.

E. Failure by the Public Works Department to inform the permit applicant of a decision within 10 business days of a required submittal shall be deemed to mean approval of the submittal and the applicant may proceed as if a permit had been issued.

3.2.2 Review Considerations. Site plan review will be completed, taking into consideration the following standards with regard to water quality protection and stormwater management:

- General site design will include appropriate stormwater drainage system details and calculations.
- Planned construction operations will include adequate Best Management Practices (BMPs) and Sediment and Erosion Control Measures to reduce water quality impacts.
- Planned BMPs must be designed to the current technical standards found on the DNR website at https://dnr.wisconsin.gov/topic/Stormwater/standards/const_standards.html
- When possible BMPs should promote on-site infiltration of stormwater runoff from impervious surfaces.
- For sites located in areas subject to Total Maximum Daily Load (TMDL) requirements, BMPs will be selected and prioritized to address the pollutant identified as the cause of the impairment.
- When possible, low impact designs (LID) and/or Green Infrastructure (GI) should be included in site design. If LID/GI are not included in the site plan, the plan reviewer will require that the applicant review opportunities for the use of LID/GI.

3.2.3 Permit Requirements

A. Notify the Public Works Department within 48 hours of commencing any land disturbing construction activity.

B. Notify the Public Works Department within 72 hours of the completion of any BMPs.

C. Obtain permission in writing from the Public Works Department prior to any modification of the erosion and sediment control plan.

D. Install all BMPs as identified in the approved erosion and sediment control plan.

E. Maintain all road drainage systems, stormwater drainage systems, BMPs and other facilities identified in the erosion and sediment control plan.

F. Repair any erosion damage to adjoining surfaces and drainage ways resulting from land disturbing construction activities.

G. Inspect the BMPs within 24 hours after each rain of 0.5 inches or more which results in runoff during active construction periods and at least once each week. Make any necessary repairs.

H. Allow the Public Works Department to enter the site for the purpose of inspecting compliance with the erosion and sediment control plan or for performing any work necessary to bring the site into compliance with the control plan. Keep a copy of the erosion and sediment control plan at the construction site.

3.2.4 Permit Conditions. Permits issued under this section may include conditions established by Public Works Department.

3.2.5 Duration. The duration of permits issued under this section shall be valid for a period of 180 days, the length of the building permit or other construction authorizations, whichever is longer. The Building Inspector or City Engineer may extend the period one or more times for up to an additional 180 days. The Building Inspector or City Engineer may require additional BMPs as a condition of the extension if they are necessary to meet the requirements of the ordinance.

3.2.6 Permit Transfers

A. When a permittee and landowner act to transfer an interest in property subject to an approved plan prior to completion of the proposed steps to attain soil stabilization, the permittee must secure approval from the City of Baraboo.

B. When a permittee and landowner transfer ownership, possession or control of real estate subject to an uncompleted erosion control pan, the successor in interest to any portion of the real estate shall be responsible to control soil erosion and runoff and shall comply with the minimum standards provided in this document.

C. When ownership, possession or control of property subject to an uncompleted erosion control plan is transferred, the former owner (seller) shall notify the new owner (buyer) as to the current status of compliance with notice to the City of Baraboo, and provide a copy of the erosion control plan or stormwater management plan, or both.

D. Transfers of interest in real estate subject to an approved, uncompleted plan may be conducted consistent with this document under any or the following arrangements:

1. The transferee shall file a new, approved erosion control or stormwater management plan, or both, with the City of Baraboo;
2. The transferee shall obtain an approved assignment from the City of Baraboo as sub-permittee to complete that portion of the approved plan regulating soil erosion and runoff on the transferee's property;
3. The permittee shall provide the City of Baraboo with a duly completed and executed continuing surety bond or certified check in an amount sufficient to complete the work proposed in the approved plan; at the time of transfer the permittee may seek to reduce the surety bond or certified check to the appropriate amount to complete remaining work. If the transferor enters into escrow agreements with the transferees to complete an approved plan, these funds shall be available to the City of Baraboo to attain plan compliance. When an approved erosion control plan and, if required, a stormwater management plan is or are not completed as proposed, the City of Baraboo may use the surety bond to complete remaining work to achieve plan compliance.

3.2.7 Permit Variances. Variances under this program shall be administered as set forth in Chapter 14.31 of the City Code.

3.3 EROSION AND SEDIMENT CONTROL PLAN AND AMENDMENTS

3.3.1 Erosion and Sediment Control Plan

A. The erosion and sediment control plan shall be designed to meet the performance standards of SPS 360.20.

B. The plan requirements of this subsection must meet the erosion control plan submittal requirements of s. NR 216.46 (4) and (5), and SPS 360.13 (1), Wis. Adm. Code, and be prepared in accordance with good engineering practices and design criteria, standards and specifications approved by the WDNR.

C. Any land disturbing activity regardless of size that, in the opinion of the City of Baraboo Public Works Department, has the potential to result in runoff that exceeds the safe capacity of the existing drainage facilities or receiving body of water, that causes undue channel erosion, that increases water pollution by scouring or the transportation of particulate matter or that endangers property or public safety, shall be required to submit a full erosion and sediment control plan.

D. Any land disturbing activity regardless of size that requires the stabilization of slopes in excess of 12% shall be required to submit a full erosion and sediment control plan.

3.3.2 Simplified Erosion and Sediment Control Plan

A. For each construction site with land disturbing construction activities of less than 10,000 square feet, a simplified erosion and sediment control plan shall be prepared as described below. This simplified plan shall be submitted to the Building Inspection Division of Public Works Department.

B. The simplified erosion and sediment control plan shall be designed to meet the performance standards of SPS 360.20.

C. The simplified erosion and sediment control plan must consist of the following at a minimum:

1. A brief narrative description of the construction site.
2. Limits of disturbed area.
3. Limits of existing and proposed impervious area.
4. Location of all erosion control measures to be installed, including a dewatering plan as needed.
5. Existing and proposed culvert sizes.
6. Topographical features and the existing and proposed direction of flow of runoff.
7. Time schedules for stabilization of ditches and slopes.
8. Existing and proposed stormwater discharge point locations.

D. The use of the form in Appendix A is intended to help ensure these requirements are met.

3.3.3 Amendments

The applicant shall amend the Erosion and Sediment Control Plan if any of the following occur:

A. There is a change in design, construction, operation or maintenance at the site which has the reasonable potential for the discharge of pollutants to waters of the state and which has not otherwise been addressed in the Erosion and Sediment Control Plan.

B. The actions required by the Erosion and Sediment Control Plan fail to reduce the impacts of pollutants carried by construction site runoff.

C. The Building Inspector or City Engineer notifies the applicant of changes needed in the Erosion and Sediment Control Plan.

3.4 INSPECTIONS

3.4.1 Soil erosion inspections shall be made by the Building Inspector concurrently will all building inspections, but at least once within the first two weeks of land disturbing activity and at least once every 45 days after that. Inactive sites shall be inspected at least once every 60 days. If a violation is found, re-inspection or other correction verification is required within seven (7) days from notice of violation. The final occupancy inspection shall include confirmation of site stabilization and evidence that permanent storm water management practices are in place.

3.4.2 Preparation shall include review of the approved erosion control plan for the project prior to inspection.

3.4.3 The Inspector shall verify that all measures are installed and maintained in accordance with the plans and best management practices. Failure to do so constitutes a code violation and shall be ordered to be remedied within a given time frame depending on the severity of the violation, usually within 24 hours. Further observations shall include, but are not limited to, effectiveness of erosion and sediment control practices or evidence to the contrary. Signs of control measure failure may be; soil deposits outside of barriers, rilling, or other signs of water movement on unprotected site boundaries.

3.4.4 All findings are recorded by the Inspector and entered into software for permit and inspection record keeping. The recorded findings are to be provided to the owner or responsible party as an integral part of the inspection report.

3.4.5 All inspection reports must include the date, address, property owner and permit holder information, and results/findings. Inspection findings related to erosion control measures may be included in the comments with additional inspection types, such as foundation, roughs, etc., or it may be provided as an independent inspection.

3.4.6 If land disturbing construction activities are occurring without a permit required by this ordinance, the Building Inspector or City Engineer may enter the land pursuant to the provisions of §66.0119(1), (2), and (3), Wis. Stats.

3.5 ENFORCEMENT

3.5.1 The City Engineer and Building Inspector have enforcement rights under this Chapter.

3.5.2 Notice of non-compliance shall be furnished to both the permit applicant of record and the owner.

3.5.3 Violation correction times vary by severity and are at the judgement of the inspector. If very severe, a Stop Work Order shall be issued and be in place until compliance is attained. Per City ordinance (CH. 14.30) the Building Inspector or City Engineer may post a stop work order if any land disturbing construction occurs without a permit, the Erosion and Sediment Control Plan is not implemented in good faith, or if the conditions of the permit are not being met. In most cases the responsible party is required to repair or replace failed practices within 48 hours. If an immediate threat to a waterway exists, violation must be addressed immediately.

3.5.4 All enforcement activities shall be regulated under Chapter of the Municipal Code.

3.5.5 All site inspectors shall obtain certification as a Soil Erosion Inspector pursuant to s. SPS 305.63, Wis. Adm. Code. For more information go the following web site: https://dsps.wi.gov/Pages/Professions/SoilErosionInspector/Default.aspx

Appendix A

Standard Erosion Control Plan for 1 & 2 Family Dwelling Construction Sites

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Standard Erosion Control Plan

for 1- & 2-Family Dwelling Construction Sites

According to Chapters Comm 20 & 21 of the Wisconsin Uniform Dwelling Code, soil erosion control information needs to be included on the plot plan which is submitted and approved prior to the issuance of building permits for 1- & 2-family dwelling units in those jurisdictions where the soil erosion control provisions of the Uniform Dwelling Code are enforced. This Standard Erosion Control Plan is provided to assist in meeting this requirement.

Instructions:

1. Complete this plan by filling in requested information, completing the site diagram and marking appropriate boxes on the inside of this form.
2. In completing the site diagram, give consideration to potential erosion that may occur before, during, and after grading. Water runoff patterns can change significantly as a site is reshaped.
3. Submit this plan at the time of building permit application.

PROJECT LOCATION _____

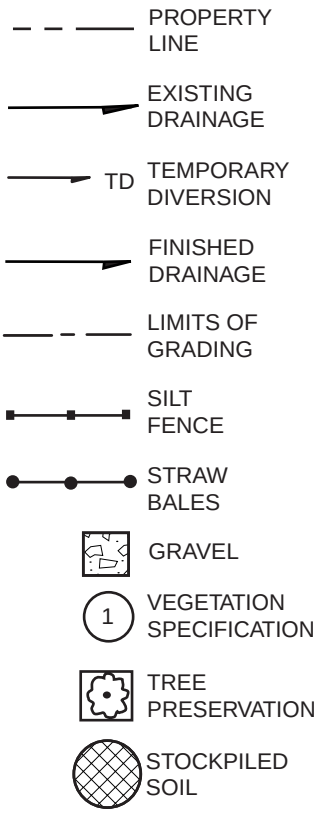
BUILDER _____ OWNER _____

WORKSHEET COMPLETED BY _____ DATE _____

SITE DIAGRAM **Scale: 1 inch = ____feet**

Please indicate north by completing the arrow.

EROSION CONTROL PLAN LEGEND



EROSION CONTROL PLAN CHECKLIST

Check (✔) appropriate boxes below, and complete the site diagram with necessary information.

COMPLETED	NOT APPLICABLE	
		Site Characteristics
❒		North arrow, scale, and site boundary. Indicate and name adjacent streets or roadways.
❒	❒	Location of existing drainageways, streams, rivers, lakes, wetlands or wells.
❒		Location of storm sewer inlets.
❒		Location of existing and proposed buildings and paved areas.
❒		The disturbed area on the lot.
❒		Approximate gradient and direction of slopes before grading operations.
❒		Approximate gradient and direction of slopes after grading operations.
❒	❒	Overland runoff (sheet flow) coming onto the site from adjacent areas.
		Erosion Control Practices
❒	❒	Location of temporary soil storage piles. Note: Soil storage piles should be placed behind a sediment fence, a 10 foot wide vegetative strip, or should be covered with a tarp or more than 25 feet from any downslope road or drainageway.
❒		Location of access drive(s). Note: Access drive should have 2 to 3 inch aggregate stone laid at least 7 feet wide and 6 inches thick. Drives should extend from the roadway 50 feet or to the house foundation (whichever is less).
❒	❒	Location of sediment controls (filter fabric fence, straw bale fence or 10-foot-wide vegetative strip) that will prevent eroded soil from leaving the site.
❒	❒	Location of sediment barriers around on-site storm sewer inlets.
❒	❒	Location of diversions. Note: Although not specifically required by code, it is recommended that concentrated flow (drainageways) be diverted (re-directed) around disturbed areas. Overland runoff (sheet flow)from adjacent areas greater than 10,000 sq. ft. should also be diverted around disturbed areas.
❒	❒	Location of practices that will be applied to control erosion on steep slopes (greater than 12% grade). Note: Such practices include maintaining existing vegetation, placement of additional sediment fences, diversions, and re-vegetation by sodding or seeding with use of erosion control mats.
❒	❒	Location of practices that will control erosion on areas of concentrated runoff flow. Note: Unstabilized drainageways, ditches, diversions, and inlets should be protected from erosion through use of such practices as in-channel fabric or straw bale barriers, erosion control mats, staked sod, and rock rip-rap. When used, a given in-channel barrier should not receive drainage from more than two acres of unpaved area, or one acre of paved area. In-channel practices should not be installed in perennial streams (streams with year round flow).
❒	❒	Location of other planned practices not already noted.

COMPLETED	NOT APPLICABLE	
		Indicate management strategy by checking (✔) the appropriate box.

Management Strategies

COMPLETED	NOT APPLICABLE	
❒	❒	Temporary stabilization of disturbed areas. Note: It is recommended that disturbed areas and soil piles left inactive for extended periods of time be stabilized by seeding (between April 1 and September 15), or by other cover, such as tarping or mulching.
❒		Permanent stabilization of site by re-vegetation or other means as soon as possible (lawn establishment). • Indicate re-vegetation method: ❒ Seed ❒ Sod ❒ Other _____ • Expected date of permanent re-vegetation: _____ • Re-vegetation responsibility of: ❒ Builder ❒ Owner/Buyer • Is temporary seeding or mulching planned if site is not seeded by Sept. 15 or sodded by Nov. 15? ❒ Yes ❒ No
❒	❒	Use of downspout and/or sump pump outlet extensions. Note: It is recommended that flow from downspouts and sump pump outlets be routed through plastic drainage pipe to stable areas such as established sod or pavement.
❒	❒	Trapping sediment during de-watering operations. Note: Sediment-laden discharge water from pumping operations should be ponded behind a sediment barrier until most of the sediment settles out.
❒		Proper disposal of building material waste so that pollutants and debris are not carried off-site by wind or water.
❒		Maintenance of erosion control practices. • Sediment will be removed from behind sediment fences and barriers before it reaches a depth that is equal to half the height o f the barrier. • Breaks and gaps in sediment fences and barriers will be repaired immediately. Decomposing straw bales will be replaced (typical bale life is three months). • All sediment that moves off-site due to construction activity will be cleaned up before the end of the same workday. • All sediment that moves off-site due to storm events will be cleaned up before the end of the next workday. • Access drives will be maintained throughout construction. • All installed erosion control practices will be maintained until the disturbed areas they protect are stabilized.

EROSION CONTROL REGULATIONS

Erosion control and stormwater regulations can be complex. Local, state and, in some cases, federal regulations may apply. Before construction make sure you have the appropriate permits.

LOCAL ORDINANCES

Check with your county, city, village, or town for any local erosion control ordinances including shoreland zoning requirements. Except for new 1- & 2-family dwellings, local ordinances may be more strict than state regulations. They may also require erosion control on construction projects not affected by state or federal regulations.

UNIFORM DWELLING CODE (DEPT. OF COMMERCE)

CONTROLS REQUIRED

- Silt fences, straw bales, or other approved perimeter measures along downslope sides and side slopes.
- Access drive.
- Straw bales, filter fabric fences or other barriers to protect on-site sewer inlets.
- Additional controls if needed for steep slopes or other special conditions.

FOR MORE INFORMATION, CONTACT:

- Local building inspector
- Department of Commerce, Safety and Buildings Division, P.O. Box 7970, Madison, Wis. 53707-7970, (608) 267-5113.

STORMWATER PERMIT (DEPT. OF NATURAL RESOURCES)

CONTROLS REQUIRED

- Erosion control measures specified in the *Wisconsin Construction Site Best Management Practice Handbook*.
- Measures to control storm water after construction.

FOR MORE INFORMATION, CONTACT

- Department of Natural Resources, Storm Water Permits, P.O. 7921, Madison, WI 53707-7921, (608) 267-7694.

For more assistance on plan preparation, refer to the Wisconsin Uniform Dwelling Code, the DNR *Wisconsin Construction Site Best Management Handbook,* and UW–Extension publication *Erosion Control for Home Builders*. The *Wisconsin Uniform Dwelling Code* and the *Wisconsin Construction Site Best Management Handbook* are available through the State of Wisconsin Document Sales, (608) 266-3358.

Erosion Control for Home Builders (GWQ001) can be ordered through Extension Publications, (608) 262-3346 or the Department of Commerce, (608) 267-4405. A PDF version of *Erosion Control for Home Builders* (GWQ001) and *Standard Erosion Control Plan* are also available at http://clean-water.uwex.edu/pubs/sheets

This publication is available from county UW-Extension offices or from Extension Publications, 45 N. Charter St., Madison, WI 53715. (608) 262-3346 or toll-free (877) 947-7827. A publication of the University of Wisconsin–Extension in cooperation with the Wisconsin Department of Natural Resources and the Wisconsin Department of Commerce.

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GWQ001A Standard Erosion Control Plan for 1 & 2 Family Dwelling Construction Sites

DNR WT-458-96 R-03-02-2M-10-S Editing and design by the Environmental Resources Center, University of Wisconsin–Extension.

Printed on recycled paper

Appendix B

Erosion Control for Home Builders

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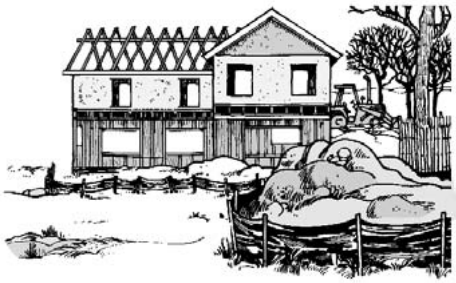


Erosion Control for Home Builders

By controlling erosion, home builders help keep our lakes and streams clean.

Eroding construction sites are a leading cause of water quality problems in Wisconsin. For every acre under construction, about a dump truck and a half of soil washes into a nearby lake or stream unless the builder uses erosion controls. Problems caused by this sediment include:

Taxes
Cleaning up sediment in streets, sewers and ditches adds extra costs to local government budgets.

Lower property values
Neighboring property values are damaged when a lake or stream fills with sediment. Shallow areas encourage weed growth and create boating hazards.

Poor fishing
Muddy water drives away fish like northern pike that rely on sight to feed. As it settles, sediment smothers gravel beds where fish like smallmouth bass find food and lay their eggs. Soil particles in suspension can act like a sand blaster during a storm and damage fish gills.

Nuisance growth of weeds and algae
Sediment carries fertilizers that fuel algae and weed growth.

Dredging
The expense of dredging sediment from lakes, harbors and navigation channels is paid for by taxpayers.

This fact sheet includes the diagrams and step-by-step instructions needed by builders on most home sites. Additional controls may be needed for sites that have steep slopes, are adjacent to lakes and streams, receive a lot of runoff from adjacent land, or are larger than an acre.

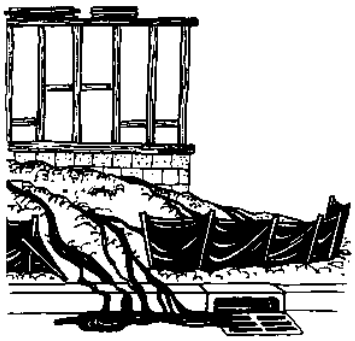
If you need help developing an erosion control plan or training your staff, contact your local building inspection, zoning or erosion control office.

Controlling Erosion is Easy

Erosion control is important even for home sites of an acre or less. The materials needed are easy to find and relatively inexpensive – straw bales or silt fence, stakes, gravel, plastic tubes, and grass seed. Putting these materials to use is a straightforward process. Only a few controls are needed on most sites:

- Preserving existing trees and grass where possible to prevent erosion;
- Revegetating the site as soon as possible;
- Silt fence or straw bales to trap sediment on the downslope sides of the lot;
- Placing soil piles away from any roads or waterways;
- Diversions on upslope side and around stockpilkes;
- Stone/rock access drive used by all vehicles to limit tracking of mud onto streets;
- Cleanup of sediment carried off-site by vehicles or storms; and
- Downspout extenders to prevent erosion from roof runoff.

GWQ001 Erosion Control for Home Builders. Additional copies are available from Cooperative Extension Publications, 45 N. Charter St., Madison, WI 53715, 608/262-3346 (toll-free 877-947-7827) or Dept. of Commerce, P.O. Box 2509, Madison, WI 53701-2509, 608/267-4405.



A poorly installed silt fence will not prevent soil erosion. Fabric must be buried in a trench and sections must overlap (see diagram on back of this fact sheet).

WARNING! Extra measures may be needed if your site:

- is within 300 feet of a stream or wetland;
- is within 1000 feet of a lake;
- is steep (slopes of 12% or more);
- receives runoff from 10,000 sq. ft. or more of adjacent land;
- has more than an acre of disturbed ground.

For information on appropriate measures for these sites, contact your local building inspection, zoning or erosion control office.

Straw Bale or Silt Fence

- Install within 24 hours of land disturbance.
- Install on downslope sides of site parallel to contour of the land.
- Extended ends upslope enough to allow water to pond behind fence.
- Bury eight inches of fabric in trench (see back page).
- Stake (two stakes per bale).
- Leave no gaps. Stuff straw between bales, overlap sections of silt fence, or twist ends of silt fence together.
- Inspect and repair once a week and after every ½-inch rain. Remove sediment if deposits reach half the fence height. Replace bales after three months.
- Maintain until a lawn is established.

Soil Piles

- Cover with plastic and locate away from any downslope street, driveway, stream, lake, wetland, ditch or drainageway.
- Temporary seed such as annual rye or winter wheat is recommended for topsoil piles.

Access Drive

- Install an access drive using two-to-three-inch aggregate prior to placing the first floor decking on foundation.
- Lay stone six inches deep and at least seven feet wide from the foundation to the street (or 50 feet if less).
- Use to prevent tracking mud onto the road by all vehicles.
- Maintain throughout construction.
- In clay soils, use of geotextile under the stone is recommended.

Sediment Cleanup

- By the end of each work day, sweep or scrape up soil tracked onto the road.
- By the end of the next work day after a storm, clean up soil washed off-site.

Sewer Inlet Protection

- Protect on-site storm sewer inlets with straw bales, silt fences or equivalent measures.
- Inspect, repair and remove sediment deposits after every storm.

Downspout Extenders

- Not required, but highly recommended.
- Install as soon as gutters and downspouts are completed to prevent erosion from roof runoff.
- Use plastic drainage pipe to route water to a grassed or paved area. Once a lawn is established, direct runoff to the lawn or other pervious areas.
- Maintain until a lawn is established.

Preserving Existing Vegetation

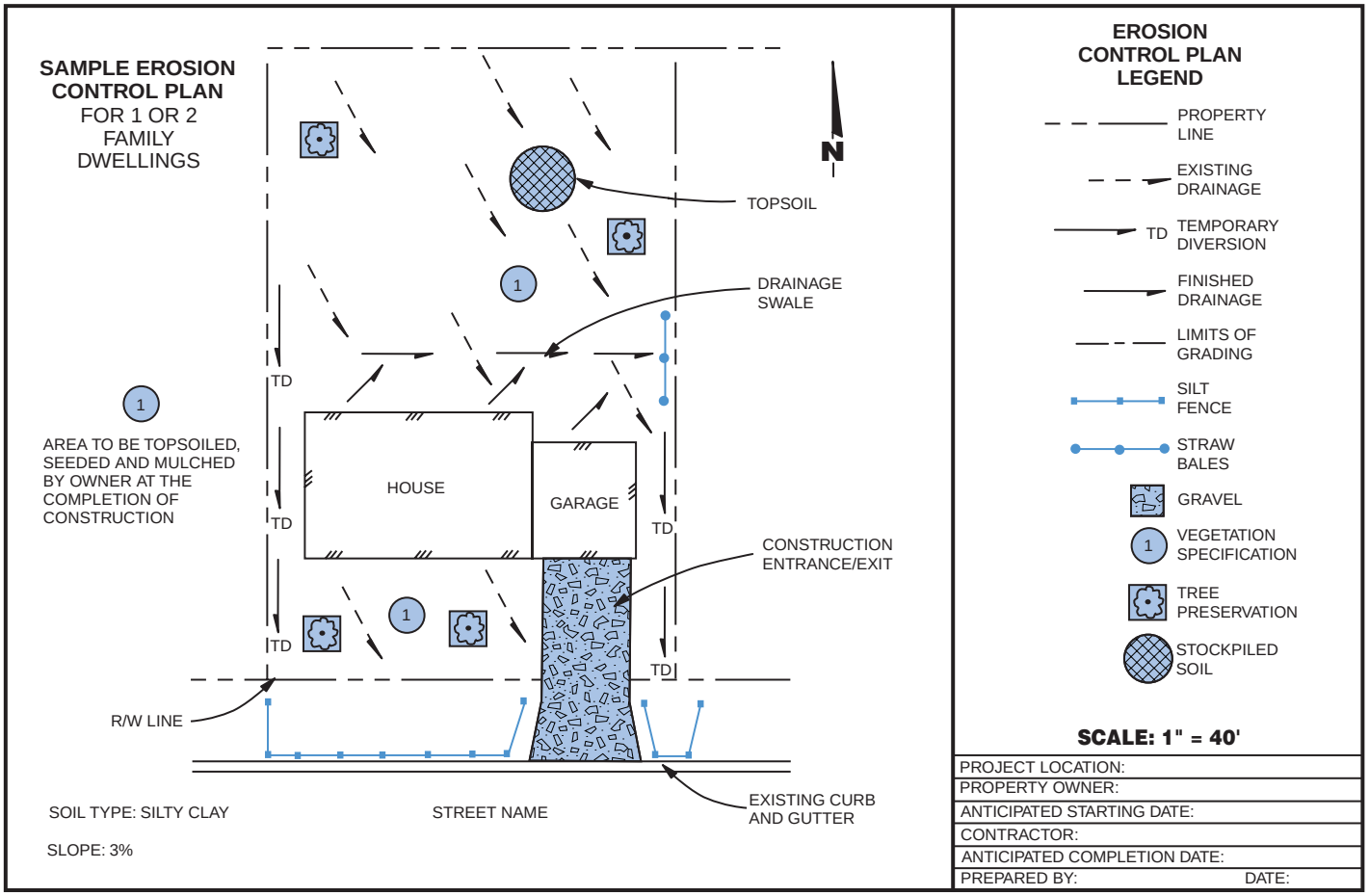
- Wherever possible, preserve existing trees, shrubs, and other vegetation.
- To prevent root damage, do not grade, place soil piles, or park vehicles near trees marked for preservation.
- Place plastic mesh or snow fence barriers around trees to protect the root area below their branches.

Revegetation

- Seed, sod or mulch bare soil as soon as possible. Vegetation is the most effective way to control erosion.

Seeding and Mulching

- Spread four to six inches of topsoil.
- Fertilize and lime if needed according to soil test (or apply 10 lb./1000 sq. ft. of 10-10-10 fertilizer).
- Seed with an appropriate mix for the site (see table).
- Rake lightly to cover seed with 1⁄4" of soil. Roll lightly.
- Mulch with straw (70-90 lb. or one bale per 1000 sq. ft.).
- Anchor mulch by punching into the soil, watering, or by using netting or other measures on steep slopes.
- Water gently every day or two to keep soil moist. Less watering is needed once grass is two inches tall.



Sodding

- Spread four to six inches of topsoil.
- Fertilize and lime if needed according to soil test (or apply 10 lb./1000 sq. ft. of 10-10-10 fertilizer).
- Lightly water the soil.
- Lay sod. Tamp or roll lightly.
- On slopes, lay sod starting at the bottom and work toward the top. Laying in a brickwork pattern. Peg each piece down in several places.
- Initial watering should wet soil six inches deep (or until water stands one inch deep in a straight-sided container). Then water lightly every day or two to keep soil moist but not saturated for two weeks.
- Generally, the best times to sod and seed are early fall (Aug. 15-Sept. 15) or spring (May). If construction is completed after September 15, final seeding should be delayed. Sod may be laid until November 1. Temporary seed (such as rye or winter wheat) may be planted until October 15. Mulch or matting may be applied after October 15, if weather permits. Straw bale or silt fences must be maintained until final seeding or sodding is completed in spring (by June 1).

Concrete Wash Water

- Dispose of concrete wash water in an area of soil away from surface waters where soil can act as a filter or evaporate the water. Dispose of remaining cement. Be aware that this water can kill vegetation.

De-Watering

- Dispose of de-watering water in a pervious area. Prevent the discharge of sediment from de-watering operations into storm sewers and surface waters.

Material Storage

- Manage chemicals, materials and other compounds to avoid contamination of runoff.

Typical Lawn Seed Mixtures

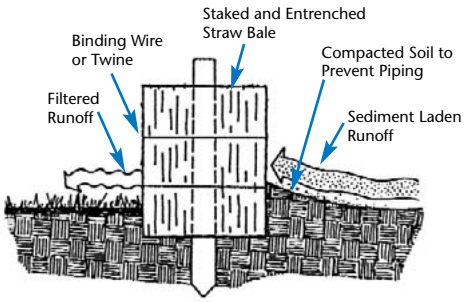
Grass	Percent by Weight: Sunny Site	Percent by Weight: Shady Site
Kentucky bluegrass	65%	15%
Fine fescue	20%	70%
Perennial ryegrass	15%	15%
Seeding rate (lb./1000 sq. ft.)	3-4	4-5

Source: R.C. Newman, Lawn Establishment, UW-Extension, 1988.

COMMONLY USED EROSION CONTROLS

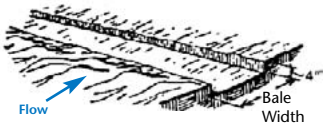
Straw Bale Fences

Cross Section of Straw Bale Installation



Source: Michigan Soil Erosion and Sedimentation Control Guidebook, 1975.

How to Install a Straw Bale Fence



1. Excavate a 4" deep trench.

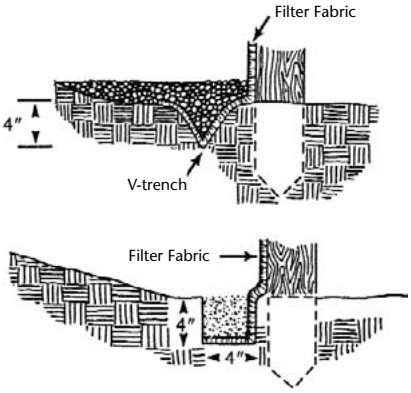
2. Place bales in trench with bindings around sides away from the ground. Leave no gaps between bales.

3. Anchor bales using two steel rebars or 2" x 2" wood stakes per bale. Drive stakes into the ground at least 8".

4. Backfill and compact the excavated soil.

Silt Fences

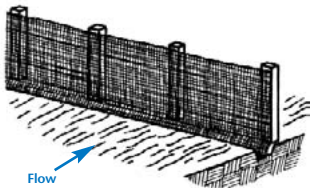
Cross Sections of Trenches for Silt Fences



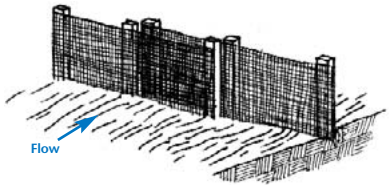
Sources: North Carolina Erosion and Sediment Control Planning and Design Manual, 1988.

How to Install a Silt Fence

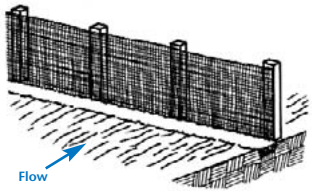
1. Excavate a 4" x 4" trench along the contour.



2. Stake the silt fence on downslope side of trench. Extended 8" of fabric into the trench.



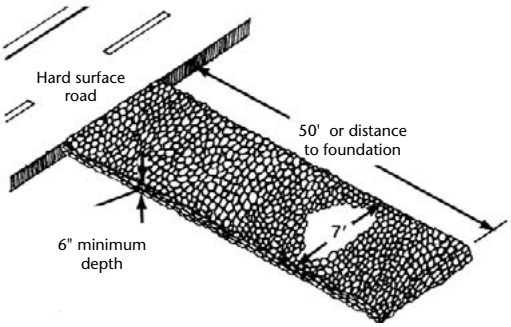
3. When joints are necessary, overlap ends for the distance between two stakes.



4. Backfill and compact the excavated soil.

Access Drive

How to Install an Access Drive



1. Install as soon as possible after start of grading.
2. Use two-to-three-inch aggregate stone.
3. Drive must be at least seven feet wide and 50 feet long or the distance to the foundation, whichever is less.
4. Replace as needed to maintain six-inch depth.

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DNR WT-457-96

R-1-00-10M-25-S

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Appendix C

Chapter 14, Subchapter II: Construction Site Erosion Control Code

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requirements for corner lots in Ch.17 of this Code.)

(b) Any person building a fence on the property of another person shall move said fence to its correct location within 30 days after discovery of the encroachment.

(c) Any fence constructed shall be constructed a minimum of 4 inches from the property line on the property of the person constructing the fence. No barbed wire fencing shall be permitted in any residential district. A sketch showing the type of fence, location of corners and the spacing of posts shall be submitted to the Building Inspector along with the building permit application.

(d) Maximum spacing of posts shall be 12 feet. Posts shall be of a durable material and shall be adequately anchored in the ground in accordance with good building practices. Wood posts shall be treated.

(e) In agricultural districts, a proper fence may be constructed on the property line providing all adjoining parties agree to said fence and said fence is constructed in accordance with State law.

(f) Temporary fences may be erected in various places if properly maintained. Such fences include snow protection fences, fences protecting construction and fences temporarily protecting hazardous locations.

(g) Security fences are permitted on property lines in all districts, except residential districts, but shall not exceed 10 feet in height and shall be of an open type similar to woven wire or wrought iron fencing. (2300 04/14/2009)

(h) The smooth-finished side of the fence must face neighboring properties or public rights-of-way, rather than the fenced property. All structural members are to be on the interior side of the fence, facing the property of the fence owner. (2454 01/24/2017)

14.19 <u>UNSAFE BUILDINGS</u>. Whenever the Building Inspector finds any building or part thereof within the City to be, in his judgment, so old, dilapidated or so out of repair as to be dangerous, unsafe, unsanitary or otherwise unfit for human habitation, occupancy or use, and so that it would be unreasonable to repair the same, he shall order the owner to raze and remove it at the owner's option. Such order and proceedings shall be carried out in the manner prescribed for the razing of buildings in §66.05, Wis. Stats. Where the public safety requires immediate action, the Building Inspector shall enter upon the premises with such assistance as may be necessary, and cause the building or structure to be made safe or to be removed, and the expenses of such work may be recovered by the City in an action against the owner or tenant.

14.20 <u>MOVING BUILDINGS</u>. See Ch. 8 of this Code.

14.21 <u>DISCLAIMER ON INSPECTIONS</u>. The purpose of the inspections under this code is to improve the quality of housing in the City. The inspections and the reports and findings issued after the inspections are not intended as, nor are they to be construed, as a guarantee. In order to so advise owners and other interested persons, a disclaimer shall be included in each inspection report as follows: "The findings of inspection contained herein are intended to report conditions of noncompliance with code standards that are readily apparent at the time of inspection. The inspection does not involve a detailed examination of the mechanical systems or the closed premises. No warranty of the operation, use or durability of equipment and materials not specifically cited herein is expressed or implied."

14.22 <u>VIOLATIONS AND PENALTY</u>.

(1) FORFEITURE ACTION. Any person who violates, disobeys, neglects, omits or refuses to comply with, or who resists the enforcement of any of the provisions of this chapter shall be subject to a penalty as provided in §25.04 of this Code. The Building Inspector shall promptly report all such violations to a police officer, and a police officer shall issue a citation to the violator. Every day a violation occurs shall constitute a separate offense.

(2) ACTION TO ABATE. Any building or structure hereafter erected, enlarged, altered, repaired or moved, or any use hereafter established, in violation of the provisions of this chapter shall be deemed an unlawful building, structure or use. The Building Inspector shall promptly report all such violations to the City Attorney, who shall bring an action to enjoin the erection, enlargement, alteration, repair or moving of such building or structure of the establishment of such use, or to cause such building, structure or use to be removed and may also be subject to a penalty as provided in §25.04 of this Code. In any such action, the fact that a permit was issued shall not constitute a defense. Compliance with the provisions of this chapter may also be enforced by injunctional order at the suit of the owner or owners of any real estate within the jurisdiction of this chapter.

SUBCHAPTER II: CONSTRUCTION SITE EROSION CONTROL CODE (1626 10/08/91, 2281 05/27/08, 2432 09/08/15)

14.23 <u>AUTHORITY</u>.

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(1) This ordinance is adopted under the authority granted by §62.234, Wis. Stats. This ordinance supersedes all provisions of an ordinance previously enacted under §62.23, Wis. Stats., that relate to construction site erosion control. Except as otherwise specified in §62.234 Wis. Stats., §62.23, Wis. Stats., applies to this ordinance and to any amendments to this ordinance.

(2) The provisions of this ordinance are deemed not to limit any other lawful regulatory powers of the same governing body.

(3) The Common Council hereby designates the Building Inspector or City Engineer to administer and enforce the provisions of this ordinance.

(4) The requirements of this ordinance do not pre-empt more stringent erosion and sediment control requirements that may be imposed by any of the following:

(a) Wisconsin Department of Natural Resources administrative rules, permits or approvals including those authorized under §§281.16 and 283.33, Wis. Stats.

(b) Targeted non-agricultural performance standards promulgated in rules by the Wisconsin Department of Natural Resources under §NR 151.004, Wis. Adm. Code.

14.23.1 <u>FINDINGS OF FACT</u>. The Common Council finds that runoff from land disturbing construction activity carries a significant amount of sediment and other pollutants to the waters of the state in City of Baraboo.

14.23.2 <u>PURPOSE</u>. It is the purpose of this ordinance to maintain safe and healthful conditions; prevent and control water pollution; prevent and control soil erosion and sediment discharge; protect spawning grounds, fish and aquatic life; control building sites, placement of structures and land uses; preserve ground cover and scenic beauty; and promote sound economic growth by minimizing the amount of sediment and other pollutants carried by runoff or discharged from land disturbing construction activity to waters of the state in the City of Baraboo.

14.23.3 <u>APPLICABILITY AND JURISDICTION</u>.

(1) APPLICABILITY.

(a) Except as provided under Sub. (b), this ordinance applied to any construction site as defined under Sec. 14.24 (6):

(b) This ordinance does not apply to the following:

1. Transportation facilities, except transportation facility construction projects that are part of a larger common plan of development such as local roads with a residential or industrial development.

2. A construction project that is exempted by federal statutes or regulations from the requirement to have a national pollutant discharge elimination system permit issued under Ch. 40, Code of Federal Regulations, part 122, for land disturbing construction activity.

3. Nonpoint discharges from agricultural facilities and practices.

4. Nonpoint discharges from silviculture activities.

5. Routine maintenance for project sites under 5 acres of land disturbance if performed to maintain the original line and grade, hydraulic capacity or original purpose of the facility.

(b) Notwithstanding the applicability requirements in paragraph (a), this ordinance applies to construction sites of any size that, as determined by the Building Inspector or City Engineer, are likely to result in runoff that exceeds the safe capacity of the existing drainage facilities or receiving body of water, that causes undue channel erosion, or that increases water pollution by scouring or the transportation of particulates.

(2) JURISDICTION. This ordinance applies to land disturbing construction activities on lands within the boundaries and jurisdiction of the City of Baraboo, as well as the extraterritorial division of land subject to an ordinance enacted pursuant to §§236.45(2) and (3), Wis. Stats.

(3) EXCLUSIONS. This ordinance is not applicable to activities conducted by a state agency, as defined under §227.01 (1), Wis. Stats.

14.24 <u>DEFINITIONS</u>

(1) AGRICULTURAL FACILITIES AND

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PRACTICES has the meaning in §281.16(1), Wis. Stats.

(2) BEST MANAGEMENT PRACTICE or BMP means structural or non-structural measures, practices, techniques or devices employed to avoid or minimize soil, sediment or pollutants carried in runoff to waters of the state. The management of peak flow through the use of control structures is considered to be part of the definition of a BMP since higher peak flows accelerate downstream erosion as well as transporting sediment pollutants generated on site.

(3) BUSINESS DAY means a day the office of the Building Inspector or City Engineer is routinely and customarily open for business.

(4) CEASE AND DESIST ORDER means a court-issued order to halt land disturbing construction activity that is being conducted without the required permit or in violation of a permit issued by the City of Baraboo.

(5) CONSTRUCTION SITE means an area upon which one or more land disturbing construction activities occur, including areas that are part of a larger common plan of development or sale where multiple separate and distinct land disturbing construction activities may be taking place at different times on different schedules but under one plan. A long-range planning document that describes separate construction projects, such as a 20-year transportation improvement plan, is not a common plan of development.

(6) DIVISION OF LAND means the creation from one parcel of one or more parcels or building sites, regardless of size, where such creation occurs at one time or through successive partition within a 5-year period.

(7) EROSION means the process by which the land's surface is worn away by the action of wind, water, ice or gravity.

(8) EROSION AND SEDIMENT CONTROL PLAN means a comprehensive plan developed to address pollution caused by erosion and sedimentation of soil particles or rock fragments during construction.

(9) EXTRATERRITORIAL means the unincorporated area within 3 miles of the corporate limits of a first, second, or third class city, or within 1.5 miles of a fourth class city or village.

(10) FINAL STABILIZATION means that all land disturbing construction activities at the construction site have been completed and that a uniform perennial vegetative cover has been established, with a density of at least 70 percent of the cover, for the unpaved areas and areas not covered by permanent structures, or that employ equivalent permanent stabilization measures.

(11) GOVERNING BODY means town board of supervisors, county board of supervisors, Common Council, village board of trustees or village council.

(12) LAND DISTURBING CONSTRUCTION ACTIVITY means any man-made alteration of the land surface resulting in a change in the topography or existing vegetative or non-vegetative soil cover, that may result in runoff and lead to an increase in soil erosion and movement of sediment into waters of the state. Land disturbing construction activity includes clearing and grubbing, demolition, excavating, pit trench dewatering, filling and grading activities.

(13) LANDOWNER means any person holding fee title, an easement or other interest in property, which allows the person to undertake cropping, livestock management, land disturbing construction activity or maintenance of storm water BMPs on the property.

(14) MEP or MAXIMUM EXTENT PRACTICABLE means a level of performance that is achievable but is not equivalent to a performance standard identified in this ordinance as determined in accordance with Sec. 14.27 of this ordinance.

(15) NOTICE OF INTENT means a written letter mailed or served from the City to the Responsible Party, after issuance of a stop work order, informing the Responsible Party of the City's intent to perform work necessary to comply with this ordinance.

(16) PERFORMANCE STANDARD means a narrative or measurable number specifying the minimum acceptable outcome for a facility or practice.

(17) PERMIT means a written authorization made by the Building Inspector or City Engineer to the applicant to conduct land disturbing construction activity or to discharge post-construction runoff to waters of the state.

(18) POLLUTANT has the meaning given in §283.01 (13), Wis. Stats.

(19) POLLUTION has the meaning given in §281.01

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(10), Wis. Stats.

(20) RESPONSIBLE PARTY means the landowner or other entity performing services to meet the requirements of this ordinance through a contract or other agreement.

(21) RUNOFF means storm water or precipitation including rain, snow or ice melt or similar water that moves on the land surface via sheet or channelized flow.

(22) SEDIMENT means settleable solid material that is transported by runoff, suspended within runoff or deposited by runoff away from its original location.

(23) SILVICULTURE ACTIVITY means activities including tree nursery operations, tree harvesting operations, reforestation, tree thinning, prescribed burning, and pet and fire control. Clearing and grubbing of an area of a construction site is not a silviculture activity.

(24) SITE means the entire area included in the legal description of the land on which the land disturbing construction activity is proposed in the permit application.

(25) STOP WORK ORDER means an order issued by the Building Inspector or City Engineer which requires that all construction activity on the site be stopped.

(26) TECHNICAL STANDARD means a document that specifies design, predicted performance and operation and maintenance specifications for a material, device or method.

(27) TRANSPORTATION FACILITY means a highway, a railroad, a public mass transit facility, a public-use airport, a public trail or any other public work for transportation purposes such has harbor improvements under §85-095(1)(b), Wis. Stats. Transportation Facility does not include building sites for the construction of public buildings and buildings that are places of employment that are regulated by the Department pursuant to §281.33, Wis. Stats.

(28) WATERS OF THE STATE includes those portions of Lake Michigan and Lake Superior within the boundaries of this state, and all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, watercourses, drainage systems and other surface water or groundwater, natural or artificial, public or private, within this state or its jurisdiction.

(29) WIS. ADM. CODE means the Wisconsin Administrative Code, published under §35.93, Wis. Stats.

(30) WIS. STATS. Means the Wisconsin Statutes published under §35.18 of the Wisconsin Statutes.

14.25 <u>ADMINISTRATION</u>

(1) City of Baraboo shall establish, administer and enforce an erosion and sediment control (ESC) permitting program for small sites (less than one acre of land disturbing activity) and a stormwater management permitting program for large sites (one acre or more of land disturbing activity). Each program shall require:

(a) The design and implementation of erosion and sediment control practices consistent with Wisconsin Department of Natural Resources approved erosion and sediment control practices;

(b) Compliance with construction site performance standards equivalent to those required by Wis. Admin. Code;

(c) Erosion and sediment control plan requirements for landowners of construction sites equivalent to those required by Wis. Admin. Code; and

(d) Requirements for construction site operators to manage waste at the construction site so as to reduce adverse impacts to waters of the state.

(2) The City of Baraboo shall administer, approve plans and enforce the provisions of this ordinance on public and private lands within the City of Baraboo.

(3) The administration, inspection and enforcement duties for small sites (less than one acre of land disturbing activity) shall be carried out in conformance with the city's erosion and sediment control (ESC) permitting program for small sites. The administration, inspection and enforcement duties for large sites (one acre or more of land disturbing activity) shall be carried out in conformance with the city's stormwater management permitting program.

14.26 <u>INCORPORATION BY REFERENCE</u>

In this ordinance, the following documents are incorporated by reference:

(1) Stormwater Management Permitting Program.

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(2) Erosion and Sediment Control (ESC) Permitting Program for Small Sites.

14.27 PERFORMANCE AND TECHNICAL STANDARDS

(1) All BMPs required to comply with this ordinance shall meet the design criteria, standards and specifications set forth in the stormwater management permitting program.

(2) APPLICABILITY OF MAXIMUM EXTENT PRACTICABLE. Maximum extent practicable applies when a person who is subject to a performance standard of this ordinance demonstrates to the Building Inspector's or City Engineer's satisfaction that a performance standard is not achievable and that a lower level of performance is appropriate. In making the assertion that a performance standard is not achievable and that a level of performance different from the performance standard is the maximum extent practicable, the responsible party shall take into account the best available technology, cost effectiveness, geographic features, and other competing interests such as protection of public safety and welfare, protection of endangered and threatened resources, and preservation of historic properties.

14.28 PERMITTING REQUIREMENTS, PROCEDURES, AND FEES.

(1) PERMIT REQUIRED. No responsible party may commence a land disturbing construction activity subject to this ordinance without receiving prior approval of an Erosion and Sediment Control Plan for the site and a permit from the Building Inspector or City Engineer.

(2) PERMIT APPLICATION AND FEES. A responsible party that will undertake a land disturbing construction activity subject to this ordinance shall submit an application for either an erosion control permit or a stormwater management permit and an Erosion and Sediment Control Plan that meets the requirements in either the erosion and sediment control (ESC) permitting program for small sites or the stormwater management permitting program and shall pay an application fee as set by the Common Council and as shown in the Official Fee Schedule. By submitting an application, the applicant is authorizing the Building Inspector or City Engineer to enter the site to obtain information required for the review of the Erosion and Sediment Control Plan.

(3) PERMIT APPLICATION REVIEW AND APPROVAL. The Building Inspector or City Engineer shall review any permit application that is submitted with an erosion and sediment control plan or statement, and the required fee. The approval procedure is outlined in the erosion and sediment control (ESC) permitting program for small sites or the stormwater management permitting program.

(4) SURETY BOND. As a condition of approval and issuance of the permit, the Building Inspector or City Engineer may require the applicant to deposit a surety bond or irrevocable letter of credit to guarantee a good faith execution of the approved Erosion and Sediment Control Plan and any permit conditions.

(5) PERMIT REQUIREMENTS. All permits issued under this ordinance shall be subject to the conditions detailed in the erosion and sediment control (ESC) permitting program for small sites or the stormwater management permitting program. Holders of permits issued under this ordinance shall be deemed to have accepted these conditions. The public works department may suspend or revoke a permit for violation of a permit condition, following written notification of the responsible party. An action by the public works department to suspend or revoke this permit may be appealed in accordance with 14.31.

(6) PERMIT CONDITIONS. Permits issued under this section may include conditions established by Building Inspector or City Engineer in addition to the requirements set forth in Sub. (5), where needed to assure compliance with the performance standards set forth in the stormwater management permitting program.

(7) PERMIT DURATION. Permits issued under this section shall be valid for a period of 180 days, or the length of the building permit or other construction authorizations, whichever is longer, from the date of issuance. The Building Inspector or City Engineer may extend the period one or more times for up to an additional 180 days. The Building Inspector or City Engineer may require additional BMPs as a condition of the extension if they are necessary to meet the requirements of this ordinance.

(8) MAINTENANCE. The responsible party throughout the duration of the construction

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activities shall maintain all BMPs necessary to meet the requirements of this ordinance until the site has undergone final stabilization.

14.28.1 <u>EROSION AND SEDIMENT CONTROL PLAN, STATEMENT, EXCEPTION, AMENDMENTS, VARIANCES AND FEES</u>.

(1) EROSION AND SEDIMENT CONTROL PLAN STATEMENT. For each construction site required to receive a permit under this ordinance, an Erosion and Sediment Control Plan Statement shall be prepared. This statement shall be submitted to the Building Inspector or City Engineer. The Erosion and Sediment Control Plan Statement shall briefly describe the site, the development schedule, and the BMPs that will be used to meet the requirements of the ordinance.

(3) EROSION AND SEDIMENT CONTROL PLAN REQUIREMENTS.

(a) <u>Preparation and Submission</u>. An Erosion and Sediment Control Plan shall be prepared and submitted to the Building Inspector or City Engineer.

(b) <u>Performance Standards</u>. The erosion and sediment control plan shall be designed to meet the performance standards in the erosion and sediment control (ESC) permitting program for small sites or the stormwater management permitting program and other requirements of this ordinance.

(c) <u>Pollution</u>. The Erosion and Sediment Control Plan shall address pollution caused by soil erosion and sedimentation during construction and up to final stabilization of the site. The Erosion and Sediment Control Plan shall include, at a minimum, all items as required under Wis. Adm. Code § NR 216.46 (4) and all of the following items:

1. The name(s) and address(es) of the owner or developer of the site, and of any consulting firm retained by the applicant, together with the name of the applicant's principal contact at such firm. The application shall also include start and end dates for construction.

2. A description of the intended sequence of major land disturbing construction activities for major portions of the construction site, including stripping and clearing; rough grading; construction of utilities, infrastructure, and buildings; and final grading and landscaping. Sequencing shall identify the expected date on which clearing will begin, the estimated duration of exposure of cleared areas, areas of clearing, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation.

3. Calculations to show compliance with the performance standard of Sec. 14.27.

4. Depth to groundwater, as indicated by Natural Resources Conservation Service soil information where available.

5. Name of the immediate named receiving water from the United States Geological Service 7.5 minute series topographic maps.

(d) <u>Site Map</u>. The Erosion and Sediment Control Plan shall include a site map. This map shall include the following items and shall be at a scale not greater than 100 feet per inch and at a contour interval not to exceed five feet.

1. All items as required under Wis. Adm. Code § NR 216.46 (5).

2. Any identified 100-year flood plains, flood fringes, and floodways shall also be shown.

(e) <u>Controls and Measures</u>. Each Erosion and Sediment Control Plan shall include a description of appropriate control BMP's as required under Wis. Adm. Code NR 216.26 (6).

(f) <u>Velocity Dissipation Devices</u>. The Erosion and Sediment Control Plan shall require that velocity dissipation devices be placed at discharge locations and along the length of any outfall channel, as necessary, to provide a non-erosive flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected.

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(3) EXCEPTION. EROSION AND SEDIMENT CONTROL PLAN STATEMENT.

(a) For each construction site with land disturbing construction activities of less than 10,000 square feet, an erosion and sediment control plan statement shall be prepared as defined in the erosion and sediment control (ESC) permitting program for small sites. This statement shall be submitted to the Building Inspector or City Engineer.

(b) Any land disturbing activity that, in the opinion of the City of Baraboo City Engineer, is likely to result in runoff that exceeds the safe capacity of the existing drainage facilities or receiving body of water, that causes undue channel erosion, that increases water pollution by scouring or the transportation of particulate matter or that endangers property or public safety, shall be required to submit a full plan versus a plan statement.

(4) EROSION AND SEDIMENT CONTROL PLAN AMENDMENTS. Requirements for submission of an amended plan are detailed in both the stormwater management permitting program and erosion and sediment control (ESC) permitting program for small sites.

14.28.2 VARIANCES. An applicant may include in the application a request for a variance from the requirements. This procedure is detailed in the small site erosion and sediment control (ESC) permitting program.

14.28.3 FEE SCHEDULE. The fees referred to in other sections of this ordinance shall be adopted by the City of Baraboo Common Council and may from time to time be modified by resolution. A schedule of the fees shall be available for review in City Hall. Fees shall be related to costs involved in handling permit applications, reviewing control plans, conducting site inspections and administering the erosion control program.

14.29 INSPECTION. If land disturbing construction activities are occurring without a permit required by this ordinance, the Building Inspector or City Engineer may enter the land pursuant to the provisions of §§66.0119(1), (2), and (3), Wis. Stats.

14.30 ENFORCEMENT.

(1) The Building Inspector or City Engineer may post a stop work order if any of the following occurs:

(a) Land disturbing construction activity regulated under this ordinance is occurring without a permit.

(b) The Erosion and Sediment Control Plan is not being implemented in good faith.

(c) The conditions of the permit are not being met.

(2) If the responsible party does not cease activity as required in a stop work order posted under this section or fails to comply with the Erosion and Sediment Control Plan or permit conditions, the Building Inspector or City Engineer may revoke the permit.

(3) If the responsible party, where no permit has been issued or the permit has been revoked, does not cease the activity after being notified by the Building Inspector or City Engineer, or if a responsible party violates a stop work order posted under Sub. (1), the Building Inspector or City Engineer may request the City Attorney to obtain a cease and desist order in any court with jurisdiction.

(4) The Building Inspector or City Engineer may retract the stop work order issued under Sub. (1) or the permit revocation under Sub. (2).

(5) After posting a stop work order under Sub. (1), the Building Inspector or City Engineer may issue a notice of intent to the responsible party of its intent to perform work necessary to comply with this ordinance. The Building Inspector or City Engineer may go on the land and commence the work after issuing the notice of intent. The costs of the work performed under this subsection by or at the direction of the Building Inspector or City Engineer, plus interest at the rate authorized by the Building Inspector or City Engineer shall be billed to the responsible party. In the event a responsible party fails to pay the amount due, the clerk shall enter the amount due on the tax rolls and collect as a special assessment against the property pursuant to Subch. VII of Ch. 66, Wis. Stats.

(6) Any person violating any of the provisions of this ordinance shall be subject to a penalty as provided in §25.04 of this code and the costs of prosecution for each violation. Each day a violation exists shall constitute a separate offense.

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ATTACHMENT "E"

CITY OF BARABOO

STORMWATER MANAGEMENT PERMITTING (2.5)

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Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

CHAPTER 1 - OVERVIEW 2
1.1 INTRODUCTION 2
1.2 PURPOSE 2
1.3 OBJECTIVES 2

CHAPTER 2 - DOCUMENT USE 4
2.1 GENERAL 4
2.2 DEFINITIONS 4
2.2 APPLICABILITY 4
2.3 LIMITATIONS 4

CHAPTER 3 – STORMWATER MANAGEMENT PERMIT APPLICATION 5
3.1 APPLICATION PROCESS. 5
3.2 MANDATORY PRE-APPLICATION MEETING 5
3.3 SUBMITTAL REQUIREMENTS. 5

CHAPTER 4 - ADMINISTRATIVE 11
4.1 GENERAL. 11
4.2 PERMITTING REQUIREMENTS AND PROCEDURES 11

Appendices

APPENDIX A: STORMWATER MANAGEMENT PERMIT APPLICATION A1
APPENDIX B: MODELING REQUIREMENTS, DETAILS AND GUIDANCE B1
APPENDIX C: EROSION CONTROL INSPECTION REPORT FORM C1
APPENDIX D: LONG-TERM INSPECTION AND OPERATION & MAINTENANCE PLAN AND AGREEMENT CRITERIA D1
APPENDIX E: STORMWATER MANAGEMENT PERFORMANCE STANDARDS FLOW CHART E1
APPENDIX F: CHAPTER 14, SUBCHAPTER V: STORMWATER MANAGEMENT F1

CITY OF BARABOO
POST-CONSTRUCTION STORMWATER MANAGEMENT (2.5)

Goal: Maintain a post-construction ordinance and provide written procedures to administer and enforce it to ensure that areas of new and redevelopment will include structural measures to control pollutants, control peak flow and maintain infiltration.

Compliance Date: March 31, 2021 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

Develop, implement and enforce a program to require control of the quality of discharges from areas of new development and redevelopment, after construction is completed. The program shall establish measurable goals and include:

2.5.1 Post-construction storm water ordinance. An ordinance or other regulatory mechanism to regulate post-construction storm water discharges from new development and redevelopment.

2.5.2 Administrative procedures. Written procedures for the administration of the post-construction storm water management program including the process for obtaining local approval and responding to complaints.

2.5.3 Storm water management plan review. Written procedures for post-construction site plan review which incorporate consideration of potential water quality impacts.

2.5.4 Long-term maintenance, inspections and enforcement. Written procedures that will be used by the permittee through its ordinance jurisdiction, approval process, and authority to, at a minimum, track and enforce the long-term maintenance of storm water management facilities implemented to meet the applicable post-construction performance standards

WORK PLAN

☒Ordinance last modified and adopted by Baraboo Common Council on 5-13-2008.
☒ The City of Baraboo Stormwater Management Permitting Program Manual completed by March 31, 2021.
☐ Update ordinance in 2021
☐ Implement items from stormwater permitting manual.

CHAPTER 1 - OVERVIEW

1.1 INTRODUCTION

The Federal Clean Water Act of 1972 made it unlawful to discharge any pollutant from a point source into navigable waters unless a permit was obtained. This permit program is called the National Pollutant Discharge Elimination System (NPDES). As part of the program, small cities are required to follow a Municipal Separate Storm Sewer System (MS4) General Permit which approves the discharge of stormwater to lakes, rivers, wetlands, and other receiving waters (EPA 2017). In Wisconsin, the MS4 Permit is administered by the WDNR.

Baraboo is an Urbanized Area, as defined by the Bureau of the Census, due to its population. The City is classified as an NPDES Phase II community, more commonly referred to as a small MS4 community, and has therefore been required to comply with the MS4 General Permit since 2006. Permit requirements were lastly revised in 2019 by the WDNR for small MS4 cities in Wisconsin. The current Wisconsin MS4 Permit has eight specific goals or Minimum Control Measures (MCM), within the permit's SWPPP, as listed below.

1. Public education and outreach
2. Public involvement and participation
3. Illicit discharge detection and elimination (IDDE)
4. Construction site pollutant control
5. **Post-construction stormwater management**
6. Pollution prevention/good housekeeping
7. Stormwater quality management
8. Storm sewer system map

This plan provides procedures and documents required to comply with the post-construction stormwater management portion of the MS4 Permit, as described in Section 2.5 of the current WPDES Permit No. WI-S050075-3.

The specific goals of the Post-Construction Stormwater Management Program are to:

- Develop and update construction site ordinance.
- Develop procedures for the administration of the post-construction stormwater management program.
- Develop procedures for post-construction site plan review.
- Develop procedures for tracking and enforcing the long-term maintenance of stormwater management facilities.

The City is committed to working internally and with state and federal environmental agencies to achieve water quality goals and protect public health. The City has established this Plan to outline procedures, goals, standard operating procedures (SOPs), and workflow processes for successful and efficient implementation of the construction site erosion control program. It is a working document and will be revised as necessary. This Plan is based on current regulatory requirements formed by the 2019 MS4 General Permit and follows City Code, Chapter 14,

Subchapter II and IV, which was developed by the City of Baraboo in originally developed in 2008 and revised lastly in 2018, and can be found in Appendix B.

1.2 PURPOSE

1.2.1 The purpose of this document is to provide all regulatory information related to stormwater management, including guidance to developers, builders, and engineers for the submittal of a City of Baraboo Stormwater Management permit application, related plans, specifications, and associated activities within the City of Baraboo and in support of City Stormwater Ordinances (Baraboo Code of Ordinances – Chapter 14, Subchapters II and IV).

1.2.2 Design and construction work shall conform to the most recent editions of the following

1. City of Baraboo Standard Specifications
2. City of Baraboo Stormwater Ordinances (Baraboo Code of Ordinances – Chapter 14, Articles II and IV)
3. Wisconsin Department of Transportation (WISDOT) Standard Specifications for Construction
4. Wisconsin Department of Natural Resources (DNR) regulations
5. Wisconsin Department of Safety and Professional Services (DSPS) regulations

1.2.3 Prior to beginning of construction, all regulatory agency permits and approvals shall be obtained including but not limited to:

A. City of Baraboo
B. Army Corps of Engineers
C. Wisconsin Department of Natural Resources
D. Wisconsin Department of Transportation
E. Sauk County Zoning

NOTE: Under s. SPS 382.20, Wis. Adm. Code, DSPS regulates plumbing installations associated with post-construction storm water treatment practices and systems such as bioretention systems, infiltration systems, storm water inlets, roof drains, and projects involving 16 or more plumbing fixtures. For post-construction storm water treatment practices and systems, the DNR does not review conveyance or subsurface plumbing for compliance with DSPS requirements. Landowners requiring coverage under the DNR construction site storm water permit must also coordinate with DSPS on the plumbing requirements for post-construction storm water management practices and systems. Contact the DSPS Plumbing Program for more information.

1.2.4 This document does not take the place of or supersede Wisconsin State Administrative Code requirements. It is the responsibility of the property owner and/or applicant to provide accurate and reliable information concerning the project in accordance with all applicable codes.

1.3 OBJECTIVES

- To specify when a City of Baraboo Stormwater Management permit is required.
- To specify the requirements for complying with the Site Erosion Control Ordinance.
- To specify the requirements for complying with the Stormwater Management Ordinance.

- To guide the development of Stormwater Management permit application submittals.
- To define the short-term and long-term financial responsibilities of the applicant.

CHAPTER 2 - DOCUMENT USE

2.1 GENERAL

This document houses all information on processes and procedures related to obtaining and following the City of Baraboo's Stormwater Management permit and permit requirements.

A. The permit and permit requirements satisfy the Erosion Control and Long-Term Stormwater Management requirements, on a per project basis, as required through the City of Baraboo's Code of Ordinances.

Different components of the process will be covered in individual chapters. For an overview of the permit application requirements, see Chapter 4.

2.2 DEFINITIONS

2.2.1 With the exception of the following defined terms, all definitions found in NR 216, NR 151, and SPS 360 are applicable to this document and referenced documents:

A. *Business day* means a day the City of Baraboo offices are open for business.

B. *Cease and Desist Order* means a court-issued order to halt land disturbing construction activity that is being conducted without the required permit or in violation of a permit issued by the City of Baraboo.

C. *Redevelopment* means areas where development is replacing older existing development.

D. *Responsible Party* means any entity holding fee title to the property or other person contracted or obligated by other agreement to implement and maintain post-construction stormwater BMPs.

E. *Stop Work Order* means an order issued by the Building Inspector or City Engineer which requires that all construction activity on the site be stopped.

2.3 APPLICABLILITY

Construction sites meeting the conditions listed below are required to obtain a Stormwater Management permit (Stormwater permit, SM permit, or permit hereafter in this document) from the City of Baraboo. Exemptions under s. NR216.42 (2), (3), (7), (8) and (11) apply.

A. Construction sites with one acre or more of land disturbing construction activity; and/or

B. Commercial or industrial construction sites with a gross aggregate area of 0.5 acres or more.

2.4 LIMITATIONS

This document only includes references and suggestions related to other potential permits or approvals which may be necessary for the development of a property. It is the responsibility of the landowner to ensure all necessary federal, state, and local permits and approvals are obtained prior to the start of construction.

CHAPTER 3 - STORMWATER MANAGEMENT (SM) PERMIT APPLICATION

3.1 APPLICATION PROCESS

3.1.1 Steps to Obtaining a Stormwater Management Permit

A. Develop a conceptual or preliminary plan.

B. Request and attend the mandatory pre-application meeting (See Sec. 4.2).

C. Complete the SM permit application and all additional documentation required. Submit application documents and application fee to the City Engineer.

D. Start construction following all details and sequencing specified in the approved plan.

3.2 MANDATORY PRE-APPLICATION MEETING

3.2.1 General Information

A. Attendance by the owner and/or their representative at this mandatory meeting is required for all projects which will require a SM permit.

B. The meeting will be coordinated through the City Engineer. This meeting will cover all site development pre-application issues including stormwater permitting.

1. The City Engineer will invite other City departments as deemed necessary to ensure all construction and code compliance concerns are communicated.
2. Representatives of Engineering and Building Inspection may be in attendance.
3. The DNR will be extended an invitation to the meeting and will be provided with a summary of the project discussion if they cannot attend.

C. This shall be initiated by the landowner or landowner representative by requesting a meeting with the Engineering Department when a conceptual or preliminary plan has been developed, but before the initiation of the final design phase.

3.2.2 Erosion and Sediment Control and Long-term Stormwater Management Meeting Topics

A. Applicant Conceptual Development Plan, including a general concept for landscaping and stormwater management

B. Site specific state and local requirements

C. Contractor/Owner Bonding

D. Short-Term and Long-Term Inspections

E. Warranty of City Infrastructure

F. Long-Term Operation & Maintenance Plan and Agreement

G. Stormwater Management Permit Application Checklist and Fees

3.3 SUBMITTAL REQUIREMENTS

3.3.1 Stormwater Management Permit Application Contents

The application form is available in Appendix A. Completed application documents shall be submitted to City Engineer and include:

A. General Information

1. Project Name – selected by the applicant
2. Property Address – site location including parcel number(s) and address

B. Contact Information

1. Applicant(s) Information
2. Owner(s) Information
3. Consultant Information
4. 24-hour contact for erosion control BMP installation/construction
   a. This person shall be appropriately trained and locally available for immediate response to erosion control issues.
5. Contact person for long-term BMP operation/maintenance

C. Project Information – to be included on the application form

1. Estimated start date – the beginning of land disturbing activities which includes placement of erosion control devices.
2. Estimated end date – this date represents the date when final stabilization is expected to be achieved and a Notice of Termination (NOT) would be issued.
3. Area to be disturbed in acres – if excess material is expected and it will be disposed of at a site that is covered by this application, then the total area including the excess material area should be included in the acreage calculation.
4. Finished site impervious area in square feet – includes all areas that are not projected to be vegetated as determined by the definition of impervious surface.
5. Amount excavated in cubic yards – this represents the in place volume of material removed to the bottom of excavation including topsoil removal.
6. Amount filled in cubic yards – this represents the compacted volume of material placed not including imported structural soils.

D. Project Type – to be included on the application form

E. Long-Term Structural BMP Type(s) – to be included on the application form

F. The integration of stormwater drainage with proposed green infrastructure BMPs and other landscaped areas

G. The application must be signed by the landowner or include a notarized statement signed by the landowner authorizing the applicant to act as the landowner's agent and bind the landowner to the terms of the Stormwater Management permit.

3.3.2 Project Narrative

A. Project purpose and approach, including approach to site design, landscaping and

stormwater management.

B. Detailed description of the overall project including stormwater management plan design considerations and selection for both erosion and sediment control BMP's and long-term structural BMP's to meet performance standards. If Green Infrastructure features are not proposed, justification for exclusion from plan.

C. Areas of potential concern for water quality and proposed management measures (e.g. protection of erosion soils and existing trees, enclosure and drainage of trash handling areas, waste generating activities, or outdoor storage, etc.).

D. Model Result Narrative (description); and Summaries (tabular format).

1. Conceptual model narrative describing rationale for translating the design plans into modeling elements for each software used. This should include description of key model inputs and assumptions used to construct the model, with special attention given to BMPs.

2. Soil Loss (required by DNR for Construction Site Erosion Control compliance).
a. USLE Model (found on DNR website, hyperlink below)
http://dnr.wi.gov/topic/stormwater/standards/conststandards.html

3. Water Quality

a. WinSLAMM or P8.

4. Peak Flow Attenuation

a. HydroCAD or similar.

E. Construction.

1. Schedule – the schedule shall include a detailed estimate of dates and milestones from the initiation to the completion of construction. It shall include overwintering if necessary and sequencing and staging considerations. This schedule shall form the basis for the required soil loss calculations.

2. Sequencing and staging shall be detailed to show any multi-stage work or work requiring a set sequence of construction. Each stage shall be illustrated on its own map with an accompanying narrative.

3. Critical points – critical points are intended to provide emphasis and milestone status to project elements or construction procedures that warrant highlighting that are essential for the successful implementation of the stormwater management plan. Areas of compliance in which critical points must be discussed include:

a. Erosion Control Plan Implementation

1) Including marking of limits of disturbance for project and protection area (at perimeter of stand or dripline of individual trees) for all existing trees > 6" dbh (diameter at breast height) planned to be retained on site.

b. Long-Term Stormwater Management BMP Implementation

c. Sequencing and Staging

3.3.3 Construction Plan Set

A. Developed to demonstrate compliance with the applicable sections of the standard conditions in Sections 5.2.3 and 5.2.4 and site specific conditions imposed by the City of Baraboo during the permit approval process. Critical installation consideration MUST be included on plan and/or detail page(s)

B. The plan, at a minimum, shall include:

1. Existing and proposed elevation contours with flow arrows.
2. Map showing the property/site boundaries, right-of-ways, easements, and buried utilities or structures.
3. Erosion Control Plan elements including limits of disturbance, trees to be protected during construction, estimated BMP quantities, estimated cost including sequencing and, if applicable, staging.
4. Long-Term Stormwater Management Plan elements; including detailed drawings, quantities, estimated cost including installation, sequencing, critical installation points, and if applicable, staging. Green infrastructure BMPs or landscaped areas intended to receive stormwater inflows shall include detailed planting plans and specifications.
5. Street/alley/roadway/parking lot typical sections – The typical sections shall show thickness, width, and cross sectional details of all structural layers.
6. Landscape Plan – This shall show all proposed landscaping items with emphasis on those that affect the implementation of the Stormwater Management Plan. This shall include the proposed timing of plantings, and if any planting plans may be affected or delayed by weather conditions.
7. Utility Plan – This shall include all proposed public and private utility installations as well as the relocation of existing utilities.

3.3.4 Long-term Operation and Maintenance (LTO&M) Plan and Agreement

A. All sites shall develop a site specific LTO&M Plan and Agreement which shall be signed by the Landowner

B. This document shall serve as an agreement between the landowner and the City of Baraboo that the landowner is responsible for fulfillment of the plan and shall allow the City of Baraboo to enter the property for inspection and repair purposes if deemed necessary by the City.

C. For complete detailed requirements, see Section 4.2.11 of this document and Appendix D.

3.3.5 Other Permits

A. Permit summary listing all required project permits, their status, and their date of actual or expected receipt

B. Electronic copies of permits, permit applications and/or approvals required by any other government entity.

3.3.6 Modeling

A. ALL electronic model files must be provided for City of Baraboo review if requested.

B. Explanations of model input values and assumptions must be included in detail in the project narrative.

C. For detailed information and specifications related to Modeling, please see Appendix B. Information found in Appendix B is intended specifically for modelers.

3.3.7 Fees

A. There are separate Erosion Control and Stormwater Management Fees.

1. Erosion Control Fee

a. The fee is based upon the total area of Land Disturbing Activity (LDA) which will occur as a result of the construction project. The fee includes:

(1) $150 for the first acre of LDA

(2) $50 for each additional acre or portion thereof

Example: the site will have 2.7 acres of LDA

The fee would then be:

$150 for the first acre + $50 for the first additional acre + $50 for the portion of the second additional acre = $250

2. Stormwater Management Permit Fee

a. Commercial & Small Industrial - $50

b. Large Industrial - $150

c. This permit fee includes costs associated with specific City of Baraboo required inspections as detailed in Section 4.2.6.E.

B. CONSULTANT SERVICES. If the City retains the services of professional consultants, including, but not limited to planners, engineers, architects, attorneys, environmental specialists, and/or other experts to assist the City in its review of a proposed permit application and/or runoff control plan, and/or if the City Engineer prepares or assists in the preparation of a runoff control plan for the development, the applicant/ developer may be required to reimburse the City for the City Engineer's time and for the costs incurred by the City to retain the services of such professional consultants and such reimbursement shall be in addition to the permit fees and other fees paid by the applicant/developer. The applicant/ developer shall reimburse the City for said costs promptly upon being invoiced for the same and the City may withhold issuance of a permit or delay final approval of a permit until the said costs and fees are reimbursed to the City in full. If the costs and fees are not reimbursed to the City within 30 days of the date of billing, an additional administrative collection charge of 10% of the charge shall be added to the amount due, plus interest shall accrue thereon at the rate of 1% per month until paid and such charge shall be extended upon the current or next tax roll as a charge against the subject property for current services as provided in §66.60(16), Wis. Stats. The City may require the applicant/developer to enter into an agreement

providing for the reimbursement to the City for said costs and the said agreement may require the applicant/developer to file with the City an Irrevocable Letter of Credit or other appropriate sureties meeting the approval of the City Attorney equal to the estimated cost of said services.

3.3.8 Certification

A. As-Built Plans shall be developed to reflect the actual construction including any changes to the design plans that were approved as plan amendments.

B. Statement of plan compliance shall be prepared and signed by a licensed Professional Engineer which indicates that the work was done in compliance with the approved plans and specifications and detailing any areas that are non-compliant or have not been verified. In the case of non-compliance or lack of verification, a resolution plan or record of acceptance by the City of Baraboo must be provided.

C. As-Built Plans must be received before a Notice of Termination is issued.

CHAPTER 4 – ADMINISTRATIVE

4.1 GENERAL

4.1.1 CITY ADMINISTRATIVE DUTIES

A. Keep accurate records of all plan data received, plans approved, permits issued, inspections made and other official actions.

B. Review all plans and permit applications received when accompanied with the necessary information and the appropriate fee and issue the permits.

C. Investigate complaints made related to land disturbing construction activities or long-term stormwater management.

D. Create a site specific list of required inspections which will trigger notification from the responsible party(s) and provide to the Landowner and responsible party for implementation.

   1. The City of Baraboo shall perform construction inspections within 5 working days of notification from the responsible party

   2. Maintain records of construction site inspections made by City staff, inform the Landowner and party(s) responsible for maintenance of the inspection results, and set a timeframe for correction of identified deficiencies.

E. Maintain a database to track annual Long-Term Stormwater Management reports. This database shall track annual reports sent in and shall flag delinquent or deficient reports. Staff shall take appropriate action on flagged reports to bring those properties into compliance.

F. Revoke any permit granted under this document if the holder of the permit has:

   1. Misrepresented any material fact in the permit application or plan; OR

   2. Has failed to comply with the plan as originally approved or as modified in writing; OR

   3. Has violated any of the other conditions of the permit as issued to the applicant.

4.2 PERMITTING REQUIREMENTS AND PROCEDURES

4.2.1 Review and Approval of Permit Application. The following approval procedure shall be used:

A. Within 30 calendar days of the receipt of a complete permit application, including all items as required by Sub. (2), the City Engineer shall inform the applicant in writing whether the application, plan, and maintenance agreement are approved or disapproved based on the requirements of this ordinance.

B. If the stormwater permit application, plan, and maintenance agreement are approved, or if an agreed upon payment of fees in lieu of stormwater management practices is made, the City Engineer shall issue the permit.

C. If the stormwater permit application, plan or maintenance agreement is disapproved, the City Engineer shall detail in writing the reasons for disapproval.

D. The City Engineer may request additional information from the applicant. If additional information is submitted, the City Engineer shall have 30 business days from the date the additional information is received to inform the applicant that the plan, and maintenance agreement are either approved or disapproved.

E. Failure by the City Engineer to inform the permit applicant of a decision within 30 business days of a required submittal shall be deemed to mean approval of the submittal and the applicant may proceed as if a permit had been issued.

4.2.2 Review Considerations. Site plan review will be completed, taking into consideration the following standards with regard to water quality protection and stormwater management:

- General site design will include appropriate stormwater drainage system details and calculations.
- Planned construction operations will include adequate Best Management Practices (BMPs) and Sediment and Erosion Control Measures to reduce water quality impacts.
- Planned BMPs must be designed to the current technical standards found on the DNR website at https://dnr.wisconsin.gov/topic/Stormwater/standards/const_standards.html
- When possible BMPs should promote on-site infiltration of stormwater runoff from impervious surfaces.
- For sites located in areas subject to Total Maximum Daily Load (TMDL) requirements, BMPs will be selected and prioritized to address the pollutant identified as the cause of the impairment.
- When possible, low impact designs (LID) and/or Green Infrastructure (GI) should be included in site design. If LID/GI are not included in the site plan, the plan reviewer will require that the applicant review opportunities for the use of LID/GI.

4.2.3 Permit Requirements

A. Notify the Public Works Department within 48 hours of commencing any land disturbing construction activity.

B. Notify the Public Works Department within 48 hours of the completion of any BMPs.

C. Obtain permission in writing from the Public Works Department prior to any modification of the erosion and sediment control plan.

D. Install all BMPs as identified in the approved erosion and sediment control plan.

E. Maintain all road drainage systems, stormwater drainage systems, BMPs and other facilities identified in the erosion and sediment control plan.

F. Repair any erosion damage to adjoining surfaces and drainage ways resulting from land disturbing construction activities.

G. Inspect the BMPs within 24 hours after each rain of 0.5 inches or more which results in runoff during active construction periods and at least once each week. Make any necessary repairs.

H. Allow the Public Works Department to enter the site for the purpose of inspecting compliance with the erosion and sediment control plan or for performing any work necessary to bring the site into compliance with the control plan. Keep a copy of the erosion and sediment control plan at the construction site.

4.2.4 Financial Guarantee

A. The City Engineer may require the submittal of a financial guarantee, the form and type of which shall be acceptable to the City Engineer. The financial guarantee shall be in an amount determined by the City Engineer to be the estimated cost of construction and the estimated cost of maintenance of the stormwater management practices during the period which the designated party in the maintenance agreement has maintenance responsibility.

4.2.5 Erosion and Sediment Control

A. Applicability and Erosion Control Plan

1. The submittal shall be in conformance with the applicability requirements of s. NR 151.11 for non-transportation projects and NR 151.23 for transportation projects with the following modifications **in bold**:

   a. NR 151.11(2) APPLICABILITY. This section applies to any construction site that consists of one acre or more of land disturbing construction activity.

      1) **City of Baraboo** APPLICABILITY. This section applies to any construction site that consists of one acre or more of land disturbing construction activity or **a post-development commercial or industrial construction site with a gross aggregate area of 0.5 acres or more.**

   b. NR 151.23(1) APPLICABILITY. This section applies to any transportation facility construction site that consists of one acre or more of land disturbing construction activity.

      1) City of Baraboo APPLICABILITY. This section applies to any construction site that consists of one acre or more of land disturbing construction activity **or adds 20,000 square feet of additional impervious area.**

2. Erosion and Sediment Control Plan

   a. Designed to meet State of Wisconsin NR Code performance standards found within NR 151.11 for non-transportation projects, and NR 151.23 for transportation projects.

   b. This includes the use of the DNR Soil Loss and Sediment Discharge Calculation Tool to show conformance with the performance standards found in NR 151.11 (6m) (b) 2 and NR 151.23 (4m) (b) 2.

   c. Demarcate the limits of disturbance on site, and demarcate protected areas for all trees greater than 6" dbh to be retained on site, either at the dripline for individual trees or around a sufficient perimeter for protection of stands of trees.

   d. The plan requirements of this subsection must meet the erosion control plan submittal requirements of s. NR 216.46 (4) and (5), and be prepared in accordance with good engineering practices and design criteria as well as the standards and specifications approved by the DNR.

   e. The erosion and sediment control plan for sites under an acre shall be designed to meet SPS 360, as applicable.

      https://docs.legis.wisconsin.gov/code/admin code/sps/safety and buildings and environment/326 360/360

4.2.6 Standard Permit Conditions – Erosion and Sediment Control

A. Obtain permission in writing from the City Engineer prior to any modification of the erosion and sediment control plan (see Permit Amendment, Sec. 4.2.14).

B. Install or implement all necessary structural and non-structural BMPs to minimize erosion and prevent off-site sedimentation or tracking as identified in the approved erosion and sediment control plan.

C. Maintain all road drainage systems, stormwater drainage systems, BMPs and other facilities identified in the erosion and sediment control plan.

D. Repair any siltation or erosion damage to adjoining or downstream properties and drainage ways resulting from land disturbing construction activities and document repairs in the site erosion control log.

E. Required Construction Site Inspections

   1. Performed by City of Baraboo

      a. The City of Baraboo requires specific inspections to be conducted by the City of Baraboo staff in addition to inspections required by NR 216 by the Landowner or Landowner's representative. These inspections include:

         1) All sites one acre or more in size:

            a) New projects shall be inspected within the first two weeks of commencement of land disturbing activities.

b) All active sites shall be inspected at least once every 45 days.

c) All inactive sites shall be inspected at least once every 60 days.

2) Follow up inspections

a) Follow up inspections are required within 7 days of any sediment discharge or inadequate control measure, unless corrections were made and observed by the inspector during initial inspection or corrections were verified via photographs submitted to the inspector.

3) Final Inspection:

a) Prior to removal of ESC BMPs, the City of Baraboo must inspect the site to ensure final stabilization has been achieved across the entire site and all permanent stormwater management BMPs are installed as designed.

b) The site must pass this final inspection to terminate the permit.

2. Performed by the Landowner or Landowner's Representative (Required by NR 216)

a. Shall be conducted:

1) by an individual or individuals who the City has deemed is/are appropriately trained.

a) There are several erosion control trainings and/or certifications offered throughout Wisconsin which the City approves. These include, but are not limited to:

(1) A valid (non-expired) Soil Erosion Inspector Certification from Wisconsin DSPS

https://dsps.wi.gov/Pages/Professions/SoilErosionInspector/Default.aspx

(2) A valid (non-expired) certification from the University of Minnesota's Erosion and Stormwater Management Program for Construction Installer.

https://www.erosion.umn.edu/certification-courses/el-1001

b) Other trainings or certifications must be approved prior to construction by the City of Baraboo. Contact the Engineering Department with the detailed information about the training/certification for a review and determination of approval.

2) at least once every seven (7) days.

3) within 24 hours after each rain of 0.5 inches or more which results in runoff during active construction periods.

b. These inspection records shall:

1) include, at a minimum:

a) the time, date, and location of inspection,

b) the name of the person conducting the inspection,

c) a description of the present phase of the construction at the site, and

d) an assessment of all BMPs

2) be kept on-site in a site erosion control log book

3) be made available to any regulatory agency who requests review

3. All needed repairs or replacements to BMPs must:

a. be completed within 24 hours of an inspection or notification that a repair or replacement is needed

b. documented on a maintenance or inspection form that is filed in the site erosion control log book

F. Allow the City Engineer or designee to enter the site for the purpose of inspecting compliance with the erosion and sediment control plan or for performing any work necessary to bring the site into compliance with the control plan.

G. Keep a copy of the approved erosion and sediment control plan at the construction site.

4.2.7 Site Specific Permit Conditions – Erosion and Sediment Control

Additional site specific permit conditions may be required to specifically address unique site conditions and adequately protect resources, adjacent properties, and the general public.

A. The content of the site specific permit conditions will be discussed and finalized with the applicant during the permit review process. If the applicant has an objection to the site specific permit conditions, they may, in discussion with the City, present alternative solutions for consideration.

B. All site specific permit conditions shall be added to the plan sheets and/or special provisions of the plans prior to issuance of the permit.

4.2.8 Long-term Stormwater Management

A. RESPONSIBLE PARTY. The responsible party shall implement a post-construction stormwater management plan.

B. PLAN. A written stormwater management plan in accordance with Section 3.3.3 shall be developed and implemented for each post-construction site.

C. MAINTENANCE OF EFFORT. For redevelopment sites where the redevelopment will be replacing older development that was subject to post-construction performance standards of ch. NR 151, Wis. Adm. Code, in effect on or after October 1, 2004, the responsible party shall meet the total suspended solids reduction, peak flow control, infiltration, and protective areas standards applicable to the older development or meet the redevelopment standards of this ordinance, whichever is more stringent

D. Applicability and Stormwater Management Plan for Non-Transportation Projects

1. The submittal shall be in conformance with the applicability requirements of NR 151.12 with the following modification **in bold**:

   a. NR 151.11(2) (by reference from NR 151.12(2)) APPLICABILITY. This section applies to any construction site that consists of one acre or more of land disturbing construction activity.

      1) **City of Baraboo:** APPLICABILITY. This section applies to any construction site that consists of one acre or more of land disturbing construction activity or **a post-development commercial or industrial construction site with a gross aggregate area of 0.5 acres or more.**

2. The Stormwater Management Plan shall be designed to meet the applicable performance standards of s. NR 151.122 – 128 with the following modifications **in bold**:

   a. NR 151.123 (1) REQUIREMENT. By design, BMPs shall be employed to maintain or reduce the 1-year, 24-hour and the 2-year, 24-hour post-construction peak runoff discharge rates to the 1-year, 24-hour and the 2-year, 24-hour pre-development peak runoff discharge rates respectively, or to the maximum extent practicable. The runoff curve numbers in Table 2 shall be used to represent the actual pre-development condition.

      1) **City of Baraboo:** REQUIREMENT. By design, BMPs shall be employed to maintain or reduce the peak runoff discharge rates from the post-construction site, according the following standards:

         a) Limit peak flow rates of storm runoff after development to seventy five percent (75%) of that which would have resulted from the same storm occurring over the site with the land in its predevelopment condition, for storms of twenty-four (24) hour duration and recurrence intervals of five (5), ten (10), and twenty- five (25) years

         b) Not increase the peak flow rates of storm runoff after development to that which would have resulted from the same storm occurring over the site with the land in its predevelopment condition, for storms of twenty-four (24) hour duration and a recurrence interval of one (1), two 2, and 50-years.

         c) On sites where on-site detention is used for runoff control, safely contain and safely pass the runoff of a 100- year storm of any duration.

      2) Peak discharges shall be calculated using TR-55 runoff curve number methodology, Atlas 14 precipitation depths, and the NRCS MSE4 precipitation distribution. Rainfall depths by

recurrence interval for a 24-hour duration are given in Table 1, below.

Table 1. 24-hour Rainfall Depths							
Return Frequency							
Precipitation Publication	1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Atlas 14	2.52”	2.86”	3.51	4.15”	5.18”	6.10”	7.11”

3) Predevelopment Conditions shall mean land which has runoff characteristics equivalent to runoff Curve Numbers (CN) in Table 2:

Table 2. Runoff Curve Numbers (CN)				
Hydrologic Soil Group	A	B	C	D
Runoff Curve Number	30	55	70	77

b. NR 151.123 (2) (a) A post-construction site where the discharge is directly into a lake over 5,000 acres or a stream or river segment draining more than 500 square miles.

1) City of Baraboo: **Not exempt.**

c. NR 151.124 (2) PRE−DEVELOPMENT. Pre−development condition shall be the same as specified in s. NR 151.123 (1), Table 2.

1) **City of Baraboo:** Predevelopment conditions shall be the same as in 5.2.6 D 2 a) 2).

d. NR 151.125 (4) (e) Areas of post−construction sites from which the runoff does not enter the surface water, including wetlands, without first being treated by a BMP to meet the requirements of ss. NR 151.122 to 151.123, except to the extent that vegetative ground cover is necessary to maintain bank stability.

1) **City of Baraboo:** Post-construction sites from which runoff does not enter the surface water, including wetlands, without first being treated by a BMP to meet the requirements for Total Suspended Solids, Total Phosphorous, and Peak Flow Reduction, except to the extent that vegetative ground cover is necessary to maintain bank stability.

3. DRAINAGE SYSTEM. Where conditions are such that the depth to the water table is three (3) feet or greater during at least nine (9) months of the year, the stormwater drainage system for the site shall include grassed swales for area drainage and underground perforated drainage pipe for storm runoff conveyance, except on industrial and commercial sites, or sites where the City Engineer finds the above to be

impracticable.

E. Applicability and Stormwater Management Plan for Transportation Projects

1. The Stormwater Management Plan shall be designed to meet the applicable performance standards of s. NR 151.241-249 with the following modifications:

a. NR 151.243 (1) REQUIREMENT. By design, BMPs shall be employed to maintain or reduce the 1-year, 24-hour and the 2-year, 24-hour post-construction peak runoff discharge rates to the 1-year, 24-hour and the 2-year, 24-hour pre-development peak runoff discharge rates respectively, or to the maximum extent practicable. The runoff curve numbers in Table 2 shall be used to represent the actual pre-development condition

1) **City of Baraboo:** REQUIREMENT. By design, BMPs shall be employed to maintain or reduce the peak runoff discharge rates from the post-construction site, according the following standards:

a) Limit peak flow rates of storm runoff after development to seventy five percent (75%) of that which would have resulted from the same storm occurring over the site with the land in its predevelopment condition, for storms of twenty-four (24) hour duration and recurrence intervals of five (5), ten (10), and twenty- five (25) years

b) Not increase the peak flow rates of storm runoff after development to that which would have resulted from the same storm occurring over the site with the land in its predevelopment condition, for storms of twenty-four (24) hour duration and a recurrence interval of one (1), two 2, and 50-years.

c) On sites where on-site detention is used for runoff control, safely contain and safely pass the runoff of a 100- year storm of any duration.

2) Predevelopment Conditions shall mean land which has runoff characteristics equivalent to runoff Curve Numbers (CN) in Table 3:

Table 3.
Runoff Curve Numbers (CN)

Hydrologic Soil Group	A	B	C	D
Runoff Curve Number	30	55	70	77

b. NR 151.243 (2) (a) EXEMPTIONS. A transportation facility post-construction site where the discharge is directly into a lake over 5,000 acres or a stream or river segment draining more than 500 square miles

1) City of Baraboo: **Not Exempt.**

4.2.9 Standard Permit Conditions – Long-term Stormwater Management

All permits issued under this ordinance shall be subject to the following conditions, and holders of permits issued under this ordinance shall be deemed to have accepted these conditions.

A. Compliance with this permit does not relieve the responsible party of the responsibility to comply with other applicable federal, state, and local laws and regulations.

B. The responsible party shall design and install all structural and non-structural stormwater management measures in accordance with the approved stormwater management plan and this permit.

C. The responsible party shall notify the City Engineer at least 2 business days before commencing any work in conjunction with the stormwater management plan, and within ten business days upon completion of the stormwater management practices. If required as a special condition under 4.2.10, the responsible party shall make additional notification according to a schedule set forth by the City Engineer so that practice installations can be inspected during construction.

D. Practice installations required as part of this ordinance shall be certified "as built" by a licensed professional engineer. Completed stormwater management practices must pass a final inspection by the City Engineer or its designee to determine if they are in accordance with the approved stormwater management plan and ordinance. The City Engineer or its designee shall notify the responsible party in writing of any changes required in such practices to bring them into compliance with the conditions of this permit.

E. The responsible party shall notify the City Engineer of any significant modifications it intends to make to an approved stormwater management plan. The City Engineer may require that the pro-posed modifications be submitted to it for approval prior to incorporation into the storm-water management plan and execution by the responsible party.

F. The responsible party shall maintain all stormwater management practices in accordance with the stormwater management plan until the practices either become the responsibility of the Common Council, or are transferred to subsequent private owners as specified in the approved maintenance agreement. The responsible party authorizes the City Engineer to perform any work or operations necessary to bring stormwater management measures into conformance with the approved stormwater management plan, and consents to a special assessment or charge against the property as authorized under Subch. VII of Ch. 66, Wis. Stats., or to charging such costs against the financial guarantee posted The responsible party authorizes the Public Works Department to perform any work or operations necessary to bring stormwater management measures into conformance with the approved stormwater management plan and permit, and consents to a special assessment or charge against the property as authorized under

subch: VI and VII of ch. 66, Wis. Stats., or to charging such costs against the financial guarantee posted.

G. If so directed by the City Engineer, the responsible party shall repair at the responsible party's own expense all damage to adjoining municipal facilities and drainage ways caused by runoff, where such damage is caused by activities that are not in compliance with the approved storm-water management plan.

H. The responsible party shall permit property access to the City Engineer or its designee for the purpose of inspecting the property for compliance with the approved stormwater management plan and this permit.

I. Where site development or redevelopment involves changes in direction, increases in peak rate and/or total volume of runoff from a site, the City Engineer may require the responsible party to make appropriate legal arrangements with affected property owners concerning the prevention of endangerment to property or public safety.

J. The responsible party is subject to the enforcement actions and penalties detailed in 14.73 of the City Codes, if the responsible party fails to comply with the terms of this permit.

K. That all land disturbances, construction and development will be done pursuant to the control plan as approved by the City Engineer.

L. That the permittee shall file a notice of completion of all land disturbing activities and/or the completion of installation of all on-site detention facilities within 10 days after completion.

M. That approval in writing must be obtained from the City Engineer prior to any modifications to the approved control plan

N. That the permittee will be responsible for maintaining all roads, road rights of way, streets, runoff, and drainage facilities and drainage ways as specified in the approved plan until they are accepted and become the responsibility of a governmental entity.

O. That the permittee will be responsible for repairing any damage at his or her expense to all adjoining surfaces and drainage ways caused by runoff and/or sedimentation resulting from activities which are not in compliance with the approved plan.

P. That the permittee must provide and install at his or her expense all drainage, and runoff control improvements as required by Ordinance and the approved control plan, and also must bear his or her proportionate share of the total cost of off-site improvements to drainage ways based upon the existing developed drainage area or planned development of the drainage area, as determined by the City Engineer, in accordance with Ch. 18 of the City Code.

Q. That no work will be done on the site during any period of time that the average hourly wind velocity at the location of the land disturbing activity exceeds twenty (20) miles per hour, unless provision has been made to eliminate dust and blowing dirt.

R. That no portion of the land which undergoes the land disturbing activity will be allowed to remain uncovered for greater than two (2) weeks after notice is given to the City Engineer that the land disturbing activity is completed.

S. That the permittee agrees to permit the City Engineer to enter onto the land regulated under this Ordinance for the purpose of inspecting for compliance with the approved control plan and permit.

T. That the permittee authorizes the City Engineer to perform any work or operations necessary to bring the condition of the lands into conformity with the approved control plan or plan as modified by the City Engineer and further consents to the City of Baraboo placing the total of the costs and expenses of such work and operations upon the tax roll as a special tax against the property.

U. PROPERTY TRANSFERS

1. When a permitted property has a transfer of ownership or possession or control, the successor in interest of any portion of the real estate shall be responsible to manage the site's runoff and comply with the LTSM Operation and Maintenance Plan and Agreement.

2. When ownership, possession, or control of property subject to a LTSM Operations and Maintenance Plan and Agreement is transferred, the former owner (seller) shall notify the new owner (buyer) as to the current status of compliance with notice to the City of Baraboo, and provide a copy of the SM permit and related documents.

3. Transfers of interest in real estate subject to a LTSM Operations and Maintenance Plan and Agreement where the construction has not been completed may be conducted consistent with this document under any of the following arrangements:

   a. The transferee shall obtain a new SM permit, from the City of Baraboo

      1) This would require all permit conditions, including the LTSM Operation and Maintenance Plan and Agreement, be signed off on by the buyer.

   b. The transferee shall obtain an approved assignment from the City of Baraboo as sub-permittee to complete construction in accordance with the approved SM permit on the transferee's property.

      1) This would require the buyer to sign and submit the LTSM Operation and Maintenance Plan and Agreement.

   c. The permittee shall provide the City of Baraboo with a duly completed and executed continuing surety bond or certified check in an amount sufficient to complete the work proposed in the approved plan; at the time of transfer the permittee may seek to reduce the surety bond or certified check to the appropriate amount to complete remaining work. If the transferor enters into escrow agreements with transferees to complete an approved

plan, these funds shall be available to the City of Baraboo to attain plan compliance. When an approved erosion control plan and, if required, a stormwater management plan is or are not completed as proposed, the City of Baraboo may use the surety bond to complete remaining work to achieve plan compliance.

4.2.10 Site Specific Permit Conditions – Long-term Stormwater Management

A. Additional site specific permit conditions may be required to specifically address unique site conditions and adequately protect resources, adjacent properties, and the general public.

B. The content of the site specific permit conditions will be discussed and finalized with the applicant during the permit review process. If the applicant has an objection to the site specific permit conditions, they may, in discussion with the City, present alternative solutions for consideration.

C. All site specific permit conditions shall be added to the plan sheets and/or special provisions of the plans prior to issuance of the permit.

4.2.11 Long-term Operation and Maintenance

A. Maintenance Agreement Required

1. A Maintenance Agreement shall be required for all sites requiring a stormwater management permit. This agreement shall be between the City and the responsible party to provide for maintenance of stormwater practices beyond the duration period of this permit. The maintenance agreement shall be filed with the County Register of Deeds as a property deed restriction so that it is binding upon all subsequent owners of the land served by the stormwater management practices.

B. Agreement Provisions - The maintenance agreement shall contain the following information and provisions.

1. Identification of the stormwater facilities and designation of the drainage area served by the facilities.
2. A schedule for regular maintenance of each aspect of the stormwater management system consistent with the stormwater management plan.
3. Identification of the responsible party(s), organization or city, county, town or village responsible for long term maintenance of the stormwater management practices identified in the stormwater management plan.
4. Requirement that the responsible party(s), organization, or city, county, town or village shall maintain stormwater management practices in accordance with the approved schedule.
5. Authorization for the City Engineer to access the property to conduct inspections of stormwater management practices as necessary to ascertain that the practices are being maintained and operated in accordance with the agreement.
6. A requirement on the City Engineer to maintain public records of the results of the site inspections, to inform the responsible party

responsible for maintenance of the inspection results, and to specifically indicate any corrective actions required to bring the stormwater management practice into proper working condition.

7. Agreement that the party designated under par. 3, as responsible for long term maintenance of the stormwater management practices, shall be notified by the City Engineer of maintenance problems which require correction. The specified corrective actions shall be undertaken within a reasonable time frame as set by the City Engineer.
8. Authorization of the City Engineer to perform the corrected actions identified in the inspection report if the responsible party designated under par. 3 does not make the required corrections in the specified time period. The City Engineer shall enter the amount due on the tax rolls and collect the money as a special charge against the property pursuant to Subch. VII of Ch. 66, Wis. Stats.

C. MAINTENANCE CERTIFICATION. Once every five years (permit period), a maintenance report shall be submitted to the City engineer detailing the operation and maintenance of the BMPs for the previous 5-year period.

1. The City will maintain a list of private stormwater BMP's and track the maintenance of each. The City will notify the Owner or responsible party of their certification requirements every 5 years in writing.
   a. The BMP certifications will be spread out over the 5 year period based on original installation dates.
   b. The Owner will be given 3 months to certify and return the report.
2. Failure to submit this maintenance report may result in;
   a. The City of Baraboo conducting a site inspection and assessing the associated charges to the property as a special assessment on the tax role
   b. The City of Baraboo hiring a professional to conduct a site inspection and assessing the associated charges to the property as a special assessment on the tax role
   c. Fines

4.2.12 Regional Water Quality BMPS

A. There are several regional BMPs owned and operated by the City of Baraboo within the city limits. These BMPs may or may not be designed with additional capacity for future development. Where a regional treatment option exists such that the City Engineer exempts the applicant from all or part of the minimum on-site stormwater management requirements, the applicant shall be required to pay a fee in an amount determined in negotiation with the City Engineer. In determining the fee for post construction runoff the City Engineer shall consider an equitable distribution of the cost for land, engineering design, construction and maintenance of the regional treatment option.

B. Sites within a regional BMP watershed must consult with the City a minimum of 3-months prior to permit application if the site wishes to utilize a Regional BMP to meet the state and local standards.

4.2.13 Variances

A. No variance shall be granted unless applicant demonstrates and the City of Baraboo finds that all of the following conditions are present:

1. Enforcement of the standard set for in this document will result in unnecessary hardship to the landowner;
2. The hardship is due to exceptional physical conditions unique to the property;
3. Granting the variance will not adversely affect the public health, safety or welfare, nor be contrary to the spirit, purpose and intent of this document;
4. The project will have no adverse impact upon any of the stated purposes of this document.
5. The applicant has proposed an alternative to the requirement from which the variance is sought that will provide protection of the public health, safety and welfare of the environment and public and private property to the maximum extent practicable;
6. The net cumulative effect of the variance will not impact downstream conditions.

B. A variance may only be granted to the minimum extent necessary to afford relief from the unnecessary hardship with primary consideration to water quality.

4.2.14 Permit Amendments

A. Any proposed modifications to approved plans, construction schedules or alterations to accepted sequencing of land disturbing site activities shall be approved by the City of Baraboo prior to implementation of said changes. Modification will be determined by the City of Baraboo to be either substantial or minor.

B. Unanticipated delays in construction schedule that affect project timing or cause a change in sequence require a permit amendment.

C. Any modification deemed by the City of Baraboo to be substantial and affecting the implementation of the erosion control plan, or elements of the long-term control plan, shall require a formal amendment submittal in writing to ESD with all affected elements submitted to the detail required in the original submittal. Within 30 business days of the receipt of the amendment request, the Public Works Department shall inform the applicant whether the amendment to the application and plan are approved or disapproved.

D. Modifications to the timing of grading or planting of landscaping and green infrastructure features may be granted on an as needed basis by the City of Baraboo, upon approval of ESD. The specific conditions affecting implementation, and the schedule and conditions for completing implementation, shall be set forth in writing and become part of the permit conditions.

E. Any substantial modification to approved plans shall be submitted to the DNR for their records.

F. Any modification that will not substantially affect the elements and/or modeling values of the approved plans is deemed by the City of Baraboo to be minor and will not require a formal amendment submittal. The City of Baraboo will convey approval or disapproval of minor modifications directly to the applicant in writing.

G. All modifications, substantial and minor, will be documented into the project files by the City of Baraboo.

4.2.15 Permit Transfers During Construction

A. When a permittee and landowner act to transfer an interest in property subject to an approved plan prior to completion of the proposed steps to attain soil stabilization, the permittee must secure approval from the City of Baraboo.

B. When a permittee and landowner transfer ownership, possession or control of real estate subject to an uncompleted erosion control plan, the successor in interest to any portion of the real estate shall be responsible to control soil erosion and runoff and shall comply with the minimum standards provided in this document.

C. When ownership, possession or control of property subject to an uncompleted erosion control plan is transferred, the former owner (seller) shall notify the new owner (buyer) as to the current status of compliance with notice to the City of Baraboo, and provide a copy of the erosion control plan or stormwater management plan, or both.

D. Transfers of interest in real estate subject to an approved, uncompleted plan may be conducted consistent with this document under any or the following arrangements:

1. The transferee shall file a new, approved erosion control or stormwater management plan, or both, with the City of Baraboo;

2. The transferee shall obtain an approved assignment from the City of Baraboo as sub-permittee to complete that portion of the approved plan regulating soil erosion and runoff on the transferee's property;

3. The permittee shall provide the City of Baraboo with a duly completed and executed continuing surety bond or certified check in an amount sufficient to complete the work proposed in the approved plan; at the time of transfer the permittee may seek to reduce the surety bond or certified check to the appropriate amount to complete remaining work. If the transferor enters into escrow agreements with the transferees to complete an approved plan, these funds shall be available to the City of Baraboo to attain compliance and safety. When an approved erosion control plan and, if required, a stormwater management plan is or are not completed as proposed, the City of Baraboo may use the surety bond to complete remaining work to achieve plan compliance.

3.2.16 Duration

A. Stormwater Management Permits shall be valid for a period beginning with the date of issuance by the City Engineer and extending six months from the date of issuance. All work must be completed prior to the expiration date of the permit.

B. However, the City Engineer is authorized to extend the expiration date of the permit if he or she finds that such an extension will not cause an increase in runoff. The City Engineer is further authorized to modify the plans if necessary to prevent any increase in runoff resulting from any extension.

1. Extension requests must be sent to the Public Works Department a minimum of 30-days prior to permit expiration. Failure to do so may result in permit termination, need for a new permit (including the permit fee), and fines for working without a valid permit.

3.2.17 Notice of Permit Termination (NOT)

A. Permit Termination

1. After the site has reached final stabilization, a final inspection is required to be completed by the City of Baraboo prior to removal of any remaining ESC BMPs.
2. After the site has passed the final inspection, all BMPs shall be removed within 24-hours.
3. A Notice of Termination (NOT) request must be submitted to the Public Works after all site work, including removal of all ESC BMPs is completed. No land disturbing activity regulated by this program may take place after the NOT is issued by the City without a new permit.
4. The responsible party shall submit record drawings or “as built” drawings certified by a licensed professional engineer upon completion of the project. Long-Term Maintenance and Inspections are the responsibility of the owner, and facilities are subject to inspection and orders for repairs

Appendix A

Stormwater Management Permit Application

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STORMWATER MANAGEMENT PERMIT APPLICATION

COVERS EROSION CONTROL AND LONG-TERM STORMWATER MANAGEMENT

Application Date: _____

Logged In) (Date/Initials):_____

Permit #:_____

Prior to application submission, please refer to the City of Baraboo's Stormwater Management Permitting Program for complete application submittal information and applicable requirements.

Submit this application to: City of **Baraboo Engineering Department**
101 South Boulevard
Baraboo, WI 5**3913**

1. GENERAL INFORMATION

PROJECT NAME: _____

PROPERTY ADDRESS:_____PARCEL NUMBER:_____

2. CONTACT INFORMATION

OWNER(S) NAME:_____ ☐**Check if applicant**

EMAIL: _____ PHONE: (_____)_____

ADDRESS:_____

CITY:_____ STATE: _____ ZIP CODE: _____

CONTRACTOR NAME*:_____ ☐**Check if applicant**

EMAIL: _____ PHONE: (_____)_____

ADDRESS:_____

CITY:_____ STATE: _____ ZIP CODE: _____

LICENSE TYPES AND NUMBER(S): _____

**Note: If the contractor section is left blank, the owner IS considered to be the contractor. Updated information shall be submitted when a contractor is hired.*

CONSULTANT NAME:_____ ☐**Check if applicant**

EMAIL: _____ PHONE: (_____)_____

ADDRESS:_____

CITY:_____ STATE: _____ ZIP CODE: _____

24 HOUR CONTACT FOR EROSION CONTROL BMP INSTALLATION/CONSTRUCTION (Must be trained):

NAME:_____

EMAIL: _____ PHONE: (_____)_____

ADDRESS:_____

CITY:_____ STATE: _____ ZIP CODE: _____

TRAINING TYPE/CERTIFICATION*:_____ DATE OF TRAINING:_____

**Include documentation showing proof of training or certification* ID #: _____

CONTACT PERSON FOR LONG-TERM BMP OPERATION/MAINTENANCE*:

NAME:_____

EMAIL: _____ PHONE: (_____)_____

ADDRESS:_____

CITY:_____ STATE: _____ ZIP CODE: _____

**If no party is indicated then owner is considered to be contact person*

3. PROJECT INFORMATION

ESTIMATED START DATE: / /	ESTIMATED END DATE: / /
AREA TO BE DISTURBED: ACRES	FINISHED SITE IMPERVIOUS AREA: FT ^{2}
AMOUNT EXCAVATED: CUBIC YDS	AMOUNT FILLED: CUBIC YDS
Discharge Information (check all that apply) ❑ Direct to Baraboo River ❑ OTHER	
Brief Project Overview:	

4. PROJECT TYPE: Check one box in column "A" and one box in column "B"

A.	B.
☐ Redevelopment	☐ Redevelopment/Development Other Than Transportation Facilities
☐ Infill	☐ Transportation and Non-Transportation Facility Development
☐ New Development	☐ Transportation Facility- Highway
☐ Combination[1]	☐ Transportation Facility- Non-Highway

[1] **Combination projects sites contain both new and redevelopment areas and requirements will be based on a weighted average**.

5. LONG-TERM STRUCTURAL BMP TYPE: (Check all that apply)

The applicant agrees to follow the criteria in the WDNR technical standard associated with each structural BMP used in the project, unless superseded by the City of Baraboo's technical standards. Where a best management practice is proposed for which there is no technical standard or the technical standard is not used in whole, references on effectiveness in meeting the performance standard must be provided.

BMP TYPES:	Technical Standard/Other Reference
☐ Bioretention for Infiltration*	1004
☐ Infiltration Basin*	1003
☐ Proprietary Storm Water Sedimentation Devices	1006
☐ Permeable Pavement	1008
☐ Rain Garden	1009
☐ Vegetated Infiltration Swales*/Infiltration Trench*	1005/1007
☐ Wet Detention Pond	1001
☐ OTHER	Reference(s):_____
***These practices require a site evaluation based on Technical Standard**	1002

6. SUBMITTALS (NOTE: Electronic copies of all submittals are required. This includes model files)

- Project Narrative
  - i. Description of project and purpose for project
  - ii. Summary of planned work
  - iii. Sources of potential pollution, including trash handling areas, and proposed management measures
  - iv. Summary of project impact on site; including downstream effects
  - v. Name and distance to nearest receiving water body (river, lake, or stream)
  - vi. Discussion of other permits required and their status
  - vii. Construction phases
- Construction Plan Sets - One hard copy (11X17) that shall include at a minimum:
  - i. Map showing existing and proposed elevation contours with flow arrows.
  - ii. Map showing the property/site boundaries, Right-of-Ways, easements, and buried utilities or structures.
  - iii. Erosion Control Plan elements including limits of disturbance, trees > 6" dbh to be retained, estimated BMP quantities, estimated cost including sequencing and if applicable, staging.
  - iv. Long Term Stormwater Management Plan Elements - including detail drawings, quantities, estimated cost including installation, sequencing, critical installation points, and if applicable, staging.
  - v. Street/alley/roadway/parking lot typical sections
  - vi. Landscape Plan including snow storage areas
  - vii. Utility Plan
- Long-Term Operations & Maintenance Plan
  - i. Narrative
  - ii. Map showing inspection points
  - iii. Inspection Schedule

iv. Inspection Form
v. This plan MUST include the owner signature indicating the plan will be followed.

- Detailed Project Schedule
- Modeling
  i. Total Suspended Solids (TSS) Reduction Modeling (Must be in the most recent version of WinSLAMM or P8)
  ii. Peak Flow Modeling
  iii. Soil Loss Modeling

7. FEE SCHEDULE

One acre or less $150.00 Plus $50.00 each additional acre or part thereof	$_____
APPLICATION REVIEW FEE (50% due at time of application – Non-refundable.)	$_____
PERMIT FEE (50% due prior to permit issuance, upon notification of approval)	$_____

8. CERTIFICATION

I hereby certify that the above information is complete and accurate. The work will be in conformance with applicable State laws and ordinances of the City of Baraboo. I understand that ***this is not a permit****, but only an application for a permit and work is not to commence without an approved permit. In addition to this permit, other local, state, and federal permits may be required. It is the responsibility of the owner/applicant to verify that all proper permits have been obtained prior to beginning work. All project activity must adhere to the City of Baraboo's Code of Ordinances. The City of Baraboo's Site Erosion Control and Long-Term Stormwater Management Ordinance (Found in Chapter 14 of the Code of Ordinances) can be viewed on the City's website at www.cityofbaraboo.com (Under the City Government). Any non-compliance will result in enforcement.*

SIGNATURE (OWNER): _____ **DATE:** _____

PRINTED NAME (OWNER): _____ DATE: _____

SIGNATURE (APPLICANT): _____ **DATE:** _____

PRINTED NAME (APPLICANT): _____ DATE: _____

FOR OFFICE USE ONLY

PERMIT NO:_____ APPLICATION DATE: _____ ISSUE DATE:_____

Contacted for Permit Payment By:_____ on (date):_____

Permit Payment Received By: _____ on (date: _____

Receipt #: _____ Payment Total: _____

Approved by Engineering Department: _____ DATE:_____

Approved by Building Inspection:_____ DATE:_____

Approved by City Engineer:_____ DATE:_____

CONDITIONS OF APPROVAL: _____

_____

_____

_____

Appendix B

Modeling Requirements, Details and Guidance

APPENDIX B-1 - CITY OF BARABOO STORMWATER MODELING REQUIREMENTS

B-1.1. IN GENERAL

1. ALL electronic model files must be provided to the City of Baraboo for review
2. Good, generally accepted, modeling practices and guidelines shall be employed by the modeler in all cases.
3. If supported by the modeling software, a background image is required to be included in the model space to aid the review.
4. Sheet flow lengths shall not exceed 100ft and must be representative of actual existing or proposed conditions.
5. Antecedent Moisture Condition shall be assumed to be 2.
6. Pervious areas and connected impervious areas shall be modeled as separate areas or sub-catchments for the purposes of peak flow calculations. Disconnected impervious areas may be combined with the pervious areas which they flow onto and modeled utilizing a composite curve number.
7. All input data for individual areas, reaches, ponds, or other routing components must be included.
8. Routing schematics shall be included for existing and proposed condition.
9. Graphical hydrographs shall be shown for all storms and all drainage areas.
10. Inflow and outflow graphical hydrographs shall be included for all structural BMP's utilized in reducing peak rates of flow.
11. Stage versus discharge data shall be included which accurately reflects the outlet structure design details, including the emergency overflow, if applicable.

B-1.2. PROJECT DESCRIPTION

1. As part of the project narrative, or as a separate document, a detailed explanation of model input values and assumptions must be included. Items to discuss include, but are not limited to:
   i. Conceptual design – How do the proposed site conditions translate into model space?
      a. Example: List the control practices with plan set names and model names
   ii. Assumptions – in all models, there are items which have to be assumed based on good sound judgement of the modeler. What items within the model required a choice, and why was that choice made?
      a. Example: Sumped catch basins are located on a site, but not included in the model. Why was that choice made?
   iii. Site Conditions – For Example: What data was used to determine soil type(s) found on the site?
   iv. Conformance and/or deviations from applicable DNR and/or COS technical standards.

APPENDIX B-2 - MODELING STANDARDS & SPECIFICATIONS

B-2.1. WATER QUALITY MODELING

1. The most recent version of WinSLAMM (preferred) or P8 shall be used.
2. Water Quality Modeling shall include TSS, any pollutants regulated by a Total Maximum Daily Load (TMDL), and any other pollutants the City communicates to the applicant, in writing.

3. Appropriate parameter, rainfall, and particle distribution files must be used as noted below.

B-2.2 MODELING WITH WINSLAMM:

1. For WinSLAMM, appropriate files can be found on the USGS website. (https://www.usgs.gov/software/winslamm)

   i. Input Values:

      a. The rain file shall be "WisReg – Madison WI 1981.RAN".

      b. Winter season dates of December 2 – March 12 shall be used

   ii. Wet Ponds

      a. "Initial Stage Elevation" must be set equal to the invert elevation of the lowest outlet.

   iii. Infiltration Rates

      a. Dynamic infiltration rates shall be used for grass swale and filter strip practices 1) The dynamic infiltration rate is equal to one-half the static infiltration rate.

      b. Static infiltrations rates shall be used for all other practices in which water infiltrates the surface of the practice.

      c. Wisconsin Department of Natural Resources Technical Standard 1002, Site Evaluation for Stormwater Infiltration, shall be used for designing all infiltration practices based on soil borings performed on the design site.

B-2.3 MODELING WITH P8

1. For P8, appropriate files can be found on the WDNR website. (http://dnr.wi.gov/topic/stormwater/standards/slamm.html)

   i. The precipitation file to be used shall be: Mdsn6095.PCP

   ii. The temperature file to be used shall be: Mdsn6095.TMP

   iii. The particle file to be used shall be: NURP50.p8p

   iv. The effective start date shall be 0901198.

   v. The effective keep date shall be 10011980.

   vi. The effective stop date shall be 09301981.

B-2.4 PEAK FLOW MODELING

1. HydroCAD or other industry accepted software shall be used.

2. By design, BMPs shall be employed to maintain or reduce the peak runoff discharge rates as compared to pre-development conditions per NR 151, the City of Baraboo's Stormwater Management Program. The pre-development curve numbers found in Chapter 14, Table 1 shall be used.

   i. If the pre-developed condition of a site is a combination of woodland, grassland, and/or cropland, the runoff curve number should be pro-rated by area.

   ii. The meaning of "hydrologic soil group" and "runoff curve number" are determined in TR-20/55

iii. The appropriate developed curve numbers for each land use and soil type, as defined in TR-20/55, shall be used when modeling developed site conditions.

3. Rainfall Data

i. Although there are several valid sources of rainfall data, there are currently two main acceptable sources for use within the City of Baraboo.

a. NOAA Atlas 14 Point Precipitation Frequency Estimates: WI, Volume 8, version 2. https://hdsc.nws.noaa.gov/hdsc/pfds/pfdsmapcont.html?bkmrk=WI

b. NRCS Engineering Field Handbook (EFH) – Part 650, Chapter 2, Wisconsin Supplement "Estimating Runoff and Peak Discharges", Appendix 1

24-hr Rainfall Event	**Atlas 14 (inches)**	**TP-40 (inches)**
1-year	2.50	2.52
2-year	2.83	2.86
5-year	3.47	3.51
10-year	4.09	4.15
25-year	5.07	5.18
50-year	5.93	6.10
100-year	6.89	7.11

ii. Other sources for consideration:

a. For other return periods and durations please refer to the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server (PFDS) at: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds map cont.html?bkmrk=wi

4. Although WinTR-55 has been released on the national level by NRCS, its use in Wisconsin is only allowed with recommendations and cautions found in the USDA NRCS memo dated November 12, 2010.

i. Click *HERE* to download the memo [http://www.nrcs.usda.gov/wps/PA NRCSConsumption/download?cid=stelprdb1261067&ext=pdf].

B-2.5. CONSTRUCTION SITE SOIL LOSS MODELING

1. Construction site soil loss modeling is required by the City of Baraboo and WDNR became effective in 2007.

2. The DNR Soil Loss and Sediment Discharge Calculation Tool shall be used to fulfill this requirement.

i. A model spreadsheet and associated guidance to assist in this analysis can be found on the Wisconsin DNR website. (http://dnr.wi.gov/topic/stormwater/publications.html)

3. If the planned BMPs, sequencing, or duration of the project are significantly modified during construction, as determined by ESDPW, updated soil loss modeling may be required to be resubmitted to the City to verify conformance with the construction site soil loss performance standard.

Appendix C

Erosion Control Inspection Report Form

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CONSTRUCTION SITE INSPECTION REPORT

Notice: Use of this specific form is voluntary, but the information contained on this form must be collected and kept by the permittee under s. 14.28 (5), for a construction site covered under the City of Baraboo Construction Site Erosion Control Code. This form is provided for the convenience of the permittee to document inspection throughout the construction process. Multiple copies of this form may be made to compile the inspection report.

Inspections of implemented erosion and sediment control best management practices must be performed weekly and within 24 hours after a precipitation event 0.5 inches or greater which results in runoff.

Weekly written reports of all inspections conducted by or for the permittee are recommended to be maintained throughout the period of general permit coverage.

The information maintained in accordance with s. NR 216.48 (4) for sites greater than one acre must be submitted to the DNR upon request.

If you have questions regarding this form or construction site erosion control requirements may contact the Engineering Department at (608) 355-2730.

Name of Permittee:	**Permit Number:**
Construction Site Name (Project):	**Field Office Phone:**
Location:	**Contractor:**

Note: Weekly inspection reports, along with erosion control and stormwater management plans, are required to be maintained on site and made available upon request.

Date of inspection (mm/dd/yy): **Time of inspection: Start: _____ a.m./p.m.** **End: _____ a.m./p.m.**	**Type of inspection:** ☐ **Weekly** ☐ **Precipitation Event ____"** ☐ **Reinspection** ☐ **Other (specify)** _____ **Name(s) of individual(s) performing inspection:**
Weather:	
Description of present phase of construction:	

Modifications Required	**Yes**	**No**	**Not Applicable**	**Comments/Recommendations** about the overall effectiveness of the erosion and sediment control measures. **Note**: For each item checked "Yes", complete the follow-up information on page 2.
Ditch Checks	☐	☐	☐	
Erosion Control Plan	☐	☐	☐	
Erosion Mat	☐	☐	☐	
Grading Practices	☐	☐	☐	
Inlet Protection	☐	☐	☐	
Mulch	☐	☐	☐	
Offsite Sediment	☐	☐	☐	
Permanent Seeding	☐	☐	☐	
Schedule / Phasing	☐	☐	☐	
Silt Fence	☐	☐	☐	
Silt Screen	☐	☐	☐	
Sod	☐	☐	☐	
Stabilized Outlet	☐	☐	☐	
Temp. Diversion Channel	☐	☐	☐	
Temp. Settling Basin	☐	☐	☐	
Temporary Seeding	☐	☐	☐	
Tracking Pads	☐	☐	☐	
Turbidity Barrier	☐	☐	☐	
Other (specify) _____	☐	☐	☐	
Other (specify) _____	☐	☐	☐	
Other (specify) _____	☐	☐	☐	
Other (specify) _____	☐	☐	☐	
Other (specify) _____	☐	☐	☐	

CONSTRUCTION SITE INSPECTION REPORT

Name of Permittee:	**Permit Number:**
Construction Site Name (Project):	**Field Office Phone:**

Use the space below for detailed follow-up action items.

Exact place of erosion/sediment control inspected	Type of erosion/sediment control and its observed condition	Description of any necessary maintenance or repair to erosion/sediment control, including anticipated date of completion

Appendix D

Long-Term Inspection and Operation & Maintenance Plan and Agreement Criteria

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APPENDIX D-1 - LONG-TERM OPERATION & MAINTENANCE REQUIREMENTS

D-1.1. In General

1. O&M plans shall be site specific and shall address all inspections and maintenance items as they pertain to the stormwater management system.
2. Outdoor good housekeeping practices specific to the industry or development should be included as they can have an impact on the system. Some good housekeeping practices that may affect the quality of runoff on the site include, but are not limited to:

   i. Outdoor storage
      a. Outdoor storage or uses/activities with the potential to generate bacteria, trash, or other pollutants should be maintained to prevent discharges or drainage to surface waters and storm drains.

   ii. Vehicle washing
      a. Washing should be done within a designed wash bay or on a vegetated surface

   iii. Parking lot cleaning
      a. Routine (e.g. monthly or semi-annually) sweeping of heavily used parking areas could reduce BMP maintenance

   iv. Vehicles
      a. Storage
         1) Storing fleet vehicles in designated areas on-site may could minimize the potential of related pollutants from entering multiple on-site BMPs
      b. Maintenance
         1) Routine inspection and maintenance of fleet vehicles will minimize potential impacts on the stormwater system.

   v. Chemical storage
      a. Any chemicals stored outside could be protected and covered to prevent spills

   vi. Garbage receptacles
      a. Trashcans and dumpsters should be easily accessible and remain closed (if possible) when not in use and drains plugged.
      b. All dumpster areas should be fully enclosed on four sides with a locking gate with drainage directed away from storm drains and surface waters

   vii. Use of sand/salt in winter months
      a. Limiting the amount of sand and salt on the site will reduce the burden these have on stormwater BMPs and will keep O&M costs lower. Safety is always the first concern.

   viii. Snow Storage
      a. Snow should be stored in designated locations only. Snow plowed into or stored in Stormwater Management BMPs can have negative impacts on the system including plant health and early clogging.

   ix. Spill Kits
      a. Keeping fully stocked, clearly labeled, spill kits in easy to access locations throughout the site will allow any spills to be contained and cleaned before they enter into and affect the stormwater system.

D-1.2. LT O&M Plan Components

1. Each O&M Plan shall include the following components

   i. Identification of the responsible party (or position) for O&M and associated documentation

   ii. Site specific inspection form(s)

   iii. A Stormwater System Manual (see D-1.2.2 for more details)

   iv. Good housekeeping practices

   v. System map with inspection locations and BMPs labeled clearly

vi. O&M Agreement signed by the owner.

2. System Manual

i. The System Manual is intended to be a comprehensive document explaining the site's stormwater management system. The manual shall include the following items:

a. Any relevant history of the site

1) Items to consider include, but are not limited to,

a) Locations of any contaminated soils

b) Remediation actions or requirements

b. An overview of the entire system including:

1) Applicable design requirements

2) General routing on-site

3) BMPs and system components

c. A description of each BMP or component and its role in the system

d. Detailed Inspection and Maintenance actions for each system component

1) Minimum requirements are listed, per BMP, in section D-2.

e. Inspection and maintenance schedule for the entire life expectancy of the system.

APPENDIX D-2 - BMP Specific Inspection and Maintenance <u>Minimum</u> Requirements

NOTE: This section only includes the minimum required items. It is highly recommended the designer refers to WI DNR technical standards and NR code, and evaluates and considers the site to include additional items or increased frequencies. Incorporate these additional items or increased frequencies in the site-specific plan, if determined appropriate.

The goal of the inspection and maintenance plan is to ensure proper operation **and** longevity of the site's stormwater management system at a reasonable cost.

D-2.1 Wet Pond (DNR Tech Standard 1001)

D-2.2 Dry Pond (DNR Tech Standard 1003)

D-2.3 Artificial Wetland

D-2.4 Biofiltration Systems (DNR Tech Standard 1004)

D-2.5 Filter Strips (DNR Tech Standard 1005)

D-2.6 Permeable Pavement (DNR Tech Standard 1008)

D-2.7 Underground Storage

D-2.8 Grit Chambers and Catch Basin Sumps

D-2.1: WET POND				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring and Late Fall.	Remove dead vegetation, re-plant or re-seed areas with poor vegetation, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow (1 to 2 times per year) to no less than 4 inches.	As needed based on inspections.
Forebay (if applicable)	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring and Late Fall.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Side slopes	Check vegetation as above and for signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Address vegetation concerns as above, mow (1 to 2 times per year) to no less than 4 inches, repair and revegetate damaged or eroded areas.	As needed based on inspections.
Permanent Pool	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Permanent Pool Capacity (including Forebay)	Verify sediment storage capacity.	TBD by Engineer - 1st check should be within 5 years of installation.	Use appropriate equipment (e.g. excavator and dump trucks) to remove the accumulated sediment to restore the original elevation and design capacity. **Material must be disposed of properly!**	Sediment removal required when average pool depth is ≤ 3.5 feet or as determined by engineer.

D-2.2: DRY POND				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring and Late Fall.	Remove dead vegetation, re-plant or re-seed areas with poor vegetation, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow (1 to 2 times per year) to no less than 5-6 inches.	As needed based on inspections.
Forebay (if applicable)	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring and Late Fall.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Side slopes	Check vegetation as above and for signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Address vegetation concerns as above, mow (1 to 2 times per year) to no less than 5-6 inches, repair and revegetate damaged or eroded areas.	As needed based on inspections.
Detention Area	Check for abnormal discoloration or sheens in water during wet periods; check for areas of scour in dry periods.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Detention Area Capacity (including Forebay)	Verify sediment storage capacity.	TBD by Engineer - 1st check should be within 5 years of installation.	Use appropriate equipment (e.g. excavator and dump trucks) to remove the accumulated sediment to restore the original elevation and design capacity. **Material must be disposed of properly!**	Sediment removal required when the pond volume has been reduced by 25% or when average pool depth (Forebay) is $\leq$ 3 feet.

D-2.3: ARTIFICIAL WETLAND				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring and Late Fall.	Remove dead vegetation, re-plant or re-seed areas with poor vegetation, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow (1 to 2 times per year) to no less than 5-6 inches.	As needed based on inspections.
Forebay (if applicable)	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring and Late Fall.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Side slopes	Check vegetation as above and for signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Address vegetation concerns as above, mow (1 to 2 times per year) to no less than 5-6 inches, repair and revegetate damaged or eroded areas.	As needed based on inspections.
Permanent Pool	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Permanent Pool Capacity (including Forebay)	Verify sediment storage capacity.	TBD by Engineer - 1st check should be within 5 years of installation.	Use appropriate equipment (e.g. excavator and dump trucks) to remove the accumulated sediment to restore the original elevation and design capacity. **Material must be disposed of properly!**	Sediment removal required when average pool depth is ≤ 3 feet or as determined by engineer.

D-2.4: BIOFILTRATION SYSTEMS				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, bare areas, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring and Late Fall.	Water plants, remove dead vegetation, re-plant, re-seed, or add mulch to areas with poor or no vegetation or mulch, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow (1 to 2 times per year) to no less than 5-6 inches.	As needed based on inspections.
Side slopes	Check vegetation as above and for signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Address vegetation concerns as above, mow (1 to 2 times per year) to no less than 5-6 inches, repair and revegetate damaged or eroded areas.	As needed based on inspections.
Detention / Infiltration Area	Check for abnormal odors, discoloration, or sheens in water during wet periods. Monitor drain down time - surface should be free of standing water 24-48 hours after rain event. Check for areas of scour or erosion and sediment accumulation in dry periods.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Use appropriate methods to address excessive pollutants causing abnormal odors, colors, or sheens. Use appropriate methods (flat bottom shovel) to remove excessive sedimentation. Restore/repair areas of erosion or scour as needed.	As needed based on inspections.
Underground Storage Layer	Monitor drain down time - system should be dry within 72 hours.	72 hours after each rain event of 0.5" or greater producing runoff.	No routine maintenance items for this component. If the system is not draining adequately, the system will need major maintenance.	N/A

D-2.5: FILTER STRIPS				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets (if applicable)	Check for structure or curb cut damage and signs of undercutting, scouring, erosion, and blockages in adjacent areas.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, bare areas, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Water, remove dead vegetation, re-plant, or re-seed areas with poor or no vegetation, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow to keep vegetation height under 12" but no less than 5-6".	As needed based on inspections.
Slope and Top of Slope	Check for damage (e.g. - rutting from vehicles) sediment accumulation and signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair and revegetate damaged or eroded areas. Remove accumulated sediment with a flat bottom shovel, dispose of appropriately, and revegetate if needed.	As needed based on inspections.

D-2.6: PERMEABLE PAVEMENT				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Pavement Condition	Check for loose blocks, spalling, cracks, heaving, sinking, loss of surface and/or joint material, etc.	Annual.	Repair any issue significant enough to adversely impact the water quality function of the system. For permeable pavers/blocks with joints that are filled with aggregate: - Replenish the joint aggregate in accordance with industry recommendations. - If necessary, remediate the system by extracting accumulated debris and aggregate from the joints using a vacuum and re-filling the joints with new aggregate. For porous asphalt and pervious concrete, repairs may be done with conventional impervious materials if the total impervious repair areas do not exceed 10% of the original permeable surface area and runoff from the repair areas will run on to adjacent permeable areas.	As needed based on inspections.
Surface Infiltration	Check for sedimentation or evidence of ponding.	Annual and after each rain event of 0.5" or greater producing runoff.	Clean the pavement surface using industry recommended methods - regenerative air or vacuum sweeping.	Minimally twice per year and as needed if ponding persists upon inspection after rain events.
Outfalls	Check all underdrain outfalls for obstructions and erosion.	Annual.	Repair blocked, restricted or eroding underdrain outfalls.	As needed based on inspections.
Surrounding (run-on) areas - vegetated	Check height and types, and for signs of poor plant health, bare areas, and erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair and replant any areas found to have vegetation health issues or have started to erode.	As needed based on inspections.

D-2.6: PERMEABLE PAVEMENT (continued)				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Surrounding (run-on) areas - non-vegetated	Check for damage to pavement, concrete, or buildings. Check for signs of inappropriate water drainage (e.g. concentrated flow through damaged areas).	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair any areas found to have issues as appropriate to mitigate excessive or concentrated flow to the permeable pavement system.	As needed based on inspections.
System Drainage	If present, check observation wells to verify the storage reservoir is draining down.	72 hours after a rain event of 0.5" or greater.	No routine maintenance items for this component. If the system is not draining adequately, the system will need major maintenance.	N/A

Additional Permeable Pavement O&M items:	
Prohibitions	Temporary or permanent stockpiling of soil or other material that can potentially cause or contribute to clogging. Application of pavement seal-coating. Application of sand for deicing.

C-2.7: UNDERGROUND STORAGE				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Pretreatment device (e.g. grit chamber)	See considerations for D-2.8: Grit Chambers and Catch basin Sumps.			
Permanent Pool Capacity	Use observation wells or inspection ports and appropriate methods to verify accumulated sediment.	Frequency schedule TBD per site by design engineer.	Use appropriate equipment (e.g. Vactor Truck) to remove the accumulated sediment to restore **the design sediment storage capacity. Material must be disposed of properly!**	As needed based on inspections.

C-2.8: GRIT CHAMBERS AND CATCH BASIN SUMPS				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Structure Condition	Check for damage, cracking, leaking, etc. on all components of the structure.	Annual.	Repair any defects, seal any cracks, replace any broken components per manufacture recommendations or industry standards.	As needed based on inspections.
Accumulation	Use appropriate method to verify the depth of accumulation - TBD per site by design engineer.	Frequency schedule TBD per site by design engineer.	Use appropriate equipment to remove the accumulated sediment to restore the design sediment storage capacity. **Material must be disposed of properly!**	As needed based on inspections.

Appendix E

Stormwater Management Performance Standards Flow Chart

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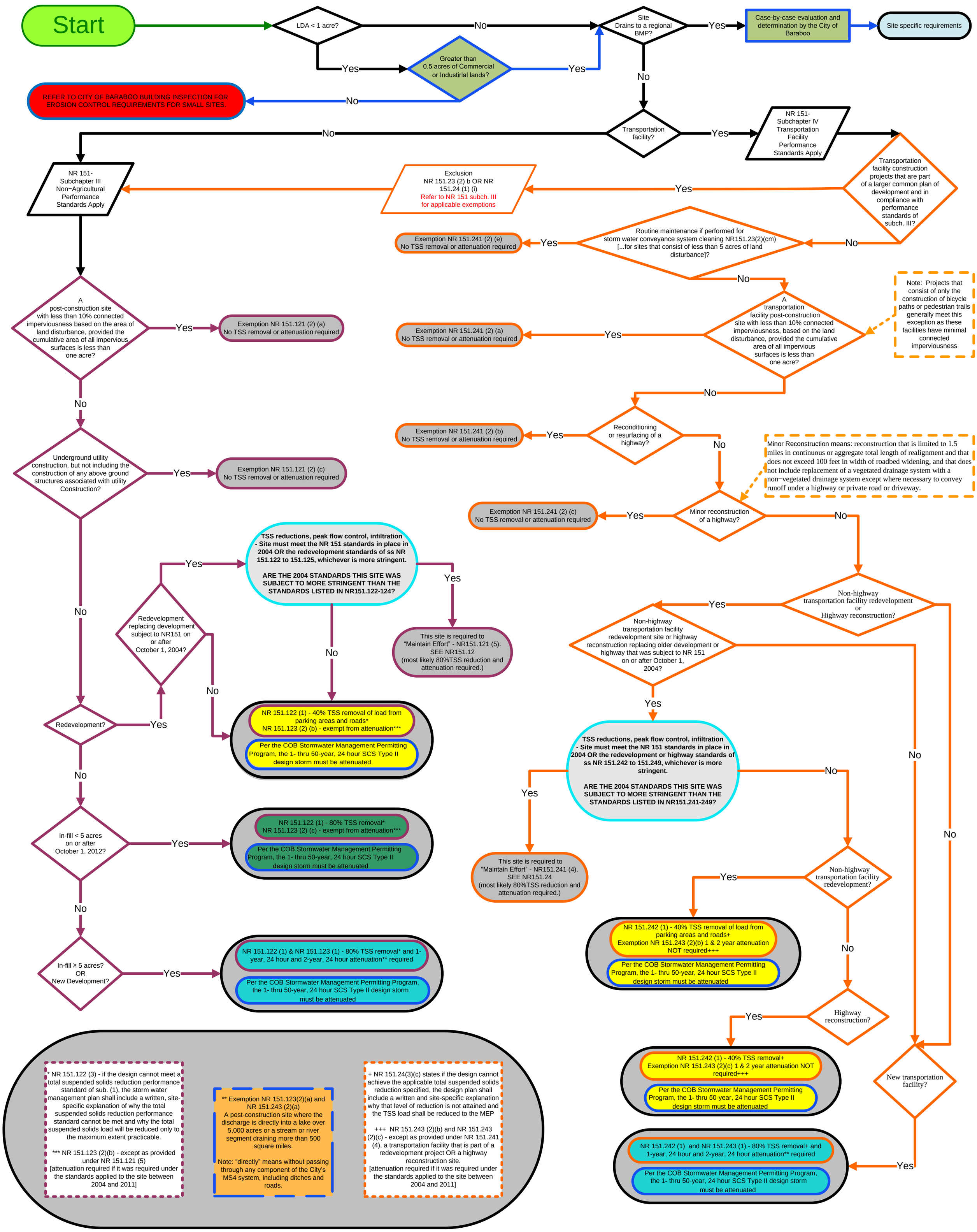
City of Baraboo Stormwater Management Performance Standards Flow Chart



Appendix F

Chapter 14, Subchapter IV: Stormwater Management

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any notice relating to the condemnation of a dwelling or dwelling unit as unfit for human habitation may request and shall be granted a hearing on the matter before the Board of Zoning Appeals under the procedure set forth in §§14.37.

(4) PLACARDING OR CONDEMNING DWELLINGS AND DWELLING UNITS AS UNFIT FOR HUMAN HABITATION. After the condemnation notice which is required under sub. (2) has resulted in an order in accordance with §§14.37, the Building Inspector shall placard the affected dwelling or dwelling unit as unfit for human habitation. The Building Inspector shall post, in a conspicuous place upon the affected dwelling or dwelling unit, a placard bearing the following words: "Condemned as Unfit for Human Habitation."

(5) VACATION OF CONDEMNED AND PLACARDED DWELLINGS AND DWELLING UNITS. Any dwelling or dwelling unit which has been condemned and placarded as unfit for human habitation by the Building Inspector shall be vacated within a reasonable time as required by the Building Inspector. No owner or operator shall let to any person for human habitation and no person shall occupy any dwelling or dwelling unit which has been condemned and placarded by the Building Inspector after the date on which the Building Inspector has required the affected dwelling or dwelling unit to be vacated.

(6) PLACARD NOT TO BE REMOVED UNTIL DEFECTS ARE ELIMINATED. No dwelling or dwelling unit which has been condemned and placarded as unfit for human habitation shall be occupied until written approval is secured from, and such placard is removed by, the Building Inspector. The Building Inspector shall remove such placard whenever the defect or defects upon which the condemnation and placarding action were based have been eliminated.

(7) PLACARD TO BE REMOVED ONLY BY BUILDING INSPECTOR. No person shall deface or remove the placard from any dwelling or dwelling unit which has been condemned as unfit for human habitation and placarded as such, except as provided in sub. (6).

14.45 **SUBCHAPTER DOES NOT IMPAIR AUTHORITY OF BUILDING INSPECTOR AND/OR CITY TO ACT ON NUISANCES OR TO RAZE BUILDING UNDER §66.05 WIS. STATS.** Nothing in this subchapter shall be construed to impair or limit the City in defining and declaring nuisances or the Building Inspector in removing or abating nuisances by summary or other appropriate proceedings or the City and/or the Building Inspector to raze buildings within the City as authorized by Wisconsin Statutes (see §66.05, Wis. Stats).

14.46 **SUBCHAPTER DOES NOT ABROGATE PROVISIONS OF BUILDING CODE.** The provisions of this subchapter shall not abrogate the responsibility of any person to comply with any provisions of the State Building Code and the Building and Zoning Codes of the City.

14.47 **DISCLAIMER ON INSPECTIONS.** The purpose of the inspections under this code is to improve the quality of housing in the City. The inspections and the reports and findings issued after the inspections are not intended as, nor are they to be construed, as a guarantee. In order to so advise owners and other interested persons, a disclaimer shall be included in each inspection report as follows: "The findings of inspection contained herein are intended to report conditions of noncompliance with code standards that are readily apparent at the time of inspection. The inspection does not involve a detailed examination of the mechanical systems or the closed premises. No warranty of the operation, use or durability of equipment and materials not specifically cited herein is expressed or implied."

14.48 **PENALTIES.** Any person violating any order of the Building Inspector based on the provisions of this subchapter or any provisions of any rule or regulation adopted by this Building Inspector pursuant to authority granted by this subchapter, shall upon conviction thereof, be subject to a forfeiture as provided by §25.04 of this Municipal Code. Each violation and each day a violation continues or occurs shall constitute a separate offense. After conviction and punishment for violation of such order of the Building Inspector based upon the provisions of this subchapter or any provisions of any rule or regulation adopted by the Building Inspector, if such person continues to violate such order, such person shall be liable for further prosecution, conviction, and punishment upon such order, without the Building Inspector issuing a new order, until such order has been complied with.

14.49 **ACTION TO ABATE.** Upon request by the Building Inspector, the City Attorney shall be empowered to bring an action to enjoin the use and/or occupancy of a dwelling unit, dwelling, accessory building or other building covered by this sub-chapter alleged to be in violation of this sub-chapter and such action may include the penalties as provided in §14.47.

14.50 thru 14.60 Reserved

SUBCHAPTER IV: STORMWATER MANAGEMENT (2037 11/28/2000, 2280 05/13/2008)

14.61 **AUTHORITY.**

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(1) This ordinance is adopted by the Common Council under the authority granted by §62.234, Wis. Stats. This ordinance supersedes all provisions of an ordinance previously enacted under §62.23, Wis. Stats., that relate to stormwater management regulations. Except as otherwise specified in §62.234, Wis. Stats., §62.23, Wis. Stats., applies to this ordinance and to any amendments to this ordinance.

(2) The provisions of this ordinance are deemed not to limit any other lawful regulatory powers of the City of Baraboo.

(3) The Baraboo Common Council hereby designates the City Engineer to administer and enforce the provisions of this Ordinance, under the direction of the Public Safety Committee. The City Engineer may appoint assistants to aid in the performance of duties and may seek technical advice from professional consultants and State and County agencies as to the adequacy of any proposed plan and permit application submitted to him or her.

(4) The requirements of this ordinance do not pre-empt more stringent stormwater management requirements that may be imposed by any of the following:

(a) Wisconsin Department of Natural Resources administrative rules, permits or approvals including those authorized under §§281.16 and 283.33, Wis. Stats.

(b) Targeted non-agricultural performance standards promulgated in rules by the Wisconsin Department of Natural Resources under §NR 151.004, Wis. Adm. Code.

(c) Rules related to State-approved Total Maximum Daily Load (TMDL) standards applicable to the Wisconsin River Basin.

14.62 <u>FINDINGS OF FACT</u>. The Common Council finds that uncontrolled, post-construction runoff has a significant impact upon water resources and the health, safety, and general welfare of the community and diminishes the public enjoyment and use of natural resources. Specifically, uncontrolled post-construction runoff can:

(1) Degrade physical stream habitat by increasing stream bank erosion, increasing streambed scour, diminishing groundwater recharge, diminishing stream base flows and increasing stream temperature.

(2) Diminish the capacity of lakes and streams to support fish, aquatic life, recreational and water supply uses by increasing pollutant loading of sediment, suspended solids, nutrients, heavy metals, bacteria, pathogens, and other urban pollutants.

(3) Alter wetland communities by changing wetland hydrology and by increasing pollutant loads.

(4) Reduce the quality of groundwater by increasing pollutant loading.

(5) Threaten public health, safety, property, and general welfare by overtaxing storm sewers, drainage ways, and other minor drainage facilities.

(6) Threaten public health, safety, property, and general welfare by increasing major flood peaks and volumes.

(7) Undermine floodplain management efforts by increasing the incidence and levels of flooding.

14.63 <u>PURPOSE AND INTENT</u>.

(1) PURPOSE. The general purpose of this ordinance is to establish long-term, post-construction runoff management requirements that will diminish the threats to public health, safety, welfare, and the aquatic environment. Specific purposes are to:

(a) Further the maintenance of safe and healthful conditions.

(b) Prevent and control the adverse effects of stormwater; prevent and control soil erosion; prevent and control water pollution; protect spawning grounds, fish, and aquatic life; promote the integration of effective stormwater management with site design and landscaping that enhances the visual and environmental quality and economic vitality of the City of Baraboo and facilitate the use of green infrastructure practices that further the city's economic, environmental and community quality.

(c) Control exceedance of the safe capacity of existing drainage facilities and receiving water bodies; prevent undue channel erosion; control

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increases in the scouring and transportation of particulate matter; and prevent conditions that endanger downstream property.

(d) Minimize the amount of pollutants discharged from the separate storm sewer to protect waters of the state.

(e) Promote the public health, safety, prosperity, and general welfare of the citizens of the City of Baraboo by conserving the soil, water, and related resources and control erosion and sedimentation.

(2) INTENT. It is the intent of the City of Baraboo that this ordinance regulates post-construction stormwater discharges to waters of the state. This ordinance may be applied on a site-by-site basis. The City of Baraboo recognizes, however, that the preferred method of achieving the stormwater performance standards set forth in this ordinance is through the preparation and implementation of comprehensive, systems-level stormwater management plans that cover hydrologic units, such as watersheds, on a municipal and regional scale. Such plans may prescribe regional stormwater devices, practices or systems, any of which may be designed to treat runoff from more than one site prior to discharge to waters of the state. Where such plans are in conformance with the performance standards developed under §281.16, Wis. Stats., for regional stormwater management measures and have been approved by the City of Baraboo Common Council, it is the intent of this ordinance that the approved plan be used to identify post-construction management measures acceptable for the community.

14.64 <u>APPLICABILITY AND JURISDICTION</u>.

(1) APPLICABILITY. This ordinance applies to a post-construction site with altered land use as described in the stormwater management permitting program.

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(2) JURISDICTION. This ordinance applies to post construction sites within the boundaries and jurisdiction of the City of Baraboo and, to the extent allowed by law, to lands subject to extraterritorial plat approval jurisdiction as provided by Ch. 18 of this Code if said lands are within a drainage basin or watershed that discharges stormwater into the City.

(3) EXCLUSIONS. This ordinance is not applicable to activities conducted by a state agency, as defined under §227.01 (1), Wis. Stats., but also including the office of district attorney, which is subject to the state plan promulgated or a memorandum of understanding entered into under §281.33 (2), Wis. Stats.

14.65 <u>DEFINITIONS</u>. Definitions in section 14.24 of this ordinance apply to this ordinance along with the following:

(1) ADEQUATE SOD OR SELF-SUSTAINING VEGETATIVE COVER means maintenance of sufficient vegetation types and densities such that the physical integrity of the streambank or lakeshore is preserved. "Self-sustaining vegetative cover" includes grasses, forbs, sedges, and duff layers of fallen leaves and woody debris

(2) ATLAS 14 means the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 8 (Midwestern States), published in 2013.

(3) AVERAGE ANNUAL RAINFALL means a typical calendar year of precipitation as determined by the Wisconsin Department of Natural Resources for used of models such as WinSLAMM, P8 or equivalent methodology. The average rainfall is chosen from a department publication for the location closest to the municipality, excluding snow, which is considered typical. In this ordinance, the recorded rainfall at Madison from 3/12/1981 through 12/2/1981 has been selected as the average annual rainfall.

(4) CITY ENGINEER means the governmental employee designated by the governmental body to administer this Ordinance, and includes any other governmental employees who are supervised by the administrator.

(5) CLOSED WATERSHED shall mean a drainage basin or watershed which does not discharge storm-water during a storm of twenty-four (24) hour duration and two- (2) year recurrence interval occurring over the basin with the land in its predevelopment condition.

(6) COMBINED SEWER SYSTEM means a system for conveying both sanitary sewage and stormwater runoff.

(7) COMMERCIAL LAND USE shall mean use of the land for the retail or wholesale of goods or services.

(8) CONNECTED IMPERVIOUSNESS means an impervious surface that is directly connected to a separate storm sewer or water of the state via an impervious flow path.

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(9) CONTROL PLAN is a written description approved by the City Engineer's authority, of methods for controlling sediment pollution from accelerated erosion on a development area and/or from erosion caused by accelerated runoff from a development area and controlling runoff.

(10) CUBIC YARDS means the amount of material in excavation and/or fill measured by the method of "average end areas."

(11) CURVE NUMBER shall mean as used in the runoff calculation methodology promulgated by the United States Soil Conservation Service National Engineering Handbook (see App. B).

(12) DEVELOPMENT means residential, commercial, industrial or institutional land uses, and associated roads.

(13) DIRECT CONDUITS TO GROUNDWATER means wells, sinkholes, swallets, fractured bedrock at the surface, mine shafts, non-metallic mines, tile inlets discharging to groundwater, quarries, or depressional groundwater recharge areas over shallow fractured bedrock.

(14) EFFECTIVE INFILTRATION AREA means the area of the infiltration system that is used to infiltrate runoff and does not include the area used for site access, berms or pretreatment.

(15) EXCEPTIONAL RESOURCE WATERS means waters listed in §NR 102.11, Wis. Adm. Code.

(16) EXCAVATION means any act by which organic matter, earth, sand, gravel, rock or any other similar material is cut into, dug, quarried, uncovered, removed, displaced, relocated or bulldozed and shall include the conditions resulting therefrom.

(17) EXISTING GRADE means the vertical location of the existing ground surface prior to excavation of filling.

(18) FILL means any act by which earth, sand, gravel, rock or any other material is deposited, placed, replaced, pushed, dumped, pulled, transported or moved by humans to a new location and shall include the conditions resulting therefrom.

(19) FILTERING LAYER means soil that has at least a 3-foot deep layer with at least 20 percent fines; or at least a 5-foot deep layer with at least 10 percent fines; or an engineered soil with an equivalent level of protection as determined by the regulatory authority for the site.

(20) FINANCIAL GUARANTEE means a performance bond, maintenance bond, surety bond, irrevocable letter of credit, or similar guarantees submitted to the City Engineer by the responsible party to assure that requirements of the ordinance are carried out in compliance with the stormwater management plan.

(21) GRADING is altering the elevation of the land surface by stripping, excavating, filling, stockpiling of soil materials or any combination thereof and shall include the land from which the material was taken or upon which it was placed.

(22) HYDROLOGIC SOIL GROUP shall mean as used in the runoff calculation methodology promulgated by the United States Soil Conservation Service National Engineering Handbook (see Appendix C).

(23) IMPERVIOUS SURFACE means an area that releases as runoff all or a large portion of the precipitation that falls on it, except for frozen soil. Rooftops, sidewalks, driveways, parking lots, and streets are examples of areas that typically are impervious.

(24) INDUSTRIAL LAND USE shall mean exterior storage areas, loading and unloading areas, equipment washing areas or other area or surface directly associated with an industrial process or a land use activity covered under the Wisconsin Pollutant Discharge Elimination System.

(25) IN-FILL AREA means an undeveloped area of land located within existing development.

(26) INFILTRATION means the entry of precipitation or runoff into or through the soil.

(27) INFILTRATION SYSTEM means a device or practice such as a basin, trench, rain garden or swale designed specifically to encourage infiltration, but does not include natural infiltration in pervious surfaces such as lawns, redirecting of rooftop downspouts onto lawns or minimal infiltration from practices, such as swales or road side channels designed for conveyance and pollutant removal only.

(28) LAND OCCUPIER OR OCCUPIER OF LAND means any person, partnership, firm or corporation that has a fee simple interest in the land either as sole owner, as a tenant in common or a joint tenant or holds as a trustee, assignee, or holds as a land contract vendee.

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(29) LAND USERS are those who use land, individually or collectively as owners, operators, lessors, renters, occupiers who are providing a service that requires access or alterations of the land in order to perform the service, or by other arrangement which gives them the responsibility of private or public land use.

(31) (30)MAINTENANCE AGREEMENT means a legal document that provides for long-term maintenance of stormwater management practices. "MEP" or MAXIMUM EXTENT PRACTICABLE means the highest level of performance that is achievable but is not equivalent to a performance standard as determined in accordance with 14.66 of this ordinance.

(32) (32)NEW DEVELOPMENT means development resulting from the conversion of previously undeveloped land or agricultural land uses.

(33) NRCS MSE4 DISTRIBUTION means a specific precipitation distribution developed by the United States Department of Agriculture, Natural Resources Conservation Service, using precipitation data from Atlas 14.

(34) OFF-SITE means located outside the property boundary described in the permit application.

(35) ON-SITE means located within the property boundary described in the permit application.

(36) ORDINARY HIGH-WATER MARK has the meaning given in §NR 115.03(6), Wis. Adm. Code.

(37) OUTSTANDING RESOURCE WATERS means waters listed in §NR 102.10, Wis. Adm. Code.

(38) PARCEL is all contiguous lands under the ownership or control of a land occupier or land user.

(39) PEAK FLOW is the maximum rate of flow of water at a given point in a channel, watercourse, or conduit resulting from the predetermined storm or flood.

(40) PERCENT FINES means the percentage of a given sample of soil, which passes through a # 200 sieve.

(41) PERMITTEE means any person to whom a permit is issued under this Ordinance.

(42) PERMIT ADMINISTRATION FEE means a sum of money paid to the City Engineer by the permit applicant for the purpose of recouping the expenses incurred by the authority in administering the permit.

(43) PERSON is any individual, corporation, partnership, joint venture, agency, unincorporated association, municipal corporation, county, or state agency within Wisconsin, the federal government, or any combination thereof.

(44) PERVIOUS SURFACE means an area that releases as runoff a small portion of the precipitation that falls on it. Lawns, gardens, parks, forests or other similar vegetated areas are examples of surfaces that typically are pervious.

(45) POST-CONSTRUCTION SITE means a construction site following the completion of land disturbing construction activity and final site stabilization.

(46) PRE-DEVELOPMENT CONDITION means the extent and distribution of land cover types present before the initiation of land disturbing construction activity, assuming that all land uses prior to development activity are managed in an environmentally sound manner. For the purposes of this ordinance, predevelopment conditions shall mean land which has runoff characteristics equivalent to runoff curve numbers of: 30, 58, 71, and 78.

(47) PREVENTIVE ACTION LIMIT has the meaning given in §NR 140.05(17), Wis. Adm. Code.

(48) PROTECTIVE AREA means an area of land that commences at the top of the channel of lakes, streams, and rivers, or at the delineated boundary of wetlands, and that is the greatest of the following widths, as measured horizontally from the top of the channel or delineated wetland boundary to the closest impervious surface.

(49) PUBLIC LANDS mean all lands that are subject to regulation by the City, including, but not limited to:

(a) All lands owned or controlled by the City, and
(b) All land, within the boundaries or extraterritorial control of the City, which are owned by another unit of government if that unit of government is acting in a proprietary rather than governmental function.

(50) RECURRENCE INTERVAL of a storm of given intensity and duration is the average period of time between storms of the same duration and equal or greater intensity.

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(51) REDEVELOPMENT means areas where development is replacing older development.

(52) SEDIMENTATION is the transportation and deposition of sediment that may ultimately degrade water quality by the presence of suspended solid particles, derived from soils by erosion or discharged into surface
waters from other sources; or the deposition of water borne sediments in stream channels, lakes, reservoirs, or on floodplains, usually because of a decrease in the velocity of the water.

(53) SEPARATE STORM SEWER means a conveyance or system of conveyances including roads with drainage systems, streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all of the following criteria:

(a) Is designed or used for collecting water or conveying runoff.
(b) Is not part of a combined sewer system.
(c) Is not draining to a stormwater treatment device or system.
(d) Discharges directly or indirectly to waters of the state.

(54) STORM(WATER) RUNOFF is the water derived from rains falling within a tributary drainage basin, flowing over the surface of the ground or collected in channels, watercourses or conduits.

(55) STORM SEWER is a closed conduit for conducting collected stormwater.

(56) STORMWATER DRAINAGE SYSTEM is all facilities used for conducting stormwater to, through and from a drainage area to the point of final outlet, including but not limited to, any of the following: conduits and appurtenant features, canals, channels, ditches, streams, culverts, streets and pumping stations.

(57) STORMWATER MANAGEMENT PLAN means a comprehensive plan designed to reduce the discharge of pollutants from stormwater after the site has under gone final stabilization following completion of the construction activity.

(58) STORMWATER MANAGEMENT SYSTEM PLAN is a comprehensive plan designed to reduce the discharge of runoff and pollutants from hydrologic units on a regional or municipal scale.

(59) STRUCTURAL MEASURES are works of improvement for land stabilization to prevent erosion, sediment or runoff which includes, but are not limited to, gully control structures, grass waterways, riprap, detention basins, sediment basins, flood retention dams, diversions, lining channels with rock, concrete or other materials. Contour strip cropping is not a structural measure.

(60) TOP OF THE CHANNEL means an edge, or point on the landscape, landward from the ordinary high- water mark of a surface water of the state, where the slope of the land begins to be less than 12% continually for at least 50 feet. If the slope of the land is 12% or less continually for the initial 50 feet, landward from the ordinary high-water mark, the top of the channel is the ordinary high-water mark.

(61) TOTAL MAXIMUM DAILY LOAD or TMDL means the amount of pollutants specified as a function of one or more water quality parameters, that can be discharged per day into a water quality limited segment and still ensure attainment of the applicable water quality standard.

(62) TOTAL PHOSPHORUS (TP) is the sum of particulate and dissolved phosphorus and includes the total amount of phosphorus in both organic and inorganic forms.

(63) TOTAL SUSPENDED SOLIDS (TSS) means all particles suspended in stormwater runoff which will not pass through a filter.

(64) TR-55 means the United States Department of Agriculture, Natural Resources Conservation Service (previously Soil Conservation Service), Urban Hydrology for Small Watersheds, Second Edition, Technical Release 55, June 1986.

(65) WATERS OF THE STATE has the meaning given in §281.01 (18), Wis. Stats.

14.66 PERFORMANCE AND TECHNICAL STANDARDS.

(1) RESPONSIBLE PARTY. The responsible party shall implement a post-construction stormwater management plan.

(2) PLAN. A written stormwater management plan in accordance with 14.68 shall be developed and implemented for each post-construction site.

(3) All BMPs required to comply with this ordinance shall meet the design criteria,

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standards and specifications set forth in the stormwater management permitting program.

(4) APPLICABILITY OF MAXIMUM EXTENT PRACTICABLE. Maximum extent practicable applies when a person who is subject to a performance standard of this ordinance demonstrates to the Building Inspector's or City Engineer's satisfaction that a performance standard is not achievable and that a lower level of performance is appropriate. In making the assertion that a performance standard is not achievable and that a level of performance different from the performance standard is the maximum extent practicable, the responsible party shall take into account the best available technology, cost effectiveness, geographic features, and other competing interests such as protection of public safety and welfare, protection of endangered and threatened resources, and preservation of historic properties.

14.67 <u>PERMITTING REQUIREMENTS, PROCEDURES AND FEES</u>.

(1) PERMIT REQUIRED. Unless specifically excluded by this Ordinance, no land occupier or land user may undertake a land disturbing activity subject to this Ordinance without receiving a permit from the City Engineer prior to commencing the proposed activity. The Building Inspector shall not issue a building permit or construction site permit involving any land disturbing activity unless and until a determination has been made by the City Engineer whether a permit is required under this subchapter. Each land occupier or land user desiring to undertake a regulated activity subject to this ordinance shall submit to the City Engineer an application for a permit together with the appropriate fee required by the fee schedule as adopted by the City of Baraboo Common Council.

(2) PERMIT APPLICATION AND FEES. Unless specifically excluded by this ordinance, any responsible party desiring a permit shall submit to the City Engineer, an application for a permit, a stormwater management plan and a maintenance agreement that meet the requirements in the stormwater management permitting program and shall pay an application fee as specified by the Common Council and as shown in the Official Fee Schedule.

(a) Exceptions to these requirements are as follows:

1. The owner and occupier of public lands are exempt from payment of any permit fees;
2. For its convenience, the City Engineer may enter into an agreement with public or private utilities and governmental units to waive the need for a permit for each individual land disturbing activity, if the utility or governmental unit will agree to adopt and follow a procedure for each land disturbing activity that meets all applicable standards contained in this Ordinance. Further, the agreement shall provide that in the event that a utility or governmental unit activity fails to meet the standard, the agreement shall terminate and the utility or governmental unit shall be subject to the penalties set forth herein.

(3) REVIEW AND APPROVAL OF PERMIT APPLICATION. The City Engineer shall review any permit application that is submitted with a stormwater management plan, maintenance agreement, and the required fee. The approval procedure is outlined in the stormwater management permitting program.

(4) PERMIT REQUIREMENTS. All permits issued under this ordinance shall be subject to the conditions detailed in the stormwater management permitting program.

(5) PERMIT CONDITIONS. In addition to the requirements needed to meet the performance standards in 14.66 or a financial guarantee as provided for in 14.70, all permits issued under this Ordinance shall be issued subject to the conditions detailed in the stormwater management permitting program and any permittee who begins to perform any land disturbing activity authorized by permit shall be deemed to have accepted all such conditions.

(a) Permits issued under this subsection may include conditions established by public works department in addition to the requirements needed to meet the performance standards or financial guarantee.

(6) PERMIT DURATION. Permits issued under this section shall be valid from the date of issuance through the date the public works department notifies the responsible party that all stormwater management practices have passed the final inspection as set forth in the stormwater management permitting program..

14.68 <u>STORMWATER MANAGEMENT PLAN</u>.

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(1) PLAN REQUIREMENTS. The stormwater management plan required under 14.66(2) shall meet the design criteria, standards and specifications and requirements set forth in the stormwater management permitting program.

(2) ALTERNATE REQUIREMENTS. The City Engineer may prescribe alternative submittal requirements for applicants seeking an exemption to on-site stormwater management performance standards under §14.67(5).

(3) PLANS PREPARED BY CITY ENGINEER. As an alternative to submitting the control plan for parcels of 0.5 acre or less, as specified in §14.64(1) the City Engineer may, if time permits, prepare a runoff control plan for the applicant's proposed land disturbing activity, adequate to meet the appropriate standards of §14.66. The City Engineer may require the applicant to submit any data or information that is necessary to prepare such a plan. Also, the applicant must submit the permit application and appropriate application fee as specified in §14.71 In addition to the permit application fee, the applicant must pay the plan preparation fee as specified in the schedule as adopted by the Common Council.

14.69 <u>MAINTENANCE AGREEMENT</u>.

(1) MAINTENANCE AGREEMENT REQUIRED. The maintenance agreement required under §14.67(2) for stormwater management practices shall meet the criteria set forth in the stormwater management permitting program.

14.70 <u>FINANCIAL GUARANTEE</u>.

(1) ESTABLISHMENT OF THE GUARANTEE. The City Engineer may require the submittal of a financial guarantee, the form and type of which shall be acceptable to the City Engineer. The financial guarantee shall be in an amount determined by the City Engineer to be the estimated cost of construction and the estimated cost of maintenance of the stormwater management practices during the period which the designated party in the maintenance agreement has maintenance responsibility. The financial guarantee shall give the City Engineer the authorization to use the funds to complete the stormwater management practices if the responsible party defaults or does not properly implement the approved stormwater management plan, upon writ-ten notice to the responsible party by the administering authority that the requirements of this ordinance have not been met.

(2) CONDITIONS FOR RELEASE. Conditions for the release of the financial guarantee are as follows:

(a) The City Engineer shall release the portion of the financial guarantee established under this section, less any costs incurred by the City Engineer to complete installation of practices, upon submission of "as built plans" by a licensed professional engineer. The City Engineer may make provisions for a partial pro-rata release of the financial guarantee based on the completion of various development stages.

(b) The City Engineer shall release the portion of the financial guarantee established under this section to assure maintenance of stormwater practices, less any costs incurred by the City Engineer, at such time that the responsibility for practice maintenance is passed on to another entity via an approved maintenance agreement.

14.71 <u>FEES</u>.

a. FEE SCHEDULE. The fees referred to in other sections of this ordinance shall be established by the City Engineer and may from time to time be modified by resolution. A schedule of the fees established by the City Engineer shall be available for review in the City Clerk's office.

(2) CONSULTANT SERVICES. If the City retains the services of professional consultants, including, but not limited to planners, engineers, architects, attorneys, environmental specialists, and/or other experts to assist the City in its review of a proposed permit application and/or runoff control plan, and/or if the City Engineer prepares or assists in the preparation of a runoff control plan for the development, the applicant/ developer may be required to reimburse the City for the City Engineer's time and for the costs incurred by the City to retain the services of such professional consultants and such reimbursement shall be in addition to the permit fees and other fees paid by the applicant/developer. The applicant/ developer shall reimburse the City for said costs promptly upon being invoiced for the same and the City may withhold issuance of a permit or delay final approval of a permit until the said costs and fees are reimbursed to the City in full. If the costs and fees are not reimbursed to the City within 30 days of the date of billing, an additional administrative collection charge of 10% of the charge shall be added to the amount due, plus interest shall accrue thereon at the rate of 1% per month until paid and such charge shall be

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extended upon the current or next tax roll as a charge against the subject property for current services as provided in §66.60(16), Wis. Stats. The City may require the applicant/developer to enter into an agreement providing for the reimbursement to the City for said costs and the said agreement may require the applicant/developer to file with the City an Irrevocable Letter of Credit or other appropriate sureties meeting the approval of the City Attorney equal to the estimated cost of said services.

14.72 <u>ADMINISTRATION</u>. In the administration and enforcement of this Ordinance, the City Engineer shall perform the following duties:

(1) Keep an accurate record of all plan data received, plans approved, permits issued, inspections made and other official actions and make a periodic permit activity report to the Public Safety Committee.

(2) Prepare plans for runoff control when requested to do so by the permit application pursuant to §14.68, but only after the appropriate fee is received.

(3) Review all plans and permit applications received when accompanied with the necessary information and the appropriate fee and issue the permits required by §14.68(1) of this Code in accordance with the procedure as set out in this Code, but only when the erosion, sedimentation and runoff will be controlled to meet the standards of §14.67.

(4) Investigate all complaints made to the application of this Ordinance.

(5) Revoke any permit granted under this Ordinance if it is found that the holder of the permit has misrepresented any material fact in his or her permit application or plan; or has failed to comply with the plan as originally approved or as modified in writing subsequently by the City Engineer; or has violated any of the other conditions of the permit as issued to the applicant.

14.73 <u>INCORPORATION BY REFERENCE -</u> In this ordinance, the following document is incorporated by reference:

(1) Stormwater Management Permitting Program.

14.74 <u>ENFORCEMENT</u>.

(1) Any land disturbing construction activity or post-construction runoff initiated after the effective date of this ordinance by any person, firm, association, or corporation subject to the ordinance provisions shall be deemed a violation unless conducted in accordance with the requirements of this ordinance.

(2) The City Engineer shall notify the responsible party by certified mail of any non-complying land disturbing construction activity or post-construction runoff. The notice shall describe the nature of the violation, remedial actions needed, a schedule for remedial action, and additional enforcement action that may be taken.

(3) Upon receipt of written notification from the City Engineer under Sub. (2), the responsible party shall correct work that does not comply with the stormwater management plan or other provisions of this permit. The responsible party shall make corrections as necessary to meet the specifications and schedule set forth by the City Engineer in the notice.

(4) If the violations to a permit issued pursuant to this ordinance are likely to result in damage to properties, public facilities, or waters of the state, the City Engineer may enter the land and take emergency actions necessary to prevent such damage. The costs incurred by the City Engineer plus interest and legal costs shall be billed to the responsible party.

(5) The City Engineer is authorized to post a stop work order on all land disturbing construction activity that is in violation of this ordinance, or to request the City Attorney to obtain a cease and desist order in any court with jurisdiction.

(6) The City Engineer may revoke a permit issued under this ordinance for non-compliance with ordinance provisions.

(7) Any permit revocation, stop work order, or cease and desist order shall remain in effect unless retracted by the City Engineer or by a court with jurisdiction.

(8) The City Engineer is authorized to refer any violation of this ordinance, or of a stop work order or cease and desist order issued pursuant to this ordinance, to the City Attorney for the commencement of further legal proceedings in any court with jurisdiction.

(9) Any person, firm, association, or corporation who does not comply with the provisions of this Code shall be subject to a forfeiture of not less than $50 or more than $500 per offense, together with the costs of

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prosecution. Each day that the violation exists shall constitute a separate offense.

(10) Compliance with the provisions of this ordinance may also be enforced by injunction in any court with jurisdiction. It shall not be necessary to prosecute for forfeiture or a cease and desist order before re-sorting to injunctional proceedings.

(11) When the City Engineer determines that the holder of a permit issued pursuant to this ordinance has failed to follow practices set forth in the stormwater management plan, or has failed to comply with schedules set forth in said stormwater management plan, the City Engineer or a party designated by the City Engineer may enter upon the land and perform the work or other operations necessary to bring the condition of said lands into conformance with requirements of the approved plan. The City Engineer shall keep a detailed accounting of the costs and expenses of performing this work. These costs and expenses shall be deducted from any financial security posted pursuant to §14.61 of this Code. Where such a security has not been established, or where such a security is insufficient to cover these costs, the costs and expenses shall be entered on the tax roll as a special charge against the property and collected with any other taxes levied thereon for the year in which the work is completed.

14.75 <u>APPEALS</u>.

(1) BOARD OF PUBLIC WORKS. The Board of Public Works (Public Safety Committee) shall hear and decide appeals where it is alleged that there is error in any order, decision or determination made by the City Engineer in administering this ordinance. The committee shall use the rules, procedures, duties, and powers authorized by §62.l4, Wis. Stats., §1.24 of this Code, and such other powers and duties assigned by the Council. Upon appeal, the committee may authorize variances from the pro-visions of this ordinance that are not contrary to the public interest, and where owing to special conditions a literal enforcement of the ordinance will result in unnecessary hardship.

(2) WHO MAY APPEAL. Appeals to the committee may be taken by any aggrieved person or by an officer, department, board, or bureau of the City of Baraboo affected by the order, requirement, decision or determination made by the City Engineer. For the purpose of this Ordinance, aggrieved person shall include applicant and property owners who own land that is subject to the Ordinance.

14.76 <u>SEVERABILITY</u>. If any section, clause, provision or portion of this ordinance is judged unconstitutional or invalid by a court of competent jurisdiction, the remainder of the ordinance shall remain in force and not be affected by such judgment.

14.77 <u>EFFECTIVE DATE</u>. This ordinance shall be in force and effect from and after its adoption and publication. The above and foregoing ordinance was duly adopted by the Common Council of the City of Baraboo on the 13th day of May, 2008.

14.78 thru 14.79 (Reserved)

SUBCHAPTER V: ILLICIT STORMWATER DISCHARGE

14.80 <u>GENERAL PROVISIONS</u>

(1) AUTHORITY. This chapter is adopted under the authority granted by §283.33, Wis. Stats. and required by §NR 216.07(3)(a), Wis. Adm. Code.

(2) LEGISLATIVE FINDINGS. The Common Council of the City of Baraboo finds that discharges to the municipal separate storm sewer system that are not composed entirely of stormwater run-off contribute to increased nonpoint source pollution and degradation of receiving waters. The impacts of these discharges adversely affect public health and safety, drinking water supplies, recreation, fish and other aquatic life, property values and other uses of lands and waters.

(3) PURPOSE AND INTENT. This ordinance establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the Wisconsin Pollutant Discharge Elimination System (WPDES) permit process. The objectives of this ordinance are:

i. To regulate the contribution of non stormwater pollutants to the municipal separate storm sewer system (MS4) by stormwater discharges by any user;

ii. To prohibit illicit connections and discharges to the municipal separate storm sewer system.

iii. To establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this ordinance

(4) ABROGATION AND GREATER RESTRICTIONS. It is not intended by this

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ATTACHMENT "F"

CITY OF BARABOO

POLLUTION PREVENTION (2.6)

Prepared by:
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Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

CHAPTER 1 -OVERVIEW 2
1.1 INTRODUCTION 2

CHAPTER 2 - STRUCTURAL STORM WATER MANAGEMENT FACILITIES INSPECTION AND MAINTENANCE 3
2.1 MUNICIPAL FACILITIES 3
2.2 PRIVATE FACILITIES 3
2.3 MUNICIPAL WET DETENTION BASINS 3
2.4 MUNICIPAL DRY DETENTION BASINS 4
2.5 MUNICIPAL BIO RETENTION BASINS 4
2.6 MUNICIPAL RAIN GARDENS 5
2.7 MUNICIPAL SUB-SURFACE WATER QUALITY DEVICES 5
2.8 MUNICIPAL SUB-SURFACE WATER QUALITY DEVICES 6
2.9 INLETS, CATCH BASINS, AND MANHOLES 6
2.10 STORM SEWERS 7
2.11 DITCHES AND CULVERTS 8
2.12 RECOMMENDATIONS 8
2.13 MEASUREABLE GOALS 8

CHAPTER 3 - STREET SWEEPING 9
3.1 STREET SWEEPING 9
3.2 RECOMMENDATIONS 9
3.3 MEASUREABLE GOALS 10

CHAPTER 4 - STREET SWEEPING, INLET, CATCH BASIN AND STORMWATER BASIN MATERIAL DISPOSAL 11
4.1 STREET SWEEPING, INLET, CATCH BASIN AND STORMWATER BASIN MATERIAL DISPOSAL. 11
4.2 RECOMMENDATIONS 11
4.3 MEASUREABLE GOALS 11

CHAPTER 5 – ROAD SALT APPLICATION AND SNOW DISPOSAL 12
5.1 ROADWAY DE-ICING (ROAD SALT) APPLICATION. 12
5.2 SNOW DISPOSAL 12
5.3 RECOMMENDATIONS 12
5.4 MEASUREABLE GOALS 12

CHAPTER 6 – COLLECTION AND DISPOSAL OF LEAVES AND GRASS CLIPPINGS 14
6.1 COLLECTION AND DISPOSAL OF LEAVES AND GRASS CLIPPINGS (YARD WASTE). 14
6.2 RECOMMENDATIONS 14
6.3 MEASUREABLE GOALS 14

CHAPTER 7 - MUNICIPAL STORM WATER POLLUTION PREVENTION PLANNING 15
7.1 MUNICIPAL STORM WATER POLLUTION PREVENTION PLANNING (SWPPP). 15
7.2 RECOMMENDATIONS 15
7.3 MEASUREABLE GOALS 15

CHAPTER 8 – MUNICIPAL APPLICATION OF LAWN AND GARDEN FERTILIZERS 16
8.1 MUNICIPAL APPLICATION OF LAWN AND GARDEN FERTILIZERS. 16
8.2 RECOMMENDATIONS 16

8.3 MEASUREABLE GOALS. 16

CHAPTER 9 – EDUCATION OF MUNICIPAL STAFF..... 17
9.1 EDUCATION OF MUNICIPAL STAFF. 17
9.2 RECOMMENDATIONS 17
9.3 MEASUREABLE GOALS. 17

CHAPTER 10 - MEASURES TO REDUCE STORM WATER CONTAMINATION WITHIN SOURCE WATER PROTECTION AREAS 18
10.1 MEASURES TO REDUCE STORM WATER CONTAMINATION WITHIN SOURCE WATER PROTECTION AREAS. 18
10.2 RECOMMENDATIONS 18
10.3 MEASUREABLE GOALS. 18

Appendices

APPENDIX A: SAMPLE FACILITIES INSPECTION FORM A1

APPENDIX B: WDOT HIGHWAY MAINTENANCE MANUAL, SECTION 20 OF CHAPTER 6, MINNESOTA SNOW AND ICE CONTROL B1

APPENDIX C: WDNR SNOW DISPOSAL MANAGEMENT GUIDANCE..... C1

APPENDIX D: STORMWATER BMP MAP AND TABLE D1

APPENDIX E: STORMWATER LONG TERM MAINTENANCE..... E1

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CITY OF BARABOO
POLLUTION PREVENTION (2.6)

Goal: continue to implement its pollution prevention program to prevent or reduce pollutant runoff from the MS4 to waters of the state.

Compliance Date: March 31, 2021 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

Develop and implement a pollution prevention program that implements the following measurable goals:

2.6.1 Storm water management facilities. Update and maintain an inventory of municipally owned or operated storm water BMPs used to meet a water quality requirement.

2.6.2 For each BMP inventoried under section 2.6.1, the permittee shall develop and implement a maintenance plan with inspection procedures and schedule to maintain the pollutant removal operating efficiency of the practice in compliance with any water quality requirement.

2.6.3 Municipally owned public works facilities. The storm water pollution prevention plans (SWPPPs) for municipal garages, municipal storage areas, and other public works related municipal facilities located within the permitted area shall be maintained and updated annually as needed.

2.6.4 Measures to reduce municipal sources of storm water contamination within source water protection areas.

2.6.5 Collection services/Storm sewer system maintenance activities.
a. Street sweeping
b. Catch basins
c. Material handling and disposal
d. Leaf management

2.6.6 Winter road management.

2.6.7 Nutrient management.

2.6.8 Environmentally sensitive development.

2.6.9 Internal training and education.

WORK PLAN

☒ The City of Baraboo Pollution Prevention Program Manual completed by March 31, 2021.
☐ The City will implement items recognized in PPP manual.

CHAPTER 1 - OVERVIEW

1.1 INTRODUCTION

The Federal Clean Water Act of 1972 made it unlawful to discharge any pollutant from a point source into navigable waters unless a permit was obtained. This permit program is called the National Pollutant Discharge Elimination System (NPDES). As part of the program, small cities are required to follow a Municipal Separate Storm Sewer System (MS4) General Permit which approves the discharge of stormwater to lakes, rivers, wetlands, and other receiving waters (EPA 2017). In Wisconsin, the MS4 Permit is administered by the WDNR.

Baraboo is an Urbanized Area, as defined by the Bureau of the Census, due to its population. The City is classified as an NPDES Phase II community, more commonly referred to as a small MS4 community, and has therefore been required to comply with the MS4 General Permit since 2006. Permit requirements were lastly revised in 2019 by the WDNR for small MS4 cities in Wisconsin. The current Wisconsin MS4 Permit has eight specific goals or Minimum Control Measures (MCM), within the permit's SWPPP, as listed below.

1. Public education and outreach
2. Public involvement and participation
3. Illicit discharge detection and elimination (IDDE)
4. Construction site pollutant control
5. Post-construction stormwater management
6. **Pollution prevention/good housekeeping**
7. Stormwater quality management
8. Storm sewer system map

This plan provides procedures and documents required to comply with the pollution prevention and good housekeeping portions of the MS4 Permit, as described in Section 2.6 of the current WPDES Permit No. WI-S050075-3.

CHAPTER 2 - STRUCTURAL STORM WATER MANAGEMENT FACILITIES INSPECTION AND MAINTENANCE

The City of Baraboo owns and maintains a combination of wet detention, dry detention, and bio retention best management practices (BMPs) as part of their structural storm water management facilities in addition to inlets, catch basins, storm sewers and ditches. The city also has numerous private facilities that they take credit for under the Water Quality Plan.

As new public and private storm water management facilities are implemented, they are added to the city's GIS system after being mapped with GPS or aerial photos by the Engineering Department. See Appendix D for a table and map of current facilities.

2.1 Private Facilities

New private storm water quality facilities BMPs require a maintenance agreement between the landowner and the city. These maintenance agreements specify the components of the BMP and the frequency and items to be inspected, and expected maintenance. Most existing facilities built over the last 15 to 20 years were also required to have a signed and recorded maintenance agreement with the city. It is a goal of the Engineering Department to research past agreements and require any facility that was required by ordinance to have an agreement that does not currently have one, to present the City with a new agreement for signatures and recording with the deed.

It is also the goal of the Engineering Department to set up a self-certification program for inspection of private facilities. Owners of stormwater bmp's will be required to inspect or have their bmp inspected and certified in writing to the City at least once every five years.

In lieu of the self-certification, the owner may choose to have the City perform the inspections. If private facilities require maintenance based on a routine inspection by the city, a letter will be written to the owner requesting that specific repairs be made within a given time period. Confirmation of completed repairs is required. The city does not conduct maintenance on private BMPs unless as a condition of the individual maintenance agreement.

2.2 Municipal Facilities

Currently, only public storm water quality BMPs are inspected by the Engineering Department on a routine basis, typically annually. The Engineering Department goal is to inspect public facilities twice per year and after approximately 2 inches of rainfall (similar to private facility requirements). A form is will be used during the inspection (see sample in Appendix A) and then entered into the city's database. A work order will be developed and forwarded to Public Works if necessary.

Inspection and maintenance of various municipally owned, operated, and maintained facilities is discussed in the following sections by facility type.

2.3 Municipal Wet Detention Basins

At the time of this report, there were a total of six (6) wet detention facilities owned, operated, and maintained by the city (see Appendix D for current facilities map). GIS mapping and database are kept current by the Engineering Department.

2.3.1 Inspection

The Engineering Department will be responsible for routine inspection of municipal wet detention facilities. City owned facilities will be inspected on a semi-annual (two times per year) basis. The inspection will include a condition assessment of embankments, inlet

pipes/outlet structures, wetland vegetation, storm sewer system components, sedimentation levels, and other notes as needed. A form and database will be developed to track the inspections.

2.3.2 Maintenance

The Department of Public Works (DPW) will be responsible for routine maintenance of city owned facilities in conjunction with their normal duties. Specific maintenance or repair needs other than routine maintenance as noted below will be either generated by the Engineering Department following inspection, DPW staff if identified during routine maintenance activities, or on a complaint basis through other means.

No formal maintenance plan is currently in place for each specific facility. The following routine maintenance activities are typically conducted by the DPW:

- Grass is cut on the upland areas of the facilities seasonally as needed.
- Wetland areas are specifically avoided during grass cutting.

2.4 Municipal Dry Detention Basins

At the time of this report, there are a total of nineteen (19) dry detention facility owned, operated, and maintained by the city (see Appendix D for current facilities map). GIS mapping and database are kept current by the Engineering Department.

2.4.1 Inspection

The Engineering Department will be responsible for routine inspection of municipal dry detention facilities. City owned facilities will be inspected on a semi-annual (two times per year) basis. The inspection will include a condition assessment of embankments, inlet pipes/outlet structures, wetland vegetation, storm sewer system components, sedimentation levels, and other notes as needed. A form and database will be developed to track the inspections.

2.4.2 Maintenance

The Department of Public Works (DPW) will be responsible for routine maintenance of city owned facilities in conjunction with their normal duties. Specific maintenance or repair needs other than routine maintenance as noted below will be either generated by the Engineering Department following inspection, DPW staff if identified during routine maintenance activities, or on a complaint basis through other means.

No formal maintenance plan is currently in place for each specific facility. The following routine maintenance activities are typically conducted by the DPW:

- Grass is cut on the upland areas of the facilities seasonally as needed.
- Wetland areas are specifically avoided during grass cutting.

2.5 Municipal Bio-Retention Basins

At the time of this report, there are a total of one (1) bio-retention basin owned, operated, and maintained by the city (see Appendix D for current facilities map). GIS mapping and database are kept current by the Engineering Department. This facility is currently identified for retrofit to a wet detention facility.

2.5.1 Inspection

The Engineering Department will be responsible for routine inspection of municipal bio-retention facilities. City owned facilities will be inspected on a semi-annual (two times per year) basis. The inspection will include a condition assessment of embankments, inlet pipes/outlet structures, wetland vegetation, storm sewer system components,

sedimentation levels, and other notes as needed. A form and database will be developed to track the inspections.

2.5.2 Maintenance

The Department of Public Works (DPW) will be responsible for routine maintenance of city owned facilities in conjunction with their normal duties. Specific maintenance or repair needs other than routine maintenance as noted below will be either generated by the Engineering Department following inspection, DPW staff if identified during routine maintenance activities, or on a complaint basis through other means.

No formal maintenance plan is currently in place for each specific facility. The following routine maintenance activities are typically conducted by the DPW:

- Grass is cut on the upland areas of the facilities seasonally as needed.
- Wetland areas are specifically avoided during grass cutting.

2.6 Municipal Rain Gardens

At the time of this report, there are a total of two (2) rain gardens owned, operated, and maintained by the city (see Appendix D for current facilities map). GIS mapping and database are kept current by the Engineering Department.

2.6.1 Inspection

The Engineering Department will be responsible for routine inspection of municipal rain garden facilities. City owned facilities will normally be inspected on a semi-annual (two times per year) basis. The inspection will include a condition assessment of embankments, inlet pipes/outlet structures, wetland vegetation, storm sewer system components, mulch, and other notes as needed. A form and database will be developed to track the inspections.

2.6.2 Maintenance

The Department of Public Works (DPW) will be responsible for routine maintenance of city owned facilities in conjunction with their normal duties. Specific maintenance or repair needs other than routine maintenance as noted below will be either generated by the Engineering Department following inspection, DPW staff if identified during routine maintenance activities, or on a complaint basis through other means.

No formal maintenance plan is currently in place for each specific facility. The following routine maintenance activities are typically conducted by the DPW:

- Grass is cut on the upland areas of the facilities as needed.
- Wetland areas are specifically avoided during grass cutting.

2.7 Municipal Infiltration Basins

At the time of this report, there are no infiltration basins owned, operated, and maintained by the city. If any are planned for the future, they will be incorporated into the Engineering Department and Public Works as needed.

2.7.1 Inspection

There is the potential that either the Engineering Department will be responsible for routine inspection of municipal infiltration basins or that the DPW will initiate a procedure of inspection will be the same or similar to the wet detention basin.

2.7.2 Maintenance

It is anticipated that the DPW will be responsible for routine maintenance of city infiltration basins in conjunction with their normal duties. Specific maintenance or repair needs are expected to be generated by DPW staff if identified during routine maintenance activities or by the Engineering Department if they conduct inspections.

No specific formal maintenance plan is currently anticipated for these types of facilities and it is likely that they will be added to the city's maintenance list.

2.8 Municipal Sub-Surface Water Quality Devices

At the time of this report, there are no sub-surface water quality devices owned, operated, and maintained by the city. If any are planned for the future, they will be incorporated into the Engineering Department and Public Works as needed.

2.8.1 Inspection

There is the potential that either the Engineering Department will be responsible for routine inspection of municipal sub-surface water quality devices or that the DPW will initiate a procedure of inspection will be the same as the new catch basin program.

2.8.2 Maintenance

It is anticipated that the DPW will be responsible for routine maintenance of city sub-surface water quality devices in conjunction with their normal duties associated with catch basins. Specific maintenance or repair needs are expected to be generated by DPW staff if identified during routine maintenance activities or by the Engineering Department if they conduct inspections.

No specific formal maintenance plan is currently anticipated for these types of facilities and it is likely that they will be added to the city's catch basin maintenance list.

2.9 Inlets, Catch Basins, and Manholes

At the time of this report, there are a total of 1,771 inlets and catch basin facilities owned, operated, and maintained by the city. Inlets are off-line structures with grates to let flow in and have no sumps (the invert of the outlet pipe is at the same elevation as the bottom of the structure). Catch basins are off-line structures with grates to let flow in and have sumps (the invert of the outlet pipe is generally 18" above the bottom of the structure). There are also 828 storm manholes in the system. Inlets, catch basins, and manholes are updated annually in the city's record files maintained by the Engineering Department electronically in ESRI GIS software.

2.9.1 Inspection

Inlet grates (on all structures – inlets, catch basins, grated manholes) are checked and cleaned after rainfall events as needed.

Inlets - The DPW is responsible for informal annual inspection during the fall cleaning and as part of the workers' day to day activities in the field. Work orders for specific repairs are generated as needed.

Catch Basins - The DPW is responsible for informal annual inspection during the fall cleaning and as part of the workers' day to day activities in the field. Work orders for specific repairs are generated as needed.

Manholes - The DPW is responsible for informal annual inspection during the fall cleaning and as part of the workers' day to day activities in the field. Work orders for specific repairs are generated as needed.

2.9.2 Maintenance

Inlets - Inlets are maintained on an annual basis by the DPW. Maintenance includes cleaning of debris and if necessary scheduled repair work (concrete, grate, etc.).

The following maintenance activities are typically conducted by the DPW on an annual basis:

• Sediment and debris is typically removed.
• Tonnage of sediment removed is recorded for the program as a whole but not tracked on a per structure basis.

Catch Basins - The DPW is responsible for routine maintenance of these facilities in conjunction with their normal duties. Specific maintenance or repair needs (concrete, grate, etc.) are either generated by DPW staff if identified during routine maintenance activities or on a complaint basis through other means.

The following maintenance activities are typically conducted by the DPW on an as-needed basis:

- Sediment is typically removed with a jet-vac unit as needed:
  - Cleaning time can take as little as 10 minutes per catch basin structure when cleaning several basins in the same area.
  - Cleaning time can take 20-30 minutes if de-mobilization/mobilization is required.
- Excess water will be decanted into the sanitary sewer system.
- Tonnage of sediment removed is recorded for the program as a whole but not tracked on a per structure basis.

Manholes - The DPW is responsible for routine maintenance of these facilities in conjunction with their normal duties. Specific maintenance or repair needs (concrete, grate, etc.) are either generated by DPW staff if identified during routine maintenance activities or on a complaint basis through other means.

The following maintenance activities are typically conducted by the DPW on an as-needed basis:

- Sediment is typically removed with a jet-vac unit as needed.
- Tonnage of sediment removed is recorded for the program as a whole but not tracked on a per structure basis.

2.10 Storm Sewers

At the time of this report, there were a total of 232,822 linear feet (44.1 miles) of storm sewers owned, operated, and maintained by the city. Storm sewer mapping is updated annually in the city's electronic record files maintained by the Engineering Department.

2.10.1 Inspection

There is currently no city-wide inspection program that has been developed to conduct a condition evaluation of all sewers over a specific time period (say 10 years) as is commonly developed for sanitary sewers. The city contracted the televising of storm sewer in 2007 and about half of the pipes were televised at that time.

2.10.2 Maintenance

There is currently no routine scheduled maintenance of storm sewers. Specific maintenance or repair needs are typically identified by PW staff during normal day to day operations. DPW most often conducts repairs or replacements. Contractors are hired to perform situational work such as cure in place pipe (CIPP) or grouting.

2.11 Ditches and Culverts

At the time of this report, ditches associated with the city's system were not quantified or mapped and are a relatively small part of the overall storm water management system**.**

2.11.1 Inspection

There is currently no routine inspection of ditches except for during routine grass cutting by the DPW. Grass is cut as needed and based on height as monitored by the DPW.

2.11.2 Maintenance

There is currently no routine scheduled maintenance of ditches beyond routine grass cutting. Specific maintenance or repair needs (such as sediment buildup or damaged culverts) are either generated by the DPW during routine grass cutting or on a complaint basis through other means.

DPW staff will carry out maintenance activities on an as-needed basis. Normal maintenance includes grading of ditches to remove accumulated sediment, culvert replacement, and vegetation restoration (seeding).

2.12 Recommendations

- Engineering Department will continue to research existing private facilities. Owners of facilities without an existing as-built plan or recorded long-term maintenance agreement will be contacted by City to have them provided.
- Owners of facilities that are going to be credited in the new Water Quality plan will be contacted to obtain written permission to use the BMP.
- Engineering staff will continue to research as-built and O&M plans for existing city owned BMP's.

2.13 Measurable Goals

1. Inspect all city owned stormwater detention and retention facilities 2 times per year and after rain events > 2.00 inches of rainfall in a 24-hour period. Document activity in the Annual Report.

CHAPTER 3 - STREET SWEEPING

3.1 Street Sweeping

3.1.1 Equipment - The city currently owns two (2) Elgin Pelican Street Sweepers (1998 and 2011 model years), which are conventional mechanical sweepers, and a Johnson vacuum sweeper. The sweepers are stored and maintained at the City of Baraboo Department of Public Works Service Center at 450 Roundhouse Ct.

3.1.2 Frequency - There are approximately 127 curb miles of street in the City of Baraboo. Typically, both street sweepers are deployed at the same time (unless under maintenance). Street sweeping currently starts at 7:00 am Monday through Friday and ends at approximately 3:00 pm.

The downtown area is swept weekly on Fridays with our Johnson vacuum sweeper. The Downtown area includes blocks from Ash St. to Birch St. and from 1st St/Ave. to 5th St/Ave., including parking stalls and alleys.

The arterials, Broadway, South Blvd., 8th St/Ave., Water St. and South Parkway, are swept weekly by the Johnson vacuum sweeper.

All other curbed areas of the city are swept monthly from south to north by the two mechanical Elgin Pelican sweepers. However, in fall when trees are losing their leaves, street sweeping efficiency is reduced.

Non-curbed streets and alleys are swept bi-annually.

There are currently no parking controls in place on a year round basis to aid in street sweeping efficiency. Parking density is considered light except for the downtown area. From October 1 to April 15, the City implements “Odd/Even” parking which makes curb access more available on both sides of the street in an effort to clean the curbs in their entirety.

The city is generally swept following informal sweeping routes. Paper maps of the city streets are maintained by the Street Superintendent in the City Service Center at 450 Roundhouse Ct. As daily sweeping is completed, street sweeper drivers track daily sweeping by indicating the date, quadrant swept, curb (broom) miles swept, and estimated yards of material collected.

Street sweepings are deposited in dump trucks when sweepers are full. Sweepers are washed out every day after sweeping in a designated wash area.

3.1.3 Staffing - The city maintains a staff of approximately 15 persons under the direction of the Street Superintendent that can participate in the street sweeping program, although most sweeping is performed by less.

3.1.4 Schedule - In general, the normal street sweeping program commences in mid-April and continues through October, depending on weather influences. DPW staff will sweep at other times of the year weather permitting.

3.2 Recommendations

Recommendations of the recently completed Stormwater Quality Plan include the following:

1. Replace the existing mechanical street sweepers with vacuum type sweepers;
2. Increasing the current street sweeping frequency; and
3. The implementation of parking controls.

The City will take into consideration the above recommendations when deciding the overall TSS and TP reduction actions.

3.3 Measurable Goals

1. Continue current street sweeping frequency and document miles swept and amount of debris removed starting in the March 2021 Annual Report based on data collected starting in 2020.

CHAPTER 4 – STREET SWEEPING, INLET, CATCH BASIN AND STORMWATER BASIN MATERIAL DISPOSAL

4.1 Street Sweeping, Inlet, Catch Basin and Stormwater Basin Material Disposal

4.1.1 Street Sweeping

Street sweepers are currently emptied into city dump trucks as the sweeping routes are planned ahead of schedule. DPW staff transfers the collected material on a daily basis to the city compost site for disposal. Inlet cleaning debris is also disposed of at the city compost site. In the fall, when the vast majority of the material the sweepers collect consists of leaves, the material is taken to the city's compost site

4.1.2 Inlets and Catch Basins

Inlets and catch basins are cleaned with a jet-vac unit. After structures are cleaned and before the material is dumped, excess water is decanted into the sanitary sewer system. Temporary stockpiling of the material is conducted as needed for additional drying and for combination of similar materials. Waste material from inlet and catch basin cleaning is quantified and ultimately taken to the city gravel pit for disposal.

1.1.3 Stormwater Basins

Stormwater basin deposition is cleaned as necessary based on inspections to so as conform to as-built size and elevation. Material being removed will be disposed of based on ch. NR 528, Wis. Admin, Code and outlined in DNR Publication WA1375, Management of Accumulated Sediment from Storm Water Structures.

4.2 Recommendations

Street sweeping, inlet, catch basin and detention pond waste materials are regulated by the Solid Waste group of the WDNR. Because of the volume demand and price of landfill disposal, there is increasing interest in alternate uses of these materials in everything from road bed base course to landscaping berms. This may require obtaining a low hazard exemption for the waste material.

Unless specifically permitted, disposal of street sweeping, inlet, catch basin and detention pond waste materials should be disposed of at a licensed landfill or managed in accordance with WDNR guidance under a low hazard exemption.

4.3 Measurable Goals

1. Document amount of material removed in the Annual Report.

CHAPTER 5 - ROAD SALT APPLICATION AND SNOW DISPOSAL

5.1 Roadway De-Icing (Road Salt) Application

5.1.1 Equipment

The city currently uses a variety of equipment for snow plowing and de-icing (road salt) application. Up to 12 pieces of equipment are currently available requiring 12 staff for plowing or loading snow on the city's 9 present routes. Equipment is stored and maintained at the City of Baraboo Department of Public Works Service Center at 450 Roundhouse Ct. Equipment and staffing resources are under the direction of the Street Superintendent.

2.1.2 Snow Plowing

Plowing operations usually begin after snow accumulation reaches two inches. In general, plowing begins at 2:00am and goes until the streets are clear, usually 8 hours if a second pass is not necessary. Operations may begin earlier if exceptional conditions (speed of accumulation, extreme cold, or drifting) are anticipated. The decision to plow is made by the Public Works Street Superintendent, or one of the DPW Foreman. Weather forecasts will be consulted during regular work hours so plowing crews can be notified to the possibility of plowing operations later that evening.

The goal of this operation is to have all City streets plowed within 10 hours of a snowfall of 2 inches or more, and temperature/forecast dependent, to clear arterial streets of all ice and snow within 24 hours of a storm's completion.

2.1.3 Sanding and/or Salting Operation

Sanding and/or Salting operations begin when road conditions become hazardous. It may be necessary to salt before, during, and after plowing operations. The decision to use sand or salt is made by the Public Works Street Superintendent or Foreman and is dependent on the type of storm that is being experienced. The Public Works Street Superintendent and/or the Foreman will train the drivers in the proper salting operations and procedures; including the proper loading of salt and liquid calcium chloride, and calibrating the equipment for the conditions.

There are 9 designated plow routes that cover the major arterials, bridges, priority intersections, hills, curves, and alleys through the City with one driver assigned to each route. Each truck designated for salt application holds approximately 7 tons of sand or salt and are equipped with tailgate or "v-box" spreaders that are capable of spreading salt or a salt/sand mixture and are used as needed to expedite safe driving conditions.

2.2 Snow Disposal

Snow Disposal is not a direct component of the city's pollution prevention program as required by the current Storm Water Permit. The city feels that snow disposal is a closely tied component of the road salting snow. A number of disposal sites are located throughout the city. Setbacks from water features are an important element of the snow disposal site selection process. Significant excess debris that remains after snow melt is removed by DPW staff and any re-seeding needed is conducted in the spring.

5.3 Recommendations

- De-icing is done by the city following best practices as they believe necessary to maintain public safety.

- Application rates for anti-icing and de-icing will be taught to the employees based on Section 20 of Chapter 6 of the Wisconsin DOT Highway Maintenance Manual and the Minnesota Snow and Ice Control Field Handbook for Snowplow Operators. These documents are provided in Appendix B as a resource.
- It is recommended that the city review alternative/additive compounds and incorporate methods that maintain safety, reduce salt usage, and reduce cost where deemed appropriate.
- The DNR has provided snow disposal BMPs. This information is provided in Appendix B in this document.

5.4 Measurable Goals

1. Document amount of salt, sand and brine used in the Annual Report.

CHAPTER 6 - COLLECTION AND DISPOSAL OF LEAVES AND GRASS CLIPPINGS

6.1 Collection and Disposal of Leaves and Grass Clippings (Yard Waste)

6.1.1 Yard waste Collection

Leafs - The City picks up leaves two times throughout the year, once in the spring and once in the fall. Spring curbside leaf cleanup occurs city-wide once the weather permits, usually in April. Fall curbside leaf cleanup begins in October and will continue till mid-November, or as weather permits. Leaves are to be placed on the treebank, unbagged, no more than one week prior to the scheduled pickup. City ordinance prohibits leaves from being placed in the gutter. Leaves are collected by the City with the use of two leaf vacuums.

Grass Clippings - The City's leaf vacs are incapable of picking up yard waste such as grass clippings, potted plants and garden materials. Those materials must be dropped off at the City of Baraboo Compost Site located at 407 Briar Street behind the old Public Works Garage.

Brush - The City picks up brush the last full week of each month, April through October (the last full week is considered Monday-Friday). All brush should be placed out for pickup by the Monday of the scheduled week. All brush should be placed on the treebank with the cut ends facing the street, no longer than six feet in length. No brush should be placed on the treebank for pickup more than one week prior to pick-up.

The requirements and procedures are published in the biannual municipal newsletter and posted on the city web site.

All residential lot owners are eligible for pickup.

6.1.2 Yard Waste Disposal

The City provides a site where residents can haul their own leaves and yard waste. This site is located behind the old City Shop facility on Briar Street. There is a leaf and yard waste pile on your left immediately behind the old City Shop building. This site is open to all City residents only. All leaves and yard waste is to be removed from bags.

The requirements and procedures are published in the local paper and posted on the city web site.

6.2 Recommendations

Leaf and yard waste collection and disposal appears to be conducted in a manner consistent with normal best management practices. Recommendations to modify the leaf collection program may be made after review and recommendations come from the newly completed Water Quality Plan.

6.3 Measurable Goals

1. Annually educate land owners on appropriate leaf and grass clipping/recycling and document outreach method/date in the Annual Report.
2. Document amount of leaves and other materials collected/recycled in the Annual Report.

CHAPTER 7 - MUNICIPAL STORM WATER POLLUTION PREVENTION PLANNING

7.1 Municipal Storm Water Pollution Prevention Planning (SWPPP)

From reviewing city-owned and operated municipal garages, storage areas, and other potential municipal sources of storm water pollution, the following facilities have been identified as candidates for development of site specific SWPPPs:

Department of Public Works Service Building
450 Roundhouse Court
Baraboo, WI 53513

A SWPPP was originally developed for the Briar Street Public Works Yard in March 2017. The existing plan will be expanded to include the rest of the City Service Center compound. The site-specific SWPPPs will include forms and guidance for quarterly inspections.

7.2 Recommendations

Any recommendations associated with the site specific SWPPPs are contained in the individual SWPPP reports.

7.3 Measurable Goals

1. Complete SWPPPs for DPW and Parks sites by December 31, 2021.
2. Implement quarterly site reviews for SWPPP sites in 2021 and document in the Annual Report.
3. Implement recommendations for SWPPP sites in accordance with individual plans and document progress in the Annual Report.

CHAPTER 8 - MUNICIPAL APPLICATION OF LAWN AND GARDEN FERTILIZERS

8.1 Municipal Application of Lawn and Garden Fertilizers

The WDNR, thorough NR 151, requires that municipalities that apply lawn and garden fertilizers on municipally controlled pervious (grassed) surfaces over five (5) acres, do so in accordance with a site specific nutrient application schedule based on appropriate soil tests.

The City of Baraboo owns several greenway and park areas that fit the criteria of grassed areas exceeding five (5) acres or more. The city maintains mapping for all parcels including parks and open spaces over five (5) acres which includes the following: City View Park, Mary Rountree Park, Ochsner Park, Pierce Park, Steinhorst Park, Maxwell-Potter Conservancy, City Arboretum, U.W. Baraboo-Sauk County.

From discussion with DPW, Parks and other city agencies, none of the departments are applying fertilizers to areas greater than five (5) acres and no nutrient management plans are developed or needed at this time.

8.2 Recommendations

Should the city decide to conduct fertilizing grassed areas greater than five (5) acres, it will be done so with a site-specific nutrient application schedule based on appropriate soil tests.

8.3 Measurable Goals

1. If the city elects to implement fertilizer application on sites with five (5) acres or more of pervious area, a site-specific nutrient application schedule will first be developed.

CHAPTER 9 - EDUCATION OF MUNICIPAL STAFF

9.1 Education of Municipal Staff

The City of Baraboo will educate appropriate municipal staff and other personnel involved in implementing this program.

9.2 Recommendations

Educate all staff involved with storm water management.

Building inspectors and DPW/Engineering staff involved with erosion control should attend WDNR or other erosion control training within one (1) year of employment and approximately every three (3) years thereafter.

DPW and Park staff at SWPPP sites should review relevant SWPPPs within 30 days of employment. DPW Street Superintendent should review Quarterly Inspection Reports annually, document any new procedural changes, evaluate comments from inspection reports and new procedures that require incorporation into and update of SWPPP. Procedural changes and SWPPP changes should be communicated to relevant staff on an annual basis after review.

The Stormwater Coordinator and other staff as needed should attend at least one (1) storm water related course or conference annually.

Elements of this Pollution Prevention Plan should be presented to appropriate municipal staff within 90 days of acceptance by the WDNR.

9.3 Measurable Goals

1. Include an educational component for appropriate staff relative to their area of work. Document training in the Annual Report.

CHAPTER 10 - MEASURES TO REDUCE STORM WATER CONTAMINATION WITHIN SOURCE WATER PROTECTION AREAS

10.1 Measures to Reduce Storm Water Contamination within Source Water Protection Areas

Based on the City of Baraboo's General Storm Water Discharge Permit, the City of Baraboo is required to review, and where appropriate, incorporate measures to reduce municipal sources of storm water contamination within source water protection areas. The information contained on Wisconsin's source water assessment program available at https://dnr.wisconsin.gov/topic/DrinkingWater/SourceWaterProtection.html will be used as a resource in this effort.

From Wisconsin Department of Natural Resources (WDNR) Staff in the Source Water Protection Program, there is not a regulatory component or set of requirements directly associated with storm water management. The goal of the program is to protect drinking water sources including groundwater (specifically through the well head protection) and surface water sources (not regulatory).

The City of Baraboo drinking water is supplied by the Baraboo Waterworks. The sole source of drinking water is groundwater supplied through the City's five active wells (Well 2 - #BG928, Well 4 - #BG929, Well 6 - #HN579, Well 7 - #AR322 and Well 8 - #RX387). These wells range in depth from 185 to 450 feet and pump from 765 to 3008 gallons per hour.

The City does not currently have a well head protection plan or ordinance in place, although they regulate activity within right-of-ways. Typical wellhead protection plans document restrictions and setback distances for particular land uses, stormwater ponds, sewers, septic tanks, etc. Because of the concern for intentional contamination of wells and water sources, documents describing wells and water supply sources are not generally widely available for public viewing. Typical wellhead protection plans include several storm water related restrictions including placing storm sewer mains no closer than 50 feet from a well and storm water drainage ponds must be a minimum of 400 feet from a well.

10.2 Recommendations

1. City of Baraboo Engineering Staff recommends that the City of Baraboo Waterworks complete a wellhead protection plan for its five drilled wells.
2. The well locations and protection areas should be documented in GIS and remain for internal use only (not published or provided to any outside sources without careful consideration and coordination with Baraboo Utilities).
3. New development and redevelopment plans should be reviewed for conflicts to setbacks, land use, and storm water management restrictions in the wellhead protection areas.

10.3 Measurable Goals

1. Prepare a wellhead protection plan and ordinance.
2. Incorporate setbacks and land use restrictions into an appropriate internal GIS layer within 120 days of obtaining the plan.

Appendix A

Sample Facilities Inspection Form

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CITY OF BARABOO

BRIAR STEET YARD
SITE INSPECTION CHECKLIST

Seasonal (quarterly) site inspections are performed to evaluate the effectiveness of controlling erosion and transport of sediment or storm water contamination and to identify any control measures that can be feasibly implemented.

1. Inspect site drainage conditions. Things to look for include the following:
   - Inspect the entire site perimeter
     - Inspect the site for possible erosion problems
     - Evaluate if drainage off the property has changed. Are there any signs of concentrated runoff?
   - Inspect stock pile areas for slumps or erosion and restore/reshape as needed.
   - Install or replace perimeter erosion control around material stock piles

Notes:

_____

_____

2. Check for any potential pollution sources. These sources may include the following:
   - Inspect the outdoor material storage areas. Is there any indication of oils or greases in the areas?
   - If there is any standing water at the time of inspection with sheens, sludge, foam, etc?
   - Are there signs of erosion or sediment transport into inlets or off site from storage areas?
   - Is there any litter or debris not associated with normal operations?
   - Inspect all areas of the property for signs of spills (oil, resins, etc.) or other contaminants.

Notes:

_____

_____

3. Inspect principal drainageways (storm sewer along Briar, open channel drainageway along southwest perimeter of site). Things to look for include the following:
   - Check sediment buildup and schedule for cleaning if necessary (sump no more than 40% full).
   - Check for floating oils and greases. Suction off floating material if necessary.

Notes:

_____

_____

4. Other observations – Take note of anything else at the Property that may be of significance to the Storm Water Pollution Prevention Plan.

Notes:

_____

_____

Signed:_____ Printed Name: _____

Title: _____ Date: _____

Appendix B

Wisconsin DOT Highway Maintenance Manual Section 20 of Chapter 6

Minnesota Snow and Ice Control – Field Handbook for Snowplow Operators

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Guidelines

Anti-Icing

PREDICTED PRECIPITATION EVENT	Recommended Locations	Rate *Application* Liquid (gal/lane-mi.)	Rate *Application* Pre-wetted Salt (lb/lane-mi)	*COMMENTS*
Frost or Black Ice	Bridge Decks and Trouble Spots	20-30 (frost) 30-40 (Black Ice)	50-150	1) Consider treating approaches as well as bridge decks. 2) Treat ice patches, if needed, with pre-wetted salt at 100 lb/lane-mi.
Sleet	Bridge Decks and Trouble Spots and Intersections	20 Recommended 30 Maximum	200-400(1) 100-300(2)	1) Consider treating approaches as well as bridge decks.2) Treat ice patches, if needed, with pre-wetted salt at 100 lb/lane-mi.
Freezing Rain	Any area of concern	Not Recommended	200-400(1) 100-300(2)	It is not recommended to apply liquid de-icing agents in an anti-icing mode prior to freezing rain events.
Light Snow (< 1/2" in./hr.)	Trouble Spots and Intersections	30 Recommended 40 Maximum	100-200	If anti-icing is performed prior to a snow event, re-application may be necessary to prevent re-freeze. It also may be necessary to switch to a de-icing mode.
Moderate or Heavy Snow (≥ 1/2 in./hr)	Trouble Spots and Intersections	40 Recommended 50 Maximum	100-300	1) Do not apply liquid anti-icing agents onto heavy snow accumulation or packed snow. 2) Applications will need to be more frequent at lower temperatures and higher snowfall rates. 3) If anti-icing is performed prior to a snow event, re-application may be necessary to prevent re-freeze. It also may be necessary to switch to a de-icing mode.

Notes:

- Anti-icing operations typically should be conducted during normal, non-overtime working hours and low traffic volume periods.
- It is not recommended to apply de-icing agents in an anti-icing mode when the pavement temperature is below 15ºF or drifting is a problem.
- Time initial anti-icing agent applications and subsequent de-icing agent applications to prevent deteriorating conditions or development of packed and bonded snow.

(1) 4-Lanes and Greater
(2) 2 Lanes

1.0 De-icing Application Rates (4-lanes and greater)

See page 2 of 3

2.0 De-icing Application Rates (2-lanes)

See page 3 of 3

DE-ICING APPLICATION RATES FOR PRE-WETTED SALT – (4-LANES AND GREATER)

This guide is not meant to be a substitute for the use of judgment and the observation of the result of treatments on existing conditions. It is meant to show variables that usually occur together and the treatment that has proven to be the most successful. This guide should then be used to assist in deciding on the best course of action depending on existing conditions. This table assumes the salt is pre-wetted. (Allow de-icing agents time to begin working before making additional plowing passes.)

4-lane Highways Application Guidelines #/LM **Pre-wetted** Salt	Pave. Temp. 28° to 32° F		Pave. Temp. 23° to 28° F		Pave. Temp. 15° to 23° F		Pave. Temp. Less than 15° F	
	Initial	Subsequent	Initial	Subsequent	Initial	Subsequent	Initial	Subsequent
Frost	100	50-100	100-150	50-150	100-200[2]	100-150[1]	100-300[1,2]	100-200[1,2]
Black Ice	200	100-200	100-300	100-200	100-400[2]	100-300[1]	200-400[1,2]	100-300[1,2]
Sleet/Freezing Drizzle	200	100-200	100-300	100-200	200-400[2]	100-300[1]	200-300[1,2]	100-300[1,2]
Freezing Rain	100-300	100-200	200-400	100-200	200-400[2]	200-300[1]	300-400[1,2]	200-300[1,2]
Dry Snow	100-200	100-200	100-300	100-200	Plow Only[1]	Plow Only[1]	Plow Only[1]	Plow Only[1]
Wet Snow	200	100-200	100-300	100-200	200-400[2]	100-300[1]	200-400[1,2]	200-400[1,2]

- Mechanical means of snow removal is the preferred method. Before applying any de-icing agents, the surface should be cleared of as much snow and ice as possible by mechanical means.
- Application rates are "MAXIMUM RECOMMENDED RATES". **Only apply the amount of pre-wetted salt necessary to accomplish the desired level of service.** Rates may vary with regard to pavement temperature, type of roadway surface, and weather conditions.
- Abrasives should not be used on roadways where speeds in the sanded areas exceed 45 mph.
- When wind speed is over 15 mph, use caution when salting and applying moisture drawing de-icing agents.
- [1] Intersections and **low** speed hazardous areas may be treated with pre-wetted abrasives when warranted.
- [2] If necessary, use alternate de-icing agents like calcium chloride and magnesium chloride in combination with a **lower application rate** of salt.

11/08

DE-ICING APPLICATION RATES FOR PRE-WETTED SALT – (2-LANES)

This guide is not meant to be a substitute for the use of judgment and the observation of the result of treatments on existing conditions. It is meant to show variables that usually occur together and the treatment that has proven to be the most successful. This guide should then be used to assist in deciding on the best course of action depending on existing conditions. This table assumes the salt is pre-wetted. (Allow de-icing agents time to begin working before making additional plowing passes.)

2-lane Highways Application Guidelines #/LM **Pre-wetted** Salt	Pave. Temp. 28° to 32° F		Pave. Temp. 23° to 28° F		Pave. Temp. 15° to 23° F		Pave. Temp. Less than 15° F	
	Initial	Subsequent	Initial	Subsequent	Initial	Subsequent	Initial	Subsequent
Frost	100	50-100	100-150	50-150	100-200[2]	100-150[1]	100-300[1,2]	100-200[1,2]
Black Ice	200	100-200	100-300	100-200	100-300[2]	100-300[1]	100-300[1,2]	100-300[1,2]
Sleet/Freezing Drizzle	200	100-200	100-300	100-200	100-300[2]	100-200[1]	100-300[1,2]	100-300[1,2]
Freezing Rain	100-300	100-200	100-300	100-200	100-300[2]	100-300[1]	200-300[1,2]	100-300[1,2]
Dry Snow	100-200	100-200	100-300	100-200	Plow Only[1]	Plow Only[1]	Plow Only[1]	Plow Only[1]
Wet Snow	200	100-200	100-300	100-200	100-300[2]	100-200[1]	100-300[1,2]	100-300[1,2]

- Mechanical means of snow removal is the preferred method. Before applying any de-icing agents, the surface should be cleared of as much snow and ice as possible by mechanical means.
- Application rates are "MAXIMUM RECOMMENDED RATES". **Only apply the amount of pre-wetted salt necessary to accomplish the desired level of service.** Rates may vary with regard to pavement temperature, type of roadway surface, and weather conditions.
- Abrasives should not be used on roadways where speeds in the sanded areas exceed 45 mph.
- When wind speed is over 15 mph, use caution when salting and applying moisture drawing de-icing agents.
- [1] Intersections and **low** speed hazardous areas may be treated with pre-wetted abrasives when warranted.
- [2] If necessary, use alternate de-icing agents like calcium chloride and magnesium chloride in combination with a **lower application rate** of salt.

11/08

HANDBOOK

Manual Number 2005-01 REV

Minnesota Snow and Ice Control

Field Handbook for Snowplow Operators
Second Revision

Minnesota LTAP
CENTER FOR TRANSPORTATION STUDIES
University of Minnesota

Minnesota Department of Transportation

Minnesota Local Road Research Board

Minnesota Snow and Ice Control

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Contents

Basic Concepts 1

Before the Winter 3

Before the Storm 5

During the Storm 9

After the Storm 13

Application Rate Guidelines 15

Materials and Quality Control 21

Bibliography and Additional Resources 27

Appendix A-1

List of Tables and Figures

Fine-tuning your program 14

Pounds of Ice Melted Per Pound of Salt..... 16

Anti-icing Application Rate Guidelines 16

Deicing Application Rate Guidelines..... 17

Chemical Melting Temperatures 21

Material Conversions 22

Salt Moisture Worksheet 25

Example Daily Salt/Sand Use Ticket A-2

Example Loader Ticket: Daily Salt/Sand Issued A-3

Example Documentation Form For Anti-Icing.....A-4

Bare Lanes Data Collection Sheet A-5

Purpose of this Handbook

The purpose of this field handbook is to help promote the understanding of the tools, best practices, and limitations for snow and ice control. The handbook will also help you understand when to use and when not to use these tools and practices. In addition, it encourages progressive changes in snow and ice control practices that will help you reduce salt/sand use and environmental impacts while meeting the safety and mobility needs of roadway users.

Practices such as anti-icing, prewetting, and pretreating are emphasized in this field handbook. Various research projects and reports are cited to support recommended practices. Also included are standard best practices expected in a quality snow and ice control program.

Throughout the field handbook you will find environmental tips shown with this fish symbol . These tips are provided to help you reduce environmental impacts from snow and ice control operations.

A blanket approach will not work for the broad range of conditions Minnesota experiences; different strategies are needed for different regions and different conditions. We encourage you to continue to test, document, and refine the practices from this field handbook.

Less material on roads means less material in lakes and streams.

Basic Concepts

Weather

Knowing existing and potential weather conditions is very important for a successful snow and ice control operation. Six pieces of information are especially valuable:

1. Start of precipitation
2. Type of precipitation
3. Total precipitation expected/storm intensity
4. Expected event length
5. Wind conditions (speed, gusts, directions)
6. Temperature trend

Monitor the weather closely so that you are available and prepared to act early in storm situations.

Weather information sources

- Phone 511 to get road condition and travel information or visit the Web: www.511mn.org.
- Subscribe to a value-added meteorological service (VAMS). These are useful for viewing weather forecasts and pavement temps.
- Check the National Weather Service.
- Check all available weather sources.
- Check MnDOT's Road and Weather Information System (RWIS) site: www.rwis.dot.state.mn.us.

Pavement temperature

Most weather stations measure temperature and other conditions 30 feet above ground, which means these conditions can differ substantially from pavement temperatures. Thus, use the pavement temperature—not the air temperature—to determine what material to use and the application rate.

Pavement temperatures can be substantially lower or higher than air temperatures.

You'll notice changes in pavement temperature first on bridge decks and ramps. Pavement temperatures will also be lower in shady areas.

Measuring with sensors or RWIS

There are various ways to measure pavement temperatures: with sensors or with a Road Weather Information System (RWIS).

Sensors can be hand-held, truck-mounted, or mounted on a structure near a road.

- Hand-held infrared laser sensors are pointed at the pavement to get a pavement or surface temperature while your vehicle is stopped or moving slowly.
- Truck-mounted temperature sensors measure pavement or surface temperatures while your truck is moving. Ideally, every agency should own at least one truck-mounted unit.
- A structure-mounted sensor is non-invasive and provides temperature readings, chemicals present, and grip or friction values.

If you do not have road sensors in your truck or on your roads, you can subscribe to a real-time weather forecasting system. Or, you can look up the road temperature from the closest state highway on RWIS (www.rwis.dot.state.mn.us). This will give you an idea of the local road temperatures. RWIS is a predictive system that consists of a network of towers and temperature sensors embedded in state highways.

Other tools: MDSS and AVL

- Maintenance Decision Support Systems (MDSS) help transportation agencies make better decisions about their winter maintenance activities by providing reliable weather and road conditions and recommending the most cost-effective treatments.
- Automated Vehicle Location (AVL) systems help support the MDSS by continuously recording plow truck locations and other pertinent information. These data are automatically forwarded to MnDOT maintenance supervisors, who can better respond to any weather related events.

To read more about MDSS/AVL, go to:
http://ihub/maintenance/mdssavl/index.html
http://www.meridian-enviro.com/.

Before the Winter

Take some time before the season to plan your routes and learn the plowing policies. A little planning up-front can help you do a more efficient job in keeping the roads safe.

Policies

- Make sure you have a plowing policy and meet to discuss it. Your level of service may be based on average daily traffic, environmental concerns, safety, mobility, economics, and other factors.
- Inform your citizens of policies.
- Learn to record what and how much material you apply on each shift. Be prepared to analyze and make adjustments to your process based on what you learn.

Using less salt doesn't have to reduce safety, but it does protect our lakes.

Plan your routes

- During the fall, inspect and make sure ditches, culverts, and surfaces are free from obstructions and ready for the spring melt.
- Remove potential snow traps, such as tall grasses, that will catch and accumulate snow.
- Drive the assigned routes prior to winter to identify critical areas and find the most efficient way to cover the routes.
- Inventory all the areas prone to drifting and have a plan to manage them.
- Know your routes. Plan which way you will start.
- Be flexible. Conditions could change the way you plow your route.
- Consider implementing a route optimization/decision support tool, such as MDSS or AVL (see page 2).

Calibrate your equipment

All good programs include calibration.

Calibration is an essential procedure to measure the amount of material applied to the roadway at various auger settings in relation to truck speed. No matter how sophisticated or simplified your operations, always calibrate or verify calibration yearly.

- Because spreaders vary, calibrate each truck. Re-calibration is required if changes are made to the hydraulic system, if the augers have extensive wear or are resurfaced or replaced, or a different material is used.
- Follow the manufacturer's guidelines for calibration, and contact the manufacturer for training.
- Calibrate separately for salt/sand mix vs. salt or sand only.
- Determine flow rate or calibrate liquid application systems at the same time as the dry systems.
- Remember: The auger plate must be in place during calibration. You are not calibrating the truck properly if the material is gravity-flowing.
- For manual sander controls, place a chart in your truck to see how much material is applied at each setting, at various speeds.
- There are two types of automatic sander controllers. Open-loop controllers monitor only truck speed during operation; closed-loop controllers monitor both truck speed and spreader discharge.

If you don't calibrate your sander, the application rates will not be accurate.

Calibration resources:

- Clear Roads has links to manufacturers' calibration instructions and a comprehensive calibration guide: http://clearroads.org/researchprojects/05-02calibration.html
- MnDOT also has calibration instructions: www.dot.state.mn.us/maintenance/training.
- For sander calibration training, contact the Minnesota Circuit Training and Assistance Program (CTAP) instructor at www.mnltap.umn.edu/about/programs/ctap.
- For liquid calibrations, see the *MnDOT Anti-icing Guide* at www.dot.state.mn.us/maintenance/training.

Before the Storm

Anti-icing

Anti-icing can be a cost-effective strategy that optimizes chemical usage. It is a proactive approach that should be first in a series of strategies for most winter storms. By applying chemical freeze-point-depressant materials before a storm, you can prevent snow and ice from bonding to the pavement.

For guidance on which anti-icing chemical is most cost effective for your agency/location, see the MnDOT Cost Benefit Analysis Tool. For guidance on how to begin or expand an anti-icing program, see the *MnDOT Anti-Icing Guide*. Both can be found at www.dot.state.mn.us/maintenance/training.

Clear Roads online cost-benefit analysis toolkit

Anti-icing can provide significant cost, safety, and environmental benefits. To help determine cost savings, use the Clear Roads toolkit available at www.clearroads.org (click on research projects).

Anti-icing can reduce airborne dust and salt particulates.

Guidelines for anti-icing

- Anti-icing is often effective for heavy frosts.
- Anti-icing works best when combined with accurate road weather information.
- Because motorists have difficulty perceiving how slippery light freezing drizzle and light frost can be, early application is important in these conditions.
- Liquids are the most efficient and may be applied days in advance of an event, but the closer to the event start time, the better, as tire action and wind wear away material.
- Similar applications of pretreated salts will also work. Use the lowest possible setting, less than 100 lbs/two-lane mile; apply as close to the start of event as possible.
- See the Application Rate Guidelines on page 16 of this field handbook.

What to do

- Apply liquids only with stream nozzles to maintain some bare pavement between sprayed areas to reduce slipperiness. Fan spray is not recommended.
- Schedule applications on bridge decks and critical areas if

Use wisely. Chlorides can increase the salinity of soil, which can lead to compaction and erosion.

temperature and conditions could produce frost or black ice.
- Consider spot-applications on hills, curves, and intersections if predicted conditions warrant.
- Use appropriate chemical for your pavement temperature range. See the chart on page 19 of this field handbook.
- Apply an anti-icing product during non-rush-hour traffic periods.
- When frost on the shoulder starts to move into the travel lanes, reapply anti-icing product.

What not to do
- Don't anti-ice under blowing conditions, in areas prone to drifting, and anywhere else you would refrain from using salt. Be aware of areas that are prone to wind issues.
- Reapplication isn't always necessary if there is still a residual. The residual effect can remain for up to five days after application if precipitation or traffic wear-off does not dilute the initial application.
- Remember that the surface can refreeze when precipitation or moisture in the air dilutes the chemical.
- Don't apply $MgCl_2$ or $CaCl_2$ to a warm road (above 28° F pavement temperature). It can become slippery and cause crashes!
- Don't apply before predicted rain.
- For the first application or after a prolonged dry spell, apply liquids at half the rate (not half the concentration). On dry roads, liquids tend to mix with oil from vehicles and cause slippery conditions.
- Over-application of liquid chemicals may make the road become slippery. Less is better. Always follow manufacturers' application recommendations.

Equipment
- See the *MnDOT Anti-Icing Guide*: www.dot.state.mn.us/maintenance/training.html

Pretreating and prewetting salt and sand

Dry material bounces or blows off the road, so everyone should be either pretreating or prewetting dry material. Liquids also increase salt's effectiveness by jump-starting the melting process. Depending on the liquid used, it may lower salt's effective working temperature.

If you must use dry material, follow best practices to reduce bounce and scatter.

Because pretreating and prewetting cause material to stick to the road, 20 to 30 percent less material is used—saving money and reducing environmental impacts.

Guidelines for pretreating

Pretreating is mixing a liquid into the stockpile of salt or sand before it is applied. Unlike prewetting, it does not require equipment changes and requires no new capital investment for equipment. You can also switch from dry application to wet application immediately—just turn down the application rate.

Chemicals leaching from a stockpile into groundwater is a common problem.

Salt stockpile
- Treat the salt stockpile with a liquid deicing chemical. It may be purchased pretreated or mixed on site by the vendor or your crew.
- When treating the stockpile at the shop, apply at 4 to 6 gallons/ton. Salt must be very dry for the chemical to stick.
- Because leach risk at a stockpile is increased, store it covered on an impervious pad.

Sand stockpile
- Pretreat the stockpile to keep it flowable.
- Apply to stockpile at 4 gallons of salt brine/ton sand.
- Store the stockpile *under cover.*

Apply wisely. We will never have a chance to recover the chlorides applied.

Guidelines for prewetting

Prewetting is adding a liquid to the salt as it is being applied—either at the spinner or through a soaker pipe in the auger box—to help it stick to the road better. Although prewetting requires some equipment changes, it provides flexibility to switch the chemical makeup depending on conditions.

- Salt brine, calcium, magnesium chlorides, and acetates may be used as prewetting agents.
- The usual application rate is 8 to 14 gallons/ton for salt brine.
- Prewetting with other chemicals at the spinner can help reduce the application rate.
- Below 15° F, salt brine becomes less effective; below 0° F, it may freeze hoses and valves.
- Salt brine should be mixed at 23.3%.
- Verify concentration of liquids you're using:
  Salt brine: 23.3%
  $CaCl_2$: 29.8%
  $MgCl_2$: 21.6%
  CMA: 32.5%
  KAC: 49%
- MnDOT completed the laboratory phase of a research project in 2012 comparing the ice-melting capacity and the cost-benefit of various pre-wetting chemicals. A second phase of this project, testing of chemicals on actual road surfaces, will begin in 2013. Information is available at www.dot.state.mn.us/maintenance/training.
- Super-saturated salt or slurry is a method in which a high volume of liquid is added to the granular salt. Two 400-gallon tanks, located within the box, pump brine at roughly 90 pounds of liquid/210 pounds of salt, resulting in a salt slurry that activates very rapidly.

During the Storm

Deicing

Deicing is a reactive operation in which a deicer is applied to the top of an accumulation of snow, ice, or frost that is already bonded to the pavement surface.

Use cautiously. Many chemicals contain trace metals including cyanide, arsenic, lead, and mercury.

Removing ice that has already bonded to the pavement can be difficult, and removing it mechanically can damage equipment and roads. Generally, enough ice must be melted chemically to break the bond between the ice and the pavement, which requires larger quantities of chemical than anti-icing.

- Use an appropriate amount of salt. Most oversalting can be prevented by using calibrated, speed-synchronized spreaders and good judgment in selecting application rates and truck speed.
- It is not necessary to melt all the snow or ice on the road with salt. This is an overuse of materials. Apply just enough to loosen the bond between the road and the ice so it can be plowed off.
- See the Application Rate Guidelines on pages 17–19 of this handbook.
- Dilution of Solution (see page 15) also applies to deicing.

The goal is not to melt everything. The goal is to penetrate through the ice and snow and break the bond so the pavement can be plowed.

Winter abrasives use has been documented as an air pollution concern.

Using abrasives

Use winter sand and other abrasives when temperatures are too cold for deicing chemicals to be effective. But be aware that sand does not melt anything. It provides temporary traction, and only when it is on top. Sand also clogs sewers, ditches, and streams. As a result, avoid sand use as much as possible.

A salt/sand mix is generally not recommended. Salt reduces the effectiveness of sand, and sand reduces the effectiveness of salt. However, a salt/sand mix may be helpful in limited situations such as a freezing rain event where the salt is washed away quickly. A 25 to 50 percent sand/salt mix has been documented as effective in increasing friction by sticking the sand to the surface, like sandpaper.

- Use abrasives in slow-moving traffic areas such as intersections and curves.
- If your purpose is melting, use salt only.
- Salt is ineffective in cold weather, so use sand or an alternative chemical.
- Sand is not cheap when you consider the handling, clean-up, and disposal costs.
- Sweep up sand frequently, after each event if feasible.

If you use a 50/50 salt/sand mix, you're generally either half right or half wrong. Using a salt/sand mix leads to overapplication of both materials.

Standard practices

- Know the pavement temperatures and trends to help you use the right application at the right time. Generally use less chemical when temperatures are rising and more when they are falling.
- Don't apply dry salt (sodium chloride) at below 15˚ F pavement temperature. It will not melt fast enough to help and it will blow off the road into the ditch.
- Below 20˚ F, switch to other tools like $CaCl_2$ and $MgCl_2$ at curves, hills, and intersections to obtain maximum melting. If unavailable, use sand for traction.
- Adjust your spinner speed to the lowest setting possible, except at intersections.
- Don't let the traffic dictate your speed. Drive at the slowest possible speed—17 to 25 mph—to keep material on the road.
- On high-speed roads, apply deicers in the center of the road or high side of the curve.

Sand that washes into a stream or lake may smother some small aquatic organisms.

- Set spinners lower to the ground or use a chute to reduce bounce and scatter. See www.dot.state.mn.us/maintenance/training.html and www.mnltap.umn.edu/about/programs/opera/fact/documents/washingtoncad.pdf for chute-building instructions.
- Turn off auger when stopped, even briefly.

Never use calcium chloride to open drains—it is extremely toxic to aquatic systems.

Loading/hauling

- Set up and load under cover and on a level surface wherever possible.
- Maintain loading area. Keep it clear and smooth.
- Don't overload. Avoid spilling on units.
- Watch for co-workers/pedestrians in or near the loading area.
- Good housekeeping and material storage recommendations are at www.dot.state.mn.us/maintenance/training.

When slush begins to stiffen and kicks to the rear from vehicle tires, it's time to plow and then reapply chemical.

Effective use of plows

Plow to remove snow and loose ice before deicing applications. If snow accumulates before or after applications, plowing directly before your next application will minimize product dilution.

- Plow first before applying deicers to avoid dilution of the salt.
- Coordinate plowing activities to eliminate windrows at intersections and prevent plowing off another operator's material.
- Remove snow from roads as quickly as possible to reduce compaction; use of underbody blades helps remove compacted or slushy snow.
- Make use of carbide, flexible, or rubber-encapsulated plow blade edges. For research information on cutting edges, see www.clearroads.org/research-projects/07-01carbideinsert.html.
- Adjust blade angle to maximize cutting efficiency or snow throwing capabilities.

Public safety/operator safety

- Perform your required CDL pre- and post-trip inspections.
- Make sure you're mentally and physically prepared to drive.
- Obey traffic laws. Use the seat belt. Clean lights and windows frequently.

Once chlorides enter the ground or surface water, they never go away.

Make sure a shield is in place to control the application or you'll overapply salt.

- Flow with traffic as much as possible. Avoid sudden moves. Be alert to all surroundings.
- Demonstrate courtesy toward other drivers and pedestrians.
- Be aware of spinner discharge at all times.
- Avoid pushing snow over bridge rails and onto roads below.
- Be alert to hazards such as downed power poles, stop lights, overhead structures, power lines, etc.
- Know the height of your truck box. Raise box only to move material to the back of the box. When raising the box, be certain no overhead obstacles are present.
- Be aware of changing braking abilities from a loaded box to an empty one.
- Keep others informed of changing conditions.
- Assist/report stranded motorists as necessary.

Snow cloud

Be aware of wind conditions and potential problems. Snow clouds can form during any plowing operation. A very slight snow cloud can temporarily block out any lighting configuration and increase chances of being hit from the rear.

- Reduce your speed to minimize snow clouds.
- Don't plow just to plow. If shoulder plowing isn't necessary when the wind is blowing, don't do it.
- If you have created a snow cloud, do not brake or slow down—just lift plow and wing.

After the Storm

Begin cleanup operations once the roads are clear to the prescribed level of service. Then, evaluate what was done, how well it worked, and what could be changed to improve operations.

- Remove snow from bridge walls to prevent ramping, and clear snow from crosswalks to allow pedestrian access. Americans with Disabilities Act (ADA) access must also be considered. For further guidance on cleanup prioritization, see www.dot.state.mn.us/maintenance/manual.html.
- Accurately record your material use at the end of your shift (see below).
- Attend a post-storm meeting in the shop to evaluate your operations.
- Look for opportunities to try new and improved practices.
- Clean and check all equipment.
- Report any hazards such as low-hanging branches, raised utilities, or other potential problems.
- At the end of the season, clean and maintain the truck, tanks, brine-making systems, and pumps according to manufacturer specifications.
- Place all piles on an impervious pad and cover them. This includes salt and salt/sand mixes.

You can't manage what you don't measure.

Standard practices

Documenting and charting

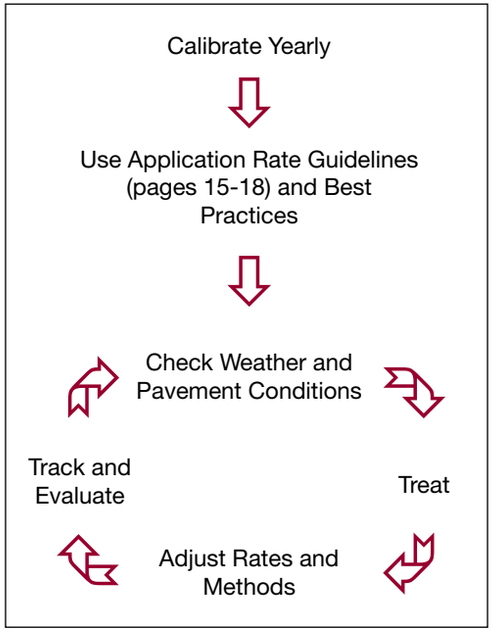
Good documentation helps you use less material, reduce costs and environmental impacts, and run a more effective snow and ice control program. Unless you document and chart, you can't measure what you are doing.

- Track your material use.
- Understand the storm conditions and the target level of service for each route.
- Refine your procedures and material use based on observations.
- Share observations to improve operations and learn from each other.
- Use forms like those shown in the appendix of this field handbook to record and track your work and observations.

Some fish species are affected by impaired water, which is equivalent to about 1 to 1.5 tablespoons of salt in 5 gallons of water.

- Complete forms at the end of your shift.
- Turn in documentation forms to your supervisor.
- Use Clear Roads online cost benefit analysis toolkit (2012) to examine costs and benefits of new and existing practices, equipment, and operations at http://clearroads.org/research-projects/08-02costbenefitanalys.html.

Fine-tuning your program



Application Rate Guidelines

Salt spray damages roadside vegetation.

Develop your own application rates using the guidelines on pages 15–18 as a starting point and modify them incrementally over time to fit your needs. You can summarize information gathered from your truck logs into application rates for your area. Be aware, though, that rate charts vary greatly. Make it a goal to apply only as much material as needed to keep the roads safe. You can reduce rates by following anti-icing and other strategies covered in this field handbook.

Guidelines for determining application rates

- Sand/salt mix isn't advised but may help in some situations such as freezing rain.
- Always plow before applying chemical.
- Generally the first pass will require an application rate at the higher end of the range, with subsequent passes requiring less and less.
- On long routes where you'll only be able to make one pass, you may have to apply more material than what's recommended in the charts.
- High traffic volume will work salt into the snow and aid in melting—so use a lower rate.
- Higher traffic speeds will blow salt off the road and hinder melting—so increase use of prewetted materials.
- Use sand for short-term traction only. It will never melt anything.
- It is usually not cost-efficient to apply salt (sodium chloride) at pavement temperatures below 15° F.

Dilution: the cause of refreeze

An ice control product will work until product dilution causes the freeze point of the brine to equal the pavement temperature. At this point, the material will stop melting and you may experience refreeze if pavement temperatures are dropping. This process is *Dilution of Solution*.

How long an application will last depends on five factors: pavement temperature, application rate, precipitation, beginning concentration, and chemical type. These factors explain why one application rate will not fit all storm events.

- If your equipment is unable to deliver material at lower rates, consider exchanging the 9-inch-diameter auger for either a 6-inch or 9-inch special auger to deliver about two-thirds less material/revolution.

Anti-icing Application Rate Guidelines

These guidelines are a starting point. Reduce or increase rates incrementally based on your experience.

Condition	Gallons/Lane Mile			Other Products
	$CaCl_2$	$MgCl_2$	Salt Brine	
1. Regularly scheduled applications	15 – 25	15 – 25	20 – 40	Follow manufacturers' recommendations.
2. Prior to frost or black ice event	15 – 25	15 – 25	20 – 40	
3. Prior to light or moderate snow	15 – 25	15 – 25	20 – 50	

Pounds of Ice Melted Per Pound of Salt

Pavement Temp. ˚F	One Pound of Salt (NaCl) melts	Melt Times
30	46.3 lbs of ice	5 min.
25	14.4 lbs of ice	10 min.
20	8.6 lbs of ice	20 min.
15	6.3 lbs of ice	1 hour
10	4.9 lbs of ice	Dry salt is ineffective and will blow away before it melts anything.
5	4.1 lbs of ice	
0	3.7 lbs of ice	
-6	3.2 lbs of ice	

At temps below 15 degrees, it may be more cost-effective to use a chemical other than NaCl.

See research at www.dot.state.mn.us/maintenance/training

Deicing Application Rate Guidelines

24' of pavement (typical two-lane road)

These rates are not fixed values, but rather the low end of a range to be selected and adjusted by an agency according to its local conditions and experience.

			Lbs/ two-lane mile			
Pavement Temp. (˚F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Salt Prewetted/ Pretreated With Salt Brine	Salt Prewetted/ Pretreated With Other Blends	Dry Salt*	Winter Sand (abrasives)
>30° ↑	Snow	Plow, treat intersections only	80 (40/lane mile)	70	100*	Not recommended
	Frz. rain	Apply chemical	80 – 160	70 – 140	100 – 200*	Not recommended
30° ↓	Snow	Plow & apply chemical	80 – 160	70 – 140	100 – 200*	Not recommended
	Frz. rain	Apply chemical	150 – 200	130 – 180	180 – 240*	Not recommended
25 - 30° ↑	Snow	Plow & apply chemical	120 – 160	100 – 140	150 – 200*	Not recommended
	Frz. rain	Apply chemical	150 – 200	130 – 180	180 – 240*	Not recommended
25 - 30° ↓	Snow	Plow & apply chemical	120 – 160	100 – 140	150 – 200*	Not recommended
	Frz. rain	Apply chemical	160 – 240	140 – 210	200 – 300*	400
20 - 25° ↑	Snow or frz. rain	Plow & apply chemical	160 – 240	140 – 210	200 – 300*	400
20 - 25° ↓	Snow	Plow & apply chemical	200 – 280	175 – 250	250 – 350*	Not recommended
	Frz. rain	Apply chemical	240 – 320	210 – 280	300 – 400*	400
15 - 20° ↑	Snow	Plow & apply chemical	200 – 280	175 – 250	250 – 350*	Not recommended
	Frz. rain	Apply chemical	240 – 320	210 – 280	300 – 400*	400
15 - 20° ↓	Snow or Frz. rain	Plow & apply chemical	240 – 320	210 – 280	300 – 400*	500 for frz. rain
0 to 15° ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	300 – 400	Not recommended	500 – 750 spot treat as needed
< 0°	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	400 – 600**	Not recommended	500 – 750 spot treat as needed

*Dry salt is not recommended. It is likely to blow off the road before it melts ice.

**A blend of 6 – 8 gal/ton $MgCl_2$ or $CaCl_2$ added to NaCl can melt ice as low as -10˚.

The following are examples of application rate charts used in Minnesota.

Temperature	Maintenance Action	Spinner Speed	Salt %	Pounds Per Lane Mile
30	Light sleet, light rain, or light snowfall stopped.	low	100%	100 to 200
	Light freezing rain or light snow continuing.			150 to 300
25	Heavy freezing rain, sleet, or snowfall continuing.	low	100%	200 to 400
	Light snowfall continues at 1/8" to 1/4" per hour.	low	100%	150 to 300
20	Heavy snowfall, repeat salting at lower rate.	low	100%	200 to 350
	Light snow falling at trace to 1/4" accumulation.			150 to 300
15	Light snowfall continues at 1/8" to 1/4" per hour.	low	100%	200 to 300
	Heavy snowfall, repeat salting at lower rate.	off	80%	
10	Snow stopped and sun is going to come out.	low	100%	200 to 300
	Light snowfall continuing or sun is going to come out.		80%	200 to 300
5 to 10	Light snowfall continuing or sun is going to come out.	low	70%	150 to 300
	Light snowfall at trace to 1/4" accumulation.		25%	200 to 400
0 to -15	Light snowfall at trace to 1/4" accumulation.	low	25%	400 to 600
	Light snowfall at trace to 1/4" accumulation.			
0 to -15	Snow stopped and roads have hard pack.	off	25%	400 to 600
	Snow stopped and roads have hard pack.			
	*Concentrate salt with low spinner speed *Rates are per lane			

Use a higher % of sand in cold temps or use 200 to 400 lbs treated salt below 15 temp

Rates are for units with salt settings of 100, 150, 200, 250, 300, 350, 400, 450, 500, 600.

Credit: Anoka County Highway Department

BEFORE & DURING SHIFT, CONSULT RWIS™ BEFORE APPLYING *ANY* CHEMICALS OR MATERIALS!

Pre-wet Material Chart

Application Rate Recommendation Chart

Pavement Temp	Weather Conditions	Pounds Per Two (2) Lane Mile: 100% Salt	50% Salt	Stock Pile	Actions & Application Recommendation
Above 30° ↑↓	Snow	150-300	Not Recommended	Not Recommended	Plow, Treat Hazards ONLY
	Freezing Rain	150-300	Not Recommended	Not Recommended	Apply As Needed
	Snow	200-400	Not Recommended	Not Recommended	Plow & Apply As Needed
	Freezing Rain	200-400	Not Recommended	Not Recommended	Apply As Needed
25° to 30° ↑↓	Snow	200-400	Not Recommended	Not Recommended	Plow & Apply As Needed
	Freezing Rain	200-400	Not Recommended	Not Recommended	Apply As Needed
	Snow	300-500	Not Recommended	Not Recommended	Plow & Apply As Needed
	Freezing Rain	300-500	500-750	Not Recommended	Apply As Needed
20° to 25° ↑↓	Snow/ Frz Rain	300-500	500-750	Not Recommended	Plow & Apply As Needed
	Snow	300-500	Not Recommended	Not Recommended	Plow & Apply As Needed
	Freezing Rain	400-500	500-750	Not Recommended	Apply As Needed
15° to 20° ↑↓	Snow	300-500	Not Recommended	Not Recommended	Plow & Apply As Needed
	Freezing Rain	400-500	500-750	Not Recommended	Apply As Needed
	Snow/ Frz Rain	400-500	500-750	Not Recommended	Plow & Apply As Needed
Below 15°	Snow	Not Recommended	Not Recommended	500-750	Plow, Treat Hazards w/ Stockpile

FROST: 15° & RISING: TREAT BY ANTI-ICING (Brine 20-40 G/LM) or 15° & FALLING: 100% SALT @ 150 #/LM

WIND CONDITIONS: PLOW, TREAT (TROUBLE SPOTS ONLY!) WITH 50/50 @ 300#/LM OR STOCKPILE @ 200-400 #/LM

IF EVENT/SHIFT TEMPERATURES WILL *RISE*, USE SALT INSTEAD OF SAND (& vise versa as temps fall)

Materials and Quality Control

Chemical Melting Temperatures

Multiple products can be used in a snow and ice control program. This chart helps you choose the correct product and apply it at the correct times. For further guidance on blending chemicals, see the *MnDOT Anti-Icing Guide*: www.dot.state.mn.us/maintenance/training. For a list of vendor contacts and chemicals available on the Minnesota Approved Products list, see the MnDOT *Winter Chemical Catalog* at www.dot.state.mn.us/maintenance/training.

Chemical	Lowest Practical Melting Temperature	Concentration
*NaCl (Sodium Chloride)—Delivered as solid rock salt; also can be made into a brine. The basis of most deicing materials. Very corrosive. Inexpensive.	15˚ F	23.3%
*$MgCl_2$ (Magnesium Chloride)—Delivered as flakes, pellets, or liquid. Often used to wet NaCl crystals to increase adherence to road and reduce melting points. Corrosive. Higher cost.	-10˚ F	27 to 30%
*$CaCl_2$ (Calcium Chloride)—Delivered as flakes, pellets, or liquid. Powerful deicer but extremely corrosive. Sometimes used incorrectly to open storm drains. Higher cost.	-20˚ F	30%
CMA (Calcium Magnesium Acetate)—Delivered as a powder, crystals, pellets, or liquid. Liquid CMA is used mainly on automated bridge deicing systems. Non-corrosive, biodegradable. Sometimes added to sodium chloride as a corrosion inhibitor. Alternative for areas where chloride use must be limited. Higher cost.	20˚ F	32%
KAc (Potassium Acetate)—Delivered as a liquid. Used on automated bridge deicing systems. Use for anti-icing, deicing, and prewetting. Non-corrosive, biodegradable. Alternative for areas where chloride use must be limited. Higher cost.	-15˚ F	50%
Winter Sand/Abrasives—Winter sand is sand treated with brine or another blend. It is often used as an abrasive for low-temperature conditions when chemicals are not effective. Sand provides temporary traction and only works when it is on top of the ice.	Never melts—traction only	
Other Blends—Proprietary-purchased blends or blended in-house.	Varies	Varies

*Liquid chlorides are available with corrosion inhibitors.

Material Conversions

The following quick reference table and the formulas below will help you convert between tons and cubic yards. Weights will vary depending upon moisture content.

Sand		Salt	
Yards	Tons	Yards	Tons
1	1.4	1	1.1
2	2.8	2	2.2
3	4.2	3	3.2
4	5.6	4	4.3
5	7.0	5	5.4
6	8.4	6	6.5
7	9.8	7	7.6
8	11.2	8	8.6
9	12.6	9	9.7
10	14.0	10	10.8
11	15.4	11	11.9
12	16.8	12	13.0
13	18.2	13	14.0
14	19.6	14	15.1
15	21.0	15	16.2
16	22.4	16	17.3
17	23.8	17	18.4
18	25.2	18	19.4
19	26.6	19	20.5
20	28.0	20	21.6

1. To convert tons of clean sand to cubic yards:
   #tons divided by 1.4 = cubic yards
2. To convert cubic yards of clean sand to tons:
   #cubic yards multiplied by 1.4 = tons
3. To convert tons of winter sand to cubic yards:
   #tons divided by 1.37 = cubic yards
4. To convert cubic yards of winter sand to tons:
   #cubic yards multiplied by 1.37 = tons
5. To convert tons of straight salt to cubic yards:
   #tons divided by 1.08 = cubic yards
6. To convert cubic yards of straight salt to tons:
   #cubic yards multiplied by 1.08 = tons

Materials testing

It is important to understand how deicing chemicals will react on the roadway. Therefore, a guide for testing the effectiveness of chemicals was developed. See the Clear Roads report at http://clearroads.org (click on research projects, completed projects).

Test your materials to ensure that they are delivered as ordered and will perform as needed. Refer to your contract or Material Safety Data Sheet (MSDS) for specific gravity.

Protect our roadside vegetation. Chlorides can damage vegetation at concentrations greater than 70 ppm (about 1/3 teaspoon of salt in 5 gallons).

Testing liquids

- Before unloading the tanker truck, use a clean container to obtain a small sample (about 2 cups).
- Measure the specific gravity or percent saturation using a hydrometer or salimeter.
- Make sure you have the correct hydrometer for your material.
- Salt brine should have a salimeter reading of 85% or a hydrometer reading of 1.176, which equates to 23.3% salt in the brine.
- If the specific gravity is not within specifications, don't unload, and notify your supervisor.

Testing sand

- Conduct a visual inspection of the material to make sure it is clean.
- Note that each user has its own specifications based on available materials.

Testing solid salt

- Make sure someone is present to watch the load being dumped and observe if it is wet.
- Test salt for moisture content. You are looking for a moisture content of less than or equal to 1.5%. (Check your agency's specification.)

How to measure the moisture content of rock salt:

•Supplies:

-A calibrated scale, triple beam, or digital accurate to 0.1 grams

-A microwave with maximum wattage of 1,200. Higher power may be too hot and make salt pop, compromising weight of sample.

-A sample of salt (about 1 cup). Ensure it is a good representation of the pile.

•Process:

1. Weigh sample before cooking, record weight on worksheet
2. Cook, once salt is dry weigh again, record dry weight
3. Do calculations on the worksheet

Salt Moisture Worksheet

(with scale zeroed out to account for container)

Date: Company:

P.O. #: Ticket #:

A. Weight of wet salt

B. Weight of dry salt

C. Weight loss (A-B)

Tested by:

Moisture Calculations:

C ÷ A x 100 = % moisture

Remarks:

For complete instructions, go to www.dot.state.mn.us/maintenance/training.html.

Bibliography and Additional Resources

Amsler Sr., D. E. "Are You Using the Right Amount of Ice Control Chemical?" *Salt & Highway Deicing,* vol. 40, no. 2, summer 2004.

Blackburn, R., et al. *Snow and Ice Control: Guidelines for Materials and Methods.* National Cooperative Highway Research Program Report 526, 2004. Washington, D.C.: Transportation Research Board. www.TRB.org

Blackburn, R., D. Amsler, and K. Bauer. *Guidelines for Snow and Ice Control.* Presented at 10th AASHTO/TRB Maintenance Management Conference, Duluth, MN, July 2003. http://maintenance.transportation.org/Documents/Final%20Report%2020-07%20Task%20250.pdf

Circuit Training and Assistance Program (CTAP). *CTAP Calibration Procedures Manual.* 2000-2001. www.mnltap.umn.edu/ctap

Clear Roads Calibration Guide. http://clearroads.org/researchprojects/05-02calibration.html

Federal Highway Administration. *Manual of Practice for an Effective Anti-icing Program: A Guide for Highway Winter Maintenance Personnel.* 1996. www.fhwa.dot.gov/reports/mopeap/eapcov.htm

Minnesota Department of Transportation
http://www.dot.state.mn.us/maintenance/training.html

Nixon, W.A. "Snow-How." *Snow & Ice Manager,* January 2004. Primedia Business Magazines and Media.
www.grounds-mag.com

University of New Hampshire Technology Transfer Center. *Manual of Practice*. www.t2.unh.edu/pubs/manofpractice_1.pdf

Utah LTAP Center. *Manual of Practice for an Effective Anti-icing Program: A Guide for Highway Winter Maintenance*. www.utaht2.usu.edu

Training and technical assistance

- The Circuit Training and Assistance Program (CTAP), a joint program of MnDOT and the Minnesota Local Technical Assistance Program (LTAP), brings training to your doorstep. For workshop registration visit www.mnltap.umn.edu/ctap.
- Minnesota LTAP offers a series of workshops around the state on a variety of topics. Visit www.mnltap.umn.edu.
- MnDOT Winter Maintenance Coordinator: 651-366-3586.

Other Web resources

- Iowa Department of Transportation. *Anti-icing Equipment Manual* (with drawings for shop-made equipment). www.dot.state.ia.us/maintenance/manuals/equip/intro.htm
- Minnesota Department of Transportation. *Guide to Field-Testing Deicing and Anti-Icing Chemicals*. www.dot.state.mn.us/maint/research/chemical/chem_evaluation_guide.pdf
- Pacific Northwest Snowfighters. www.wsdot.wa.gov/partners/pns/default.htm
- Salt Institute.
  - *Practical Guide for Storing and Handling Deicing Salt*. www.saltinstitute.org/snowfighting
  - Calibration Instructions (with downloadable Excel worksheet) www.saltinstitute.org/snowfighting/6-calib.html
- Clear Roads Pooled-Fund Project. www.ClearRoads.org

Appendix

Example Daily Salt/Sand Use Ticket A-2

Example Loader Ticket: Daily Salt/Sand Issued A-3

Example Documentation Form For Anti-Icing A-4

Bare Lanes Data Collection Sheet A-5

Example Daily Salt/Sand Use Ticket

Operator	Shift	Date
Truck No.	Capacity	
Weather		Temp.

Stockpile	Route	Yards Sand	Yards Salt	Yards Used	Yards Returned	Liquid Gallons
TOTALS						

Example Loader Ticket: Daily Salt/Sand Issued

Operator	Shift	Date
Loader No.	Capacity of Bucket	

Stockpile	Truck #	Yards Sand	Yards Salt	Stockpile	Truck #	Yards Sand	Yards Salt
TOTALS							

Example Documentation Form For Anti-Icing

Anti-icing Route Data Form				
Truck Station: Date:				
Air Temp.	Pavement Temp.	Relative Humidity	Dew Point	Sky
Reason for applying: Route: Chemical: Application Time: Application Amount: Observation (1st day): Observation (After event): Observation (Before next application): Name:				

Bare Lanes Data Collection Sheet

Event Began		Event Ended		Event Type	
Date	Time	Date	Time	(snow, rain, both, drifting)	
Description	Route #	Bare Lanes Lost		Bare Lanes Regained	
		Date	Time	Date	Time

Appendix C

WDNR Snow Disposal Management Guidance

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- Avoid landfills. Added moisture should be kept out of landfills.

- Avoid wetlands and floodplains. These areas are especially sensitive to excess water.

Street strategies for pollution prevention

Contaminants can build up in large snowpiles and lead to "shock" doses of pollutants into waterways during spring runoff. Thus, maintain clean snow at disposal sites by always removing snow from busy roads within 48 hours of snowfall. Use less sand and especially less salt. Consider using alternative de-icers such as calcium chloride. If you use sand, use covered, sturdy street barrels that are no taller than they are wide. Make sure barrels are level and avoid placing them near gutters or storm water drains, where any spills would get an easy ride to surface waters.

Here are some additional ways to "go for clean snow:"

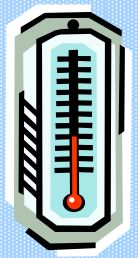
- Equip sand-spreading trucks with sensors that control release rates.
- In the spring and fall, clean up debris that has accumulated in the streets.
- Develop a local snow management policy.

For assistance with water pollution prevention or choosing a snow disposal site, contact the Wisconsin Department of Natural Resources (DNR) office nearest you.

DNR does not have direct authority to choose municipal snow disposal sites or set snow management policies, but can assist with these matters. DNR staff do have the authority to address any complaints regarding water resources contamination in Wisconsin and will handle these matters case by case.

Smart salting

Vermont's "smart salting" program calculates sale application rates using infrared sensors on trucks to measure winter pavement temperatures, which are typically 7 to 40°F warmer than the air. When the pavement is so cold (about -6°F) that salt would be inefficient, crews apply sand or other abrasives.



Sand is frequently mixed with salt to help "embed" the sand into colder surfaces and increase friction. Overall, state transportation crews have found that applying salt and sand in frequent, small doses *during* a snowfall, versus "waiting out the storm," achieves the best results. They are using 25 percent less salt and sand than in previous years.

Where to go with the snow

Snow treatment and disposal guidance for municipalities

Wisconsin Department of Natural Resources
PUBL-WR-154-06REV

DNR Runoff Management:
http://dnr.wi.gov/runoff/

To Wisconsin municipalities, winter means snow and having to find a place to put the tons of it removed from roads, sidewalks and parking lots. Along with protecting safety and maintaining access to homes and businesses, a primary concern in handling snow should be to prevent environmental damage. We hope the following tips will help guide your community's decisions on snow removal and disposal.

What's in the white stuff?

Snow removed from streets, cars and parking lots can contain salt, nutrients, oil, sand, silt, litter, heavy metals and toxic chemicals. All these things can harm surface waters and groundwater, especially when tons of snow are dumped directly into lakes and streams. Spring meltwater from large snow piles can also deliver accumulated doses of pollutants directly to waterbodies.

Suitable disposal sites

Disposing of snow on land where contaminants and debris can be gradually released, contained or collected is better than dumping it into surface waters or on land that drains directly into surface waters, groundwater or storm drains.

The best disposal sites are lands that drain to detention basins, which capture meltwater pollutants that would otherwise reach storm sewers and surface waters. A dike or berm may be needed to prevent overload drainage to nearby lakes and streams.

The amount of snow brought to a site should be based on estimated runoff rates, meltwater quality, the receiving water's ability to absorb runoff, and downstream uses of the receiving water. Local WDNR staff can help in making these assessments.

- Do not choose disposal sites with steep slopes or readily erodible soils.
- Choose sites where there is little risk of human exposure to potential contaminants.
- Avoid playgrounds, ballparks and parking lots.
- Remove debris from snowpiles after spring thaw or before any potential flooding. Fencing the site will prevent litter from blowing offsite or into waterways.
- Avoid placing sites near high-traffic areas to lessen salt and heavy metal buildup from tire and brake wear.

Protect groundwater

- Snow piles should be at least 1,000 feet away from water supply wells. Locate sites downhill of wells, avoiding lakes, streams and wetlands.
- Fine-textured soils are better than sandy soils for filtering certain heavy metals, thus they help protect surface waters and groundwater. (However, most soils cannot detain road salt chlorides, which are soluble in water.)
- Avoid areas with fractured bedrock near the surface. Contaminants can be easily channeled to groundwater at these sites.

The concern over contaminated snow

Toxic substances, sand, silt and litter in city snow that's improperly disposed of can combine with other polluted runoff to:

- Reduce levels of dissolved oxygen in surface waters.
- Stimulate nuisance aquatic plant and algae growth.
- Kill fish and other aquatic life.
- Contribute to contamination in game fish, making them inedible.
- Introduce heavy metals into water and sediments.
- Cover habitat for fish and other aquatic life.
- Clog navigation channels.
- Impair terrestrial plant growth and erode soil.
- Little stream and lake bottoms and shorelines.
- Contaminate groundwater.

Appendix D

Stormwater BMP Map and Table

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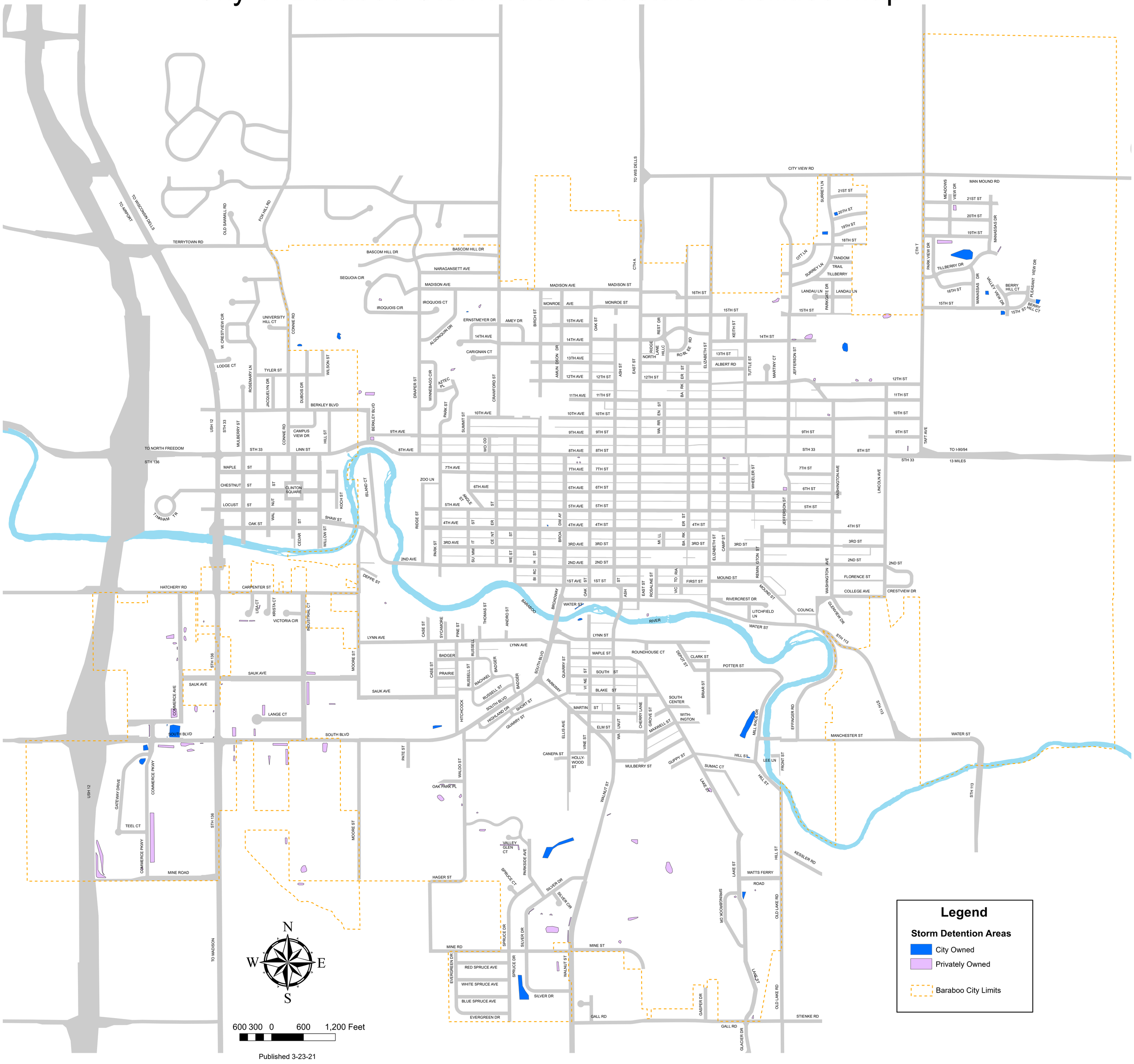
City of Baraboo Stormwater Structural Facilities Map



WET DETENTION BASINS

BMP Name	BMP ID	Tax Parcel Number	Location Description	Owner	Install Date	SWMP ?	Existing O & M Plan?	As-Built Drawing?	Written Permission to Use?	Comments
Gateway Business Park OL 2	r	206-2119-40400	Gateway and Commerce - north	City of Baraboo	2007				N/A	
Gateway Business Park OL 1		206-2119-40300	Gateway and Commerce - south	City of Baraboo	2007				N/A	
Summit Pond		206-1152-90110	east of Summit Credit Union	City of Baraboo	Existing				N/A	
Boo U SE		206-0039-00000	UW-B/SC just East of tennis courts	City of Baraboo, Sauk Co	2011				N/A	
Pleasant View OL 7		206-2883-35470	City View Park	City of Baraboo	2015				N/A	
Deppe Pond		206-0925-01000	Deppe Recreational Area	City of Baraboo	< 1987				N/A	
Alliant on Commerce Pkwy	A	206-1152-52100	SE Corner Alliant on Commerce Pkwy	Wisc Power & Light Co	2006	YES				
Wal-mart Pond West	Q	206-3426-21000	Wal-mart	Wal-mart Real Estate	2000/2004	YES				
Kwik Trip West/ Autozone		206-1152-51200+	1330 South Blvd west side	Convenience Store Investments	2016	YES				
Baraboo Storage		002-0082-00000	E11245 County Road W	Baraboo Storage LLC	2013					Pond outside of City Limits
Menard Pond West		206-2552-28000	Commerce Parkway	Menard Inc	2004					
Teel Plastics pond	U1	206-1152-93010	1670 Mine Road	Renewal I LLC	2006					
Oak Park Place Pond 1		206-1075-01100	800 Waldo Street	Oak Park Prop of Baraboo LLC	2008	YES				
Oak Park Place Pond 4		206-1075-01000	800 Waldo Street	Oak Park Prop of Baraboo LLC	2008	YES				
South Point Apts		206-1153-53020	SW Walnut and Mine	South Point Apts LLC		YES				
Balanced Rock Winery		206-1154-31100	1065 Walnut St	Harrington Holdings LLC	2019	YES				
Off Site Trapped Pond	Bw - Off	002-0759-00000								Pond outside of City Limits
Onsite Landlocked - Bm LL	Bm-LL	206-0021-20000								Natural Low Area, trapping not eligible
Landlocked NE Drainage - Be Off	Be - Off	002-0769-00000								Pond outside of City Limits
Landlocked NE Drainage - Bf Off	Bf - Off	002-0769-00000								Pond outside of City Limits
Landlocked NE Drainage - Bg Off	Bg - Off	002-0748-00000								Pond outside of City Limits
Landlocked NE Drainage - Bh Off	Bh - Off	002-0748-00000								Pond outside of City Limits
Onsite Landlocked - Bi LL	Bi-LL	206-0015-00000+								Natural Low Area, trapping not eligible
Landlocked Drainage - Bj Off	Bj-Off	002-0754-10000								Pond outside of City Limits
Landlocked Drainage Bk Off	Bk-Off	002-0754-10000								Pond outside of City Limits
Landlocked Drainage Bl Off	Bl-Off	002-0754-10000								Pond outside of City Limits
Onsite Landlocked - Bn LL	Bn-LL	206-0035-10000								Natural Low Area, trapping not eligible

DRY DETENTION BASINS

BMP Name	BMP ID	Tax Parcel Number	Location Description	Owner Name	Manager Name, if Different	Year Constructed	SWMP?	Existing O & M Plan?	As-Built Drawing?	Written Permission to Use?	Comments
Summit Credit NE	M	206-1152-90110	South Blvd	City of Baraboo		2007	YES			N/A	
Summit Credit SE	N	206-1152-90110	South Blvd	City of Baraboo		2007	YES			N/A	
Weickgenant Pond	Bv	206-1052-200000	NW of South Blvd & Hitchcock	City of Baraboo		2004?				N/A	
Boo U SW		206-0039-00000	UW-B/SC SW corner	City of Baraboo, Sauk Co	City of Baraboo	< 2003				N/A	
Mary Hoppe Felts Park	Aj	206-0031-10000	Madison Ave	City of Baraboo		2002				N/A	south edge
Mueller Trust	Ah	206-0128-00000	s end of Mueller Trust , n end Park St	Mueller Memorial Trust	City of Baraboo	2002				N/A	
High School		206-0134-00000	n of parking lot/s of JV baseball field	School District of Baraboo	City of Baraboo	2010				N/A	
River Walk Park		206-0931-00000	Water Street	City of Baraboo		2010				N/A	east of NAPA
Baraboo Assembly of God		206-0311-00000	10th and Washington	Baraboo Assembly of God	City of Baraboo	2013				N/A	
Steinhorst Park Pond	Aq	206-0299-00000	east end of 15th Street	City of Baraboo		2004				N/A	
Highland Addition Lot 2		206-2150-02000	19th and Surrey	City of Baraboo		1992				N/A	
First Add to Highland Add OL 1	Bd	206-2150-51010	20th and Surrey	City of Baraboo		2003				N/A	
Pleasant View Subd Outlot 3	Am	206-2883-32110	SW corner 15th St and Valley View Dr	City of Baraboo		2004				N/A	
Spruce Haven 2nd Add OL 2	Ag	206-3117-66001	South end Silver Drive	City of Baraboo		2002				N/A	
Pleasant View 1st Addition OL 2		206-2883-35420	East of 1601 Manassas	City of Baraboo		2004?				N/A	
Dog Park		206-0899-00000	Hill Street	City of Baraboo		1900				N/A	
Old Mill Race		206-0895-00000	Mill Race Drive	City of Baraboo		1900				N/A	
Lake/Spingbrook		206-1154-10419	east of Springbrook N	City of Baraboo		2003				N/A	
Pierce Park Pond	z	206-1135-00000	Walnut St	City of Baraboo		2002				N/A	
Equity Livestock North		206-1152-52299	400 Commerce Ave	Equity Coop Livestock Sales Assoc		2009					
Equity Livestock South		206-1152-52299	400 Commerce Ave	Equity Coop Livestock Sales Assoc		2009					
Baraboo DayCare Main Pnd	B 1	206-1152-52020	620 Commerce Ave	Two Boos for You LLC		2003					
Baraboo DayCare Pre Pnd	B 2	206-1152-52020	620 Commerce Ave	Two Boos for You LLC		2003					
Del Tool Co. Inc. Pond 1	C 1	206-1152-52021	640 Commerce Ave	Brinker Properties LLC		2001					
Del Tool Co. Inc. Pond 2	C 2	206-1152-52021	640 Commerce Ave	Brinker Properties LLC		2001					
North Wal-mart Pond	O	206-3426-21000	Wal-mart	Wal-mart Real Estate		2000/2004	YES				
South Wal-mart Pond	P	206-3426-21000	Wal-mart	Wal-mart Real Estate		2000/2004	YES				
KFC		206-3426-23000	900 State Rd 136	Quick Service Realco LLC		2002					
Slumberland	K	206-1152-54040	1660 Commerce Ave	Larson Enterprises		2000	YES				
Dollar Tree		206-1152-96050	905 State Rd 136	Campbell Properties LP		2015	YES				
WCCU		209-1152-96040	1333 South Blvd	Westby Co-op Credit Union		2014	YES				
Kwik Trip West Diesel Addition		206-1152-51300+	1330 South Blvd east side	KT Real Estate Holdings LLC		2017	YES				
Wedekind Prop	I	206-1152-80000	Wild Side strip Mall	Private		2002					
Golden Buffet - West Pnd	J 1	206-1152-60000	801 State Rd 136	Golden Bowl LLC		< 1992					
Golden Buffet - East Pnd	J 2	206-1152-60000	802 State Rd 136	Golden Bowl LLC		2014					
Dairy Queen		206-1152-51000	701 State Rd 136	RNT Properties LLC		2007					
Blackhawk South	V	206-1153-11000	West of Lot 414	Blackhawk Manor LLC							
Blackhawk West	W	206-1152-97000	North of Lot 463	Blackhawk Manor LLC							
Blackhawk SW	X	206-1152-97000	South of Lot 461	Blackhawk Manor LLC							
Blackhawk Natural	Bt	002-0092-00000	South of 2-A	Baraboo Storage LLC							
N. of Lange Court & W. of Sauk Co Parking Lot	G	206-1727-10000	East of jail parking lot	Sauk County		< 2003					
Sysco Expan. East Basin	H 1	206-1152-9999	800 Sauk	Sysco Food Services of Baraboo		2001					
Sysco Expan. West Basin	H 2	206-1152-10000	800 Sauk	Sysco Food Services of Baraboo		2001					
2002 Deppe Warehouse Indust Ct.	f	206-1148-10000	SW corner of property 501 Industrial Ct	Custom Warehouse & Distrib LLC		2002					
West Fork Ph III Sediment Basin	E	206-3569-12800	331 Lisa Ct	Logan & Stephanie Rabata		2005					
Baraboo Mini Wharehouse Storage		206-1040-10000	804 Lynn Ave	Karl A & Margery I Parker Trust							north end of mini units
Blackhawk NE	Bu	206-1080-00400	Behind Casey's, west of Pate St	Blackhawk Manor LLC		< 2003					
Armory	Bs	206-1080-00000	NE Armory	Tamdee LLC							
Chuch of Latter Day Saints		206-3217-56600	813 Iroquois Circle	Chuch of Latter Day Saints		< 1992					
Cummings Condos	Ai	206-2232-110600	Irish Glen condos - Crawford St	Cummings Construction Inc.		2003					
Kwik Trip East		206-0475-00000	618 8th St	Convenience Store Investments		2010					
St Clare Meadows - North Swale	Ar	206-0304-10000	1414 Jefferson	SSM Health care		2001					
St Clare Meadows - East Swale	As	206-0304-10000	707 14th St	SSM Health care		2001					
St Clare Meadows - South Swale	At	206-0304-10000	1416 Jefferson	SSM Health care		2001					
Supportive Our Lady of Perp Help	Aw	206-3053-00000	1414 Jefferson	Supportive Our Lady of Perp Help		2001					

East High Pt Senior Housing	Ap 2	206-0298-01000	1141 12th St	Highpointe Commons Sr Housing		2005					
West High Pt Senior Housing	Ap 1	206-0298-01000	1141 12th St	Highpointe Commons Sr Housing		2006					
East Elementary School		206-0464-00000	6th & Jefferson	School District of Baraboo		2010					
West of St Claire Add. Pnd & E. of Jefferson St	Au	City ROW	16th St			2005					
St Clare Hospital - Addition	Av	206-0025-10100	707 14th St - East side of Clinic	SSM Health care		2005	YES				
Meadow Ridge Memory Care Main Pond		206-0304-11000	1600 Jefferson St	Sisters of St Mary		2006					
Meadow Ridge Memory Care Pond 2		206-0304-11000	14th Street Right-of-way	Sisters of St Mary		2006					Built in city right-of-way
Rolling Meadows Estates OL 1		206-3001-31900	Park View Dr & 19th St	Sauk County Treasurer		2004?					Tax Deed
Berry Hill		206-1154-84300	east end of Berry Hill Ct	MFIP LLC		2009					
Pleasant View Addition OL 6	An	206-2883-35460	east of 1802 Manassas	Baraboo National Bank		2004					
NE Drainage Study - Knuth Pond	Bx	206-0298-00000	east of Steinhorst Park - off of 15th St	Dennis & Dale Knuth		< 1992					
Oak Park Place Pond 2		206-1075-01000	800 Waldo Street	Oak Park Prop of Baraboo LLC		2008	YES				
Oak Park Place Pond 3		206-1075-01000	800 Waldo Street	Oak Park Prop of Baraboo LLC		2008	YES				
Oak Park Place Pond 5		206-1075-01000	800 Waldo Street	Oak Park Prop of Baraboo LLC		2017	YES				
1st Add to Park Ridge - North Pond	Aa	206-2745-24700	617 Parkside Ave - rear yard	Velicko and Suzana Nojkic		1999					Small detention basin in rear yard of S-F Lot
1st Add to Park Ridge - South Pond	Ab	206-2745-29000+	630, 624 Parkside Ave - rear yards	multiple		1999					
Parkside Condos	Ad 1	206-2745-10100	1300 block Silver Dr	multiple		< 2003					
South Point Apts		206-1153-53020	SW Walnut and Mine	South Point Apts LLC		2013	YES				
Fox Pt Exempt Pond 1	Af 1	206-2745-01300	Fox Point Apts	Fox point Apts LLC		2005					
Fox Pt Exempt Pond 2	Af 2	206-2745-01300	Fox Point Apts	Fox point Apts LLC		2005					
Fox Pt Exempt Pond 3	Af 3	206-2745-01300	Fox Point Apts	Fox point Apts LLC		2005					
Kraus Homes Lot 16	Ad 2	206-2745-01600	1200 Silver Dr	3 TD LLC		< 2003					
NW Pond - River's Edge Apt	Ac 1	206-2745-01700	behind 1220 Silver Dr	River's Edge Rentals LLC		<2003					
SE Pond - River's Edge Apt	Ac 2	206-2745-01700	in front of 1220 Silver Dr	River's Edge Rentals LLC		< 2003					
2001 Warehouse Add -Deppe Pond 1	Bc 1	206-1154-20000	1515 Walnut St	Deppe Enterprises		2001					
2001 Warehouse Add -Deppe Pond 2	Bc 2	206-1154-20000	1515 Walnut St	Deppe Enterprises		2001					
Ph1 Dan Goff Condos - Pnd 2	Ax	206-3152-01000+	301+303 Inverness Terrace	Inverness Golf Condo		2004					
Ph1 Dan Goff Condos - Pnd 3	Ay	206-1137-00000	?	Inverness Golf Condo		2004					
Ph1 Dan Goff Condos - Pnd 1	Az	206-2127-85210	?	Inverness Golf Condo		2004					
Inverness Golf Development	Ba	206-2232-03900	Inverness Terrace Ct - outlot 2	Inverness Golf Condo		2006	YES				
Baraboo Country Club - Clubhouse	Bb	206-0918-00000	401 Mine St	Baraboo Country Club, Inc		2006					
1st Add Springbrk Hills Pnd 1	Br 1	206-3117-00431	1215 Springbrook - Lot 1	Samuel & Alexis Marlette		2007					
1st Add Springbrk Hills Pnd 2	Br 2	206-3117-00436	lot 6	D Mitchell LLC		2007					
1st Add Springbrk Hills Pnd 3	Br 3	206-3117-00441	1325 Springbrook - lot 11	Jason & Julie Lane		2007					
Baraboo News	Bo	206-1154-10421	714 Matts Ferry Rd	Baraboo Paper LLC		2006					
Culligan	Bq	206-1154-10430	1501 Lake St	Total Water of Baraboo Real Estate LLC		2005	YES				
Head Start North		206-1154-10440	1531 Lake St	Renewal Unlimited Inc		2007					
Head Start South		206-1154-10440	1531 Lake St	Renewal Unlimited Inc		2007					
Mine Road Condos	Ae1	206-2232-20100	Behind Bldg 1								
Mine Road Condos	Ae2	206-2232-20100	Behind Bldg 3								

INFILTRATION BASINS

BMP Name	BMP ID	Tax Parcel Number	Location Description	Owner	Year Constructed	SWMP?	Existing O & M Plan?	As-Built Drawing ?	Written Permission to Use?	Comments
M & S Auto		206-0039-43010	357 State Rd 136	Michael Price	2015	YES				Built?
West Fork Ph III SW Infilt - 2005	D 1	206-3569-12900	324 Lisa Ct	Quality Home Construction	2005					
West Fork Ph III NE Infilt - 2005	D 2	206-3569.12500	313 Lisa Ct	Susan Schadewaldt	2005					
Phase I Teel Plastics - Infiltration	U 2	206-1152-93010	West end of Mine Road	Renewal I LLC	2006					Recieves only discharge from pond U1
St Claire Meadows - Infiltration	Bp	206-0304-10000		SSM Health care	2001					

VEGETATED SWALES

BMP Name	BMP ID	Tax Parcel Number	Location Description	Owner	Year Constructed	SWMP?	Existing O & M Plan?	As-Built Drawing ?	Written Permission to Use?	Comments
Villas At Baraboo		206-0038-00000	BOO U	City of Baraboo, Sauk County	2014	YES				

UNDERGROUND STORAGE TANKS

BMP Name	BMP ID	Tax Parcel Number	Location Description	Owner	Year Constructed	SWMP?	Existing O & M Plan?	As-Built Drawing?	Written Permission to Use?	Comments	
Anytime Fitness		206-1152-52013	Under parking lot west side of building	434 HWY 12 LLC	2011	YES			N/A		
Anytime Fitness		206-1152-52013	Under parking lot west side of building	434 HWY 12 LLC	2013	YES			N/A		

BIO-RETENTION BASINS

BMP Name	BMP ID	Tax Parcel Number	Location Description	Owner	Year Constructed	SWMP?	Existing O & M Plan?	As-Built Drawing?	Written Permission to Use?	Comments
Baraboo VA Office		206-1152-54010	1670 South Blvd	Den-Tech Investments	2013	YES				
Dez Indoor Shooting Range		206-1152-96020	1223 South Blvd	DEZ Holdings	2019	YES				north side
Dez Indoor Shooting Range		206-1152-96020	1223 South Blvd	DEZ Holdings	2019	YES				east side
Glacier Valley Ford		206-1152-96030	1243 South Blvd	Hoppe Properties LLC	2014	YES				
Baraboo Municipal Building		206-1776-00000	north of Police garage	Baraboo Community Dev Auth	2018	YES				
Dominos		206-0158-00000	844 8th Ave	Hardeb Enterprises LLC	2018	YES				west side
Driftless Glen Distillery		206-0831-00000	300 Water St	Driftless Glen Properties LLC	2013	YES				se corner
Rolling Meadows North		206-3638-00000	OL 1, SE 21st & Meadows View	Legacy Housing LLC	2016	YES				

RAIN GARDENS

BMP Name	BMP ID	Tax Parcel Number	Location Description	Owner	Year Constructed	SWMP?	Existing O & M Plan?	As-Built Drawing?	Written Permission to Use?	Comments
CF Bank 1		206-1176-00000	122 8th Ave	Community First Bank	2019	YES				
CF Bank 2		206-1176-00000	123 8th Ave	Community First Bank	2019	YES				
Library		206-1396-00000	230 4th Ave	City of Baraboo						
FUMC		206-1399-00000	615 Broadway St	First United Methodist Church						
Zoo		206-0190-00000	NE Corner Zoo	City of Baraboo	2020					

Appendix E

Stormwater Long-Term Maintenance

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APPENDIX E-1 - LONG-TERM OPERATION & MAINTENANCE REQUIREMENTS

E-1.1. In General

1. O&M plans shall be site specific and shall address all inspections and maintenance items as they pertain to the stormwater management system.
2. Outdoor good housekeeping practices specific to the industry or development should be included as they can have an impact on the system. Some good housekeeping practices that may affect the quality of runoff on the site include, but are not limited to:

   i. Outdoor storage
      a. Outdoor storage or uses/activities with the potential to generate bacteria, trash, or other pollutants should be maintained to prevent discharges or drainage to surface waters and storm drains.

   ii. Vehicle washing
      a. Washing should be done within a designed wash bay or on a vegetated surface

   iii. Parking lot cleaning
      a. Routine (e.g. monthly or semi-annually) sweeping of heavily used parking areas could reduce BMP maintenance

   iv. Vehicles
      a. Storage
         1) Storing fleet vehicles in designated areas on-site may minimize the potential of related pollutants from entering multiple on-site BMPs
      b. Maintenance
         1) Routine inspection and maintenance of fleet vehicles will minimize potential impacts on the stormwater system.

   v. Chemical storage
      a. Any chemicals stored outside could be protected and covered to prevent spills

   vi. Garbage receptacles
      a. Trashcans and dumpsters should be easily accessible and remain closed (if possible) when not in use and drains plugged.
      b. All dumpster areas should be fully enclosed on four sides with a locking gate with drainage directed away from storm drains and surface waters

   vii. Use of sand/salt in winter months
      a. Limiting the amount of sand and salt on the site will reduce the burden these have on stormwater BMPs and will keep O&M costs lower. Safety is always the first concern.

   viii. Snow Storage
      a. Snow should be stored in designated locations only. Snow plowed into or stored in Stormwater Management BMPs can have negative impacts on the system including plant health and early clogging.

   ix. Spill Kits
      a. Keeping fully stocked, clearly labeled, spill kits in easy to access locations throughout the site will allow any spills to be contained and cleaned before they enter into and affect the stormwater system.

E-1.2. LT O&M Plan Components

1. Each O&M Plan shall include the following components
   i. Identification of the responsible party (or position) for O&M and associated documentation
   ii. Site specific inspection form(s)
   iii. A Stormwater System Manual (see D-1.2.2 for more details)
   iv. Good housekeeping practices
   v. System map with inspection locations and BMPs labeled clearly
   vi. O&M Agreement signed by the owner.
2. System Manual

i. The System Manual is intended to be a comprehensive document explaining the site's stormwater management system. The manual shall include the following items:

a. Any relevant history of the site

1) Items to consider include, but are not limited to,

a) Locations of any contaminated soils

b) Remediation actions or requirements

b. An overview of the entire system including:

1) Applicable design requirements

2) General routing on-site

3) BMPs and system components

c. A description of each BMP or component and its role in the system

d. Detailed Inspection and Maintenance actions for each system component

1) Minimum requirements are listed, per BMP, in section D-2.

e. Inspection and maintenance schedule for the entire life expectancy of the system.

APPENDIX E-2 - BMP Specific Inspection and Maintenance Minimum Requirements

NOTE: This section only includes the minimum required items. It is highly recommended the designer refers to WI DNR technical standards and NR code, and evaluates and considers the site to include additional items or increased frequencies. Incorporate these additional items or increased frequencies in the site-specific plan, if determined appropriate.

The goal of the inspection and maintenance plan is to ensure proper operation **and** longevity of the site's stormwater management system at a reasonable cost.

E-2.1 Wet Pond (DNR Tech Standard 1001)

E-2.2 Dry Pond (DNR Tech Standard 1003)

E-2.3 Artificial Wetland

E-2.4 Biofiltration Systems (DNR Tech Standard 1004)

E-2.5 Filter Strips (DNR Tech Standard 1005)

E-2.6 Permeable Pavement (DNR Tech Standard 1008)

E-2.7 Underground Storage

E-2.8 Grit Chambers and Catch Basin Sumps

E-2.1: WET POND				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring and Late Fall.	Remove dead vegetation, re-plant or re-seed areas with poor vegetation, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow (1 to 2 times per year) to no less than 4 inches.	As needed based on inspections.
Forebay (if applicable)	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring and Late Fall.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Side slopes	Check vegetation as above and for signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Address vegetation concerns as above, mow (1 to 2 times per year) to no less than 4 inches, repair and revegetate damaged or eroded areas.	As needed based on inspections.
Permanent Pool	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Permanent Pool Capacity (including Forebay)	Verify sediment storage capacity.	TBD by Engineer - 1st check should be within 5 years of installation.	Use appropriate equipment (e.g. excavator and dump trucks) to remove the accumulated sediment to restore the original elevation and design capacity. **Material must be disposed of properly!**	Sediment removal required when average pool depth is ≤ 3.5 feet or as determined by engineer.

E-2.2: DRY POND				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring and Late Fall.	Remove dead vegetation, re-plant or re-seed areas with poor vegetation, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow (1 to 2 times per year) to no less than 5-6 inches.	As needed based on inspections.
Forebay (if applicable)	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring and Late Fall.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Side slopes	Check vegetation as above and for signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Address vegetation concerns as above, mow (1 to 2 times per year) to no less than 5-6 inches, repair and revegetate damaged or eroded areas.	As needed based on inspections.
Detention Area	Check for abnormal discoloration or sheens in water during wet periods; check for areas of scour in dry periods.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Detention Area Capacity (including Forebay)	Verify sediment storage capacity.	TBD by Engineer - 1st check should be within 5 years of installation.	Use appropriate equipment (e.g. excavator and dump trucks) to remove the accumulated sediment to restore the original elevation and design capacity. **Material must be disposed of properly!**	Sediment removal required when the pond volume has been reduced by 25% or when average pool depth (Forebay) is $\leq$ 3 feet.

E-2.3: ARTIFICIAL WETLAND				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring and Late Fall.	Remove dead vegetation, re-plant or re-seed areas with poor vegetation, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow (1 to 2 times per year) to no less than 5-6 inches.	As needed based on inspections.
Forebay (if applicable)	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring and Late Fall.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Side slopes	Check vegetation as above and for signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Address vegetation concerns as above, mow (1 to 2 times per year) to no less than 5-6 inches, repair and revegetate damaged or eroded areas.	As needed based on inspections.
Permanent Pool	Check for abnormal discoloration of water, sheens, algal growth and aquatic vegetation health.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Use appropriate methods to address excessive pollutants and algal growth. Restore/replant aquatic vegetation as needed.	As needed based on inspections.
Permanent Pool Capacity (including Forebay)	Verify sediment storage capacity.	TBD by Engineer - 1st check should be within 5 years of installation.	Use appropriate equipment (e.g. excavator and dump trucks) to remove the accumulated sediment to restore the original elevation and design capacity. **Material must be disposed of properly!**	Sediment removal required when average pool depth is ≤ 3 feet or as determined by engineer.

E-2.4: BIOFILTRATION SYSTEMS				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, bare areas, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring and Late Fall.	Water plants, remove dead vegetation, re-plant, re-seed, or add mulch to areas with poor or no vegetation or mulch, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow (1 to 2 times per year) to no less than 5-6 inches.	As needed based on inspections.
Side slopes	Check vegetation as above and for signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Address vegetation concerns as above, mow (1 to 2 times per year) to no less than 5-6 inches, repair and revegetate damaged or eroded areas.	As needed based on inspections.
Detention / Infiltration Area	Check for abnormal odors, discoloration, or sheens in water during wet periods. Monitor drain down time - surface should be free of standing water 24-48 hours after rain event. Check for areas of scour or erosion and sediment accumulation in dry periods.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Use appropriate methods to address excessive pollutants causing abnormal odors, colors, or sheens. Use appropriate methods (flat bottom shovel) to remove excessive sedimentation. Restore/repair areas of erosion or scour as needed.	As needed based on inspections.
Underground Storage Layer	Monitor drain down time - system should be dry within 72 hours.	72 hours after each rain event of 0.5" or greater producing runoff.	No routine maintenance items for this component. If the system is not draining adequately, the system will need major maintenance.	N/A

E-2.5: FILTER STRIPS				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets (if applicable)	Check for structure or curb cut damage and signs of undercutting, scouring, erosion, and blockages in adjacent areas.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Vegetation	Check height and types, and for signs of poor plant health, bare areas, erosion, rodent activity, and woody and/or invasive vegetation.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Water, remove dead vegetation, re-plant, or re-seed areas with poor or no vegetation, repair and revegetate damaged or eroded areas, remove and prevent large woody and/or invasive vegetation from growing within the system, mow to keep vegetation height under 12" but no less than 5-6".	As needed based on inspections.
Slope and Top of Slope	Check for damage (e.g. - rutting from vehicles) sediment accumulation and signs of erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair and revegetate damaged or eroded areas. Remove accumulated sediment with a flat bottom shovel, dispose of appropriately, and revegetate if needed.	As needed based on inspections.

E-2.6: PERMEABLE PAVEMENT				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Pavement Condition	Check for loose blocks, spalling, cracks, heaving, sinking, loss of surface and/or joint material, etc.	Annual.	Repair any issue significant enough to adversely impact the water quality function of the system. For permeable pavers/blocks with joints that are filled with aggregate: - Replenish the joint aggregate in accordance with industry recommendations. - If necessary, remediate the system by extracting accumulated debris and aggregate from the joints using a vacuum and re-filling the joints with new aggregate. For porous asphalt and pervious concrete, repairs may be done with conventional impervious materials if the total impervious repair areas do not exceed 10% of the original permeable surface area and runoff from the repair areas will run on to adjacent permeable areas.	As needed based on inspections.
Surface Infiltration	Check for sedimentation or evidence of ponding.	Annual and after each rain event of 0.5" or greater producing runoff.	Clean the pavement surface using industry recommended methods - regenerative air or vacuum sweeping.	Minimally twice per year and as needed if ponding persists upon inspection after rain events.
Outfalls	Check all underdrain outfalls for obstructions and erosion.	Annual.	Repair blocked, restricted or eroding underdrain outfalls.	As needed based on inspections.
Surrounding (run-on) areas - vegetated	Check height and types, and for signs of poor plant health, bare areas, and erosion.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair and replant any areas found to have vegetation health issues or have started to erode.	As needed based on inspections.

E-2.6: PERMEABLE PAVEMENT (continued)				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Surrounding (run-on) areas - non-vegetated	Check for damage to pavement, concrete, or buildings. Check for signs of inappropriate water drainage (e.g. concentrated flow through damaged areas).	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair any areas found to have issues as appropriate to mitigate excessive or concentrated flow to the permeable pavement system.	As needed based on inspections.
System Drainage	If present, check observation wells to verify the storage reservoir is draining down.	72 hours after a rain event of 0.5" or greater.	No routine maintenance items for this component. If the system is not draining adequately, the system will need major maintenance.	N/A

Additional Permeable Pavement O&M items:	
Prohibitions	Temporary or permanent stockpiling of soil or other material that can potentially cause or contribute to clogging. Application of pavement seal-coating. Application of sand for deicing.

E-2.7: UNDERGROUND STORAGE				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for structure damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Pretreatment device (e.g. grit chamber)	See considerations for D-2.8: Grit Chambers and Catch basin Sumps.			
Permanent Pool Capacity	Use observation wells or inspection ports and appropriate methods to verify accumulated sediment.	Frequency schedule TBD per site by design engineer.	Use appropriate equipment (e.g. Vactor Truck) to remove the accumulated sediment to restore **the design sediment storage capacity. Material must be disposed of properly!**	As needed based on inspections.

E-2.8: GRIT CHAMBERS AND CATCH BASIN SUMPS				
Component	Inspection Description	Inspection Frequency	Routine Maintenance Description	Routine Maintenance Frequency
Inlets and Outlets	Check for damage and signs of undercutting, scouring, erosion, and blockages.	Early Spring, Late Fall, and after each rain event of 0.5" or greater producing runoff.	Repair or replace damaged structures. Repair and stabilize areas undercut or eroded. Repair areas damaged by scouring- consider installing hard armor or energy dissipation to prevent scour. Remove all debris or blockages.	As needed based on inspections.
Structure Condition	Check for damage, cracking, leaking, etc. on all components of the structure.	Annual.	Repair any defects, seal any cracks, replace any broken components per manufacture recommendations or industry standards.	As needed based on inspections.
Accumulation	Use appropriate method to verify the depth of accumulation - TBD per site by design engineer.	Frequency schedule TBD per site by design engineer.	Use appropriate equipment to remove the accumulated sediment to restore the design sediment storage capacity. **Material must be disposed of properly!**	As needed based on inspections.

ATTACHMENT "G"

CITY OF BARABOO

STORMWATER QUALITY MANAGEMENT (2.7)

Prepared by:
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Origination Date: 03/05/2021
Revision Dates:

Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

Appendices

APPENDIX A: SWQMP - 2020 ..... A1

CITY OF BARABOO
STORMWATER QUALITY MANAGEMENT (2.7)

Goal: Control Total Suspended Solids (TSS) carried in storm water from existing urban areas.

Compliance Date: March 31, 2021 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

The city shall implement its municipal storm water quality management program. This program shall maintain compliance with the developed urban area performance standards of s. NR 151.13(2)(b)1., Wis. Adm. Code, for those areas of the municipality that were not subject to the post-construction performance standards of ss. NR 151.12 or 151.24, or ss. NR 151.122 through 151.126, or ss. 151.242 through 151.246, Wis. Adm. Code. The permittee shall implement the following measurable goals:

2.7.1 To the maximum extent practicable, implementation and maintenance of all storm water management practices necessary to meet the more restrictive total suspended solids reduction of either of the following:

a. The permittee shall maintain all source area controls, structural storm water management facilities, and non-structural storm water BMPs that the permittee implemented on or before July 1, 2011, to achieve a reduction of 20% or more of total suspended solids carried by storm water runoff from existing development to waters of the state. If the permittee removes or modifies a storm water BMP, the permittee shall continue to achieve the reduction by installing, implementing, and maintaining the necessary storm water BMPs to, at a minimum, equal the same level of treatment. All structural storm water management facilities utilized to meet the requirements in section 2.7.1.a shall be inventoried and maintained in accordance with sections 2.6.1 and 2.6.2.

b. A 20% reduction in the annual average mass of total suspended solids discharging from the MS4 to surface waters of the state as compared to implementing no storm water management controls. All source area controls, structural storm water management facilities, and non-structural storm water BMPs implemented to achieve the 20% reduction in total suspended solids shall be maintained. If the permittee removes or modifies a storm water BMP, the permittee shall continue to achieve the 20% reduction by installing, implementing, and maintaining the necessary storm water BMPs to equal, at a minimum, the same level of treatment. All structural storm water management facilities utilized to meet the requirements in section 2.7.1.b shall be inventoried and maintained in accordance with sections 2.6.1 and 2.6.2.

WORK PLAN

☒ The City of Baraboo Stormwater Quality Plan Update was completed in 2020 and is hereby incorporated as a supplement into this as a separate document.

☐ The City will look to implement recommendations in water quality plan.

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Appendix A

2020 Stormwater Quality Management Plan

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Stormwater Quality Plan Update

Wisconsin River TMDL Assessment

City of Baraboo, Wisconsin

MSA Project No. R.00035104

December 2020

Prepared by:

MSA Professional Services, Inc.
1702 Pankratz Street
Madison, WI 53704

Table of Contents

1.0 EXECUTIVE SUMMARY 3
2.0 INTRODUCTION 5
3.0 WATER QUALITY MODELING 5
3.1 RAINFALL DATA 6
3.2 WINSLAMM POLLUTANT LOADING FILES 7
3.3 MODEL PARAMETER FILES 7
3.4 WATERSHEDS, LAND USES, SOURCE AREAS, AND SOIL TYPES. 8
3.4.1 DETERMINATION OF WATERSHED BOUNDARIES 8
3.4.2 DEVELOPMENT OF WINSLAMM LAND USE DATA 9
3.4.3 DEVELOPMENT OF WINSLAMM SOURCE AREA DATA 11
3.4.4 DEVELOPMENT OF WINSLAMM SOIL TEXTURE DATA 11
3.5 WATER QUALITY MANAGEMENT PRACTICES 14
3.5.1 APPLICATION OF STREET SWEEPING IN WINSLAMM 15
3.5.2 APPLICATION OF DETENTION PONDS AND BIOFILTERS IN WINSLAMM 16
3.5.2 APPLICATION OF VEGETATED SWALES IN WINSLAMM 16
4.0 APPLICATION OF REGULATORY CONDITIONS TO WINSLAMM INPUT DATA 18
5.0 FINDINGS 20
5.1 MODEL RESULTS AND DISCUSSION 20
5.2 STREET SWEEPING EFFICIENCY 21
6.0 STORMWATER QUALITY TREATMENT PERFORMANCE ALTERNATIVES ANALYSIS 21
6.1 PROGRAMMATIC STORMWATER QUALITY RECOMMENDATIONS 22
6.2 OPERATIONAL STORMWATER QUALITY ALTERNATIVES 22
7.0 RECOMMENDATIONS 31
7.1 IMPLEMENTATION SCHEDULE 33
APPENDICES
Appendix A – Maps
Appendix B – Modeling Guidance Documents
Appendix C – Existing Structural BMP Data
Appendix D – Alternative New BMP Concept Plans
Appendix E – Alternative New BMP Construction Cost Estimates
Appendix F – Summary Water Quality Model Data
Appendix G – Infiltration Model Data

1.0 EXECUTIVE SUMMARY

The City of Baraboo is an operator of a municipal separate storm sewer system (MS4). The operation of the MS4 is regulated by the Wisconsin DNR under General Permit WI-S050075-3 which requires compliance with the standards specified in Administrative Code NR 216.07(6)(b) and NR 151.13. These codes require quantification of annual loads and reductions of Total Phosphorus (TP) and Total Suspended Solids (TSS) in stormwater runoff passing through the City's MS4. The standards outlined within NR 151 require that regulated communities achieve a 20% reduction in TSS in runoff that enters waters of the state, relative to no controls. This reduction was to be measured City-wide.

In April 2019, USEPA approved a Total Maximum Daily Load (TMDL) for the Wisconsin River Watershed which identified reductions of TP necessary to restore water quality to achieve designated uses for selected reaches of the Wisconsin River and its tributaries. In addition to the requirement for City-wide reductions in TSS loads previously discussed, General Permit WI-S050075-3 requires additional reductions in TSS and TP according to the recommendations of USEPA approved TMDLs. The City of Baraboo is located entirely within the Wisconsin River Watershed; these five reaches are shown on Figure 1 in the Appendix A of this report. Tables 1 and 2, below, summarize existing pollutant reductions achieved by 41 existing structural stormwater management practices and the City's existing street sweeping program. Additionally, the tables summarize TSS and TP reductions achieved from all the recommended alternative BMPs evaluated in this report.

The City is currently in compliance with TP reduction stormwater quality standards for Reach 5, Reach 137, Reach 230, and Reach 234. However, Reach 179 does not achieve the TMDL required TP reduction. The City also does not achieve the NR151 City-wide required TSS reduction.

This study evaluated 20 new alternative stormwater practices intended to improve TSS and TP reductions. Each alternative practice was evaluated for reductions in TSS and TP from stormwater runoff. Of the 20 practices evaluated, four (4) were found as effective based on an ability to achieve a TP reduction cost of less than $1000/lb/yr. The total estimated construction cost of the four (4) recommended BMPs in this report is approximately $1.4M, including land acquisition. The four recommended structural BMPs do not quite achieve goals, therefore an enhanced street sweeping program is also required to provide the remaining TSS and TP reduction.

This report was prepared to specifically address the water quality requirements of the Wisconsin River TMDL and only specifically addresses reductions in TP loads from the City's regulated MS4. While TSS was not addressed in the TMDL, the City is still subject to the 20% TSS reduction standard of NR 151.13; this reduction is intended to be achieved on a city-wide average basis. The WDNR guidance which describe the modeling protocols necessary to demonstrate compliance with NR151 are substantially different than those required to demonstrate compliance with TMDLs and is outside the scope of work of this current study. References to TSS

reductions included in this report are useful as an indication of relative levels of stormwater quality treatment but are not, on their own, strictly suitable for demonstrating compliance with the 20% TSS reduction required in NR151. Note, however, that baseline conditions in the TMDL study are predicated on achieving the NR151 required TSS reductions, and so it is reasonable to assume that meeting the required TMDL TP reduction levels will be commensurate to achieving the required NR151 TSS reduction levels.

Table 1 – Current and Proposed TSS Reduction Performance

Study Area	Regulated Area	TSS					
	acres	Load In (tons/yr)	Condition[2]	Trapped (tons/yr)	Reduction	Required	Proposed Total Reduction
City-wide[1]	3,262	478.1	Existing Proposed	69.5 31.7	14.5% 6.6%	20%	21.2%

1. There is only a City-wide requirement for TSS, not TP.
2. In the context of this table, proposed condition includes only recommended BMPs.

Table 2 – Current and Proposed TP Reduction Performance

Study Area	Regulated Area	TP					
	acres	Load In (lbs/yr)	Condition[2]	Trapped (lbs/yr)	Reduction	Required	Proposed Total
Reach 5	370	340.0	Existing Proposed	56.1 NA	16.5% NA	15%	16.5%
Reach 137	372	318.3	Existing Proposed	71.9 NA	22.6% NA	15%	22.6%
Reach 179	2,481	2,277.2	Existing Proposed	174.4 152.8	7.7%[1] 6.7%	15%	14.4%
Reach 230	39	35.7	Existing Proposed	18.2 NA	51.0% NA	31.2%	51.0%
Reach 234[3]	0	0.0	Existing Proposed	0.0 NA	NA NA	NA	NA

1. For existing conditions, the city is not in compliance with the TMDL TP reduction target for Reach 179.
2. In the context of this table, proposed condition includes only recommended BMPs.
3. Approximately 90 acres of Reach 234 are within the City limits of Baraboo. However, none of this area is regulated.

2.0 INTRODUCTION

The City of Baraboo is an operator of a municipal separate storm sewer system (MS4). The operation of the MS4 is regulated by the Wisconsin DNR under General Permit WI-S050075-3 which requires compliance with the standards specified in Administrative Code NR 216.07(6)(b) and NR 151.13. These codes require quantification of annual loads and reductions of Total Phosphorus (TP) and Total Suspended Solids (TSS) in stormwater runoff passing through the City's MS4.

The standards outlined within NR 151 require that regulated communities achieve a 20% reduction in TSS in runoff that enters waters of the state, relative to no controls. This reduction was to be measured City-wide. The City's 2007 Stormwater Quality Improvement Plan identified that the City was achieving 15.6% TSS reduction, and so was not in compliance with standards in effect at the time.

In April 2019, USEPA approved a Total Maximum Daily Load (TMDL) for the Wisconsin River Watershed which identified reductions of TP necessary to restore water quality to achieve designated uses for selected reaches of the Wisconsin River and its tributaries. In addition to the requirement for City-wide reductions in TSS loads previously discussed, General Permit WI-S050075-3 requires additional reductions in TSS and TP according to the recommendations of USEPA approved TMDLs. The City of Baraboo is located entirely within the Wisconsin River Watershed and drains to five reaches tributary to the Wisconsin River; Reach 5, Reach 137, Reach 179, Reach 230 and Reach 234. The watersheds within the City draining to these five reaches are shown on Figure 1 in the Appendix A of this report. The Wisconsin River TMDL does not require a TSS reduction target for any of the five reaches. Meanwhile, the Wisconsin River TMDL TP reduction target for all reaches is 15%, except for Reach 230, with a TP reduction target of 31.2%.

This report outlines the processes, findings, and recommendations of City-wide modeling of the stormwater features in the City of Baraboo for TSS and TP reduction standards. The recommendations given are expected to be completed during the next 25 to 50 years, to achieve compliance with TSS and TP reduction goals, respectively.

3.0 WATER QUALITY MODELING

The findings of this study were developed from detailed WinSLAMM Version 10.4 models of the City's stormwater management system. WinSLAMM is a Wisconsin Department of Natural Resources (WDNR) approved model recommended for use in determining TSS and TP removal rates from stormwater management practices for assessment of compliance with WPDES requirements. (See notation NR216.07(6)(b) – "The department believes that computer modeling is the most efficient and cost-effective method for calculating pollutant loads. Pollutant

loading models such as WinSLAMM, P8 or equivalent methodology may be used to evaluate the efficiency of the design in reducing total suspended solids.")

"WinSLAMM" abbreviates as "Source Loading and Management Model [for Windows]." WinSLAMM was originally developed to better understand the relationships between sources of urban runoff pollutants and runoff quality. It has been continually expanded since the late 1970s and has been revised to include a wide variety of source areas (runoff and pollutant generators) and outfall control practices (runoff and pollutant management practices). WinSLAMM is based on actual field observations and has minimal reliance on theoretical processes.

Use of WinSLAMM as the principal water quality model for this current study represents a change from previous work. The 2007 Stormwater Management Plan Update for the City of Baraboo was completed using the P8 model (version 3.4). At the time, P8 was preferred to WinSLAMM due to its ability to evaluate water quality treatment of 'end-of-pipe' management practices in series, a function not available in the version of WinSLAMM available at the time. WinSLAMM version 10.4, as used in this study, has been substantially revised since 2007 and now includes the ability to route BMPs in series, as well as the ability to evaluate a wider variety of management practices than can currently be evaluated in P8.

Input data required by WinSLAMM for each model application includes a number of data files that describe local meteorological and hydrological conditions, and pollutant loading characteristics. These files are prescribed for use in the WinSLAMM model by the United States Geological Survey (USGS) Wisconsin Water Science Center and include parameter files for rainfall, pollutant distribution, runoff coefficients, particulate solids concentrations, and pollutant delivery data.

3.1 RAINFALL DATA

The USGS has evaluated rainfall data collected across the state of Wisconsin for many years and has identified annual rainfall records for five locations in the state that are felt to be representative of typical rainfall precipitation conditions. For Baraboo, the closest rainfall record recommended for use in water quality modeling is the Madison five-year rainfall record starting in 1980 (a five-year model run is specified by WDNR for evaluations which include street sweeping). Occasionally, it was necessary to use the Madison one-year 1981 rainfall record instead of the Madison five-year 1980 rainfall record due to memory constraints within WinSLAMM and limitations for how models can be subdivided. All models which included street sweeping used the Madison five-year rainfall record starting in 1980. Modeling protocols established by WDNR require elimination of the winter season (where precipitation principally falls as snow or ice) from the model simulation as WinSLAMM cannot accommodate snowfall and runoff from snowmelt events. The range of winter dates applicable to the Madison rainfall data run from December 2 to March 12. Thus, any single-year simulation runs from March 13 to

December 1.

3.2 WinSLAMM POLLUTANT LOADING FILES

Pollutant loading files required by the WinSLAMM model include a Pollutant Probability Distribution File, Runoff Coefficient File, Particulate Solids Concentration File, Particulate Residue Reduction File, and a Street Delivery Parameter File.

The Pollutant Probability Distribution File describes the pollutant loading from different source areas (land use types). This data is based upon actual pollutant loading collected from the study area or region.

The Runoff Coefficient File describes parameters specific to different source areas (land use types) that determine the runoff volumes resulting from rainfall events of different depth.

The Particulate Solids Concentration File contains parameters allowing the WinSLAMM model to determine the weight of particulate solids loadings resulting from runoff events of different volumes. The particulate solids concentration file includes data measured by the USGS from source areas including residential, commercial, and industrial rooftops; residential lawns; residential driveways; residential, commercial and industrial streets; commercial and industrial parking lots; freeways; and undeveloped areas.

The Particulate Residue Reduction File describes the fraction of total particulates that remains within the drainage system after rainfall events and so do not reach the system outfall.

The Street Delivery Parameter File contains data describing the fraction of total particulates that do not reach the outfall during a rain event, for different rain depths and street textures.

3.3 MODEL PARAMETER FILES

The following model parameter files were entered into the WinSLAMM model(s) for evaluation of the City of Baraboo's stormwater management system.

Rainfall Files -	WisReg – Madison Five Year Rainfall.ran
	WisReg – Madison WI 1981.ran (alternate)
Pollutant Probability Distribution File -	WI_GEO03.ppdx
Runoff Coefficient File -	WI_SL06 Dec06.rsv
Particulate Solids Concentration File -	v10.1 WI_AVG01.pscx
Street Delivery File:	

Residential/Other -	WI_Res and Other Urban Dec06.std
Institutional/Commercial/Industrial -	WI_Com Inst Indust Dec06.std
Freeway -	Freeway Dec06.std

3.4 WATERSHEDS, LAND USES, SOURCE AREAS, AND SOIL TYPES.

Watersheds are the sources of runoff and pollutants simulated by the program. WinSLAMM Version 10.4 is capable of modeling complex systems of interconnected watersheds each of which can contain up to six discrete land uses; residential, institutional, commercial, industrial, freeway, and other urban areas. Each land use contains specific runoff and pollutant source areas including roofs, paved parking/storage areas, unpaved parking/storage areas, playground, driveways, sidewalks/walks, street areas, landscaped areas (small and large), undeveloped areas, isolated/water body area, other pervious areas and impervious areas (directly connected and indirectly connected). Each source area is further categorized by soil texture, including sand, silt, and clay soil types.

3.4.1 Determination of Watershed Boundaries

For this study, watershed areas draining to discrete elements of the stormwater management system were delineated using the Geographic Information System (GIS) program ArcMap 10. Delineation of watersheds was completed using one-foot contour interval topographic maps overlaid with storm sewer and surface drainage system base maps provided by the City of Baraboo. In some cases, engineering documents from various development related stormwater management plans or other documents (all provided by the City) were used to determine watershed boundaries.

The major watershed (i.e. TMDL reachshed) boundaries as determined by this study vary from those utilized in the approved Wisconsin River TMDL as detailed information including storm sewer system maps were not factored into the development of watershed divides used in the TMDL. WDNR anticipated that as municipalities updated their water quality plans, there would be differences in reachshed boundaries due to local utilization of more precise data and expansion or contraction of municipal boundaries, as well as for other reasons. Current WDNR guidance issued February 2016 and titled “TMDL Guidance for MS4 Permits: Planning, Implementing, and Modeling Guidance - Addendum A (Percent Reduction)” directs the modeler to apply the applicable percent reductions from baseline as stated in the TMDL to the revised or expanded MS4 reachsheds. A copy of this guidance document is included in Appendix B. Figure 1 in Appendix A illustrates the differences in watershed boundaries used in this study vs. that of the TMDL.

Figure 2 in Appendix A identifies the total study area evaluated in this report. The study area consists of an envelope of the City Limits and areas outside the City limits that drain to existing BMPs inside the City limits. Note, however, that pollutant loads from areas outside the City (as well as from certain areas inside the City) are not included in load or reduction calculations. Only stormwater runoff volume from these areas is accounted for as stormwater runoff may have impact on BMP performance. More information regarding these 'exempt' areas is included in Section 4 of this report.

3.4.2 Development of WinSLAMM Land Use Data

MSA created a GIS Land Use data layer file describing land use within the city based on a review of the 2020 parcel dataset available from Sauk County, combined with visual interpretation aerial photography (2015: Sauk County). Each parcel within the City was assigned a unique land use corresponding to one of the "Standard Land Uses" defined within the WinSLAMM model. For street right-of-way (ROW) areas, MSA assigned the land use of each parcel to that half of the ROW directly adjacent to the parcel. The WinSLAMM Land Uses Classifications used for this study are summarized in Table 3, below. Figure 3 in Appendix A identifies WinSLAMM land uses within the study area.

Table 3 - WinSLAMM Land Use Classifications

General Land Use	WinSLAMM Land Use
Commercial	Downtown
	Office Park
	Shopping Center
	Strip Commercial
Industrial	Light Industrial
Institutional	Hospital
	Institutional, Misc.
	School
Highway	6-Lane Rural XS with Median, ADT = 55000, slope S2
Residential	Suburban
	Low Density Residential
	Medium Density Residential No Alley
	High Density Residential No Alley
	Duplex
	Multi-Family Residential
Other Urban	Agricultural and Wooded[1]
	Airport, Bike Path, Railroad[2]
	Cemetery
	Open Space
	Park

1. Agricultural and wooded lands were modeled as 100% 'other pervious area'.
2. Airport, Railroad and Bike Path Standard Land Use created based on impervious area and connectivity specific to Beaver Dam. For the railroad bed, the impervious area was classified as unconnected unpaved parking areas.

3.4.3 Development of WinSLAMM Source Area Data

The WinSLAMM model requires that each land use be further divided into source areas such as "sidewalk", "driveway", "roof", etc. In addition to requiring the size and type of each source area, it is necessary to describe the level of "connectedness" that each source area has to the stormwater drainage system. Some impervious areas which discharge runoff across pervious areas prior to reaching the drainage system can be defined as "disconnected". Current detailed source area data was not available from the City and would have required a substantial digitization effort to develop, which was beyond the scope of this plan update. WinSLAMM "Standard Land Use" files were applied to the study area; these files describe the distribution and connectedness of typical source areas within each of the various land use types. MSA applied the WinSLAMM Standard Land Use files uniformly across each land use area.

Note that applying the Standard Land Use files to an individual BMP's watershed introduces error into the modeling if the BMP serves only a singular site. Typically, a site will be designed to direct most or all of the site's impervious area runoff to the BMP, while landscaped areas and occasional unconnected impervious areas may drain away from the BMP. The Standard Land Use files apply each source area homogeneously across each parcel regardless of the actual drainage conditions within the parcel, or groups of parcels, or watershed. Since impervious surfaces typically represent the greatest sources of pollutants, this approach results in a conservative modeling approach as the model will underestimate loads routed to BMPs and will overestimate loads not routed to, and treated by, BMPs.

3.4.4 Development of WinSLAMM Soil Texture Data

WinSLAMM requires that the soil underlying all source areas be classified by texture as sand, silt, or clay. The WinSLAMM "Frequently Asked Questions (FAQ)" document on the WinSLAMM web site (http://winslamm.com/faq.html) states that soil textures are to be assigned according to the hydrologic soil group (HSG) assigned each soil type by the USDA-NRCS SSURGO Soil Database for Sauk County; "When we set up the soil classifications clayey, silty and sandy, we assumed that they would correspond to the SCS classification A, B, C, and D soils, with: A – Sandy, B – Silty, C and D - Clayey."

Figure 4 in Appendix A and Table 4, below, identifies the soil types as of October 2020 within the project study area identified in the Sauk County SSURGO Soil Database and identifies the soil texture class assigned to each soil for entry into WinSLAMM according to the relationship described above. Soils with a dual

classification such as B/D indicate the HSG of the soil in a drained and undrained condition, respectively. All dual classification soils were assumed to be drained as this is a common condition in both urban areas and agricultural land improved with tile drainage systems.

There was one exception to the approach described above for the application of soil textures to the study area: soils identified in the county soil atlas as Water do not have an assigned HSG. As necessary, these areas were manually reclassified to the match the HSG and WinSLAMM soil texture of the directly adjacent soil types.

Table 4 - WinSLAMM Soil Textures

Mapped Symbol	Soil Name	Mapped HSG	Modeled Soil Texture
Ad	Adrian muck	B/D	Silty
Ar	Arenzville silt loam	B	Silty
At	Atterberry silt loam	C	Clayey
Ba	Baraboo silt loam	C	Clayey
Bb	Baraboo stony silt loam	C	Clayey
Bc	Baraboo-Rock	C	Clayey
Be	Bertrand silt loam	B	Silty
Bm	Billett fine sandy loam	A	Sandy
Bl	Billett sandy loam	A	Sandy
Bo	Boone sand	A	Sandy
Br	Brems loamy sand	A	Sandy
Bt	Briggsville silt loam	C	Clayey
Ch	Chaseburg silt loam	B	Silty
Co	Colwood loam	C/D	Clayey
387A	Curran silt loam	B/D	Silty
Da	Dakota loam	B	Silty
De	Dells silt loam	C	Clayey
Dk	Dickinson sandy loam	A	Sandy
El	Eleva sandy loam	B	Silty
En	Elkmound sandy loam	D	Clayey
Et	Ettrick silt loam	C/D	Clayey
679A	Ettrick silt loam	B/D	Silty
Fu	Fluvaquents	B	Silty
Fw	Fluvaquents, wet	D	Clayey
Fx	Fox loam	C	Clayey
Go	Gotham loamy sand	A	Sandy
Gv	Granby variant	C/D	Clayey
Hx	Hixton silt loam	C	Clayey
Ho	Houghton muck	A/D	Sandy
Ja	Jackson silt loam	B	Silty
Kl	Kendall silt loam	C	Clayey

Mapped Symbol	Soil Name	Mapped HSG	Modeled Soil Texture
Mc	Marshan loam	B/D	Silty
Md	McHenry silt loam	B	Silty
Ms	Mosel loam	C/D	Clayey
Nr	Norden and Eleva	C	Clayey
1648A	Northbend-Ettrick	B/D	Silty
Or	Orion silt loam	B/D	Silty
Os	Ossian silt loam	B/D	Silty
Pa	Palms muck	B/D	Silty
Pc	Pillot silt loam	B	Silty
Pd	Pits, gravel	A	Sandy
Pf	Plainfield loamy sand	A	Sandy
305B	Richwood silt loam	B	Silty
Rm	Rimer loamy sand	C/D	Clayey
Rn	Ringwood silt loam	B	Silty
Rt	Rock outcrop, quartzite	D	Clayey
328A	Rowley silt loam	B/D	Silty
Se	Saprists and Aquents	A/D	Sandy
Sr	Seaton silt loam	B	Silty
Sv	Seaton silt loam	B	Silty
Sf	Shiffer loam	C	Clayey
Sh	Shiffer variant	B	Silty
Sn	Sisson loam	B	Silty
Sc	St. Charles silt loam	B	Silty
Ta	Tama silt loam	C	Clayey
Te	Tell silt loam	B	Silty
336B	Toddville silt loam	B	Silty
Tw	Tustin loamy sand	C	Clayey
Va	Valton silt loam	C	Clayey
W	Water	Water	Silty
Ww	Wildale channery	C	Clayey
Wx	Wyocena sandy loam	A	Sandy

3.5 WATER QUALITY MANAGEMENT PRACTICES

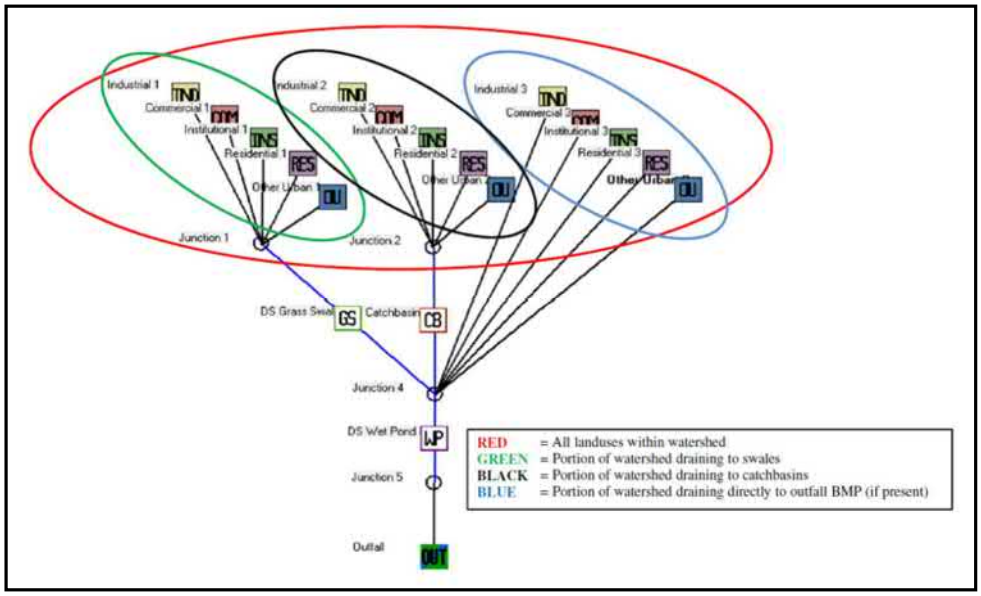
WinSLAMM allows for assignation of water quality management practices for individual source areas within a land use type, within the drainage system serving the watershed, or at the "outfall" (point of discharge of the watershed). If applicable, each practice was input into the models according to the structure identified in Table 5, below.

Table 5 - Application of BMPs within WinSLAMM Model network

Practice	Level of Application within WinSLAMM
Street Sweeping	Source Area (Street Only)
Swales	Drainage System/Outfall
Detention Ponds (Wet/Dry/Infiltration)	Outfall
Biofilters	Outfall

The structure of any WinSLAMM model follows a cascading pattern; starting first with land uses which contain source areas; these are then connected to drainage system elements; and finally, outfall system elements. Diagram 1, below, presents a typical example of how any individual subwatershed in the City of Baraboo's WinSLAMM modeling was constructed. The model nodes which are circled represent nodes describing drainage areas for various land uses and source areas. Each possible land use is included multiple times in the model network to reflect the portion of each watershed which drains to a system of catch basins or swales (or neither). Collectively all three drainage network types are collected in a single junction and routed to the pond or other outfall device which receives runoff and pollutant loads from the entire subwatershed. Note that not all land uses, drainage system BMPs, or outfall BMPs are found in every subwatershed.

Diagram 1 - Example WinSLAMM model Network Subwatershed Level



*Catchbasins were not modeled in this study because the city does not have any that qualify.

3.5.1 Application of Street Sweeping in WinSLAMM

Street sweeping is a management practice applied at the street source area level within the WinSLAMM model and was the only management practice evaluated in this manner.

WinSLAMM is capable of modeling both mechanical and vacuum-assisted street sweeping. Sweeping intervals may be altered and sweeping may be evaluated with and without parking restrictions. Parking restrictions assume that cars are not allowed to park on streets on days when sweeping is to occur.

Street sweeping parameters were provided by the City of Baraboo. The City operates a mechanical (non-vacuum) sweeper and a vacuum sweeper. Downtown areas are swept weekly with a vacuum sweeper. Downtown areas include major arterial roads through the city to include Broadway, South Blvd, 8th Street, Water Street, and South Parkway. All other areas are swept monthly using a mechanical sweeper. Sweeping occurs continuously from March until freezing temperatures. Model analysis was completed assuming a light parking density with no parking restrictions.

Figure 6 in Appendix A identifies the areas in the City where street sweeping occurs.

3.5.2 Application of Detention Ponds and Biofilters in WinSLAMM

The City's current GIS database identifies 41 existing public and private structural stormwater BMPs. Figure 7 in Appendix A identifies the location of known stormwater management practices in the City. The City's engineering department provided construction plans or stormwater management plans for the majority of these BMPs documenting necessary geometric data such as storage volume and outlet device configuration. Those BMPs where plan information was not available were visually inspected and/or necessary geometry data was developed using aerial photos, aerial contour mapping, or through other sources.

Appendix C presents the geometric data of the existing structural stormwater management practices which were modeled. Note that the information in Appendix C is presented using the computer model HydroCAD 10.00, which was done for two reasons; the first is simply due to the fact that HydroCAD provides a good template for recording stormwater pond geometric data; the second is that on occasion, pond outlet structures are too complex to be accommodated by WinSLAMM, in these cases a numeric outlet rating curve (table of depth vs. storage volume vs. discharge rate) was developed using HydroCAD and then directly entered into WinSLAMM.

Many of the existing BMPs are either dry ponds or are wet ponds with less than three feet permanent pool depth. Internal routines within the WinSLAMM model force TSS reduction estimates to zero for dry detention ponds. TSS reduction estimates for wet ponds with less than three feet permanent pool depth are prorated downward in a linear fashion; a pond with a three-foot permanent pool is allowed the full modeled TSS reduction efficiency, a pond with a 1.5-foot permanent pool depth is assigned 50% of the modeled TSS reduction efficiency.

3.5.2 Application of Vegetated Swales in WinSLAMM

Vegetated swales are management practices which have been historically defined as part of the drainage system level of a WinSLAMM model. However, with the evolution of WinSLAMM into version 10, the application of drainage system and outfall BMPs are treated similarly and are applied as nodes directly downstream from land use nodes.

WinSLAMM requires several input parameters in order to evaluate the effectiveness of vegetated swales at reducing pollutants in stormwater runoff. These parameters include; total swale length, average swale length to outlet, average swale geometry (bottom width, side-slope, longitudinal slope),

vegetation height, flow retardance factor, and infiltration rate.

3.5.2.1 Determining Eligible Swales and Swale Drainage Area

The principal input parameters of drainage area and swale densities were determined using GIS. Swales were identified through visual observation using aerial photographs and field reconnaissance. MSA digitized the locations of swales in GIS and, as with other structural BMPs, manually delineated subwatershed areas tributary to the outfall of the collective swale system.

The resulting exercise identified 21 eligible swale systems (swales with a longitudinal slope less than 4%, no visible evidence of surface scour or erosion, and that did not drain to an existing downstream BMP were considered eligible) serving a total area of 1,018.3 acres.

Figure 5 in Appendix A shows modeled swales within the City.

3.5.2.2 Determining Swale Geometry Data and Other Model Inputs

Swale Length. Swale lengths were measured using GIS tools and aerial photographs. Swale lengths did not include culverts located along swale alignments.

Typical Swale Geometry. Each swale system was assigned a unique geometry which was physically measured in the field. Geometry measurements included bottom with and side slopes.

Swale Longitudinal Slopes. Each swale segment identified in GIS was assigned an average slope based on a digital elevation model (DEM). The average swale slope was then determined by taking a weighted average by length of all the swale segments within each individual watershed. Swales with slopes greater than 4% (without slope interruption devices) were not included in WinSLAMM modeling as required by WDNR modeling guidance.

Typical Grass Height and Swale Retardance Factor. An average grass height was assigned to be 4-inches from visual observation. In January 2011, WDNR held a 'Consultant Round Table' where WDNR technical staff and the developers of the WinSLAMM model indicated that it was most appropriate to assign a retardance factor of 'D' to swales in residential lands. This value has been applied throughout the City.

Swale Dynamic Infiltration Rates. A series of eight double-ring infiltrometer tests were conducted within the City of Baraboo in September of 2020 to measure the static infiltration rate. Some tests were located within existing structural BMPs, while others were located within swale areas. Test results were aggregated using the Thiessen Polygons method to assign standardized infiltration rates for different regions of the city, with some exceptions. Per modeling guidance, the 'dynamic' infiltration rate used in modeling of swales is 50% of the static infiltration rate. For more information for how infiltration rates were assigned to swales, see Appendix G.

4.0 APPLICATION OF REGULATORY CONDITIONS TO WINSLAMM INPUT DATA

WinSLAMM modeling for this study was conducted in accordance with the following published WDNR modeling guidance documents for evaluation of the level of compliance with TMDLs. Complete copies of these documents are included in Appendix B.

- TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance. Effective October 20, 2014
- TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance Addendum A (Percent Reduction). Effective February 2016

Several (not all) key modeling protocols from the guidance documents, along with how they were applied within this study, are discussed below. Note that Appendix B also includes other guidance documents that may come into play as the City investigates other avenues to achieve TMDL pollutant reduction goals.

1. MS4 compliance with TMDL requirements were considered on a reachshed basis because of the varying target reductions in each reachshed. Separate models were constructed for each reach and results for each reach are tabulated separately.
2. The preferred option for implementing TMDLs uses a percent reduction methodology similar to NR 151.13 (as opposed to using a methodology based on the mass wasteload allocation (WLA)). The usage of a percent reduction methodology allows both the MS4 and WDNR the ability to implement the reductions without having to continually reallocate and track WLAs across changing reachshed and municipal boundaries. The study results are presented on a "percent reduction from baseline" basis. Watershed (reachshed) and municipal boundaries have been adjusted based on the currently best available information.
3. Percent reductions from baseline were calculated according to the requirements of the guidance document: TMDL Guidance for MS4 Permits: Planning,

Implementation, and Modeling Guidance. Section D. Part 1 – Expressing WLAs and Reduction Targets.

4. Areas which were excluded from the calculations include those listed below. A map showing these areas is included as Figure 9 in Appendix A.
   a. Pollutant loadings from an upstream MS4. Pollutant loads originating within surrounding townships, Wisconsin DOT rights-of-way, and Connected Highways were excluded from the analysis.
   b. Property that drains directly to a water of the state without passing through the permittee's MS4. These areas are located primarily along the City perimeter and lake and river fronts. Pollutant loads from these areas were excluded from the analysis.
   c. Pollutant loadings from Agricultural land.

As it pertains to the regulatory guidance for modeling swales and leaf collection for TP reduction, the applicable WDNR regulatory modeling guidance documents were used in the evaluation of existing swales and a proposed leaf collection program. Complete copies of these documents are included in Appendix B.

- Correspondence/Memorandum: Process to Assess and Model Grass Swales for ss. NR 151.13(2) and NR 216.07(6), Wis. Adm. Code – Total Suspended Solids Reduction
- Bureau of Watershed Management Program Guidance: Interim Municipal Phosphorus Reduction Credit for Leaf Management Programs.

This report was prepared to specifically address the water quality requirements of the Wisconsin River TMDL and only included reductions in TP loads from regulated MS4s. The TMDL is specifically intended to be implemented on a reach-by-reach basis, and so as a result, the City of Baraboo has specific TP reduction requirements for different locations with the City. While TSS was not addressed in the TMDL, the City is still subject to the 20% TSS reduction standard of NR 151.13; however this reduction is intended to be achieved on a city-wide average basis. The WDNR guidance which describe the modeling protocols necessary to demonstrate compliance with NR151 are substantially different than those required to demonstrate compliance with TMDLs and is outside the scope of work of this current study. References to TSS reductions included in this report are useful as an indication of relative levels of stormwater quality treatment but are not suitable for demonstrating compliance with the 20% TSS reduction required in NR151. Note, however, that baseline conditions in the TMDL study are predicated on achieving the NR151 required TSS reductions, and so it is reasonable to assume that meeting the required TMDL TP reduction levels will be commensurate to achieving the required NR151 TSS reduction levels.

5.0 FINDINGS

5.1 MODEL RESULTS AND DISCUSSION

Table 6, below, summarizes the pollutant reduction performance achieved by the City's existing stormwater management system on a reach-by-reach basis.

Table 6 Current TSS and TP Reduction Performance

Study Area	Regulated Area	TSS Load				TP Load			
	(acres)	Load In (tons/yr)	Trapped (tons/yr)	Reduction[1]	Req.	Load In (lbs./yr)	Trapped (lbs./yr)	Reduction[1]	Req.
Reach 5	370	73.4	15.8	21.5%	NA	340.0	56.1	16.5%	15%
Reach 137	372	44.1	9.7	22.0%	NA	318.3	71.9	22.6%	15%
Reach 179	2,481	353.4	38.4	10.9%	NA	2,277.2	174.4	7.7%[2]	15%
Reach 230	39	7.2	5.6	77.2%	NA	35.7	18.2	51.0%	31.2%
Reach 234	0	NA	NA	NA	NA	NA	NA	NA	15%

1. All reductions are relative to a "No Controls" condition.
2. For existing conditions, the city is not in compliance with the TMDL TP reduction target for Reach 179.

The City is currently in compliance with TP reduction standards for Reach 5, Reach 137, Reach 230, and Reach 234, but does not achieve the TMDL required TP reductions for Reach 179. As a result, the City must take additional steps to improve stormwater quality treatment in Reach 179 to be in compliance with its WPDES permit. Specifically, it will be necessary to remove an additional 26.1 tons/yr of TSS City-wide for compliance with NR151 and to remove an additional 167.2 lbs/yr of TP in Reach 179 for compliance with the TMDL. Appendix F presents detailed modeling results for the existing and proposed conditions in the City of Baraboo.

5.2 STREET SWEEPING EFFICIENCY

Shown in Table 7, the City's existing street sweeping program captures 94.3 pounds of TP per year, 5.2% of the respective total City-wide annual loads.

Table 7 - Street Sweeping Efficiencies for TP Removal

Study Area	Regulated Swept Area	TP		
	acres	Regulated Load In (lbs/yr)	Trapped (lbs/yr)	Total Reduction
Reach 5	180	177	6.7	2.0%
Reach 137	74	76	3.2	1.0%
Reach 179	1,551	1,556	84.4	3.7%
Reach 230	1	0	0.0	0.0%
Reach 234[1]	0	0	0.0	0.0%
City-wide	1,806	1,809	94.3	5.2%

1. Approximately 90 acres of Reach 234 are within the City limits of Baraboo. However, it is all exempt area (see Figure 9 in Appendix A).

6.0 STORMWATER QUALITY TREATMENT PERFORMANCE ALTERNATIVES ANALYSIS

As identified in the previous section, the evaluation of the City's existing stormwater management system shows that the City is falling short of TP reductions for Reach 179 as recommended by the Wisconsin River TMDL. As such, the City must make modifications to its stormwater management program to improve stormwater quality treatment to be in compliance with its WPDES permit. These actions can be categorized as Programmatic, such as requiring landowners whose property contains a stormwater BMP to periodically inspect the BMP and conduct maintenance when required; Operational, such as changing the frequency or type of street sweeping program operated by the City; or Structural, which include the construction of new stormwater ponds or modification to existing stormwater ponds.

6.1 PROGRAMMATIC STORMWATER QUALITY RECOMMENDATIONS

In general, there are certain Programmatic actions that any regulated municipality should follow, and they are not subject to an alternatives analysis and so are not further discussed in this section. Programmatic recommendations appear as the first items identified in Section 7.0 Recommendations.

6.2 OPERATIONAL STORMWATER QUALITY ALTERNATIVES

The City currently practices street sweeping and leaf collection, but it has not yet been quantified for the purposes of water quality performance. MSA analyzed the City's operational practices to evaluate TSS and TP reduction alternatives. The following sections address the evaluation, with recommendations shown in Section 7.0.

6.2.1 Leaf Collection

Leaf collection can be credited to non-exempt medium density residential areas with curb & gutter. Eligible areas have an average of one or more mature trees, having a diameter greater than 5 inches or a height greater than 15 feet, located between the sidewalk and the curb for every 80 linear feet of curb. Where sidewalk is not present, trees within 15 feet of the curb may be counted toward tree cover. If all the requirements are met, a 17% TP reduction may be assured from no controls phosphorous loads. WinSLAMM modeling of standard 'Medium Density Residential' land use shows that areas with sandy soils produce 0.63 lbs/acre/year and silty soils produce 0.97 lbs/acre/yr. The total area eligible for leaf collection within reach 179 is 38.22 acres, of which, 4.27 acres contains sandy soils and 33.95 acres contains silty soils. This area generates a TP load 35.62 lb/yr. Applying the eligible 17% TP reduction from proposed leaf collection results in additional TP reduction of 6.1 lbs/yr. See Figure 10 in Appendix A for a map of the eligible areas for leaf collection.

6.2.2 Street Sweeping

The only operational practice that the City currently conducts which is quantifiable in the context of WinSLAMM modeling for the evaluation of TSS and TP reductions alternatives is street sweeping. As mentioned previously, the City operates a mechanical (non-vacuum) sweeper monthly and a vacuum sweeper weekly in the areas shown in Figure 6 of Appendix A. Sweeping occurs continuously from March until freezing temperatures. Tables 8 and 9, below, summarize the results of the current WinSLAMM analysis of the City's existing street sweeping program for Reach 179 as well as three alternative street sweeping programs. Only Reach 179 was evaluated as the majority of the swept area is within Reach 179, and it is the only reach that does not currently

meet TP reduction goals. Within Reach 179, if the mechanical sweeping was replaced with vacuum sweeping, the additional TSS and TP removed roughly doubles.

The proposed sweeping options for Reach 179 are presented as an aggressive, but flexible program, which, in combination with other water quality treatment methods, can help the City achieve their TSS and TP reduction goals. These sweeping options should be evaluated and modified when it comes time to implement the improved sweeping practices to achieve TMDL required reductions, as likely a less rigorous sweeping program will likely be sufficient. Alternatively, the City could optimize TSS and TP reduction by expanding the street sweeping program to reaches other than Reach 179. At this time, only Reach 179 was analyzed as it is the only reach out of compliance with TP reduction requirements.

Table 8 – Current and Proposed TSS Reduction Achieved by Street Sweeping for Reach 179

Status	Sweeper Type	Frequency	Parking Controls Status	TSS			
				Regulated Sweeping Area (acres)	Regulated Load In (tons/yr)	Trapped (tons/yr)	Reduction
Existing	Mechanical	Monthly	No	1,380	249.7	21.7	8.7%
	Vacuum	Weekly	No	171			
Option 1	Mechanical	Weekly	No	1,380	249.7	22.1	8.8%
	Vacuum	Weekly	No	171			
Option 2	Vacuum	Weekly	No	1,551	249.7	39.2	15.7%
Option 3	Vacuum	Weekly	Yes	1,551	249.7	49.8	19.9%

Table 9 – Current and Proposed TP Reduction Achieved by Street Sweeping for Reach 179

Status	Sweeper Type	Frequency	Parking Controls Status	TP			
				Regulated Sweeping Area (acres)	Regulated Load In (lbs/yr)	Trapped (lbs/yr)	Reduction
Existing	Mechanical	Monthly	No	1,380	1,556.2	84.4	5.4%
	Vacuum	Weekly	No	171			
Option 1	Mechanical	Weekly	No	1,380	1,556.2	86.3	5.5%
	Vacuum	Weekly	No	171			
Option 2	Vacuum	Weekly	No	1,551	1,556.2	159.5	10.2%
Option 3	Vacuum	Weekly	Yes	1,551	1,556.2	202.2	13.0%

6.3 STRUCTURAL STORMWATER QUALITY IMPROVEMENT ALTERNATIVES

This study identified 20 preliminary locations where new water quality BMPs may be constructed or where significant modifications to existing BMPs could be made to substantially improve water quality treatment performance. The 20 preliminary locations are shown in Figure 8 located in Appendix A. All 20 potential locations were evaluated for necessity, feasibility, and effectiveness for the addition of a proposed BMP or, when applicable, a retrofitted BMP. However, of the 20 locations, only four (4) are recommended. Table 10, below, shows which preliminary locations are not recommended and why.

Of the 20 preliminary locations, 15 were not evaluated for cost-effectiveness for reasons shown in Table 10. Of the five (5) that were evaluated, only four (4) are cost-effective. Table 11, below, summarizes the anticipated performance and cost-effectiveness of each pond. The total estimated construction cost of the 4 recommended BMPs in this report is approximately $1.4M, including land acquisition. Additional details on the development of present worth calculations are included in Appendix E.

Table 10 – Preliminary Summary of Structural BMPs Evaluated

Reach Number	Pond ID[1]	Preliminary Recommendation Status	Comment
R5	P100	Not Recommended	Reach 5 in compliance with TMDL in existing conditions.
R5	P120	Not Recommended	
R5	P140	Not Recommended	
R137	P30	Not Recommended	Reach 137 in compliance with TMDL in existing conditions.
R137	P130	Not Recommended	
R137	R30	Not Recommended	
R179	P10	Not Recommended	Land Acquisition Issues
R179	P20	Not Recommended	Land Acquisition Issues
R179	P40	Recommended for Consideration	Sufficient TP/TSS Reduction; No Conflicts
R179	P50	Recommended for Consideration	Sufficient TP/TSS Reduction; No Conflicts
R179	P60	Not Recommended	Not Enough Land
R179	P70	Recommended for Consideration	Sufficient TP/TSS Reduction; No Conflicts
R179	P80	Not Recommended	Sanitary Sewer Conflict
R179	P90	Not Recommended	Not Enough Land
R179	P110	Not Recommended	Sanitary Sewer Conflict
R179	P150	Not Recommended	Not Enough Land
R179	P160	Not Recommended	Not Enough Land
R179	P170	Recommended for Consideration	Sufficient TP/TSS Reduction; No Conflicts
R179	R10	Not Recommended	Insignificant Additional TP/TSS Reduction
R179	R20	Recommended for Consideration	Sufficient TP/TSS Reduction; No Conflicts

1. Under Pond ID, 'R' stands for retrofitting an existing BMP and 'P' stands for construction of a new BMP.

Table 11 – Summary of Alternative BMP Performance Reach 179

Pond ID	Net TSS Removed (lbs/yr)	Net TP Removed (lbs/yr)	Estimated Land Acquisition Cost	Estimated Engineering and Construction Cost	Dredging Cost Present Worth	Total Present Worth	Lifetime TP Removed (lbs)	TP Removal ($/lb/yr)	Recommended
R20[2]	20,387	49.9	$ -	$187,700	$8,394	$244,389	2,495.0	$98	Yes
P40	31,398	71.6	$ -	$642,980	$9,847	$717,152	3,578.5	$200	Yes
P50	7,993	21.8	$ -	$271,660	$6,758	$342,742	1,087.5	$315	Yes
P70	3,638	9.6	$ -	$258,690	$6,183	$329,197	480.5	$685	Yes
P170	4,044	5.1	$ 25,659	$385,790	$6,236	$482,010	254.1	$1,897	No[1]

1. Not "Recommended" due to cost efficiencies greater than 1000 $/lb/yr of TP reduction.
2. TSS and TP removal from retrofitted BMPs is shown as ADDITIONAL TSS and TP removal over the existing condition, not the total TSS and TP to be removed.

Table 12 and Table 13 show the current TSS and TP reductions for existing and proposed conditions where all four (4) recommended BMPs are built. If all four (4) recommended BMPs are constructed, the TP reduction provided would not be enough to achieve the required TP reduction target. The recommended BMPs for Reach 179, in combination with other water quality treatment methods outlined in Section 6, can help the City achieve their TSS and TP reduction goals.

Table 12 – Current and Proposed TSS Reduction Performance

Study Area	Regulated Area	TSS					
	acres	Load In (tons/yr)	Condition[2]	Trapped (tons/yr)	Reduction	Required	Proposed Total Reduction
City-wide[1]	3,262	478.1	Existing	69.5	14.5%[3]	20%	21.2%
			Proposed	31.7	6.6%		

1. There is only a City-wide requirement for TSS, not TP.
2. In the context of this table, proposed condition includes only recommended BMPs.
3. For existing conditions, the city is not in compliance with the NR151 City-wide TSS reduction target. However, MS4 modeling guidance was not followed as it was not part of the scope of work.

Table 13 – Current and Proposed TP Reduction Performance

Study Area	Regulated Area	TP					
	acres	Load In (lbs/yr)	Condition[2]	Trapped (lbs/yr)	Reduction	Required	Proposed Total
Reach 5	370	340.0	Existing	56.1	16.5%	15%	16.5%
			Proposed	0.0	0.0%		
Reach 137	372	318.3	Existing	71.9	22.6%	15%	22.6%
			Proposed	0.0	0.0%		
Reach 179	2,481	2,277.2	Existing	174.4	7.7%[1]	15%	14.4%[1]
			Proposed	152.8	6.7%		
Reach 230	39	35.7	Existing	18.2	51.0%	31.2%	51.0%
			Proposed	0.0	0.0%		
Reach 234[3]	0	0.0	Existing	0.0	NA	NA	NA
			Proposed	0.0	NA		

1. For existing conditions, the city is not in compliance with the TMDL TP reduction target for Reach 179.
2. In the context of this table, proposed condition includes only recommended BMPs.
3. Approximately 90 acres of Reach 234 are within the City limits of Baraboo. However, it is all exempt area (see Figure 9 in Appendix A).

6.4 STORMWATER QUALITY IMPROVEMENT COMBINATION ALTERNATIVES

Several combinations of recommended BMPs, leaf collection program, and street sweeping programs are possible. Table 14, below, shows five (5) different options for combinations of recommended BMPs, leaf collection, and street sweeping programs. Subsequently, Table 15 shows which combinations presented in Table 14 achieve the TP reduction for TMDL compliance and the City-wide TSS reduction target. Alternative street sweeping options presented are an aggressive, but a flexible program. In this combinations analysis, street sweeping program modification was limited to the 1,380 acre area in reach 179 that is mechanically swept once per month without parking controls and it is assumed that other street sweeping programs through the city do not change. Supporting calculations for the results presented in Tables 14 and 15 can be found in Appendix F.

Other important key findings from Table 14 include the following. First, additional TP reduction provided by leaf collection is less than a recommended BMP by a magnitude of three (3) or more, making leaf collection insignificant in comparison to a recommended BMP. Second, additional TP reduction provided by changing the sweeping schedule of a mechanical sweeper from monthly to weekly is less than a recommended BMP by a magnitude of 10 or more, making modification to the mechanically swept street sweeping schedule insignificant in comparison to a recommended BMP. Third, TP reduction provided by additional vacuum street sweeping can be equivalent to or greater than a recommended BMP.

Table 14 – Summary of Alternative Stormwater Quality Treatment Options Part A

Reach Number	Pond ID	Net TSS Removed (tons/yr)	Net TP Removed (lbs/yr)	Estimated Engineering and Construction Cost	Option 1	Option 2	Option 3	Option 4	Option 5
R179	R20	10.2	49.9	$ 187,700	x	x			x
R179	P40	15.7	71.6	$ 642,980	x		x	x	
R179	P50	4.0	21.8	$ 271,660				x	
R179	P70	1.8	9.6	$ 258,690					x
R179	Leaf Collection Program	0.0	6.1						
R179	Weekly Mech. Sweeping No Parking Control[1]	0.4	1.9						
R179	Weekly Vacuum Sweeping No Parking Control[1]	17.5	75.1		x				
R179	Weekly Vauum Sweeping with Parking Control[1]	28.1	117.8			x	x	x	x
Total Additional TSS Reduction (tons/yr)					43.4	38.3	43.8	47.8	40.1
Total Additional TP Reduction (lbs/yr)					75.1	117.8	117.8	117.8	117.8
Total Estimated Engineering and Construction Cost[2]					$ 830,680	$ 187,700	$ 642,980	$ 914,640	$ 446,390

1. Alternative sweeping options presented are an aggressive, but flexible program, which in combination with recommended BMPs can provide treatment equivalent to one or more wet ponds. In this analysis, it is assumed the 1,380-acre area in Reach 179 that is mechanically swept once per month without parking controls is modified and the remaining street sweeping throughout the city does not change.
2. Total estimated engineering and construction cost of each option includes only the costs associated with proposed ponds.

Table 15 – Summary of Alternative Stormwater Quality Treatment Options Part B

	Option 1 TSS Removed (tons/yr)	Option 2 TSS Removed (tons/yr)	Option 3 TSS Removed (tons/yr)	Option 4 TSS Removed (tons/yr)	Option 5 TSS Removed (tons/yr)
Total Additional TSS Removed (Tons/yr) using Wet Ponds and Leaf Collection	25.9	10.2	15.7	19.7	12.0
Total Additional TSS Removed (Tons/yr) by Modified Sweeping in Reach 179[1]	17.5	28.1	28.1	28.1	28.1
Total Additional TSS Removed (Tons/yr)	43.4	38.3	43.8	47.8	40.1
Total Additional TSS Removed (Tons/yr) to Achieve City Wide TSS Reduction Target	26.1	26.1	26.1	26.1	26.1
City Wide TSS Reduction Target Achieved	Yes	Yes	Yes	Yes	Yes
	Option 1 TP Removed (lbs/yr)	Option 2 TP Removed (lbs/yr)	Option 3 TP Removed (lbs/yr)	Option 4 TP Removed (lbs/yr)	Option 5 TP Removed (lbs/yr)
Additional TP Removed (lbs/yr) using Wet Ponds	121.5	49.9	71.6	93.3	59.5
Additional TP Removed (lbs/yr) by Modified Sweeping in Reach 179[1]	75.1	117.8	117.8	117.8	117.8
Total Additional TP Removed (lbs/yr)	196.6	167.7	189.4	211.2	177.3
Total Additional TP Removed (lbs/yr) to Achieve Reach 179 TP Reduction Target	167.2	167.2	167.2	167.2	167.2
Reach 179 TP Reduction Target Achieved	Yes	Yes	Yes	Yes	Yes

1. Alternative sweeping options presented are an aggressive, but flexible program, which in combination with recommended BMPs can provide treatment equivalent to one or more wet ponds. In this analysis, it is assumed the 1,380-acre area in Reach 179 that is mechanically swept once per month without parking controls is modified and the remaining street sweeping throughout the city does not change.

7.0 RECOMMENDATIONS

MSA recommends the following improvements to achieve the creditable TSS and TP reductions for the City of Baraboo's stormwater management system.

1. Secure maintenance agreements for privately owned BMPs. For the City to take credit for the pollutant reduction achieved by structural BMPs it will be necessary for the City to demonstrate that it has the authority to either require private land owners to maintain BMPs on their property or to maintain the management practices directly. The City should undertake a project to contact property owners with BMPs on their property and enter into long term maintenance agreements with them. The City may be able to incentivize property owners by allowing credits on their stormwater utility bills by establishing these agreements.

2. Improve existing dry stormwater quality ponds. The City should retrofit existing BMPs as identified in Tables 11. The retrofit BMP recommended in this report is capable of achieving a total additional TSS reduction of 10.2 tons/year and total TP reduction of 49.9 lbs/year. As with new stormwater quality ponds, consideration should be given to cost-efficiency, total cost, and other factors. The estimated cost of the one retrofitted BMP is $0.2 million.

3. Construct new stormwater quality ponds. The City should construct the structural BMPs identified in Table 11. Collectively, the three (3) alternative new BMPs evaluated in this report are capable of achieving a total additional TSS reduction of 21.5 tons/year and a total TP reduction of 102.9 lbs/year. However, construction of new stormwater quality ponds alone will not be sufficient to achieve the TMDL TP reduction target. Implementation of BMPs should be conducted in the order of increasing TP removal cost as identified in Tables 11, although total construction costs as well as other factors such as the ability to acquire land need to be considered. Ponds whose TP removal costs exceed approximately $1000/lb should be considered low priority, if not outright ineffective and not implemented in favor of other potential water quality projects. If all three (3) recommended BMPs are constructed, the estimated cost is $1.2 million.

4. Evaluate the effectiveness of a City leaf collection program. The City could implement a leaf collection program to achieve an additional TP reduction of 6.1 lbs/year. WDNR has published a draft guidance concerning 'Municipal Phosphorus Reduction Credit for Leaf Management Programs'. The document indicates a procedure for establishing a numeric credit for Total Phosphorus (TP) discharges through fall leaf collection programs. The credit is limited to Medium Density Residential (MDR) land use areas that are not also treated by structural BMPs. Assuming these and other criteria are satisfied, the City could receive as much as an additional 17% reduction in TP reductions for these areas. A copy of the Interim Municipal Phosphorus Reduction Credit for Leaf Management Programs, effective March 2018, is included in Appendix

B of this report.

5. Change frequency or type of street sweeping. In general, there is limited benefit to be achieved through increasing street sweeping frequency. However, switching from a mechanical-assisted to vacuum-assisted street sweeper over a larger area can provide additional stormwater quality treatment. Improvement to water quality can be achieved in this method and should be considered for curbed streets that do not drain to existing or proposed future pond sites.

6. Implement a program to require inspection and routine maintenance of structural stormwater management practices. A fundamental assumption of this study is that each management practice is operating as originally planned. It is an accepted fact that once management practices capture a certain critical volume of TSS, their ability to capture additional TSS is reduced, or is lost altogether. The City should implement a routine inspection program to ensure that publicly owned BMPs are kept in proper working order. Long Term Maintenance Agreements for privately owned BMPs should require routine, perhaps annual, inspection and reporting requirements.

7. Periodically update this plan. As the City expands and develops, existing cropland will be converted to urban development which, by requirement of City ordinance will need to incorporate stormwater management practices to control the discharge of pollutants from stormwater runoff. As these new practices are constructed, the creditable TSS and TP reductions applicable to the City will go up. If pollutant reductions achieved by new BMPs exceed those required by the TMDL, this will compensate for areas within the City which do not achieve TMDL goals and will slowly advance the City towards achieving required reductions.

7.1 IMPLEMENTATION SCHEDULE

The City of Baraboo is currently covered under WDNR General Permit S050075-3. Appendix C of this permit defines the terms of compliance for MS4 Permittees Subject to the Wisconsin River Basin TMDL, which includes the City of Baraboo. The implementation schedule for achieving the required TSS and TP reductions allows for the following for each permit term:

- Achieve a reduction of at least 20% (5.2 tons/year per permit) of the remaining reduction needed beyond baseline to achieve full compliance for TSS, and
- Achieve a reduction of at least 10% (16.7 lbs/year per permit) of the remaining reduction needed beyond baseline to achieve full compliance for TP, and

Each permit term has a duration of 5-years; the City has five (5) permit cycles (25 years) to achieve compliance with the TSS reduction goals and ten (10) permit cycles (50 years) to achieve the TP reduction requirement. That means achieving 5.2 tons/yr of TSS reduction and 16.7 lbs/yr of TP reduction. Comparing this information to Table 14, building retrofitted BMP R20 or proposed BMP P40 will allow the city to meet or exceed the target reductions. Therefore, it is recommended to construct BMP R20 or BMP P40 first, as funding allows. The duration of this schedule is an important consideration, since it will allow for additional planning efforts to revise the assessments and findings of this report as emerging technologies and management approaches are developed which may be most cost-effective than BMPs currently available. Additionally, as the City develops new properties and existing properties redevelop, there will be opportunity to assess how these changes to the stormwater management system may affect the need to implement future BMPs.

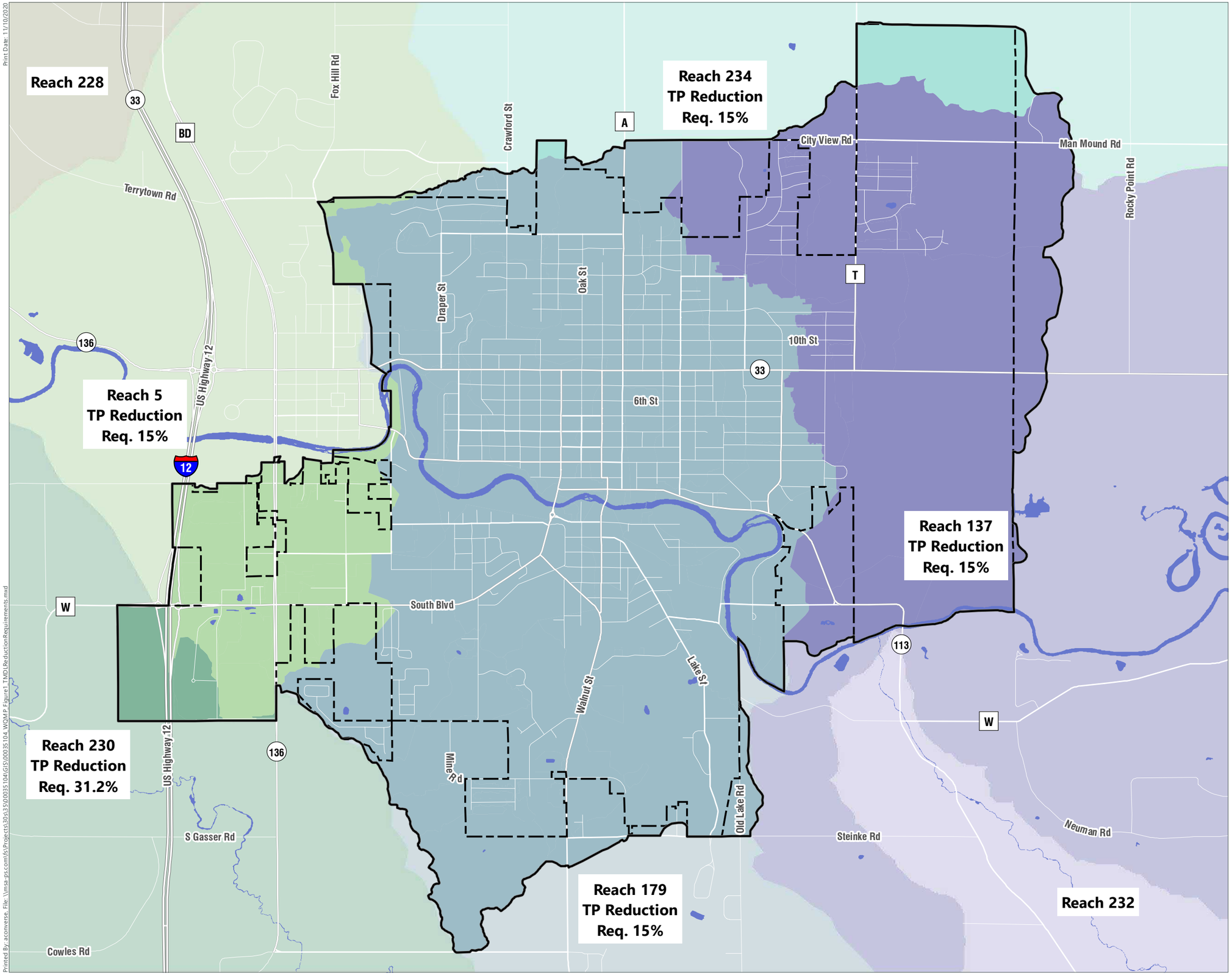
APPENDIX A

Maps

TMDL Reduction Requirements

FIGURE 1
Water Quality Master Plan

City of Baraboo
Sauk County, WI



City of Baraboo
StudyArea
Waterbody
TMDL Reachshed
5
137
179
228
230
232
234

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
TMDL Reachsheds: WDNR, Modified by MSA

MSA

0 0.2 0.4 Miles

Print Date: 11/10/2020

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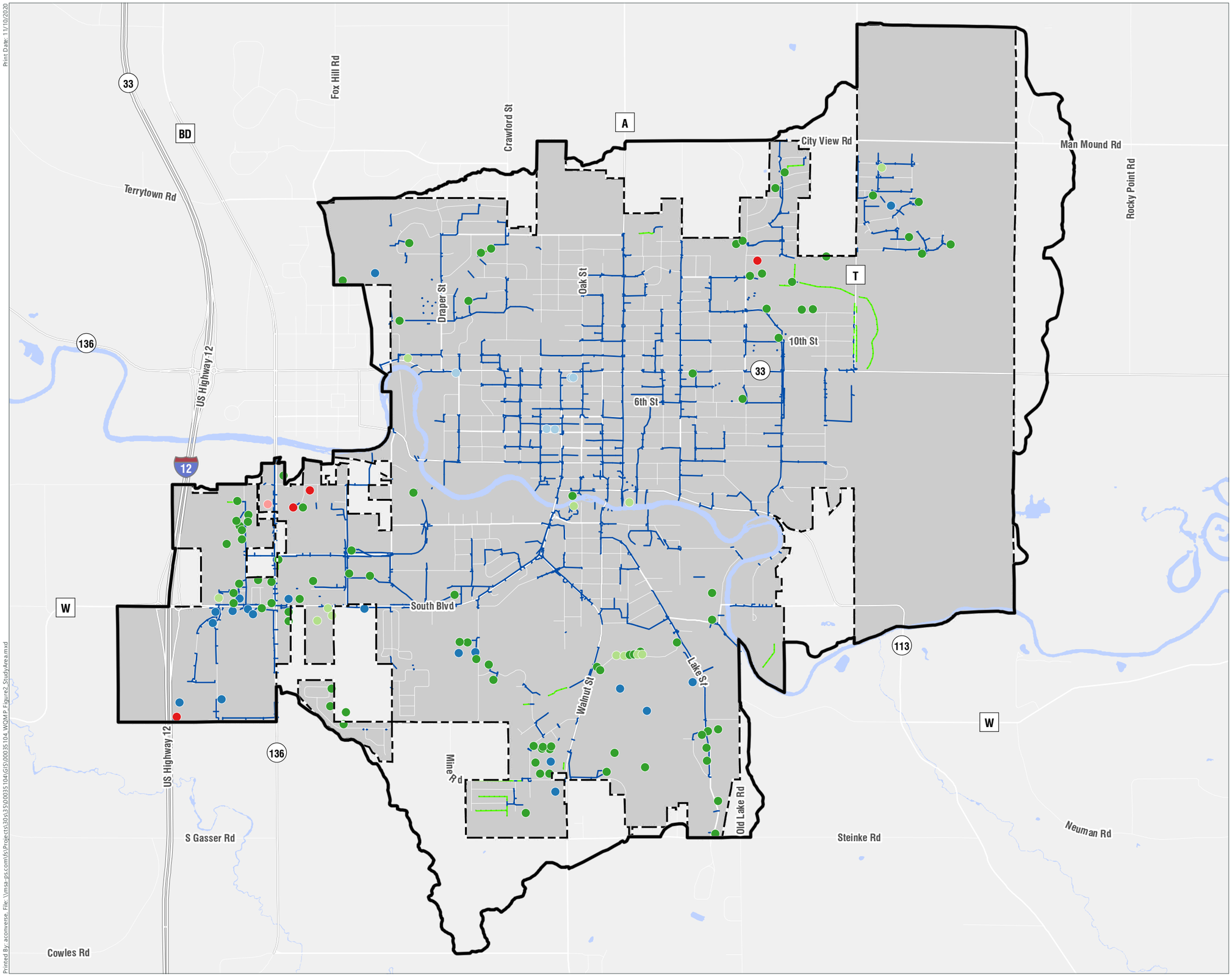
Study Area

FIGURE 2
Water Quality Master Plan

City of Baraboo
Sauk County, WI



- StudyArea
- City of Baraboo
- Waterbody
- Stormwater Main
- Swale

Existing BMPs

- Wet Pond
- Dry Pond
- Bio-retention basin
- Infiltration
- Rain Garden
- Underground Tank

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
TMDL Reachsheds: WDNR, Modified by MSA

MSA

0 0.2 0.4 Miles

N

Print Date: 11/10/2020
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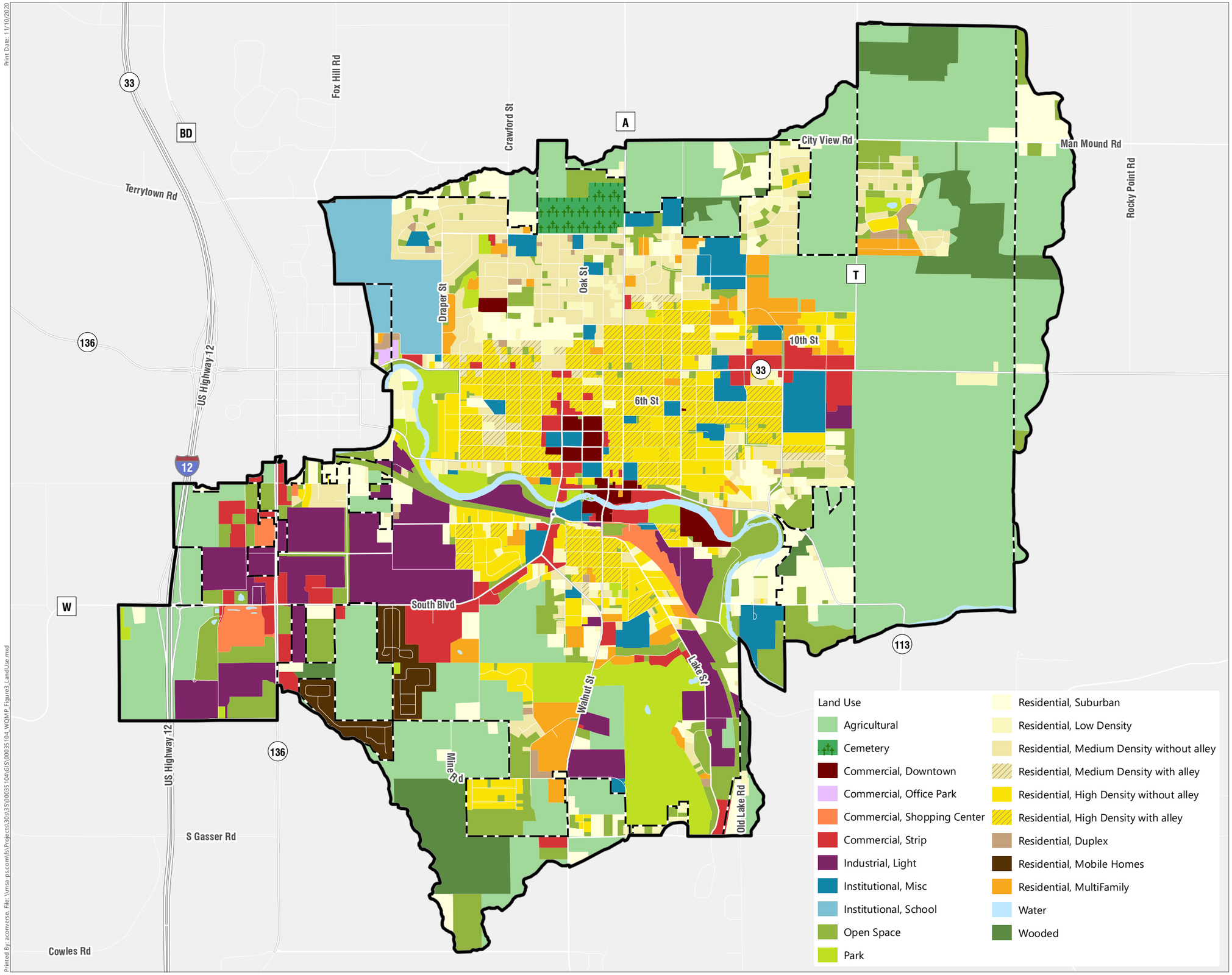
Land Use

FIGURE 3
Water Quality Master Plan

City of Baraboo
Sauk County, WI



StudyArea
City of Baraboo

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
Land Use: Derived from Parcel data and Aerial Imagery

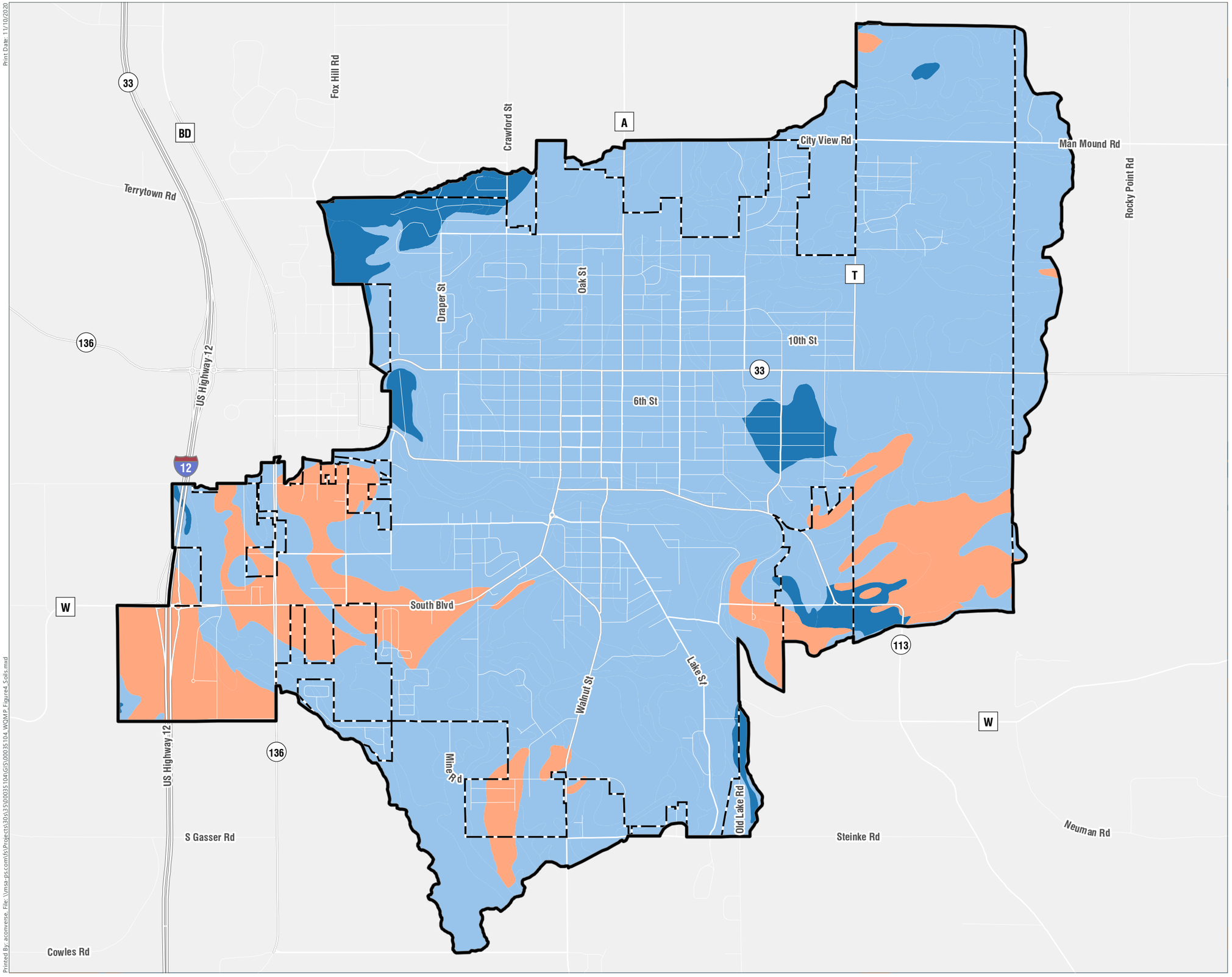
MSA

0 0.2 0.4 Miles

Soils

FIGURE 4
Water Quality Master Plan

City of Baraboo
Sauk County, WI



StudyArea
City of Baraboo
Modeled Hydrologic Soil Group
A (Sandy)
B (Silty)
C or D (Clayey)

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
Soils: NRCS (SSURGO)

MSA

0 0.2 0.4 Miles

N

Print Date: 11/10/2020
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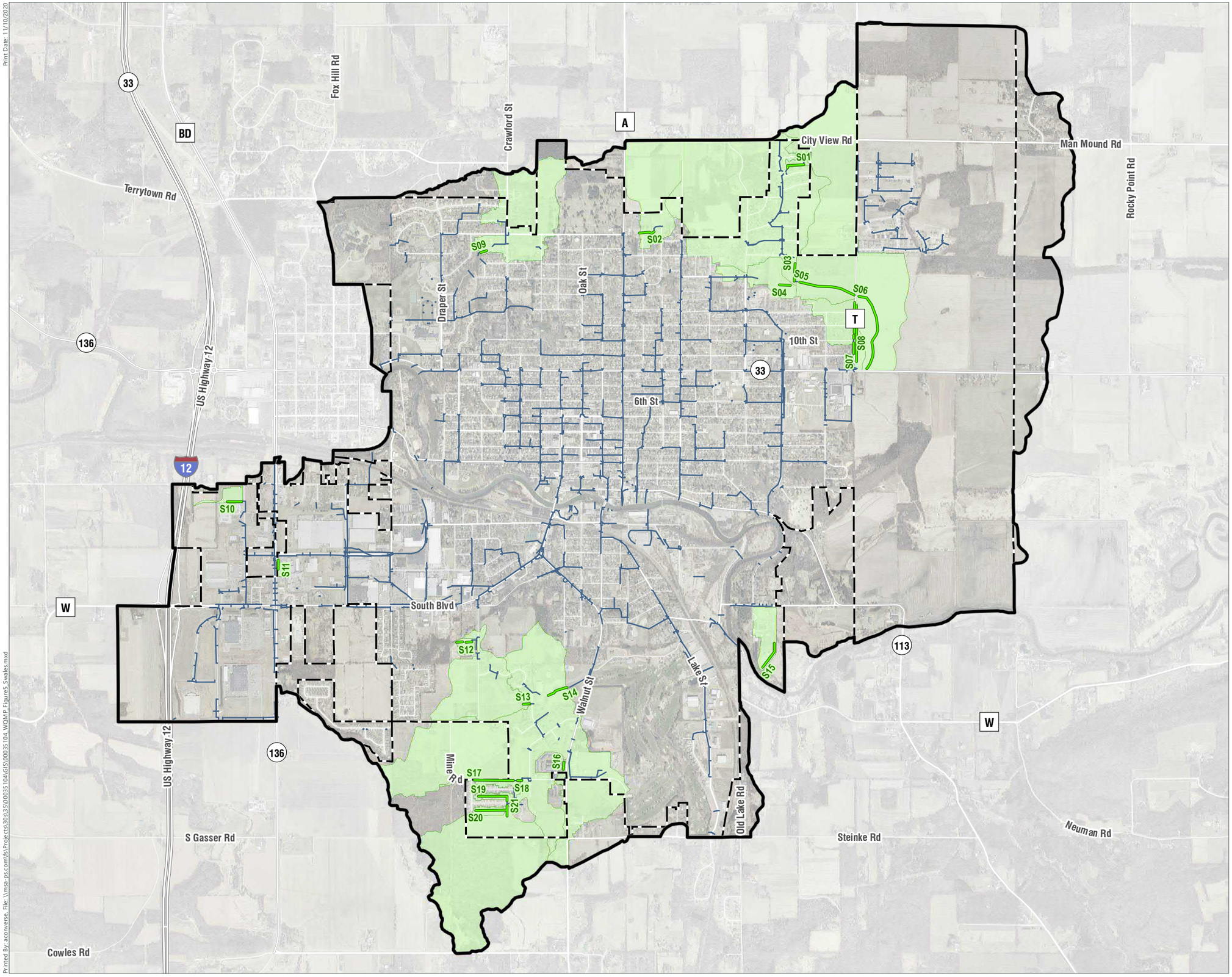
Swales

FIGURE 5
Water Quality Master Plan

City of Baraboo
Sauk County, WI



StudyArea
City of Baraboo
Modeled Swale
Swale Watershed

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
Soils: NRCS (SSURGO)

MSA

0 0.2 0.4 Miles

N

Print Date: 11/10/2020

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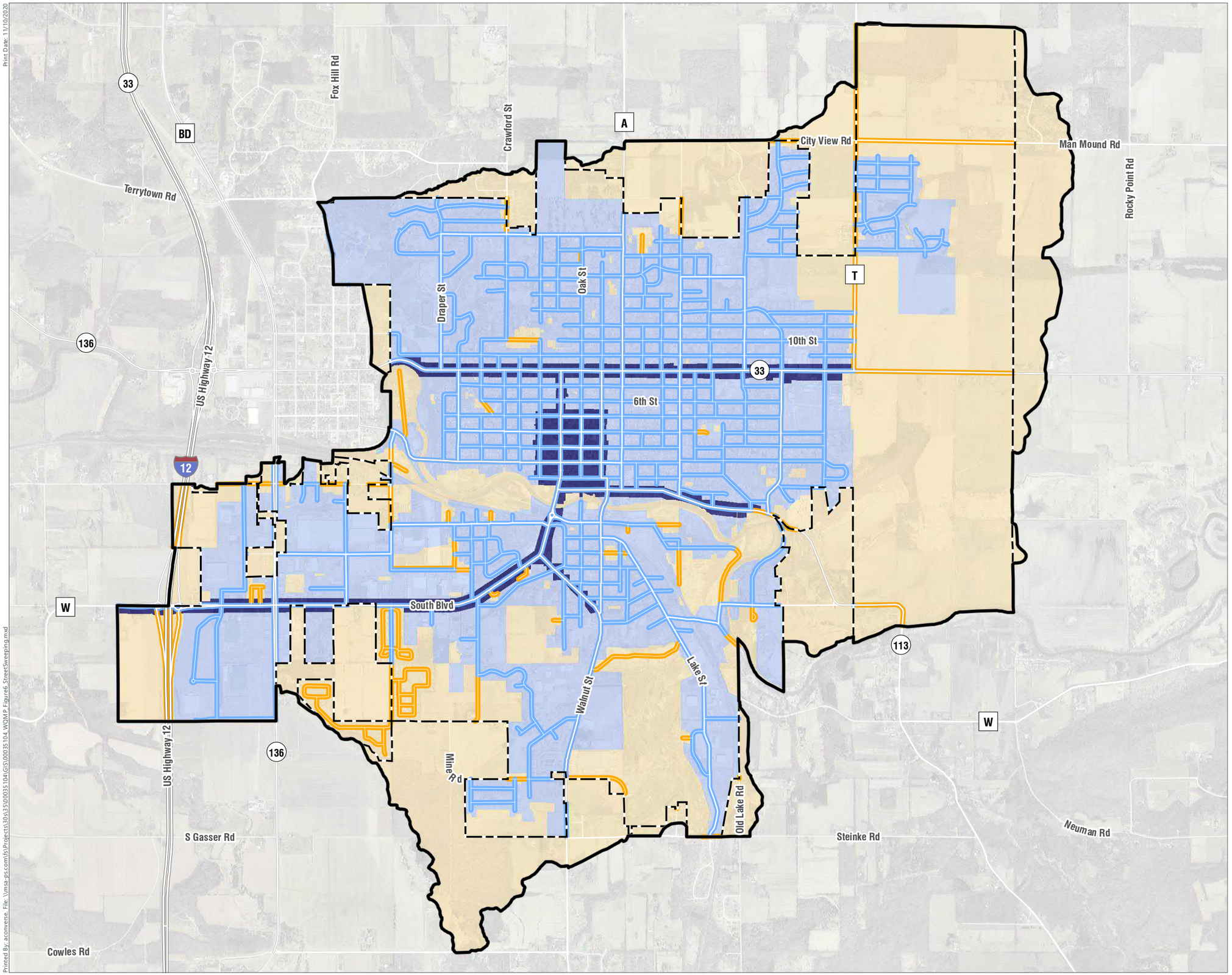
Modeled Street Sweeping

FIGURE 6
Water Quality Master Plan

City of Baraboo
Sauk County, WI



- StudyArea
- City of Baraboo

Modeled Sweeping Frequency

- Swept Weekly
- Swept Monthly
- Unswept
- Curb & Gutter
- No Curb & Gutter

Downtown areas are swept weekly with a vacuum sweeper.
Main roads are also swept weekly with a vacuum sweeper.
All other areas are swept monthly using a mechanical sweeper.

Note that for modeling purposes, only those streets with curb and gutter can be assigned credit for water quality improvements. Therefore, any areas without curb and gutter were not modeled for sweeping.

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
Aerial: Sauk County (2015)

MSA

0 0.2 0.4 Miles

N

Print Date: 11/10/2020
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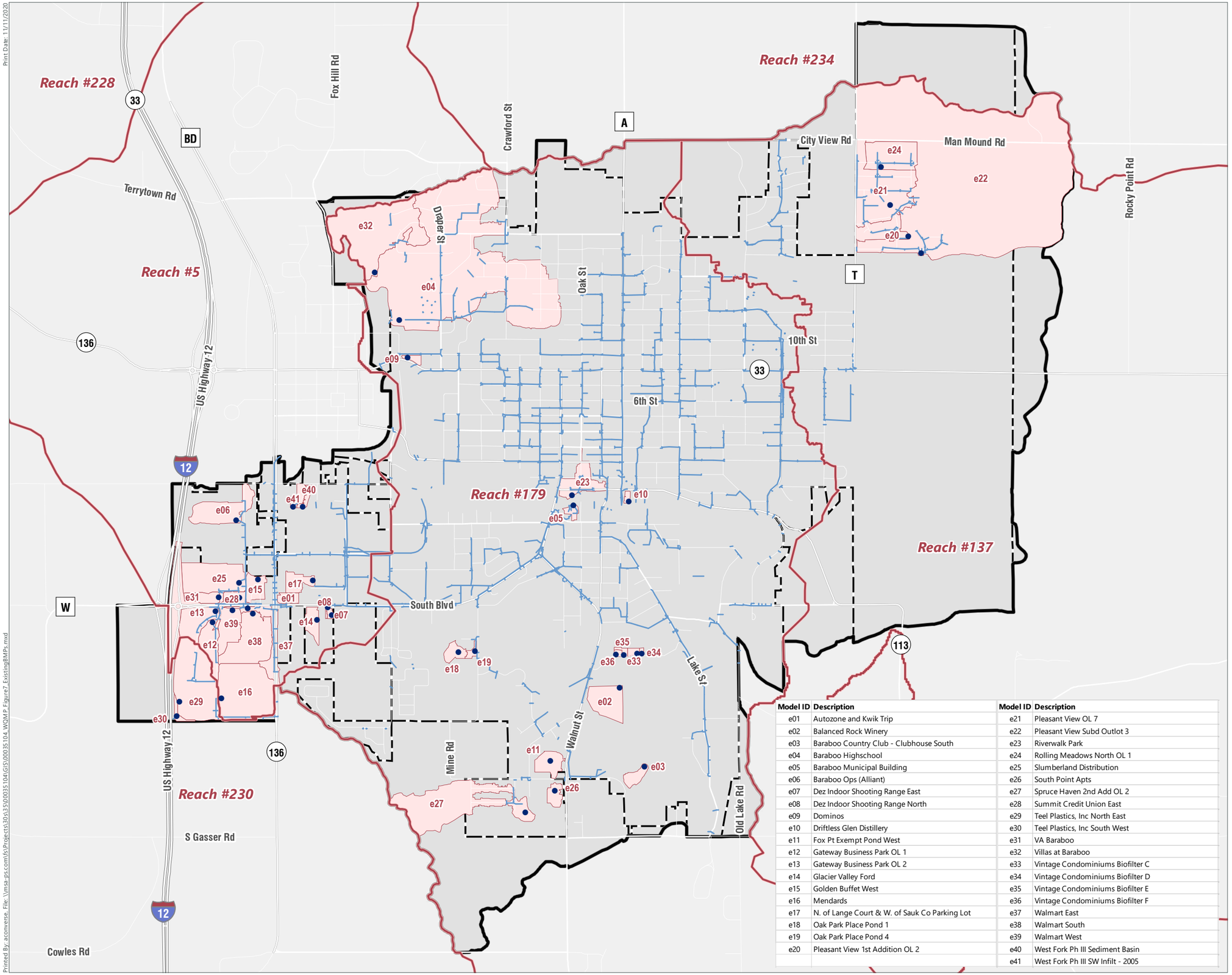
Modeled Existing BMPs

FIGURE 7
Water Quality Master Plan

City of Baraboo
Sauk County, WI



Model ID	Description	Model ID	Description
e01	Autozone and Kwik Trip	e21	Pleasant View OL 7
e02	Balanced Rock Winery	e22	Pleasant View Subd Outlot 3
e03	Baraboo Country Club - Clubhouse South	e23	Riverwalk Park
e04	Baraboo Highschool	e24	Rolling Meadows North OL 1
e05	Baraboo Municipal Building	e25	Slumberland Distribution
e06	Baraboo Ops (Alliant)	e26	South Point Apts
e07	Dez Indoor Shooting Range East	e27	Spruce Haven 2nd Add OL 2
e08	Dez Indoor Shooting Range North	e28	Summit Credit Union East
e09	Dominos	e29	Teel Plastics, Inc North East
e10	Driftless Glen Distillery	e30	Teel Plastics, Inc South West
e11	Fox Pt Exempt Pond West	e31	VA Baraboo
e12	Gateway Business Park OL 1	e32	Villas at Baraboo
e13	Gateway Business Park OL 2	e33	Vintage Condominiums Biofilter C
e14	Glacier Valley Ford	e34	Vintage Condominiums Biofilter D
e15	Golden Buffet West	e35	Vintage Condominiums Biofilter E
e16	Mendards	e36	Vintage Condominiums Biofilter F
e17	N. of Lange Court & W. of Sauk Co Parking Lot	e37	Walmart East
e18	Oak Park Place Pond 1	e38	Walmart South
e19	Oak Park Place Pond 4	e39	Walmart West
e20	Pleasant View 1st Addition OL 2	e40	West Fork Ph III Sediment Basin
		e41	West Fork Ph III SW Infilt - 2005

- StudyArea
- TMDL Reachshed
- City of Baraboo
- Modeled Existing BMP Watershed
- Modeled Existing BMP

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
Aerial: Sauk County (2015)

MSA

0 0.2 0.4 Miles

N

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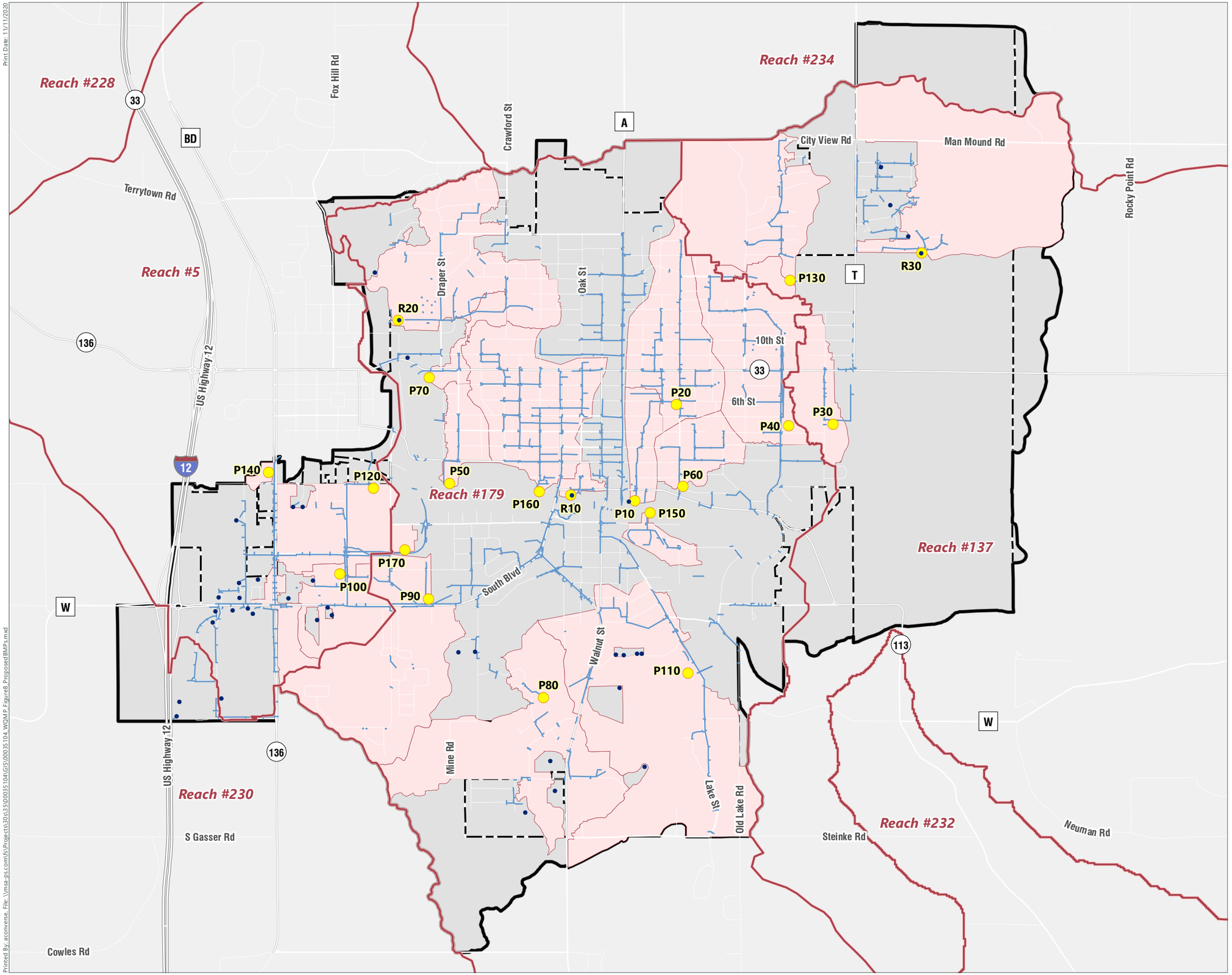
Proposed BMPs

FIGURE 8
Water Quality Master Plan

City of Baraboo
Sauk County, WI



- StudyArea
- TMDL Reachshed
- City of Baraboo
- Proposed or Retrofit BMP Watershed
- Proposed or Retrofit BMP
- Modeled Existing BMP

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
TMDL Reacsheds: WDNR modified by MSA

MSA

0 0.2 0.4 Miles

N

Print Date: 11/11/2020

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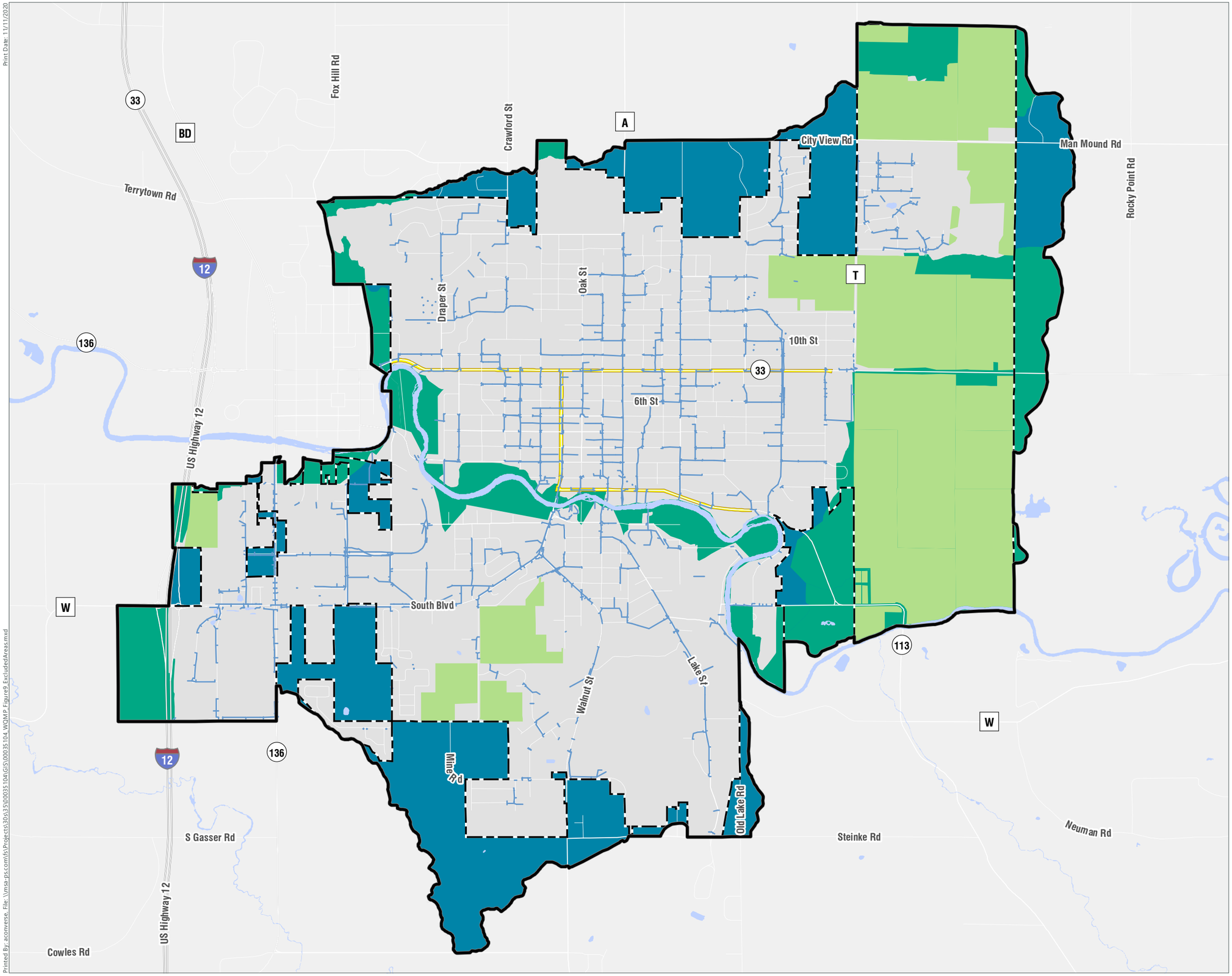
Excluded Areas

FIGURE 9
Water Quality Master Plan

City of Baraboo
Sauk County, WI



- StudyArea
- City of Baraboo
- Waterbody
- Connected Highways
- Agricultural Land
- Riparian Area
- Outside of City
- Stormwater Main

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
Connected Highways: WisDOT
Agricultural Land: Aerial imagery displayed Agriculutral use and City zoning also classified as agricultural

**Note some regions have more than one rationale for being excluded.*

MSA

0 0.2 0.4 Miles

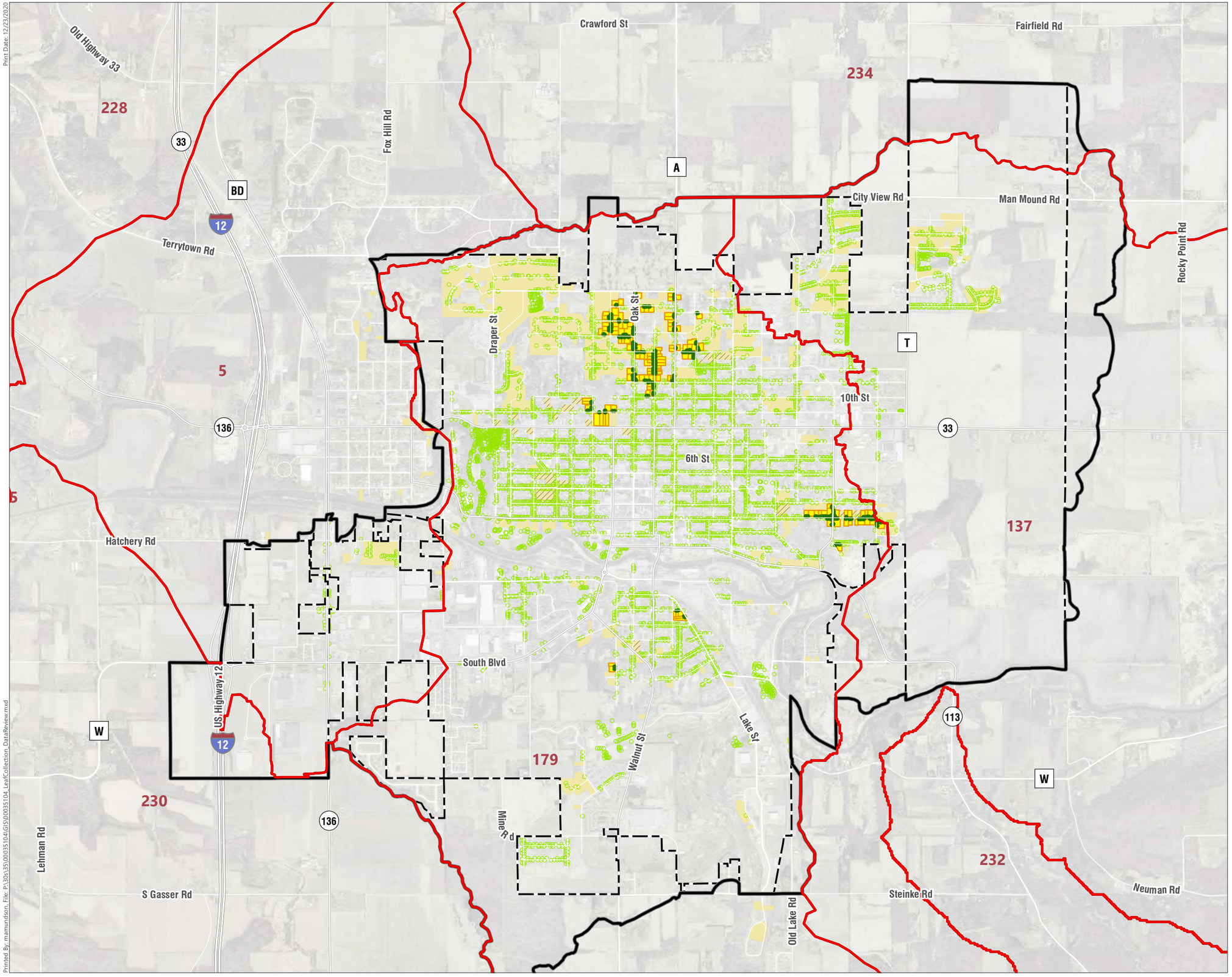
N

Print Date: 11/11/2020
Printed By: aconverse, File: \\msa-ps.com\fs\Projects\30\135\00035104\GIS\00035104_WQMP_Figure9_ExcludedAreas.mxd

Leaf Collection Credit

FIGURE 10
Water Quality Master Plan

City of Baraboo
Sauk County, WI



- StudyArea
- City of Baraboo
- TMDL Reachsheds
- Eligible MDR Parcels
- MDR without alley
- MDR with alley
- Deciduous, Mature, within ROW, MDR parcel, No BMP, Reach 179, Not Exempt,
- Trees

Data Sources:
Municipal Boundary: Sauk County
Roads: Sauk County
Aerial: Sauk County (2015)

MSA

0 0.2 0.4 Miles

N

Print Date: 12/23/2020

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APPENDIX B

Modeling Guidance Documents

BUREAU OF WATERSHED MANAGEMANT PROGRAM GUIDANCE

Storm Water Management Program

TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance

Effective: October 20, 2014
Guidance #: 3800-2014-04

Notice: This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

APPROVED:

Pam Biersach

Pam Biersach, Director
Bureau of Watershed Management

10/28/14
Date

A. Statement of Problem

The U.S. Environmental Protection Agency (EPA) requires the wasteload allocations (WLAs) developed as part of a Total Maximum Daily Load (TMDL) be reflected and implemented through permits. In Wisconsin, storm water discharge permits are issued pursuant to ch. NR 216, Wis. Adm. Code. As part of the TMDL process, permitted Municipal Separate Storm Sewer Systems (MS4s) are assigned individual TMDL WLAs. The placement of the WLA in a storm water permit can create numerous challenges including defining the municipal area encompassed by the WLA and modeling conditions to which the storm water WLA is to be applied. Department staff, municipal officials and storm water management plan developers need guidance to clarify how assessment of permit compliance with a WLA is to be demonstrated.

B. Background

A TMDL quantifies the amount of pollution that a waterbody can assimilate and still meet water quality standards. EPA requires that waters listed as impaired on Wisconsin's 303-d list have TMDLs developed. At a minimum, TMDLs must allocate the assimilative capacity between the load allocation, the WLA, and a margin of safety. The WLA is the portion of the assimilative capacity that is allocated to point sources. Nonpoint sources receive load allocations (LAs). WLAs are established for continuous point source discharges and also intermittent pollutant releases such as permitted storm water discharges.

Establishing WLAs for storm water sources requires an understanding of under what flow conditions impairments occur, and how storm water discharges are contributing to the identified impairments. Establishing WLAs for storm water sources also requires an understanding of exactly where the discharges are occurring. In many cases, municipal separate storm sewer systems (MS4s) have multiple discharge points that can be located in more than one reachshed[1]. In a TMDL, WLAs are assigned for each pollutant of concern and by reach. In a TMDL a MS4 can have multiple and different pollutant reduction goals within its municipal jurisdiction.

C. Discussion

Once EPA has approved a TMDL that contains permitted MS4s, the next permit issued must contain an expression of the WLAs consistent with the assumptions and requirements contained in the TMDL. As part of the TMDL process EPA approves the WLAs and generally these WLAs are mirrored directly in the permit. While this seems like a relatively straight forward permit process, the direct application of the WLA can present certain challenges in implementation due to assumptions required during the development of the TMDL. These assumptions revolve around aerial extent of the MS4 and its boundary, incorporation of new areas and expansion of the municipal boundary, and modeling differences between the tools used to create the TMDL versus the compliance tools used by the MS4. In addition, permitted MS4s have already performed municipal wide analysis to comply with requirements stipulated in ch. NR 151.13, Wis. Adm. Code. These requirements expressed reduction goals as a percent reduction from a defined no controls scenario with defined climate records.

[1] Reachsheds are also referred to as subwatersheds or segment sheds in TMDL development. A reach is a stream segment or individual lake or reservoir that is artificially assigned a compliance point or "pour point" where the applicable in-stream water quality standards must be met. Breaks for stream reaches are made at changes in stream listing (each individually named 303(d) water must have their own set of TMDLs), changes in water quality criteria, and at pour points or compliance points just upstream of significant changes in flow/assimilative capacity.

To build on established methodologies contained in s. NR 151.13, DNR's preferred option for implementing TMDLs is using a percent reduction methodology similar to s. NR 151.13. The use of a percent reduction strategy will utilize reduction goals consistent with the TMDL and allow implementation to continue to build on the same percent reduction strategy employed in s. NR 151.13 using the same models and tools that MS4s have already been utilizing. Since EPA only approves the WLA and not the corresponding percent reduction it is important that the TMDL reports and permit fact sheets, as appropriate, highlight that the percent reductions being used for implementation are consistent with the approved WLAs in the TMDL.

The usage of a percent reduction framework for implementation allows both the MS4 and DNR the ability to implement the reductions without having to reallocate and track WLAs across reachsheds, MS4s, and other land uses. This will minimize the need to continually update the TMDL as municipal boundaries evolve and ease reporting requirements. In some rare cases allocations may need to be adjusted. This is discussed in Attachment A.

D. Guidance

This document divides DNR's guidance for implementing TMDL WLAs for permitted MS4s into three parts:

- **Part 1** – Expressing WLAs and Reduction Targets
- **Part 2** – Implementation and Compliance Benchmarks
- **Part 3** – Modeling

PART 1 – Expressing WLAs and Reduction Targets

An MS4 will have a WLA for each pollutant of concern addressed by the TMDL. Generally the pollutant of concern for TMDLs in Wisconsin include total suspended solids (TSS) and total phosphorus (TP); however, allocations for other pollutants such as bacteria or chlorides are possible depending on what pollutants are causing impairments to surface waters.

Unlike the requirements contained in s. NR 151.13, individual MS4s may be divided in multiple reachsheds. As such, MS4s may have multiple WLAs and percent reductions instead of the uniform municipal wide percent reduction employed in s. NR 151.13. Multiple WLAs and percent reductions are the result of needing to meet water quality requirements for all water bodies and account for changes in water body type, changes in water quality criteria or targets, changes in flow, changes in designated use, and other similar factors. Compliance with TMDL requirements will need to be achieved on a reach by reach basis.

Due to the complexity of natural systems, the WLAs identified in the TMDL are the best estimate for meeting water quality standards and are modeled or simulated predictions. Initial implementation of the TMDL will be in most cases by design using SLAMM, P-8, or equivalent methodologies to estimate and track pollutant reductions. The MS4 is typically not required to perform ambient monitoring to assess if water quality standards are being met, but MS4s do need to track implementation activities and reductions achieved, and report on TMDL implementation in MS4 annual reports. Once an adequate level of implementation has been achieved, ambient monitoring can be used to judge progress and monitoring will ultimately be needed to de-list impaired waters and show compliance with the TMDL.

During the first term of an MS4 permit, after EPA approval of a TMDL, DNR will request that each permitted MS4 report its actual MS4 area served within each reachshed. Existing MS4 permittees should already have

sewershed mapping completed to satisfy previous MS4 permit conditions and this should be used to verify the current MS4 area served within each reachshed. The Department will provide the GIS data sets used for the TMDL reachshed boundaries through its website. The main reasons for reporting this information are to determine if the MS4 area served by each permittee corresponds to each other and does not overlap or omit MS4 service areas and to provide a detailed accounting of MS4 areas and responsible parties.

In most TMDLs, non-traditional MS4s such as permitted universities and state and county highway facilities were not given unique WLAs and these areas will need to be identified. In addition, most TMDLs are not able to account for modifications in drainage due to manmade conveyance systems such as storm sewers. These modifications may require modification of reachshed boundaries. To account for this, the MS4 permit (MS4 General Permit see section 1.5.4.3) will require that permittees submit information to the DNR to verify appropriate boundaries and areas. To accomplish this DNR will require the following information:

- Updated storm sewer system map that identifies:
    - The current municipal boundary/permitted area. For city and village MS4s, identify the current municipal boundary. For MS4s that are not a city or village, identify its permitted area. The permitted area for towns, counties and non-traditional MS4s pertains to the area within the Urbanized Area of the 2010 Decennial Census.
    - The TMDL reachshed boundaries within the municipal boundary, and the area in acres of each TMDL reachshed within the municipal boundary.
    - The MS4 drainage area boundary associated with each TMDL reachshed, and the area in acres of the MS4 drainage area associated with each TMDL reachshed.
- Identification of areas on a map and the acreage of those areas within the municipal boundary that the permittee believes should be excluded from its analysis to show compliance with its WLA (see "WLA Analysis Area" in Part 3 of this document"). In addition, the permittee shall provide an explanation of why each area identified should not be its responsibility.
  Note: This information is to be acquired by the DNR through an MS4 annual report.

DNR will evaluate this information and consider whether modifications to the TMDL are warranted. It is common for TMDL derived MS4 areas and reachsheds to deviate from the actual MS4 drainage areas. Such deviations can have an impact on the TMDL; however in most cases, these deviations will not have a significant effect on the calculated percent reduction needed to meet the TMDL allocations.

To assist in understanding allocations the TMDLs developed in Wisconsin have in many cases expressed reduction goals in both a WLA format (a load expressed as a mass) and a percent reduction format. The percent reduction is calculated from the baseline condition used in the TMDL to quantify what is needed to meet water quality standards. During the development of the TMDLs, the percent reduction is calculated using the following equation:

$$\text{Percent Reduction (from baseline)} = 100 * (1 - (\text{WLA Loading Condition} / \text{Baseline Loading Condition}))$$

The baseline loading condition should be described in the TMDL. While there is some variation across TMDLs in Wisconsin, the baseline loading condition should reflect the regulatory conditions stipulated in s. NR 151.13 and utilize either the 20% TSS control requirement or the 40% TSS control requirement as the starting point for TMDL allocations. This is because TMDLs are required, at a minimum, to meet existing regulatory requirements.

In 2011, the Wisconsin Legislature approved Act 32 which prohibited the Department from enforcing the 40% TSS reduction contained in s. NR 151.13, Wis. Adm. Code. As such, TMDLs under development and approved by EPA prior to January 1, 2012 used the 40% reduction as the baseline loading condition. For TMDLs approved by EPA after January 1, 2012, the 20% reduction serves as the baseline loading condition. The 20% reduction required under s. NR 151.13, Wis. Adm. Code, was to have been achieved by 2008.

For consistency with existing s. NR 151.13 guidance and requirements, the permittee's MS4 permit (MS4 General Permit - see section 1.5.4.4.1) will be requiring that the no-controls modeling condition be used such that the TMDL percent reduction goals will be measured from the no controls modeling condition. Since TMDL development uses the 20% or 40% TSS reduction baseline loading condition, implementation planning will necessitate converting the TMDL stipulated percent reduction back to a no-controls percent reduction for pollutants of concern such as TSS and Total Phosphorus (TP). As identified in the approved Rock River TMDL, a 40% TSS reduction corresponds with a 27% Total Phosphorus (TP) reduction. Based on loading data from the WinSLAMM model, a 20% TSS reduction for MS4s from the no-controls condition corresponds with a 15% TP reduction. This can be done using a mathematical conversion:

For a TMDL that uses 20% TSS reduction as the baseline loading condition (TMDLs approved after January 1, 2012) the conversion to the no-controls modeling condition is:

TSS Percent Reduction (no-controls) = 20 + (0.80 * % control from baseline in TMDL)
TP Percent Reduction (no-controls) = 15 + (0.85 * % control from baseline in TMDL)

For a TMDL that uses 40% reduction as the baseline loading condition (TMDLs approved prior to January 1, 2012) the conversion to the no-controls modeling condition is:

TSS Percent Reduction (no-controls) = 40 + (0.60 * % control from baseline in TMDL)
TP Percent Reduction (no-controls) = 27 + (0.73 * % control from baseline in TMDL)

The above calculated reductions correspond to the percent reduction measured from no-controls as required by the permittee's MS4 permit (MS4 General Permit - see section 1.5.4.4.1). These percent reductions can be compared to the reduction already achieved with existing management practices as required under the permittee's MS4 permit (MS4 General Permit - see section 1.5.4.4.4). This comparison, needed for each reachshed, will determine if additional reductions are needed to meet the TMDL requirements. The MS4 percent reductions from the no-controls condition for the Rock River TMDL and Lower Fox River TMDL are given in Attachments C and D.

For the MS4 area contained in each reachshed, the no controls load is calculated using SLAMM, P-8, or equivalent. The MS4 area includes the entire acreage that the MS4 is responsible for excluding areas not under the jurisdiction of the permittee. As new MS4 area is added or subtracted, the TMDL percent reduction applied to these areas remains the same. The percent reduction from no controls to meet the TMDL is applied to the MS4's modeled no-controls load to obtain the necessary load reduction to meet the TMDL. This load reduction may be different from that needed to meet the stipulated TMDL WLA; however, MS4 implementation of the TMDL is driven by the percent reduction and its corresponding load reduction.

For permittees that elect to use water quality trading or where adaptive management may lead to water quality trading, the load reduction calculated from the no-controls percent reduction should be used when evaluating the necessary mass.

TMDLs do not negate requirements stipulated in s. NR 151.13, Wis. Adm. Code. Therefore, both TMDL percent reductions and s. NR 151.13 requirements must be met. Once an MS4 meets the s. NR 151.13 requirement of 20% TSS control, an MS4 does not need to continue to update their s. NR 151.13 development urban area modeling. This is because s. 281.16 (2)(am)3., Wis. Stats., requires a municipality to maintain storm water treatment practices that are already in place prior to July 1, 2011.

TMDL reports may include both an average annual WLA and a percent reduction for MS4s. For implementation, MS4s should use the percent reduction. The average annual allocations represent the sum of allocations over the year and do not account for the monthly variations in the loading capacity of the receiving water. The percent reductions provided in the TMDL are based on monthly reductions and better reflect the reductions required to meet the water quality standards.

> Example: Appendix V in the Rock River TMDL lists annual mass allocations for Reach 81. The City of Beloit has a baseline loading for TSS of 181.75 tons and a WLA of 259.62 tons (a net increase). However, Appendix I identifies that Beloit needs a 7% reduction in TSS for Reach 81 from the 40% TSS baseline condition. This is because on an overall annual basis Beloit meets its allocation but in certain individual months it does not. The percent reduction is calculated based on the average of the monthly allocations used to determine compliance with the water quality standards.

PART 2 – Implementation and Compliance Benchmarks

Storm Water Management Planning (SWMP)

As described in the permittee's MS4 permit (MS4 General Permit - see sections 1.5.4.4 and 1.5.4.5), DNR will be requiring a TMDL implementation analysis and plan be completed by MS4 permittees subject to TMDL WLAs. This analysis and plan should be incorporated in the SWMP as required by the permittee's MS4 permit (MS4 General Permit - see section 1.5.4). Each MS4 permittee should evaluate all potentially cost-effective alternatives to reduce its discharge of pollutants of concern so that its discharge is comparable to the percent reductions stipulated in the TMDL. MS4 permittees may work together with other MS4s that reside in the same reachshed.

A focus of the SWMP should be on improving storm water treatment for areas of existing development during times of redevelopment. Older, urban development patterns typically did not include the same level of stormwater management controls that new development does. Reductions achieved through redevelopment can be counted towards compliance with WLAs. Each municipality should estimate the pollutant reductions that are expected to be achieved over time through redevelopment of both public and private facilities, including roadway reconstruction. The rate of redevelopment should be estimated in order to provide a gauge as to how long it would take to improve storm water management in areas of redevelopment.

When developing components of a TMDL implementation plan, municipalities should, at a minimum, consider the following implementation methods:

- **Ordinance Review and Updates** – A municipality may elect to revise its current post-construction storm water management ordinance to require greater levels of pollutant control for redevelopment and highway reconstruction that are above the minimum performance standards of ch. NR 151, Wis. Adm. Code and are consistent with the reduction requirements contained in the TMDL.

  Current ch. NR 151 post-construction performance standards for areas of new development include an 80% TSS control level and maintaining 60 - 90% of predevelopment infiltration (with certain exemptions

and exclusions). Areas that have stormwater management practices designed and maintained to meet these performance standards should already be controlling TSS and total phosphorus to levels comparable to TMDL water quality targets.

In addition, core provisions in the municipality's SWMP could be strengthened. For example, if bacteria are a pollutant of concern the MS4 may want to place greater emphasis on detecting and eliminating cross-connections between wastewater pipes and storm sewers or stronger pet waste programs.

- **Quantifiable Management Practices** – These practices include, but are not limited to, structural controls such as wet detention ponds, infiltration basin, bioretention, sump cleaning, low impact development (LID), street cleaning and vegetated swales where reductions can be quantified through water quality modeling such as WinSLAMM and P-8.

- **Non-Quantifiable Management Practices –** Quantifiable pollutant reductions may be difficult to determine for some practices such as residential leaf and yard debris management programs, lawn fertilizer bans and information and education outreach activities. This could also include strengthened provisions of the core SWMP. For example, if bacteria is a pollutant of concern the MS4 may place greater emphasis on detecting and eliminating cross connections, stronger pet waste programs and greater focus on elimination of leaching from dumpsters. As data becomes available to quantify reductions the appropriate credit will be given toward meeting the TMDL reduction requirements. In the interim, DNR and the permittee should be able to come to an agreement as to whether the measure is beneficial. In cases where quantifiable reductions are not possible, the use of a non-quantifiable but beneficial practice shall be deemed as making progress toward compliance with the TMDL reductions. The DNR, in consultation with stakeholders, will evaluate these practices as new science and data becomes available.

- **Stabilization of MS4** – Stabilization of eroding streambanks are eligible for a 50% cost share match through DNR's Runoff Management Grant Program. DNR considers streambank stabilization activities an important step in reducing the discharge of sediment. However, TMDL baseline modeling already assumes that drainage systems are stable; therefore, it is not appropriate to take credit against the WLA or percent reduction in the TMDL for stabilization of a drainage ditch or channel of the MS4. However stabilization projects should be identified in the TMDL implementation plan and can serve as a compliance benchmark toward meeting overall TMDL goals.

- **Streambank Stabilization Outside of the Permitted MS4** – Permitted MS4s may take credit through pollutant trading for stabilization of channels and streambanks which are outside of the area served by their MS4. Applicable credit thresholds and trade ratios would apply.

- **Water Quality Trading and Adaptive Management -** If economically beneficial, a MS4 may wish to participate in one of these programs. MS4s are eligible to participate in water quality trading to help meet WLAs. MS4 permittees with areas in the same reachshed can share load reduction credits for practices within those reachsheds using a 1:1 trade ratio. Also a MS4 may be invited by a Waste Water Treatment Facility (WWTF) to participate in an adaptive management program pursuant to s. NR 217.18, Wis. Adm. Code, to reduce phosphorus. Water quality trading and adaptive management guidance are covered under separate DNR guidance documents available on the DNR website.

- **Constructed Wetland Treatment –** Wetlands constructed for the purpose of providing storm water treatment are eligible for treatment credit provided that a long-term maintenance plan is implemented. Wetlands that receive runoff pollutants are expected to, at some point, reach a certain equilibrium point

where they would provide minimal pollutant removal or even act as a pollutant source unless they are maintained by harvesting vegetation and/or have accumulated sediment removed from them. Additionally, constructed wetlands installed need to be maintained as stormwater treatment areas in order to maintain their "non-waters-of-the-state" status. Per federal regulations, wetlands constructed as part of wetland mitigation cannot be used for treatment credit.

- **Storm Water Practices and Existing Wetlands** - Wetlands are waters of the state and wetland water quality standards under ch. NR 103, Wis. Adm. Code apply. Additionally, the U.S. Army Corps of Engineers has authority to protect wetlands as well. As such, existing wetlands cannot be used for treatment, however, in limited circumstances storm water practices can be installed in a wetland provided all applicable state and federal wetland permits are obtained. It is often difficult to obtain state and federal permits to construct a storm water treatment facility in a wetland. Contact the local DNR water management specialist to discuss whether this project might be permissible and the associated written justification needed to support a wetland permit application.

As discussed, SWMPs for municipalities with approved TMDLs should identify what pollutant reduction measures will be employed and over what time frame reductions will occur (i.e. 20 tons/yr TSS for redevelopment sites over the next 20 years).

Compliance Schedule and Benchmarks

Once a TMDL is approved, affected MS4 permittees will receive a TMDL implementation planning requirement within their next (or potentially initial) permit term. TMDL implementation planning will include determining storm water management treatment and other measures needed and their associated implementation costs and timelines to achieve TMDL reductions consistent with the TMDL WLAs. It is expected that the following MS4 permit term will include a compliance schedule to implement pollutant reduction measures in accordance with a storm water management plan to meet applicable TMDL reductions.

The compliance schedule will require that the permittee be able to show continual progress by meeting 'benchmarks' of performance within each permit term. In this case, a 'benchmark' means a progress increment – a level of pollutant reduction or an application of a pollutant reduction measure, which is part of a larger TMDL implementation plan designed to bring the overall MS4 discharge of pollutants of concern down to a level which is comparable to the MS4's TMDL WLA. It is possible that certain benchmarks will not be easily quantifiable but there needs to be evidence that such benchmarks will provide a legitimate step toward reducing the discharge of pollutants of concern.

DNR may elect to place specific benchmarks in an MS4 permit. However, it is expected that MS4 permittees will have the primary role in establishing their own benchmarks for each 5-year permit term. Benchmarks should be reevaluated at least once every 5 years and are interim steps/goals of compliance. Where substantial reductions are required multiple benchmarks of compliance will be needed and likely implemented over more than one permit cycle. However, the schedule should lead to meeting the TMDL WLA as quickly as is feasible.

Redevelopment ordinances designed to implement stormwater management controls to achieve compliance with the TMDL requirements are an excellent tool to show progress in meeting the WLA with smart growth and development patterns. Management practices should be installed as infrastructure is replaced. For example, it may be most cost-effective for municipalities to install storm water treatment and infiltration practices as other street or sewer projects are scheduled.

Under a TMDL, EPA does not acknowledge the concept of maximum extent practicable as defined in s. NR 151.006, Wis. Adm. Code, but rather compliance schedules can be structured in SWMPs and permits to allow MS4s the flexibility needed to meet TMDL goals. Any storm water control measures employed by the MS4 permittee to reduce its pollutant discharge to comply with the TMDL reductions will need to be maintained or replaced with comparable stormwater control measures to ensure that load reductions will be maintained into the future.

Runoff Treatment Outside of the MS4's Jurisdiction
In order for an MS4 to take credit for the control of pollutants by another municipality or private property owner (i.e. industry or riparian property owner), the MS4 must have an agreement with the entity with control over such treatment measure. This agreement must specify how the pollutant reduction credit will be shared or otherwise granted to an MS4. Responsibilities for maintenance of the BMPs and preservation of the BMPs over time should also be addressed in any such agreement.

Tracking
The permittee will need to track and show progress in reducing discharges of pollutants of concern. This tracking should assist in showing that MS4 permit compliance benchmarks have been achieved in accordance with an overall storm water management plan to achieve compliance with the TMDL percent reduction targets.

A tabular TMDL compliance summary of pollutant loading per reach will be required to be submitted to DNR with the MS4 report at least once every MS4 permit term. The summary should identify the following: reach name and number (consistent with the name and number in the TMDL report), the MS4 outfall numbers, named/labeled drainage areas, the applicable TMDL percent reduction target(s), pollutant reduction benchmarks, storm water management control measures implemented, and pollutant reduction achieved as compared to no controls. Attachment B is an example of a tabular TMDL MS4 compliance summary.

PART 3 – Modeling

Discussion

The following discussion highlights the main compatibility challenges between TMDL development and MS4 implementation and how they will be addressed.

TMDL waste load allocations are by definition expressed as daily loads. There is flexibility, however, to implement the loads using monthly, seasonal, or annual load allocations. Due to the variability of storm water events and associated pollutant loadings, MS4's have historically used modeling to estimate flows and pollutant loadings using a percent reduction format for the purpose of s. NR151.13 compliance. As part of TMDL implementation, average percent reductions have been developed for MS4s for each reach. These percent reductions generally reflect an average of monthly reductions needed to meet allocations because waters are evaluated against the phosphorus criteria based on monthly sampling protocols. This will allow MS4s to continue using water quality models such as WinSLAMM and P-8 for demonstrating compliance with TMDL allocations. As with s. NR 151.13, TMDL compliance for MS4s will be by design.

Since the modeling tools used to demonstrate compliance with s. NR151.13 pollutant loadings are the same tools used to demonstrate compliance with TMDL pollutant load allocations, much of the existing mapping, water quality modeling, and planning methodologies used for s. NR151.13 compliance can be used or adjusted for TMDL compliance planning.

Generally, the modeling completed as part of TMDL development is at a less detailed scale than the modeling completed by individual MS4s. Due to the scale at which the respective models are completed, it is not unusual to have differences in the drainage areas and the pollutant mass loadings associated with them. Because of the scale at which they are developed, allocations from a TMDL have generally been applied across the entire urban area that is served by the permitted MS4. It is important to note that while many components of existing planning efforts and modeling results can be used for TMDL implementation, adjustments will likely be necessary to account for a TMDL focus on compliance by reachshed.

There may be inconsistencies between the TMDL modeled drainage areas to the actual MS4 drainage areas. Actual MS4 drainage areas may not follow the surface drainage areas and MS4 drainage areas commonly expand due to urban development. For example, the modeled versus actual MS4 drainage areas commonly deviated by 30% and by as much as 60% in the Rock River TMDL. Although these deviations may have a significant effect on a mass wasteload allocation, its affects are greatly moderated on a percent reduction basis across the reachshed. Area deviations commonly affect the MS4 percent reductions by only a few percent. Given the modeling assumptions that have gone into TMDL modeling, deviations by even 10% are within the expected error range of TMDL modeling. Modeling is not an exact science and the TMDL MS4 percent reductions are still considered valid implementation targets to work toward achieving in-stream water quality.

As noted above, MS4s subject to a TMDL should perform analyses and planning to identify cost-effective approaches for reducing discharges of pollutants of concern. To cost-effectively achieve pollutant reductions, MS4s should look for opportunities such as site redevelopment and road reconstruction projects, implementation of streambank stabilization and wetland restoration projects, implementation of traditional BMPs, and possibly water quality trading and adaptive management[2]. Each of these elements can be considered for implementation to meet the requirements of a TMDL. It is likely that existing MS4 water quality modeling and mapping can be used and adjusted as necessary for SWM planning needs for TMDL implementation.

Guidance

TMDL-established WLAs and LAs are 'targets' of treatment performance and/or pollutant control for point and non-point sources. The WLAs and LAs are TMDL modeled estimates of the level of pollutants that can be discharged and still meet in-stream standards. The ultimate goal of a TMDL is for continual reduction of pollutants discharged so that both the listed impaired waters and other waters meet in-stream water quality standards, which would then allow for removal of waters from the 303-d impaired waters list. Municipalities should consider the drainage area served by their MS4 and look for the most cost-effective means to reduce discharges of pollutants of concern until their discharge is comparable with its TMDL requirements.

TMDL Analysis Area

An MS4 is to include all areas within its corporate boundary unless it is listed as optional. Although the MS4 permit focuses on current areas served by an MS4, it may be appropriate to include future land use planning areas.

Incorporation of rural areas: A city or village may have incorporated the entire township or a large portion of the rural township in which it resides. In this situation, the city or village needs to include all areas within the most

2 The Department has prepared separate guidance documents on water quality trading and adaptive management. MS4s are considered non-point sources for the purposes of adaptive management. This does not preclude them from participating in an adaptive management program if approached by a traditional point source such as a municipal or industrial wastewater treatment facility. The "Adaptive Management Technical Handbook" is available for download at http://dnr.wi.gov/topic/surfacewater/adaptivemanagement.html

recent urbanized area, adjacent developed and developing areas whose runoff is connected or will connect to their MS4.

Highways: A permitted MS4 owner/operator of a highway needs to account for the pollutants generated within the Right-Of-Way (ROW). An exception would be a roadway crossing over a highway where the owner of the roadway crossing structure is responsible for the pollutants associated with their bridge and approach structure within the lower highway's ROW. WisDOT is responsible for state highways that are not connected highways. A county is responsible for county highways that it maintains. Cities and villages need to include connecting highways as identified and listed in the Official Highway State Truck Highway System Maps at: http://www.dot.wisconsin.gov/localgov/highways/connecting.htm

Optional: The pollutant loads associated with the following areas are optional for an MS4 to include:

1. Area that never passes through a permittee's MS4 such as a riparian area.
2. Land zoned for agricultural use and operating as such.
3. Manufacturing, outside storage and vehicle maintenance areas of industrial facilities permitted under subch. II of ch. NR 216, Wis. Adm. Code, are optional to include. This does not include any industrial facilities that have certified a condition of "no exposure" pursuant to s. NR 216.21(3), Wis. Adm. Code. *Note: DNR recommends that municipalities include all industrial facility areas within their WLA analysis area instead of creating 'holes' within its area of analysis.*
4. Any area that discharges to an adjacent municipality's MS4 (Municipality B) without passing through the jurisdictional municipality's MS4 (Municipality A). Municipality B that receives the discharge into their MS4 may choose to be responsible for this area from Municipality A. If Municipality B has a stormwater treatment practice that serves a portion of A as well as a portion of B, then the practice must be modeled as receiving loads from both areas, independent of who carries the responsibility for the area. However, if runoff from an area within Municipality A's jurisdiction drains into Municipality B's MS4 but then drains back into Municipality A's MS4 farther downgradient, then Municipality B does not have the option of including the load from Municipality A in their analysis and the load from that area is Municipality A's responsibility.
5. For county and towns, the area outside of the most recent urbanized area as defined by the US Census Bureau. This area is classified as non-permitted urban and part of the non-point source load allocation (NPS LA).

MS4 Water Quality Models and Related Information

To model pollutants such as TSS and total phosphorus in the area served by the MS4, the municipality must select a model such as SLAMM, P8 or an equivalent method deemed acceptable by the Department. For the analysis to show compliance, SLAMM version 9.2 or P8 version 3.4 or a subsequent version of these models may be used.

All roadway right-of-ways within the urbanized area that are part of a county or town's MS4 are the responsibility of the county or town. Model the road based on the urban land use that will most typify the traffic, even if agricultural land use is on one or both sides of the road (for example commercial or residential) and include that area in the corresponding standard land use file.

A municipality is not required to use the standard land use files if it has surveyed the land uses in its developed urban area and has "real" source area data on which to base the input files. The percent connected imperviousness beyond the standard land use files must be verified in the field. Disconnection may be assumed for residential rooftops where runoff has a flow path of 20 feet or greater over a pervious area in good condition. Disconnection for impervious surfaces other than residential rooftops may be assumed provided all of the following are met:

- The source area flow length does not exceed 75 feet,

- The pervious area is covered with a self-sustaining vegetation in “good” condition and at a slope not exceeding 8%,
- The pervious area flow length is at least as long as the contributing impervious area and there can be no additional runoff flowing into the pervious area other than that from the source area.
- The pervious area must receive runoff in a sheet flow manner across an impervious area with a pervious width at least as wide as the contributing impervious source area.

Water quality modeling is a means to determine a storm water management control practice’s treatment efficiency. If the model cannot predict efficiencies for certain storm water management control measures that a municipality identifies as a water quality management practice, then a literature review should be conducted to estimate the reduction value. Proprietary stormwater management control measures that utilize settling as their means of TSS reduction should be modeled in accordance with DNR Technical Standard 1006 (Method for Predicting the Efficiency of Proprietary Storm Water Sedimentation Devices).

When designing storm water management practices, runoff draining to a management practice from off-site must be taken into account in determining the treatment efficiency of the measure. Any impact on the efficiency must be compensated for by increasing the size of the measure accordingly.

Storm water management practices on private property that drain to an MS4 can be given treatment credit, provided the municipality enters into an agreement or has an equivalent enforceable mechanism with the facility/land owner that will ensure the management practice is properly maintained. The municipality will need a tracking system that includes maintenance of treatment practices. An operation and maintenance plan, including a maintenance schedule, must be developed for the stormwater management practice in accordance with relevant DNR technical standards. The agreement or equivalent mechanism between the municipality and the private owner should include the following:

- A description of the stormwater management practice including dimensions and location.
- Identify the owner of the property on which the stormwater management practice is located.
- Identify who is responsible for implementing the operation and maintenance plan.
- Outline a means of terminating the agreement that includes notifying DNR.

The efficiency of a storm water management practice on both public and private property must be modeled using the best information the municipality can obtain on the design of the practice. For example, permanent pool area is not sufficient information to know the pollutant reduction efficiency of a wet detention basin even if it matches the area requirements identified in Technical Standard 1001 Wet Detention Basin for an 80% reduction. Information on the depth of the wet pool and the outlet design are critical features that determine the level of control a detention pond is providing.

Modeling Clarifications

- A TMDL might remove certain internally drained areas from its analysis. If an internally drained area is removed from the TMDL analysis, the MS4 permittee shall not include such area in its MS4 analysis to show compliance with its TMDL requirements. Under this scenario if stormwater is pumped from inside the internally drained area to an external drainage area, then this additional pollutant discharge needs to be accounted for in the MS4 analysis to show compliance with its TMDL requirements.
- Where an internally drained area is included in the TMDL analysis, an MS4 permittee has the option of including this area in its TMDL analysis to show compliance with its TMDL requirements. However, credit for pollutant removal in internally drained areas may only be taken provided the April 6, 2009 DNR Internally Drained Area guidance memo is met with respect to taking pollutant reduction credit within internally drained areas.

- When water is pumped rather than gravity drained from an internally drained area of many acres in area, the MS4 will be expected to use monitoring data to determine the annual average mass of pollutants discharged to the surface water to which the TMDL applies. This does not apply to dewatering covered under a DNR storm water construction site general permit.
- If a portion of a municipality's MS4 drains to a stormwater treatment facility in an adjacent municipality, the municipality generating the load will not receive any treatment credit due to the downstream municipality's treatment facility unless there is an inter-municipal agreement where the downstream municipality agrees to allow the upstream municipality to take credit for such treatment. DNR anticipates that such an agreement would have the upstream municipality assist with the construction and/or maintenance of the treatment facility. This contract must be in writing with signatures from both municipalities specifying how the treatment credit will be shared.
- For reporting purposes, the pollutant reductions must be summarized by TMDL reachshed. Additionally, pollutant loads for grouped drainage areas as modeled shall also be reported. Drainage areas may be grouped at the discretion of the modeler for such reasons as to emphasize higher priority areas, balance model development with targeting or for cost-effectiveness.
- The additional runoff volume from areas that are outside of the analysis area needs to be accounted for when it drains into treatment devices. The pollutant load can be "turned off" but the runoff hydrology needs to be accounted for to properly calculate the treatment efficiency of the device.
- Due to concerns of sediment resuspension, basins with an outlet on the bottom are generally not eligible for pollutant removal based solely on settling. However, credit may be taken for treatment due to infiltration or filtration. Filtration might occur through engineered soil or proprietary filters. Features to prevent scour should always be included for any practice where appropriate.
- Credit should not be taken for street cleaning unless a curb or equivalent barrier is present which leads to sediment buildup on the street.
- To model a combination of mechanical broom and vacuum assisted street cleaning, it may require an analysis of several model runs depending on the timing of the mechanical and vacuum cleaning. If mechanical broom and vacuum cleaning occur at generally the same time (e.g. within two weeks of each other) then only the removal efficiency of the vacuum cleaning should be taken. If the municipality performs broom sweeping in the spring or fall and vacuum clean the remained of the year, calculate the combined cleaning efficiency using the following method:
  (A) Model the entire street cleaning program as if entire period is done by a mechanical broom cleaner.
  (B) Model just the period of time for vacuum cleaning (do not include the mechanical broom cleaning).
  (C) Model the same period as B) but with a mechanical broom.
  (D) The overall combined efficiency would be A + B – C.

WinSLAMM clarification

- WinSLAMM 9.4 and earlier versions of WinSLAMM result in double counting of pollutant removal for most treatment practices modeled in series. WinSLAMM 9.2 and subsequent versions contain warnings to help alert modelers of this issue. The modeler will need to make adjustments to ensure that the results do not include double credit for removal of the same particle size. PV & Associates has created a document titled 'Modeling Practices in Series Using WinSLAMM' which helps to guide a user as to whether and or how certain practices can be modeled in series and this document is available at: http://winslamm.com/Select_documentation.html
- In WinSLAMM 9.4 and earlier versions, when street cleaning is applied across a larger modeled area with devices that serve only a certain area within the larger modeled area, it is acceptable to first take credit for street cleaning across the entire larger area but then the treatment efficiency for other devices must be reduced by the efficiency of the street cleaning to prevent double counting.

P8 clarifications

- P8 does not account for scour and sediment resuspension. DNR requires that a wet basin with less than a 3-foot permanent pool have its treatment efficiency reduced. A basin with zero permanent pool depth should be considered to get zero credit for pollutant removal due to settling and a basin with 3 or more feet of permanent pool depth can be given the full pollutant removal efficiency credited by settling. The pollutant removal efficiency may be given straight-line depreciation such that a basin with a 1.5 foot-deep permanent pool would be eligible for 1/2 the pollutant removal efficiency that would be credited due to settling.
- A device that DNR gives no credit for pollutant removal may still be modeled if it is in series with other practices because of its benefit on runoff storage capacity that may enhance the treatment efficiency of downgradient treatment devices. To do so, turn the treatment efficiency off in P-8.
- P8 should be started an extra year or at least several months before the "keep dates", in order to allow the model to build up representative pollutant concentrations in wet basins.

CREATED:

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On behalf of the Storm Water Liaison Team

Kevin Kirsch, Water Resource Engineer — 10/20/14 Date
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APPROVED:

Mary Anne Lowndes, Chief — 10/21/14 Date
Runoff Management Section

Runoff Management Policy Management Team approved on 9/30/14 (date).

Attachment A: Technical Notes

Establishing relationships between multiple point and nonpoint pollutant sources and their influences on stream flow and water quality is complex. This process is often further complicated by the spatial scale under which TMDLs are developed. In order to help make TMDL development manageable, TMDLs are often developed using large scale modeling approaches that can be difficult to translate to the smaller scale often needed for implementation. For instance, loadings from "non-traditional" permitted MS4s (WDOT and county highways and UW campus systems) are often aggregated with the loadings of traditional MS4s (cities, villages and towns). This loss in resolution can result in inconsistencies in the WLA assignment necessitating a more thorough examination and possible reallocation of a portion of the WLA to non-traditional MS4 permittees.

In many cases where there is an existing TMDL that aggregated WLAs, the Wisconsin Department of Natural Resources (DNR) will need to review, and may need to reallocate WLAs to MS4 permittees. MS4 permittees will then need to conduct storm water management planning to evaluate their current pollutant loads relative to the TMDL reduction goals and create and implement a plan to meet the TMDL reductions.

Whether or not a municipality changes in size or land use, the allowable pollutant load that the receiving water can handle does not change. In the TMDL, the total allowable permitted MS4 load was determined by reach and typically was distributed uniformly across permitted MS4s on a unit area load basis. Since the permitted MS4 allowable unit area load is the same across a reachshed, MS4 WLAs can be reallocated between each other based on area. However, this reallocation must occur at the same time step that was used in the TMDL development process.

> Example: the Rock River TMDL generated allocations on a monthly basis so any reallocation of the WLA between sources must also proceed on a monthly basis. Simply adding the monthly allocations into an annual load and reallocating using an average annual unit load approach will result in a misrepresentation of the TMDL allocations. Analysis must be conducted on a monthly basis.

It is expected that the extent area that will need to be modeled for the MS4 WLA will be larger than that modeled under the s. NR 151.13 (developed urbanized area modeling analysis). This is because the s. NR 151.13 modeling area has many optional and excluded areas, whereas, the TMDL WLA analysis generally lumps all of these areas into the WLA. Also, s. NR 151.13 modeling was based on year 2004 developed area condition versus a TMDL which generally considers most recent development information.

In municipalities that have recently experienced significant growth, there may be a significant increase in urban area. In addition, in some instances the total actual permitted MS4 area within a reachshed is different than that used in the TMDL development process. Initially DNR believed that it would be easy to reallocate a portion of the non-point source LA to the permitted MS4s based on a unit load approach; however, the task can be more difficult than it initially appears. As explained above, the reallocation needs to be conducted using the same time step used in the development of the TMDL and at the same critical flow period used to develop the TMDL. In many cases, this critical flow period used in the development of the TMDL may not correspond with an average annual unit load.

<u>Reallocation Option</u>: In some cases, where TMDL analysis was conducted on an average annual basis it may be appropriate to adjust WLAs based on the acreage associated with each MS4 by reachshed. If reallocating WLAs and LAs within the same reach will still not be adequate to address significant area differences between actual and TMDL modeled reachsheds, DNR will consider on a case-by-case basis as to whether a reallocation between reaches is warranted. For example, an MS4 may collect runoff from a substantial amount of area from one reachshed and discharge it directly into another reachshed.

DNR would include reallocated WLAs in the next reissued permit of affected MS4s. MS4s would have the opportunity to comment and/or adjudicate reallocated WLAs when the permit is public noticed.

Attachment B: TMDL Compliance Summary

TMDL Reach Number & Name: 64 (Yahara River, Lake Mendota & Lake Monona)
MS4 TMDL Percent Reductions needed (no controls): 73% (TSS) & 68% (TP)*
MS4 Existing Controls Percent Reduction (year 2014): 32% (TSS) & 24% (TP)
Modeled MS4 Annual Average Pollutant Load (no controls): 433 tons/yr (TSS) & 124 lb/yr
Modeled MS4 Annual Average Pollutant Load (existing controls): 294 tons/yr (TSS) & 94 lb/yr

Benchmark (BM)	Description of BM Measure	Outfalls Affected by BM control	Affected Drainage Areas (as modeled)	Implementation Date	Measure Treatment Performance	BM % Reduction toward TMDL Reduction	MS4 Cumulative % Control (from no controls)
N/A	Existing control measures	All	All	Ongoing	TSS: 32% TP: 24%	TSS: 32% TP: 24%	TSS: 32% TP: 24%
1	Increased SWM control for Roadway Reconstruction	All	All	1/1/2020	TSS: 60% TP: 40% to MEP	TSS: 0.6% (annually) TP: 0.4% (annually) (30% TSS reduction over 50 years)	TSS: 35% TP: 26% (Accounts for 5 years of reduction)
2	Implement Enhanced Street Cleaning Program	001 003 004 008	1A - 1D 3A – 3K 4C – 4F 8D	1/1/2020	TSS: 12% TP: 8% (no redundant controls)	TSS: 9% TP: 6% (eff. reduced for redundant measures)	TSS: 44% TP: 32%
3	Implement Enhanced Yard Waste Collection Program	All	All	1/1/2021	TSS: 2% TP: 6% (no redundant controls)	TSS: 1.6% TP: 5% (eff. reduced for redundant measures)	TSS: 46% TP: 37%
4	Ordinance Revised – Higher Redevelopment Standard	All	All	1/1/2022	TSS: 60% TP: 40% to MEP	TSS: 0.6% (annually) TP: 0.4% (annually) (30% of TSS reduction over 50 years)	TSS: 49% TP: 39% (Accounts for 5 years of reduction)
5	Retrofit 2nd St. Basin into wet basin	002	B4	1/1/2023	TSS: 60% TP: 40%	TSS: 2% TP: 1% (only serves part of MS4)	TSS: 51% TP: 40%
6	New Wet Basin B15	005	5B - 5H	1/1/2023	TSS: 60% TP: 40% to MEP	TSS: 3% TP: 2% (only serves part of MS4)	TSS: 54% TP: 42%
7	Stabilize MS4 Drainage Ways between X and Y streets	003	3D and 3E	1/1/2024	20 tons/year sediment reduction	N/A Streambank & MS4 stabilization does not count against TMDL reduction requirement	TSS: 54% TP: 42%

* The TSS and TP percent reductions were taken from the Rock River Report's Appendix H and I. All other mass and percent reductions listed are fictitious and shown for example purposes only.

Attachment C: Rock River TMDL MS4 Annual Average Percent Reductions

Reach	Appendix H TP reduction from baseline of 27%	Appendix I TSS reduction from baseline of 40%	Calculated TP reduction from no-controls	Calculated TSS reduction from no-controls
2	29%	1%	48%	41%
3	82%	26%	87%	56%
20	14%	0%	37%	40%
21	10%	0%	34%	40%
23	12%	11%	36%	47%
24	11%	12%	35%	47%
25	64%	32%	74%	59%
26	35%	29%	53%	57%
27	0%	0%	27%	40%
28	1%	0%	28%	40%
29	51%	7%	64%	44%
30	0%	0%	27%	40%
33	29%	9%	48%	45%
34	81%	31%	86%	59%
37	66%	54%	75%	72%
39	0%	0%	27%	40%
45	13%	8%	36%	45%
51	14%	0%	37%	40%
54	61%	6%	72%	44%
55	68%	43%	77%	66%
56	19%	0%	41%	40%
59	54%	15%	66%	49%
60	29%	1%	48%	41%
61	6%	2%	31%	41%
62	70%	70%	78%	82%
63	14%	11%	37%	47%
64	47%	55%	61%	73%
65	49%	46%	63%	68%
66	37%	37%	54%	62%
67	0%	0%	27%	40%
68	52%	18%	65%	51%
69	72%	21%	80%	53%
70	1%	1%	28%	41%
71	29%	31%	48%	59%
72	0%	0%	27%	40%
73	51%	49%	64%	69%
74	17%	20%	39%	52%
75	15%	19%	38%	51%
76	75%	29%	82%	57%
78	4%	0%	30%	40%
79	54%	37%	66%	62%
81	20%	7%	42%	44%
83	37%	25%	54%	55%

Baseline reductions of TP = 27% & TSS = 40% were identified in the RR TMDL report on pages 25 & 27.
% TP reduction from no-controls = 27 + [0.73 x (% TP control in Appendix H)]
% TSS reduction from no-controls = 40 + [0.60 x (% TSS control in Appendix I)]
Reaches that are not listed above did not have a permitted MS4 within the reach.

Table developed by: Eric Rortvedt, DNR Stormwater Engineer
Dated: 9/16/2014

Attachment D: Lower Fox River Basin TMDL MS4 Annual Average Percent Reductions

Sub-Basin	TMDL Report TP reduction from baseline of 15%	TMDL Report TSS reduction from baseline of 20%	Calculated TP reduction from no-controls	Calculated TSS reduction from no-controls
East River	30.0%	40.0%	41%	52%
Baird Creek	30.0%	40.0%	41%	52%
Bower Creek	30.0%	40.0%	41%	52%
Apple Creek	30.0%	40.0%	41%	52%
Ashwaubenon Creek	30.0%	40.0%	41%	52%
Dutchman Creek	30.0%	40.0%	41%	52%
Plum Creek	30.0%	40.0%	41%	52%
Kankapot Creek	30.0%	40.0%	41%	52%
Garners Creek	63.1%	49.9%	69%	60%
Mud Creek	39.0%	28.5%	48%	43%
Duck Creek	30.0%	40.0%	41%	52%
Trout Creek	30.0%	40.0%	41%	52%
Neenah Slough	30.0%	40.0%	41%	52%
Lower Fox River Main Stem	30.0%	65.2%	41%	72%
Lower Green Bay	30.0%	40.0%	41%	52%

Baseline reductions of TP = 15% & TSS = 20%.
% TP reduction from no-controls = 15 + [0.85 x (% TP control in Lower Fox TMDL Report)]
% TSS reduction from no-controls = 20 + [0.80 x (% TSS control Lower Fox TMDL Report)]

Table checked by : Eric Rortvedt and Amy Minser, DNR Stormwater Engineers
Dated: 9/16/2014

BUREAU OF WATERSHED MANAGEMANT PROGRAM GUIDANCE

Storm Water Management Program

TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance

Addendum A (Percent Reduction)

Effective: February 2016
Guidance #: 3800-2015-13

Notice: This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

APPROVED:

Pam Biersach

Pam Biersach, Director
Bureau of Watershed Management

February 12, 2016
Date

A. Statement of Problem

As permitted Municipal Separate Storm Sewer Systems (MS4s) are added in watersheds with approved TMDLs it is not always clear how to assign a percent reduction corresponding with the appropriate Waste Load Allocation (WLA) or Load Allocation (LA) for new, expanded, or missed MS4 areas.

B. Background

At the time of TMDL development, there may not be sufficient information to separate out individually permitted MS4s from other MS4s permitted areas. For example, state and county highway MS4s and UW campus MS4s may not have been able to be assigned a specific WLA and their allocation gets lumped in with the city/village/town WLA where it is located. However all permitted MS4s that are located within in a municipality that received a WLA will be subject to the same annual average percent reductions. Additionally, urban developed areas not regulated under an MS4 permit are by default considered part of the non-point source LA when a TMDL is developed; however, once permitted, the MS4 system must be addressed in a consistent methodology as the other permitted MS4s contained in the TMDL.

C. Discussion

As discussed in the MS4 TMDL guidance, dated October 2014, permitted MS4s will implement their assigned WLAs based on an annual average percent reduction. This approach will also apply to new, expanded, or missed MS4s that were not assigned WLAs or percent reductions in the EPA approved TMDL.

During the development of a TMDL, it is common to assign an average unit area load across the MS4 service area as the baseline condition from which allocations are then derived. From this baseline load condition, a percent reduction (often equivalent) is applied across all sources to come up with the applicable LAs and WLAs.

For sediment or Total Suspended Solids (TSS) and Total Phosphorus (TP), the baseline condition for agricultural non-point sources generally reflects compliance with NR 151 agricultural performance standards including tolerable soil loss rate and the phosphorus index. Neither of these performance standards have an easy or direct translation with the baseline condition and the NR 151 percent reductions used for permitted MS4s.

In order to be equitable and consistent with the baseline condition assumed in TMDLs for permitted MS4s, the “no-controls” and subsequent NR 151.13 percent reduction will be utilized as the baseline MS4 condition for all new, expanded, or missed permitted MS4s. Consistent with existing Department guidance, implementation of the TMDL for new, expanded, or missed MS4s will utilize a percent reduction framework consistent with the EPA approved TMDL. The methodologies outlined below are designed to be consistent with allocations needed to achieve water quality standards.

D. Guidance

The following approach is recommended for assigning MS4 annual average percent reductions to permitted MS4s that are not specifically identified in a TMDL but discharge to a receiving water to which the TMDL applies:

1. In a TMDL reach where there is a permitted MS4 that was assigned a WLA, the same annual average percent reduction will apply to new, expanded, or missed permitted MS4s in the same reach so long as the MS4 has the same baseline condition. In some TMDLs, such as the Wisconsin River TMDL, the MS4 baseline load condition may vary due to soil or other conditions. If this is the case, consult with the DNR and we will select or adjust the percent reduction as needed to ensure consistency with the EPA approved TMDL.

2. In a TMDL reach where there was no WLA assigned to any MS4, the following approach should be used:

For a TMDL that uses 20% TSS reduction as the baseline loading condition (TMDLs approved after January 1, 2012) the conversion to the no-controls modeling condition is calculated by reach as follows:

TSS % Reduction (no-controls) = 20 + (0.80 * % NPS reduction from baseline in TMDL)
TP % Reduction (no-controls) = 15 + (0.85 * % NPS reduction from baseline in TMDL)

For a TMDL that uses 40% reduction as the baseline loading condition (TMDLs approved prior to January 1, 2012) the conversion to the no-controls modeling condition is:

TSS % Reduction (no-controls) = 40 + (0.60 * % NPS reduction from baseline in TMDL)
TP % Reduction (no-controls) = 27 + (0.73 * % NPS reduction from baseline in TMDL)

Note: For TMDLs that specifically call out nonpermitted MS4 reductions, such as the Milwaukee TMDLs, use the % reduction assigned to the nonpermitted MS4s in the equations above instead of the "% NPS reduction from baseline in the TMDL" listed in the equations above.

The recommended calculation approach will give a somewhat different annual average percent reduction than if it had been calculated from conversion of a mass LA. However, the recommended approach will yield reductions that are consistent with those that would have been calculated had non-permitted MS4 area been included in the TMDL's calculation as an area of MS4 WLA instead of an area of LA.

Example Calculation: The Rock River TMDL report does not have MS4 annual average percent reductions calculated for Reach 80. Following the above guidance, the calculated MS4 annual average percent reductions for TSS and TP are as follows:

TSS % Reduction (no-controls) = 40 + (0.60 * % NPS reduction from baseline in TMDL)
*Appendix I of the approved RR TMDL report, dated July 2011, identifies the % NPS reduction from baseline for TSS as 25%.
TSS % Reduction (no-controls) = 40 + (0.60 * 25) = 55% (Rock River Basin Reach 80)

TP % Reduction (no-controls) = 27 + (0.73 * % NPS reduction from baseline in TMDL)
*Appendix H of the approved RR TMDL report, dated July 2011, identifies the % NPS reduction from baseline for TP as 49%.
TP % Reduction (no-controls) = 27 + (0.73 * 49) = 63% (Rock River Basin Reach 80)

CREATED:

Eric S. Rortvedt, Water Resource Engineer
On behalf of the Storm Water Liaison Team

2/10/16
Date

Kevin Kirsch, Water Resource Engineer
TMDL Development Coordinator

2/11/16
Date

APPROVED:

Mary Anne Lowndes, Chief
Runoff Management Section

2/12/16
Date

Runoff Management Policy Management Team approved on February 10, 2016.

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: November 24, 2010

TO: Regional Water Leaders, Basin Leaders and Experts
Storm Water Permit Staff (via email)

FROM: Russ Rasmussen, Director, Bureau of Watershed Management
DNR Storm Water Permit Engineers

SUBJECT: Process to Assess and Model Grass Swales for ss. NR 151.13(2) and NR 216.07(6), Wis. Adm. Code - Total Suspended Solids Reduction

This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts. ***This guidance document supersedes the guidance document on Dated April 24, 2008 and subsequent erratas dated August, 2008 and April, 2009.***

Issue

Under s. NR 151.13(2), Wis. Adm. Code, a municipality subject to the municipal storm water permit requirements of s. NR 216.07(6), Wis. Adm. Code, must implement a 20% reduction in total suspended solids (TSS), by March 10, 2008 or 24 months from coverage under the Municipal Separate Storm Sewer System (MS4) general permit, and a 40% TSS reduction by March 10, 2013. This memorandum provides DNR staff with guidance to advise affected municipalities and their consultants on how to evaluate grassed swales in the developed urban area for water quality credit. (This guidance does not address design of grassed swales to serve new development. The Vegetated Infiltration Swale, Interim Technical Standard, No. 1005 provides information on construction of new grassed swales.)

Discussion

To meet the requirements of the MS4 permit and the TSS reduction goal of s. NR 151.13(2), Wis. Adm. Code, a municipality must assess existing best management practices (BMPs) for TSS control and propose additional BMPs if the performance standard cannot be met with existing practices. One BMP available to many permitted municipalities is the grassed swale. This guidance provides a basis for assessing and modeling swales for TSS reduction to foster consistent application of this practice in all permitted municipalities. The goals of this guidance are to:

- Determine which water quality swales in the MS4 are eligible to receive TSS reduction credit, and
- Identify a typical swale geometry that can be considered representative. (It may be appropriate to develop more than one typical swale geometry if the swale characteristics in the MS4 are highly variable.)

DNR Guidance

Step 1. Identify which swales in the municipality can be considered water quality swales for the purpose of meeting the 20% and 40% TSS reduction goal.

The following apply to all swales in the developed urban area if they are to be considered water quality swales:

A. Swales are not required to have pretreatment swales or equivalent pretreatment.
B. The longitudinal slope must be less than 4% unless slope interruption devices are installed in the swales to ensure low flow velocities. Slope interruption devices must be consistent with Ditch Check Technical

Standard, No. 1062. Swales with slope interruption devices will be evaluated using a modified longitudinal slope of 1%.

C. The Department is concerned about channel scouring and re-suspension of previously settled particles in swales that are being used for MS4 pollutant removal credit. To address this concern, all swales should be inspected for visual evidence of scour. Swales with visual evidence of scour, such as channel cuts in the bottom or areas of bare soil, can not be included.

There are two ways of identifying water quality swales within an MS4:

A. If swale survey data is available, determine the locations of water quality swales and arrive at typical swale geometry based on statistical methods.

B. In the absence of survey data, a desktop and field survey would be appropriate. The desktop and field procedure is as follows:

1. Identify potential water quality swale areas by using available topographic, land use and soil information.

2. Based on results of the desktop evaluation, select a representative number of typical swale locations in the MS4 by conducting a field survey. A minimum of five locations should be selected. At each location:

   - Measure the width of the swale bottom using a tape measure.
   - For side slopes, measure the vertical drop over the level length using a carpenter's level and tape measure.
   - Select at least three cross-sections of the swale and average the results to determine the bottom width and side slopes.
   - Determine longitudinal slope using 2-ft contour mapping or other available topographic information.

3. Use the typical swale geometry that best represents each drainage area.

Step 2. Model the swales identified in **Step 1.** using a model such as SLAMM or P8.

When modeling swales in SLAMM or P8 the following must be considered:

How should drainage basins with a mix of swale and storm sewer conveyance systems be evaluated?

Drainage basins with a combination of swales and storm sewer should be subdivided by conveyance system type and the subdivisions modeled separately. In SLAMM, swales need to be modeled separately because drainage system type (e.g., swale vs. storm sewer) cannot be assigned to individual source areas.

Where swale density varies within a modeled area, the swale density should be an area weighted average across the model area. For example, if a 100 acre modeled area has 90 acres of residential land use with an average swale density of 359 ft/acre and 10 acres of strip commercial with an average swale density of 412 ft/acre then the area weighted average across modeled area is [(90 x 359) + (10 x 412)] / 100 = 364 ft/acre.

Table 1 identifies the average swale density used in the standard land use files from SLAMM version 9.2. It is recommended that rather than using these averages, the municipality should identify the actual swale density for each of the representative areas.

TABLE 1

Land use	Swale Density (ft/acre)
Low density residential	238
Medium density residential	359
High density residential	385
Strip commercial	412
Shopping centers	92
Industrial	265
Freeway (Shoulder only)	1309
Freeway (Shoulder and Center)	1964

Note: These average swale density figures are from the SLAMM version 9.2 Standard Land Use files available on the USGS website at: http://wi.water.usgs.gov/slamm/

Should swales be modeled using the "wetted perimeter" or "typical swale geometry" option?

The typical swale geometry option must be used. Both SLAMM and P8 calculate wetted perimeter from the geometry for each storm event, which is more accurate than a user selected defined wetted perimeter.

What Manning's "n" should be used for the typical swale geometry[1]?

A Manning's "n" value of 0.30 or less is recommended, based on type of vegetation, mowing height and depth of flow. Supporting documentation should be provided if Manning's "n" values greater than 0.30 are used

How should the infiltration rate be determined?

The guidance provided in the Site Evaluation for Stormwater Infiltration Technical Standard, No. 1002 should be followed. The swale infiltration rate should be determined based on the representative soil texture identified in the NRCS soil survey or other soil data if available. When the representative soil texture has been determined, the appropriate design infiltration rate should be selected from Table 2 of the Technical Standard, No. 1002. If the infiltration rate is measured in the field using a scientifically credible field test method, the measured value can be used for the static infiltration rate without using the correction factors in Table 3 of Technical Standard, No. 1002. **Prior to entering an infiltration rate in the model, the design infiltration rate from Table 2, or the measured infiltration rate must be reduced by 50%.** The SLAMM default "infiltration rate by soil type" values should not be used.

Existing language in Technical Standard 1002 V. Step C. 4.b indicates that a measured infiltration rate using a double-ring infiltrometer test must follow the requirements of ASTM D3385. While this may be appropriate for designing new swales, is there any flexibility for measuring an existing swale using a double-ring infiltrometer test?

To determine the static infiltration rate of existing swales using a double-ring infiltrometer the following modifications to procedures in ASTM D3385 are allowed:

While the dimension and materials used for the double-ring should be based on the requirements of ASTM D3385, the infiltration rate can be measured in a time frame of a minimum of 2 hours instead of 24 hours and the water level in both rings does not have to stay constant during the test. The following procedure is a more cost-effective

[1] SLAMM version 9.3 will adjust Manning's "n" based on flow, swale geometry and vegetative retardance classifications

approach to obtaining a reasonable estimate of the infiltration rate of existing grass swales. For most soil types the infiltration rate measured by the procedure should represent the soils under more saturated conditions. Sandier soil types might not be represented by saturated conditions, but the higher infiltration rate will probably represent reality for the duration of most storm events. The lowest infiltration rate observed is the one to be used for estimating the TSS reduction for the swales and is considered a static infiltration rate. The static rate should be cut in half to represent the dynamic infiltration rate in the model.

Field Test Procedure for Double-Ring Infiltrometer

1. Select a relatively flat test area so that the double-ring infiltrometer will not be placed at an angle.
2. Cut the grass to a height of between two to four inches.
3. Gently drive the infiltrometer into the ground.
4. Inspect the soil seal around each ring to make sure that it is even and smooth.
5. Pour clean water into the inner chamber and allow it to overflow and fill up the outer ring. Maintain a level in the outer ring approximately equal to the level in the inner ring.
6. Add more water to both rings when the level in the inner ring has dropped a measurable amount. For most soil types this should be less than an inch.
7. Repeat this step until the rate the water level drops begins to decline.
8. When the rate of decline begins to slow, bring the water level up to the top and start timing the decrease in water level.
9. Record the start time.
10. Stop timing when the water level in the inner ring has gone down a measureable level (the ASTM standard requires keeping the water level constant). Timing the rate of decline should probably be started almost immediately for more clayey soils, since it might be difficult to observe when the rate change has slowed.
11. Record the time, elapsed time, and change in water level.
12. Refill both rings and restart the timing.
13. Record the time, elapsed time, change in water level, and the elapsed time since the beginning of the first measurement.
14. Repeat the timing steps until the infiltration rate has become relatively constant or the test has been conducted for a minimum of two hours. (The ASTM standard requires 24 hours).
15. The measured rate of infiltration is considered a static infiltration rate. The dynamic infiltration rate is ½ the static rate. Be aware some models, such as WinSLAMM, call for the dynamic rate for swales.

I have taken a number of measurements along a swale length and have several infiltration rates to average. How do I average the results of my in-field tests?

The geometric mean(s) of infiltration testing results should be used. However, equally important is to consider whether the measured infiltration rates should be 'grouped' in order to apply separate geometric means to different areas in order to provide representative TSS results across a municipality. Grouping of results might be done based on soil type, spatial reasons or simply done as a method to help provide representative results. For instance, if there are several relatively low infiltration rates measured and the geometric mean of the entire data set is quite high, it may be prudent to group the relatively low rates together and assign them to a representative area.

Note: In order to calculate a geometric mean, the data set of values must be greater than zero. Where the infiltration rate is too low to measure, a rate of 0.03 in/hr may be used to calculate a geometric mean of the data set.

Are velocity calculations required?

The swales that were not eliminated by visual inspection should be evaluated for scour and re-suspension using the results of velocity or shear stress calculations conducted at the representative swale locations

from **Step 1**. Velocity or shear stress calculations should be conducted based on the peak discharge rate for a 2-yr, 24-hr design event (or a reasonably equivalent event from the SLAMM or P8 rainfall file for the area) to verify that scour and re-suspension will not be a problem.

Do water quality swales need to meet the slope parameters identified in Vegetated Infiltration Swale, Interim Technical Standard, No. 1005?

If functioning as vegetated conveyance systems, swales with longitudinal slope less than 1% can be used. However, there is concern that swales with slopes less than 1% can clog. Where visual evidence indicates that the infiltration rate has been reduced (e.g., significant duration of ponded water or evidence of wetland vegetation), infiltration rates appropriate for clay soils should be used.

How do I model road runoff that sheet flows off the road and is dispersed with no apparent concentrated flow path?

For roads where runoff sheet flows off to the side of the road and is dispersed into adjacent pervious areas with no concentrated flow path in the vicinity, the roadway would be considered a disconnected impervious surface. Currently, SLAMM does not have the option of disconnecting a roadway, whereas rooftops and driveways can be disconnected. Therefore, an alternative method is needed to give treatment credit for such a system. If there is no concentrated flow path near the roadway and the runoff is dispersed as sheet flow across healthy vegetated areas, model this as a very broad, flat swale unless there is an option to model it as a vegetated filter strip.

Approved By:

Gordon Stevenson, Chief
Runoff Management Section

BUREAU OF WATERSHED MANAGEMENT PROGRAM GUIDANCE

RUNOFF MANAGEMENT POLICY AND MANAGEMENT TEAM
Storm Water Management Program

Wisconsin Department of Natural Resources
101 S. Webster Street, P.O. Box 7921
Madison, WI 53707-7921

Interim Municipal Phosphorus Reduction Credit for Leaf Management Programs

03-08-18
EGAD Number: 3800-2018-01

Notice: This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

APPROVED:

Pam Biersach, Director
Bureau of Watershed Management

March 8, 2018
Date

A. Introduction/Statement of Problem Being Addressed

Permitted Municipal Separate Storm Sewer Systems (MS4s) will be subject to an annual average reduction for the discharge of a pollutant of concern to a surface water that has an approved TMDL. Recent studies indicate that phosphorus loads in stormwater in the fall of the year may be reduced by frequent leaf collection followed by street cleaning. Many municipalities are currently developing plans to meet TMDL limits and wish to include fall leaf management efforts in their plans.

While additional research is needed on a broader range of conditions and management methods, sufficient data is available to determine a preliminary phosphorus reduction credit for the most common municipal land use type. This credit is limited to the specific conditions and methods for which data is available. No credit has been quantified for other land uses, tree canopies, or collection programs but it is the Department's intent to expand the applicability of the guidance to more conditions and programs as additional studies are completed. This expansion is dependent on availability of funding for further data collection and evaluation.

B. Objectives

This guidance identifies a percent phosphorus reduction credit which may be taken by municipalities as part of TMDL planning and the conditions required to take that credit.

C. Background and Definitions

Urban trees provide a host of benefits to the residents and workers within a community, such as energy savings, aesthetics, airborne pollutant reduction, noise reduction, and providing bird habitat. Trees are also an important part of the hydrologic cycle. However, without adequate management of leaf litter, they also contribute to the nutrient loading in urban stormwater. Each tree species contributes a different amount of phosphorus to the stormwater, but since a diverse set of tree species is beneficial to long-term maintenance of a healthy canopy this effect is not being addressed at this time.

While there are many sources of phosphorus in urban stormwater, a primary contributor is organic detritus, especially in areas with dense overhead tree canopy (Duan et al, 2014; Hobbie et al, 2014; and Kalinosky et al, 2014). Measurement of end-of-pipe phosphorus concentrations has demonstrated that phosphorus loads in urban stormwater vary seasonally in certain medium density residential areas, with higher concentrations coinciding with leaf accumulation on streets (Selbig, 2016). As phosphorus discharges in stormwater can vary from year to year depending on timing of rainfall events, seasonal phosphorus loads were modeled over a twenty-year period with WinSLAMM to determine the average proportion that is discharged in the fall. From this information, it is estimated that on average 43% of the annual phosphorus load is discharged in the fall.

A variety of public works programs are already in place to collect leaves from the streets and properties in the fall, but until recently, little was known about the phosphorus reduction potential of different leaf collection programs. Over the last four years, the United States Geological Survey (USGS) conducted a study to characterize reductions of total and dissolved forms of phosphorus in stormwater through a municipal leaf collection and street cleaning programs in Madison, Wisconsin, USA. Some credit for phosphorus reduction is warranted based on the information.

To estimate the efficiency of leaf collection, leaves were collected three to four times at the test site and collected only once at the end of the fall at the control site. A small vehicle was used to push the leaves from the terrace into the street and then the leaves were pushed into garbage trucks. Within 24 hours of leaf collection, remaining leaf litter in the street was collected using mechanical street cleaners. Eight end-of-pipe phosphorus concentration measurements were compared at the test and control sites during the fall of 2016. Water quality data collected indicate that the collection and transfer method resulted in a 40% reduction of total phosphorus discharge in the fall at the test site versus the control site.

D. Guidance Content

A municipality may assume the specified reduction from no controls phosphorus loads provided all of the conditions are met. Further evaluation is required to determine how leaf collection methods may reduce loading to structural best management practices (BMPs) such as ponds. Therefore, this credit may not be taken in addition to phosphorus reductions from other BMPs in the drainage area at this time.

Transfer Plus Street Cleaning Method of Leaf Collection

Municipalities may assume 17% (40% reduction due to collection efforts x 43% of annual phosphorus load occurring in fall) Total Phosphorus annual load reduction for the leaf collection effort in the Medium Density Residential No Alleys (MDRNA) land use for this option. If the credit is desired for an area containing MDRNA and other land uses, the annual load reduction must be modified by the percent of the total phosphorus load from the area that is from the MDRNA. For example, the phosphorus load from a MDRNA might represent 60% of the load from the entire area. The new annual percent reduction for the area would be 10% (17% X 60%). Municipalities may apply the leaf credit to a subset of their MDRNA area if other BMPs are providing more phosphorus reduction for the remaining area. At this time credit for leaf collection is not available for other land uses or lower-density tree canopies. The Total Phosphorus annual load reduction for this option may be assumed if the following conditions are met:

1. Medium Density (2-6 units/acre) Residential (Single-family) land use without alleys. Medium Density Residential with alleys land use may be included if the alleys receive the same level of leaf collection and street cleaning as the streets.

2. Curb and gutter with storm sewer drainage systems and light parking densities during street cleaning activities.
3. An average of one or more mature trees located between the sidewalk and the curb for every 80 linear feet of curb. Where sidewalk is not present, trees within 15 feet of the curb may be counted toward tree cover. Generally, this equates to a tree canopy over the street (pavement only) of 17% or greater. Field investigations or aerial photography may be used to document the tree cover.
4. The municipality has an ordinance prohibiting residents from placement of leaves in the street and a policy stating that residents may place leaves on the terrace in bags or piles for collection.
5. Municipal leaf collection provided at least 4 times spaced throughout the months of October and November. Leaves may be pushed, vacuumed, or manually loaded into a fully enclosed vehicle, such as a garbage truck or covered dump truck. No leaf piles are left in the street overnight.
6. Within 24 hours of leaf collection, remaining leaf litter in the street must be collected using street cleaning machines, such as a mechanical broom or vacuum assisted street cleaner. A brush attachment on a skid steer is not an acceptable equivalent.

It is anticipated that additional scenarios will be added as research is completed.

E. References

Duan, S., Delaney-Newcomb, K., Kaushal, S.S., Findlay, S.E.G., Belt, K.T., 2014. Potential effects of leaf litter on water quality in urban watersheds. Biogeochemistry 121, 61–80. http://dx.doi.org/10.1007/s10533-014-0016-9.

Hobbie, S.E., Baker, L.A., Buyarski, C., Nidzgorski, D., Finlay, J.C., 2014. Decomposition of tree leaf litter on pavement: implications for urban water quality. Urban Ecosyst. 17 (2), 369–385. http://dx.doi.org/10.1007/s11252-013-0329-9.

Kalinosky, P., Baker, L.A., Hobbie, S., Bintner, R., Buyarksi, C., 2014. User support manual: estimating nutrient removal by enhanced street sweeping. Report to the Minnesota Pollution Control Agency (available at: http://larrybakerlab.cfans.umn.edu/files/2011/07/Kalinosky-et-al.-2014.-Street-Sweeping-Guidance-Manual-final-9-24-2014.docx, (accessed April 11th, 2016)).

Selbig, W.R., 2016, Evaluation of leaf removal as a means to reduce nutrient concentrations and loads in urban stormwater, Science of the Total Environment, 571, pp. 124 – 133. http://dx.doi.org/10.1016/j.scitotenv.2016.07.003

CREATED:

Amy Minser 3/8/18

Amy Minser, Stormwater Engineer
On behalf of the Storm Water Liaison Team

Date

APPROVED:

Mary Anne Lowndes 3/9/18

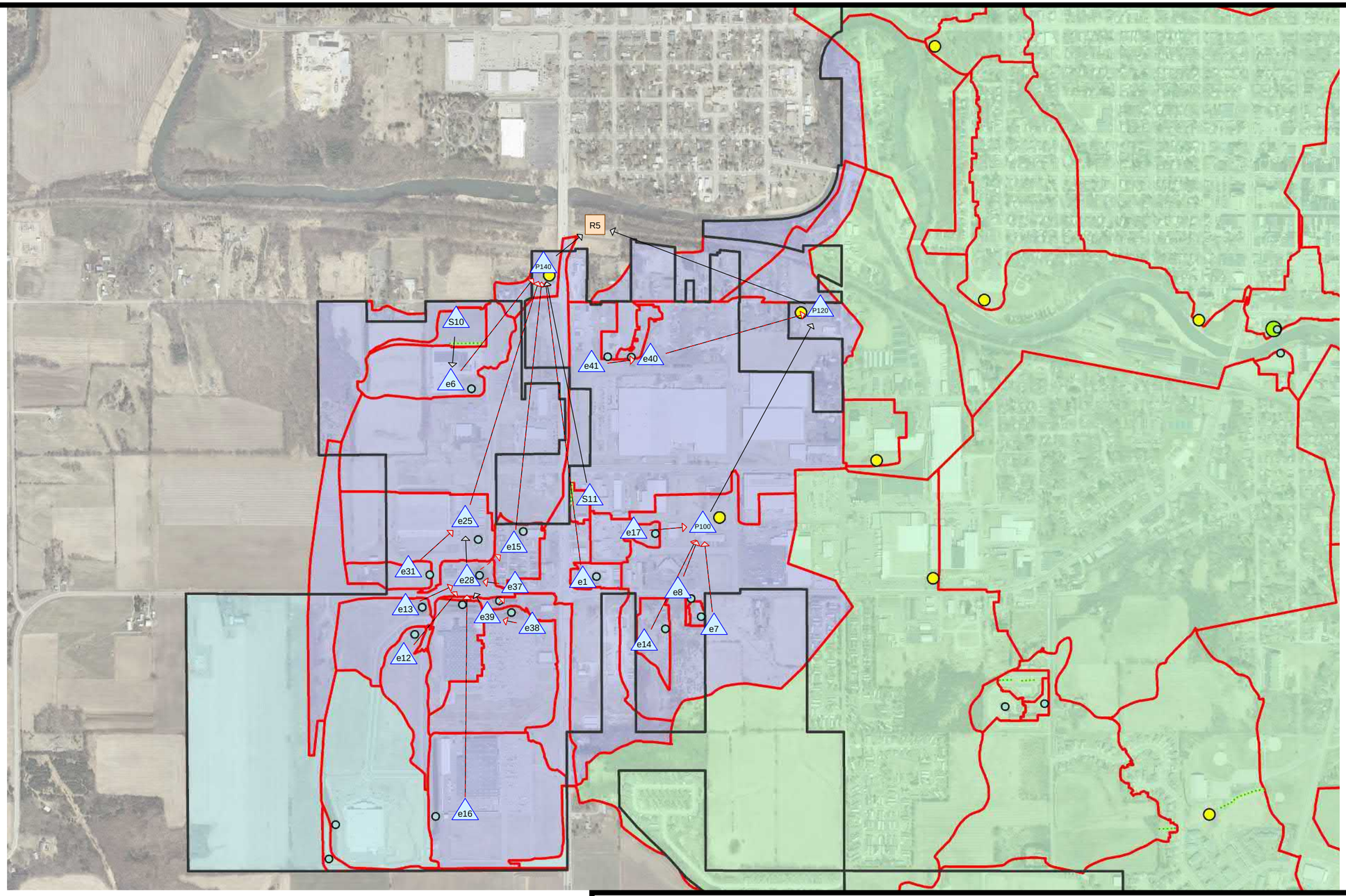
Mary Anne Lowndes, Chief
Runoff Management Section

Date

Runoff Management Policy Management Team approved on February 1, 2018.
Division Administrator approved March 6, 2018.

APPENDIX C

Existing Structural BMP Geometric Data

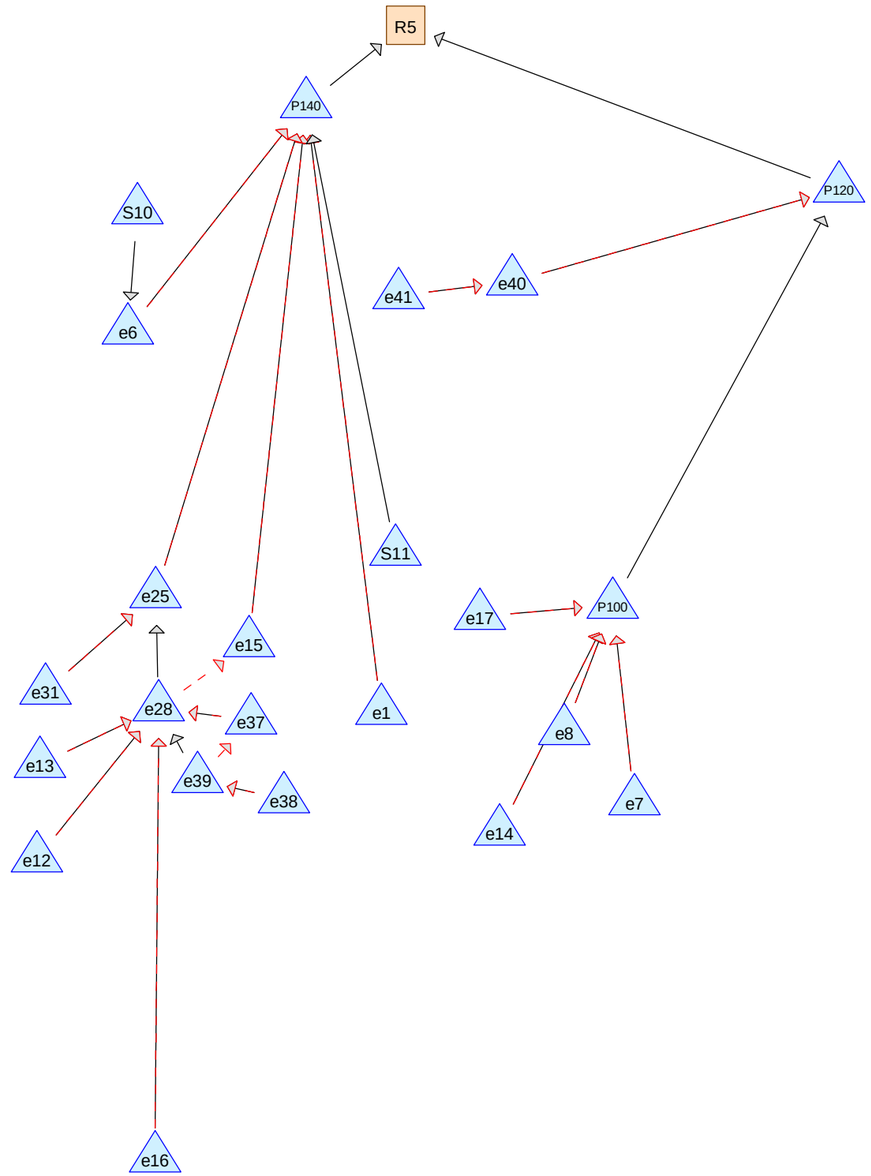


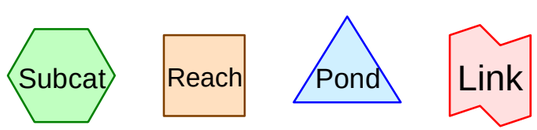
Subcat Reach Pond Link

Routing Diagram for Reach_5

Prepared by MSA Professional Services, Inc., Printed 12/2/2020

HydroCAD® 10.00-15 s/n 01114 © 2015 HydroCAD Software Solutions LLC





Routing Diagram for Reach_5

Prepared by MSA Professional Services, Inc., Printed 12/2/2020

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Summary for Pond e1:

Used WinSLAMM and HydroCAD data directly from SWMP

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 925.00' Surf.Area= 0.176 ac Storage= 0.363 af
Peak Elev= 925.00' @ 5.00 hrs Surf.Area= 0.176 ac Storage= 0.363 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	921.00'	2.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
921.00	0.050	0.000	0.000
924.00	0.100	0.225	0.225
925.00	0.176	0.138	0.363
926.00	0.203	0.190	0.553
927.00	0.230	0.216	0.769
928.00	0.258	0.244	1.013
931.00	0.400	0.987	2.000

Device	Routing	Invert	Outlet Devices
#1	Primary	925.00'	**12.0" Round Culvert** L= 274.0' Ke= 0.500 Inlet / Outlet Invert= 925.00' / 923.96' S= 0.0038 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Secondary	925.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	927.50'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	930.50'	**50.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=925.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=925.00' (Free Discharge)
├─**2=Orifice/Grate** (Controls 0.00 cfs)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e12:

Contours 954 and 956 are from LiDAR. The remaining contours are offsets of the 954 contour per the slope 10:1 slope and the 3:1 slope shown in the plans.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 951.00' Surf.Area= 9,047 sf Storage= 26,852 cf
Peak Elev= 951.00' @ 5.00 hrs Surf.Area= 9,047 sf Storage= 26,852 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	945.00'	104,119 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
945.00	2,077	0	0
950.00	5,712	19,473	19,473
951.00	9,047	7,380	26,852
954.00	16,768	38,723	65,575
956.00	21,561	38,329	103,904
956.01	21,561	216	104,119

Device	Routing	Invert	Outlet Devices
#1	Primary	950.50'	**15.0" Round Culvert** L= 78.0' Ke= 0.500 Inlet / Outlet Invert= 950.50' / 950.30' S= 0.0026 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	951.00'	**4.0" Round Culvert** L= 18.0' Ke= 0.500 Inlet / Outlet Invert= 951.00' / 943.00' S= 0.4444 '/' Cc= 0.900 n= 0.013, Flow Area= 0.09 sf
#3	Device 1	953.60'	**10.0" Round Culvert** L= 8.0' Ke= 0.500 Inlet / Outlet Invert= 953.60' / 953.60' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.55 sf
#4	Device 1	955.50'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	956.00'	**50.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=951.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 0.67 cfs potential flow)
  ├─**2=Culvert** (Controls 0.00 cfs)
  ├─**3=Culvert** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=951.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e13:

942 contour is from LiDAR. The 937 contour is from a 15 foot offset of the 942 contour per the pond bottom elevation of 937 and 3:1 side slopes called for in the plans. All contours above 942 are from LiDAR.

Outlet details are from the plans. Secondary emergency overflow was measured from LiDAR.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 943.00' Surf.Area= 7,813 sf Storage= 28,370 cf
Peak Elev= 943.00' @ 5.00 hrs Surf.Area= 7,813 sf Storage= 28,370 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	937.00'	96,789 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
937.00	2,457	0	0
942.00	6,107	21,410	21,410
944.00	9,518	15,625	37,035
946.00	15,201	24,719	61,754
948.00	19,638	34,839	96,593
948.01	19,638	196	96,789

Device	Routing	Invert	Outlet Devices
#1	Primary	943.00'	**15.0" Round Culvert** L= 42.0' Ke= 0.500 Inlet / Outlet Invert= 943.00' / 943.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	943.00'	**4.0" Round Culvert** L= 8.0' Ke= 0.500 Inlet / Outlet Invert= 943.00' / 943.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.09 sf
#3	Device 1	945.60'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	947.50'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	948.00'	**70.0' long x 5.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=943.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Culvert** (Controls 0.00 cfs)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=943.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e14:

Used WinSLAMM and HydroCAD data directly from SWMP

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[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	930.00'	0.925 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
930.00	0.090	0.000	0.000
931.00	0.098	0.094	0.094
932.00	0.143	0.120	0.214
933.00	0.168	0.155	0.370
934.00	0.220	0.194	0.564
935.00	0.242	0.231	0.795
935.50	0.278	0.130	0.925

Device	Routing	Invert	Outlet Devices
#1	Primary	930.00'	**24.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 930.00' / 929.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#2	Device 1	934.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	930.80'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Discarded	930.00'	**3.600 in/hr Exfiltration over Surface area**
#5	Secondary	935.00'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**4=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e15:

All contours are from LiDAR. Outlet details are from HydroCAD data from the SWMP.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 923.50' Surf.Area= 7,392 sf Storage= 6,330 cf
Peak Elev= 923.50' @ 5.00 hrs Surf.Area= 7,392 sf Storage= 6,330 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	922.00'	43,409 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
922.00	1,048	0	0
924.00	9,506	10,554	10,554
926.00	23,349	32,855	43,409

Device	Routing	Invert	Outlet Devices
#1	Primary	923.50'	**18.0" Round Culvert** L= 40.0' Ke= 0.500 Inlet / Outlet Invert= 923.50' / 923.00' S= 0.0125 '/' Cc= 0.900 n= 0.025, Flow Area= 1.77 sf
#2	Secondary	925.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=923.50' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=923.50' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e16:

The 982 contour is from LiDAR. The 980 contour is a 8 foot offset of the 982 contour per the plans that call for a pond bottom of 980 and 4:1 side slopes. The 984, 986 and 988 contours are from LiDAR

Upong field inspection, the outlet structure does not appear in the plans. Details for the outlet structure were estimated by scaling and looking up the Neenah casting that most closely matches what exists. The NWL elevation is based on the elevation shown by LiDAR data. Without walking into the pond and removing the beehive grate, the primary outlet pipe parameters are unknown. Assumed a 12" pipe at 0.5% slope to a nearby existing structure to the north west on Commerce Parkway as the primary structure.

Secondary over flow outlet details are from the plans.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 982.00' Surf.Area= 42,424 sf Storage= 69,701 cf
Peak Elev= 982.00' @ 5.00 hrs Surf.Area= 42,424 sf Storage= 69,701 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	980.00'	524,381 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
980.00	27,277	0	0
982.00	42,424	69,701	69,701
984.00	55,877	98,301	168,002
986.00	73,724	129,601	297,603
988.00	101,360	175,084	472,687
988.51	101,360	51,694	524,381

Device	Routing	Invert	Outlet Devices
#1	Primary	982.00'	**12.0" Round Culvert** L= 145.0' Ke= 0.500 Inlet / Outlet Invert= 982.00' / 981.25' S= 0.0052 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	982.00'	**6.0" Vert. Orifice/Grate X 6.00** C= 0.600
#3	Device 1	986.00'	**22.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	988.50'	**70.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=982.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=982.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e17:

All Contours are from LiDAR. Primary outlet structure is from field inspection. Secondary outlet structure is from LiDAR.
Dry pond. See infiltration memo for method for calculating the static infiltration rate.

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[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	902.00'	87,842 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
902.00	4,960	0	0
904.00	8,986	13,946	13,946
906.00	11,100	20,086	34,032
908.00	13,314	24,414	58,446
910.00	16,082	29,396	87,842

Device	Routing	Invert	Outlet Devices
#1	Primary	902.00'	**6.0" Round Culvert** L= 38.0' Ke= 0.500 Inlet / Outlet Invert= 902.00' / 901.00' S= 0.0263 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Secondary	909.50'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Discarded	902.00'	**0.030 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**3=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e25:

All contours are from LiDAR, except for the bottom of the pond at 922.5. The 992.5 contour is from the HydroCAD data in the SWMP. Outlet details are from the plans and HydroCAD data.

Inflow	=	0.03 cfs @	13.52 hrs,	Volume=	0.026 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 100%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 922.58' @ 20.00 hrs Surf.Area= 14,876 sf Storage= 1,134 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	922.50'	217,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
922.50	14,810	0	0
926.00	17,813	57,090	57,090
928.00	21,942	39,755	96,845
930.00	25,722	47,664	144,509
932.00	47,088	72,810	217,319

Device	Routing	Invert	Outlet Devices
#1	Primary	922.50'	**36.0" Round Culvert** L= 94.0' Ke= 0.500 Inlet / Outlet Invert= 922.50' / 921.65' S= 0.0090 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	923.00'	**15.0" Round Culvert** L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 923.00' / 922.50' S= 0.0333 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 1	928.00'	**72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	931.90'	**100.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=922.50' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 0.00 cfs potential flow)
  ├─**2=Culvert** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=922.50' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e28:

928 contour is from LiDAR. No grading plan exists for the pond. Assumed a 4 foot depth at a 2:1 slope to generate the 924 contour. The 930 contour was generated from LiDAR
Primary outlet details are from plans. Secondary outlet details are from LiDAR

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[82] Warning: Early inflow requires earlier time span

Inflow	=	0.07 cfs @	7.51 hrs,	Volume=	0.046 af
Outflow	=	0.03 cfs @	13.52 hrs,	Volume=	0.026 af, Atten= 58%, Lag= 360.1 min
Primary	=	0.03 cfs @	13.52 hrs,	Volume=	0.026 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 927.50' Surf.Area= 13,073 sf Storage= 38,767 cf
Peak Elev= 927.58' @ 13.52 hrs Surf.Area= 13,167 sf Storage= 39,845 cf (1,078 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 211.3 min (842.4 - 631.1)

Volume	Invert	Avail.Storage	Storage Description
#1	924.00'	192,736 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
924.00	9,079	0	0
928.00	13,644	45,446	45,446
932.00	60,001	147,290	192,736

Device	Routing	Invert	Outlet Devices
#1	Primary	927.50'	**36.0" Round Culvert** L= 32.0' Ke= 0.500 Inlet / Outlet Invert= 927.50' / 927.42' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Secondary	929.00'	**120.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.02 cfs @ 13.52 hrs HW=927.58' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.02 cfs @ 0.71 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=927.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e31:

Stage storage data is from SWMP WinSLAMM and HydroCAD data.
Outlet details are from plans.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.12 cfs @	5.00 hrs,	Volume=	0.153 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.12 cfs @	5.00 hrs,	Volume=	0.153 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 941.00' Surf.Area= 2,536 sf Storage= 9,112 cf
Peak Elev= 941.00' @ 5.00 hrs Surf.Area= 2,536 sf Storage= 9,112 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	936.00'	21,642 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
936.00	2,536	0.0	0	0
936.10	2,536	33.0	84	84
938.00	2,536	33.0	1,590	1,674
938.10	2,536	33.0	84	1,757
941.00	2,536	100.0	7,354	9,112
942.00	3,615	100.0	3,076	12,187
943.00	5,097	100.0	4,356	16,543
944.00	5,100	100.0	5,099	21,642

Device	Routing	Invert	Outlet Devices
#1	Primary	934.79'	**12.0" Round Culvert** L= 37.0' Ke= 0.500 Inlet / Outlet Invert= 934.79' / 934.43' S= 0.0097 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	942.50'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	942.80'	**10.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#4	Discarded	936.00'	**2.100 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.12 cfs @ 5.00 hrs HW=941.00' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=941.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 9.04 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=941.00' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e37:

928 contour is from LiDAR. The 927 is a 2 foot offset of the 928 contour per the 2:1 slope measured between the LiDAR contours. The pond bottom called for by the plans is 927. Alll of the other contours are from LiDAR.

Outlet Details are from the update plans. It should be noted the the outlet structure was modified in 2004 to have a V-shaped sharp crested weir.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 928.85' Surf.Area= 12,213 sf Storage= 20,542 cf
Peak Elev= 928.85' @ 5.00 hrs Surf.Area= 12,213 sf Storage= 20,542 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	927.00'	65,963 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
927.00	10,065	0	0
928.00	11,155	10,610	10,610
930.00	13,645	24,800	35,410
932.00	16,908	30,553	65,963

Device	Routing	Invert	Outlet Devices
#1	Primary	928.85'	**24.0" Round Culvert** L= 21.0' Ke= 0.500 Inlet / Outlet Invert= 928.85' / 927.80' S= 0.0500 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	928.85'	**60.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.53 (C= 3.16)
#3	Device 1	930.49'	**9.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	931.00'	**22.0" W x 4.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#5	Device 1	930.26'	**8.0" W x 2.0" H Vert. Orifice/Grate X 3.00** C= 0.600
#6	Device 1	931.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#7	Secondary	931.75'	**150.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=928.85' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  ├─**4=Orifice/Grate** (Controls 0.00 cfs)
  ├─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**6=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=928.85' (Free Discharge)
└─**7=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e38:

928 contour is from LiDAR. The 927 is a 2 foot offset of the 928 contour per the 2:1 slope measured between the LiDAR contours. The pond bottom called for by the plans is 927. Alll of the other contours are from LiDAR.

Outlet details are from plans, see general notes 11. Pipe connecting to the west pond acts as an equilizer pipe.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.53 cfs @	5.00 hrs,	Volume=	0.059 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.53 cfs @	5.00 hrs,	Volume=	0.059 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 929.50' Surf.Area= 6,085 sf Storage= 12,698 cf
Peak Elev= 929.50' @ 5.00 hrs Surf.Area= 6,085 sf Storage= 12,698 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	927.00'	185,407 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
927.00	4,073	0	0
928.00	4,878	4,476	4,476
932.00	8,096	25,948	30,424
934.00	10,469	18,565	48,989
936.00	13,375	23,844	72,833
938.00	16,650	30,025	102,858
940.00	20,190	36,840	139,698
942.00	25,519	45,709	185,407

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**48.0" Round Culvert** L= 255.0' Ke= 0.500 Inlet / Outlet Invert= 929.00' / 929.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf

#2 Secondary 941.50' **170.0' long x 8.0' breadth Broad-Crested Rectangular Weir**
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.53 cfs @ 5.00 hrs HW=929.50' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.53 cfs @ 0.90 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=929.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e39:

928 contour is from LiDAR. The 927 is a 2 foot offset of the 928 contour per the 2:1 slope measured between the LiDAR contours. The pond bottom called for by the plans is 927. Alll of the other contours are from LiDAR.

Outlet details are from plans. Outlet was modified in 2004.

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[82] Warning: Early inflow requires earlier time span
[81] Warning: Exceeded Pond e38 by 0.48' @ 19.95 hrs

Inflow	=	0.53 cfs @	5.00 hrs,	Volume=	0.059 af
Outflow	=	0.07 cfs @	7.51 hrs,	Volume=	0.046 af, Atten= 87%, Lag= 150.8 min
Primary	=	0.07 cfs @	7.51 hrs,	Volume=	0.046 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 929.50' Surf.Area= 11,047 sf Storage= 22,786 cf
Peak Elev= 929.62' @ 7.51 hrs Surf.Area= 11,232 sf Storage= 24,080 cf (1,294 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 182.8 min (631.1 - 448.3)

Volume	Invert	Avail.Storage	Storage Description
#1	927.00'	313,565 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
927.00	7,350	0	0
928.00	8,661	8,006	8,006
932.00	15,023	47,368	55,374
934.00	18,998	34,021	89,395
936.00	23,161	42,159	131,554
938.00	27,524	50,685	182,239
940.00	32,258	59,782	242,021
942.00	38,898	71,156	313,177
942.01	38,898	389	313,565

Device	Routing	Invert	Outlet Devices
#1	Primary	929.50'	**12.0" Round Culvert** L= 145.0' Ke= 0.500 Inlet / Outlet Invert= 929.50' / 928.33' S= 0.0081 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	929.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	937.64'	**8.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	940.65'	**6.0" W x 4.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#5	Device 1	942.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	941.00'	**15.0' long x 14.9' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.05 cfs @ 7.51 hrs HW=929.62' (Free Discharge)
└─**1=Culvert** (Barrel Controls 0.05 cfs @ 1.48 fps)
  ├─**2=Orifice/Grate** (Passes 0.05 cfs of 0.06 cfs potential flow)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  ├─**4=Orifice/Grate** (Controls 0.00 cfs)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=929.50' (Free Discharge)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e40:

900 contour generated from LiDAR. The bottom contour of 898.2 was a 5.4 foot offset of the 900 contour per the pond bottom elevation of 898.2 and side slopes 3:1 called out in the plans. The 932 contour is from LiDAR.
Outlet details are from the plans. Infiltration rate is from plans

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 898.20' @ 5.00 hrs Surf.Area= 6,170 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	898.20'	47,820 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
898.20	6,170	0	0
900.00	11,399	15,812	15,812
902.00	20,609	32,008	47,820

Device	Routing	Invert	Outlet Devices
#1	Primary	898.20'	**8.0" Round Culvert** L= 16.0' Ke= 0.500 Inlet / Outlet Invert= 898.20' / 898.00' S= 0.0125 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Device 1	899.50'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	900.00'	**24.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#4	Discarded	898.20'	**0.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=898.20' (Free Discharge)
└─**4=Exfiltration** (Passes 0.00 cfs of 0.03 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=898.20' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=898.20' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e41:

Used WinSLAMM data directly from SWMP for stage storage and outlet information.

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[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	903.00'	15,952 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
903.00	4,937	0	0
905.00	11,015	15,952	15,952

Device	Routing	Invert	Outlet Devices
#1	Discarded	903.00'	**0.200 in/hr Exfiltration over Surface area**
#2	Secondary	904.80'	**14.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Primary	904.30'	**9.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e6:

Added a stage storage elevation slightly above 941 feet because the secondary spill elevation is at the highest stage storage elevation in the SWMP. See infiltration memo for how the infiltration rate was calculated.

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[43] Hint: Has no inflow (Outflow=Zero)

Discarded =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	932.00'	149,833 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
932.00	7,690	0	0
933.00	9,370	8,530	8,530
934.00	11,170	10,270	18,800
935.00	13,100	12,135	30,935
936.00	15,160	14,130	45,065
937.00	17,345	16,253	61,318
938.00	19,610	18,478	79,795
939.00	21,990	20,800	100,595
940.00	24,455	23,223	123,818
941.00	27,035	25,745	149,563
941.01	27,035	270	149,833

Device	Routing	Invert	Outlet Devices
#1	Primary	932.00'	**12.0" Round Culvert** L= 135.0' Ke= 0.500 Inlet / Outlet Invert= 932.00' / 929.06' S= 0.0218 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	932.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	936.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	940.50'	**30.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#5	Secondary	941.00'	**400.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#6	Discarded	932.00'	**0.030 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**6=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
├─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e7:

Used WinSLAMM data directly from SWMP. SWMP WinSLAMM data references Pond 7 as Biofilter 2.
SWMP HydroCAD data references Pond 7 as 108P Bio-Filter.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.004 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	5.00 hrs,	Volume=	0.004 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 913.50' Surf.Area= 1,150 sf Storage= 1,380 cf
Peak Elev= 913.50' @ 5.00 hrs Surf.Area= 1,150 sf Storage= 1,380 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	909.50'	12,657 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
909.50	1,150	0.0	0	0
909.51	1,150	33.0	4	4
911.50	1,150	33.0	755	759
911.51	1,150	27.0	3	762
913.50	1,150	27.0	618	1,380
913.51	1,150	100.0	11	1,391
917.00	5,306	100.0	11,266	12,657

Device	Routing	Invert	Outlet Devices
#1	Primary	909.50'	**12.0" Round Culvert** L= 140.0' Ke= 0.500 Inlet / Outlet Invert= 909.50' / 908.10' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	916.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	909.50'	**0.130 in/hr Exfiltration over Surface area**
#4	Device 1	914.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Secondary	916.25'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=913.50' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=913.50' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 5.44 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=913.50' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e8:

Used WinSLAMM data directly from SWMP. SWMP WinSLAMM data references Pond 8 as Biofilter 1.
SWMP HydroCAD data references Pond 7 as 106P Bio-Filter.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.001 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	5.00 hrs,	Volume=	0.001 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 912.50' Surf.Area= 221 sf Storage= 265 cf
Peak Elev= 912.50' @ 5.00 hrs Surf.Area= 221 sf Storage= 265 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	908.50'	6,057 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
908.50	221	0.0	0	0
908.51	221	33.0	1	1
910.50	221	33.0	145	146
910.51	221	27.0	1	146
912.50	221	27.0	119	265
912.51	221	100.0	2	267
913.50	967	100.0	588	855
914.50	2,110	100.0	1,539	2,394
915.50	3,432	100.0	2,771	5,165
915.76	3,432	100.0	892	6,057

Device	Routing	Invert	Outlet Devices
#1	Primary	908.50'	**12.0" Round Culvert** L= 90.0' Ke= 0.500 Inlet / Outlet Invert= 908.50' / 907.60' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	915.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	908.50'	**0.130 in/hr Exfiltration over Surface area**
#4	Device 1	913.50'	**4.0" Vert. Orifice/Grate** C= 0.600
#5	Secondary	915.75'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=912.50' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=912.50' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 5.98 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=912.50' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P100:

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond P120:

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af	
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond P140:

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af	
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond S10:

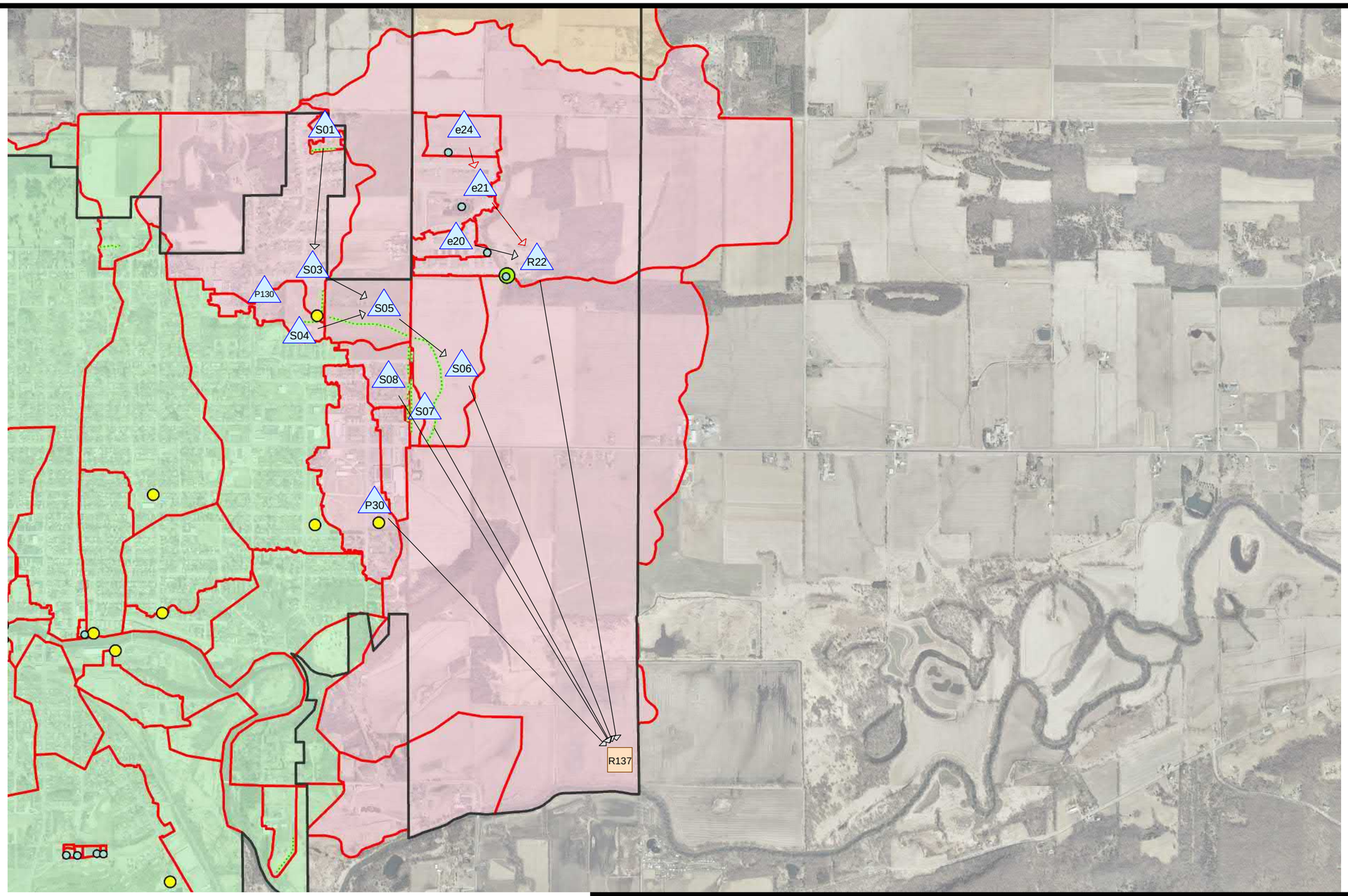
[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S11:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)



Subcat Reach Pond Link

Routing Diagram for Reach_137

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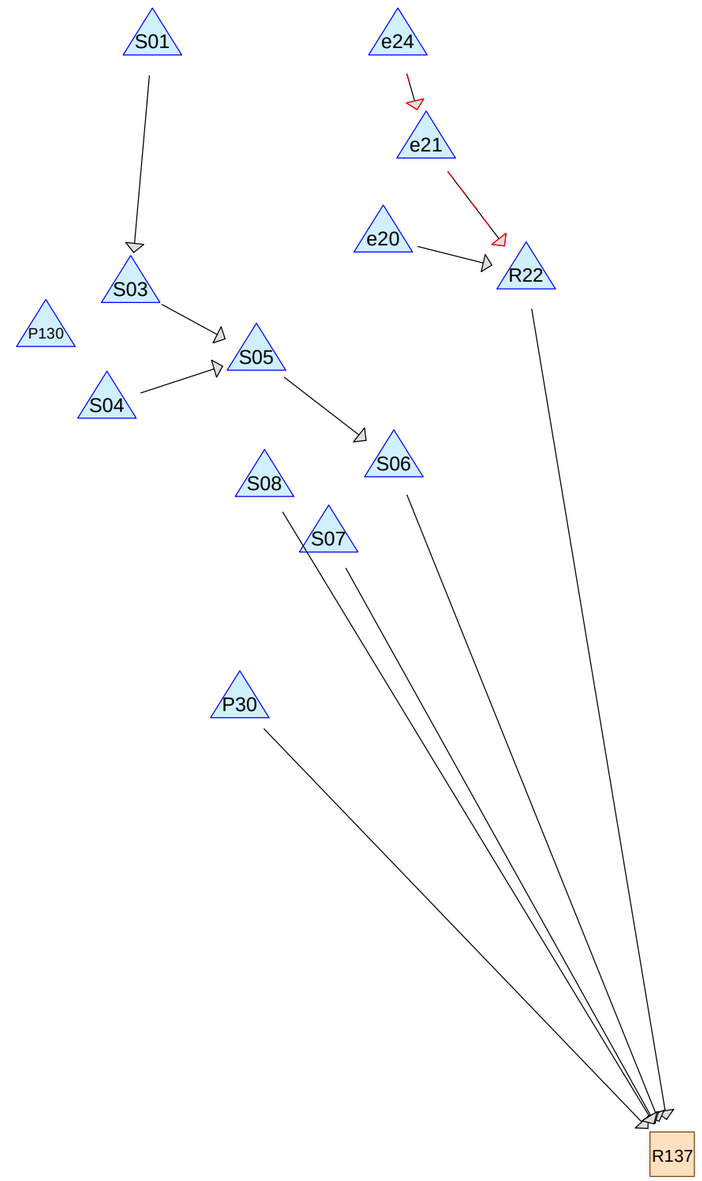

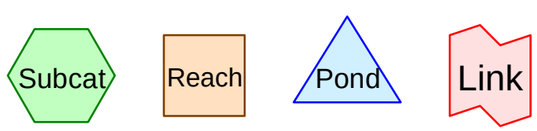

Routing Diagram for Reach_137

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Summary for Pond e20:

Contours are from LiDAR.
Outlet info is from the plans.
See infiltration memo for method for calculating the static infiltration rate.

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[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	916.00'	18,329 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
916.00	2,226	0	0
918.00	4,621	6,847	6,847
920.00	6,861	11,482	18,329

Device	Routing	Invert	Outlet Devices
#1	Primary	918.00'	**25.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32
#2	Discarded	916.00'	**0.040 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e21:

The 932 contour was generated from LiDAR. The 927 contour is a 10 foot offset of the 932 contour per the plans that call for a pond bottom of 927 with side slopes of 2:1. All contours above 932 from from LiDAR.

According to plans, this pond has no outlet.
According to the SWMP, "the primary source of infiltration at the site will be the existing pond. There is no discharge from this pond aside from a relief provided for emergency overflow. This is uncommon and would be the result of the pond at an elevated level and a large 100 year event occurring."
See infiltration memo for method for calculating the static infiltration rate.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 927.00' @ 5.00 hrs Surf.Area= 33,774 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	927.00'	1,212,456 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
927.00	33,774	0	0
932.00	44,709	196,208	196,208
934.00	53,104	97,813	294,021
936.00	61,317	114,421	408,442
938.00	69,611	130,928	539,370
940.00	77,881	147,492	686,862
942.00	86,519	164,400	851,262
944.00	97,897	184,416	1,035,678
945.00	126,564	112,231	1,147,908
945.51	126,564	64,548	1,212,456

Device	Routing	Invert	Outlet Devices
#1	Primary	939.20'	**36.0" Round Culvert** L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 938.60' / 939.20' S= -0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Secondary	945.50'	**130.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Discarded	927.00'	**0.040 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=927.00' (Free Discharge)
└─**3=Exfiltration** (Passes 0.00 cfs of 0.03 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=927.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=927.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e24:

Storage and Outlet Data from WinSLAMM Data provided by the SWMP. BMP has 1.5 feet of engineered soils and 1 foot of rock fill.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Starting Elev= 2.50' Surf.Area= 0 sf Storage= 0 cf
Peak Elev= 957.00' @ 5.00 hrs Surf.Area= 4,445 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	957.00'	28,764 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
957.00	4,445	0.0	0	0
959.50	4,445	30.0	3,334	3,334
963.50	8,270	100.0	25,430	28,764

Device	Routing	Invert	Outlet Devices
#1	Secondary	963.00'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	957.00'	**12.0" Round Culvert** L= 70.0' Ke= 0.500 Inlet / Outlet Invert= 957.00' / 956.80' S= 0.0029 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	960.50'	**36.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	957.00'	**6.0" Round Drain Tile** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 957.00' / 957.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=957.00' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Drain Tile** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=957.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P130:

Proposed wet pond P130 would replace swales S04 and S03

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[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond P30:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond R22:

Stage-storage data from SWMP.
SWMP says that the outlet structure "incorporates numerours gabion structures with no direct discharges."
Broadcrested weir data is from section X-X in the plans.
See infiltration memo for method for calculating the static infiltration rate.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 904.00' @ 5.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	904.00'	67,121 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
904.00	0	0	0
905.00	4,900	2,450	2,450
906.00	6,400	5,650	8,100
908.00	8,100	14,500	22,600
910.00	12,100	20,200	42,800
912.01	12,100	24,321	67,121

Device	Routing	Invert	Outlet Devices
#1	Primary	912.00'	**75.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	904.00'	**0.040 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=904.00' (Free Discharge)
└─**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=904.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond S01:

See infiltration memo for method to calculate the static infiltration rate. 0.02 in/hr dynamic infiltration rate

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S03:

See infiltration memo for method to calculate the static infiltration rate. 0.02 in/hr dynamic infiltration rate

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[40] Hint: Not Described (Outflow=Inflow)

Routing by Stor-Ind method

Summary for Pond S04:

See infiltration memo for method to calculate the static infiltration rate. 0.02 in/hr dynamic infiltration rate

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[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S05:

See infiltration memo for method to calculate the static infiltration rate. 0.02 in/hr dynamic infiltration rate

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[40] Hint: Not Described (Outflow=Inflow)

Routing by Stor-Ind method

Summary for Pond S06:

See infiltration memo for method to calculate the static infiltration rate. 0.02 in/hr dynamic infiltration rate

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[40] Hint: Not Described (Outflow=Inflow)

Routing by Stor-Ind method

Summary for Pond S07:

See infiltration memo for method to calculate the static infiltration rate. 0.02 in/hr dynamic infiltration rate

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[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S08:

See infiltration memo for method to calculate the static infiltration rate. 0.02 in/hr dynamic infiltration rate

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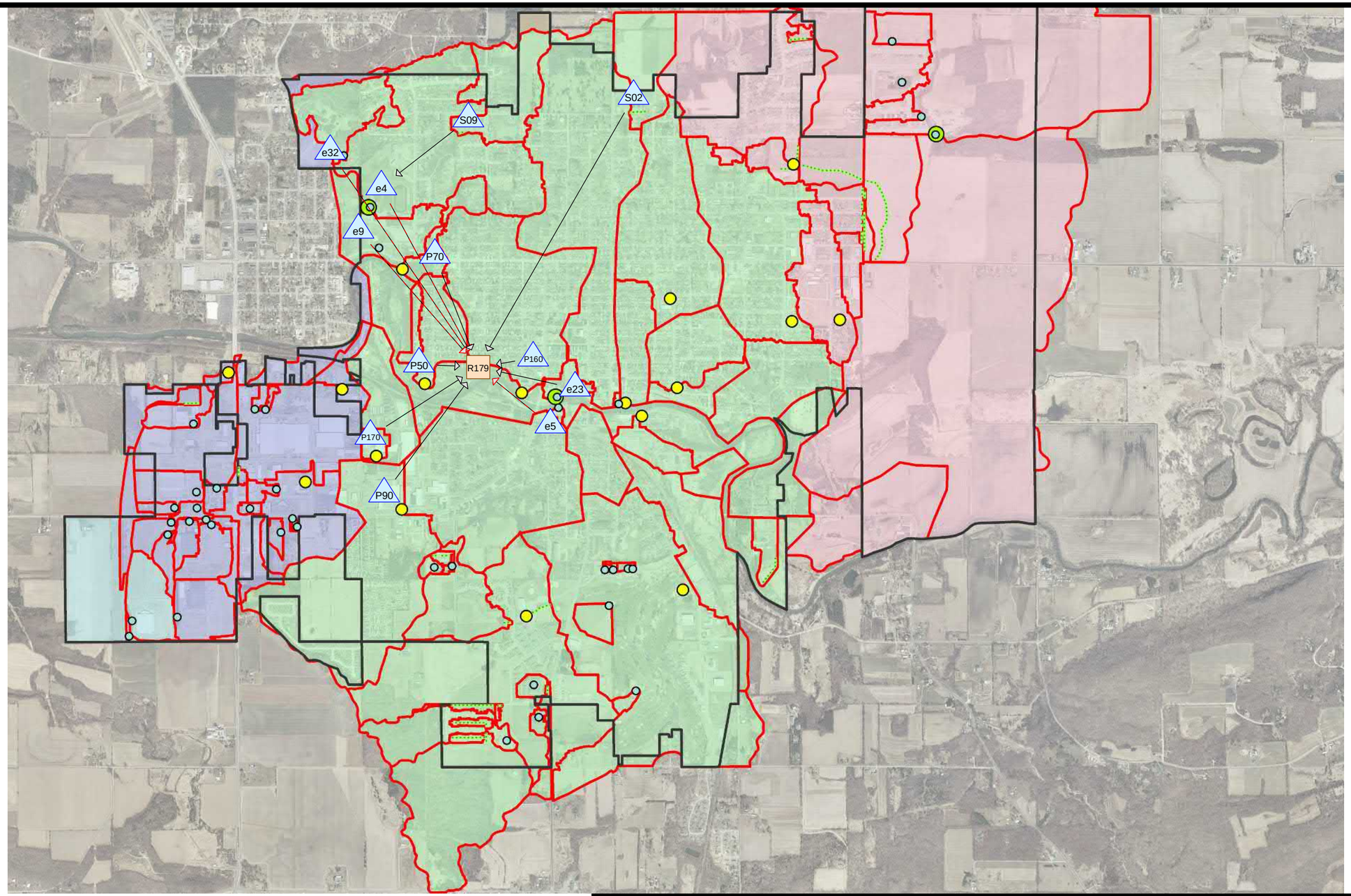
[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)



Subcat Reach Pond Link

Routing Diagram for Reach_179_Model_1of3_North

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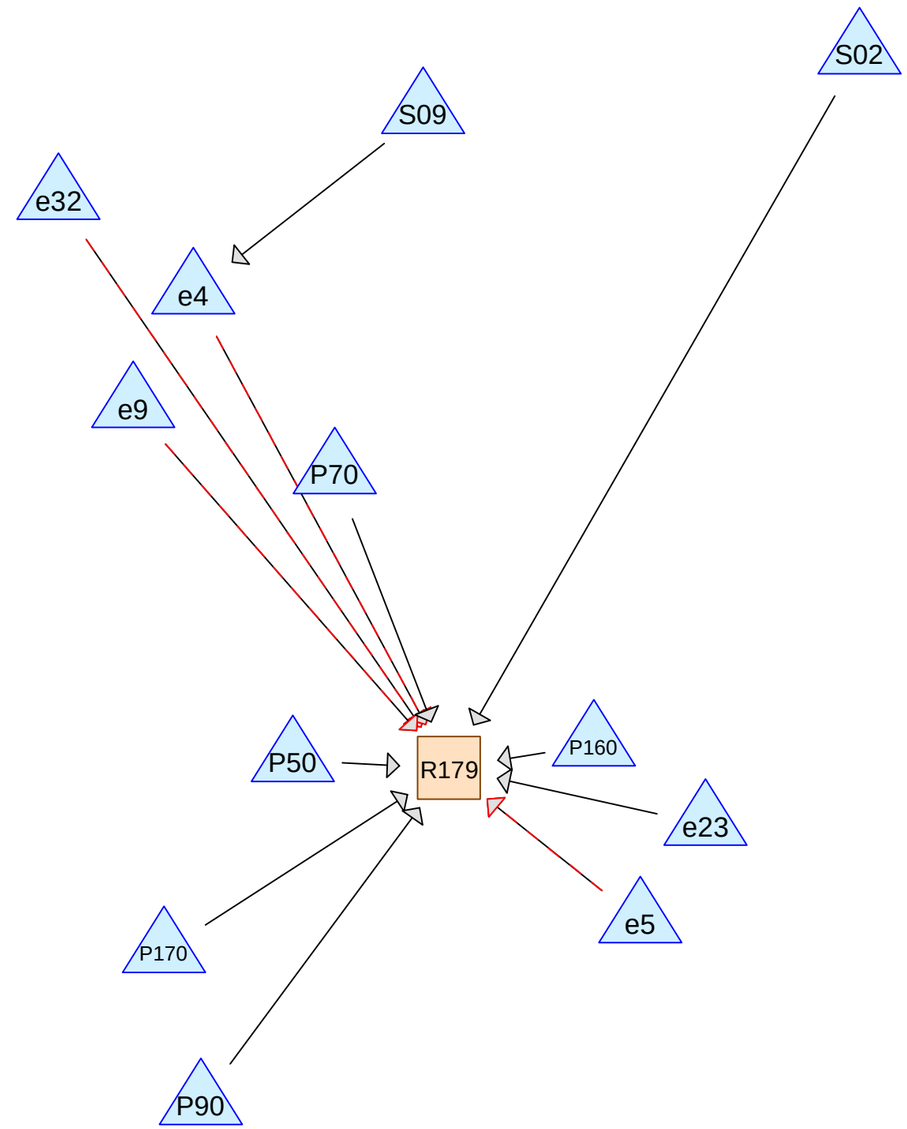

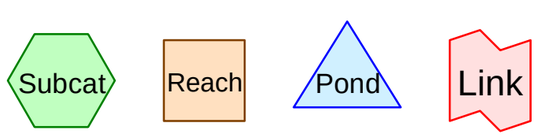

Routing Diagram for Reach_179_Model_1of3_North

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Summary for Pond e23:

Stage storage areas and outlet details are from LiDAR. No other outlet structure exists other than the spillway based on field inspection. BMP construction plans are not available.
See infiltration memo for method to calculate the static infiltration rate.

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[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	828.00'	33,539 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
828.00	703	0	0
830.00	6,804	7,507	7,507
832.00	19,228	26,032	33,539

Device	Routing	Invert	Outlet Devices
#1	Primary	828.30'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	828.00'	**6.610 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e32:

Contours are from LIDAR. Emergency overflow details are from LiDAR. Cuvlert Pipe details are from field observations. Pond was wet upon field observation and appears wet in aerial imagery. Assumed a pond depth of 2 foot.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 922.00' Surf.Area= 10,063 sf Storage= 17,244 cf
Peak Elev= 922.00' @ 5.00 hrs Surf.Area= 10,063 sf Storage= 17,244 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	920.00'	76,997 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
920.00	7,181	0	0
922.00	10,063	17,244	17,244
924.00	14,967	25,030	42,274
926.00	19,756	34,723	76,997

Device	Routing	Invert	Outlet Devices
#1	Secondary	923.40'	**50.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	923.00'	**12.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 923.00' / 922.00' S= 0.0500 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=922.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=922.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e4:

Contours are from LiDAR
See infiltration memo for method to calculate the static infiltration rate.

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[43] Hint: Has no inflow (Outflow=Zero)

Discarded =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	874.00'	206,884 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
874.00	15,191	0	0
876.00	21,274	36,465	36,465
878.00	25,996	47,270	83,735
880.00	30,659	56,655	140,390
882.00	35,835	66,494	206,884

Device	Routing	Invert	Outlet Devices
#1	Primary	873.90'	**48.0" Round Culvert** L= 101.0' Ke= 0.500 Inlet / Outlet Invert= 873.90' / 873.40' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	874.00'	**18.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 874.00' / 873.90' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Device 1	879.00'	**84.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	880.50'	**75.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#5	Discarded	874.00'	**0.240 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**5=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Culvert** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e5:

Biofilter Data From SWMP WinSLAMM and HydroCAD data.

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[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	831.50'	7,071 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.50	925	0.0	0	0
831.51	925	33.0	3	3
832.50	925	33.0	302	305
832.51	925	27.0	2	308
835.00	925	27.0	622	930
835.01	925	100.0	9	939
837.50	4,000	100.0	6,132	7,071

Device	Routing	Invert	Outlet Devices
#1	Primary	832.50'	**12.0" Round Culvert** L= 40.0' Ke= 0.500 Inlet / Outlet Invert= 832.50' / 832.00' S= 0.0125 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	832.55'	**6.0" Round Culvert** L= 40.0' Ke= 0.500 Inlet / Outlet Invert= 832.55' / 832.55' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#3	Device 1	835.75'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	831.50'	**0.130 in/hr Exfiltration over Surface area**
#5	Secondary	837.45'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**4=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Culvert** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e9:

Stage storage and outlet data are from the SWMP WinSLAMM and HydroCAD data.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.05 cfs @	5.00 hrs,	Volume=	0.054 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.05 cfs @	5.00 hrs,	Volume=	0.054 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 865.90' Surf.Area= 1,350 sf Storage= 2,349 cf
Peak Elev= 865.90' @ 5.00 hrs Surf.Area= 1,350 sf Storage= 2,349 cf

Plug-Flow detention time= (not calculated: no plugs found)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	859.90'	12,075 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
859.90	1,350	0.0	0	0
859.91	1,350	33.0	4	4
861.90	1,350	33.0	887	891
861.91	1,350	27.0	4	895
865.90	1,350	27.0	1,454	2,349
865.91	1,350	100.0	13	2,362
866.00	1,770	100.0	140	2,503
869.50	3,700	100.0	9,573	12,075

Device	Routing	Invert	Outlet Devices
#1	Primary	865.36'	**12.0" Round Culvert** L= 36.5' Ke= 0.500 Inlet / Outlet Invert= 865.36' / 865.20' S= 0.0044 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	866.50'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	867.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	867.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	868.75'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Discarded	859.90'	**1.630 in/hr Exfiltration over Surface area**
#7	Secondary	868.90'	**0.5' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.05 cfs @ 5.00 hrs HW=865.90' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=865.90' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 0.76 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  ├─**4=Orifice/Grate** (Controls 0.00 cfs)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=865.90' (Free Discharge)
└─**7=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P160:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond P170:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond P50:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond P70:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond P90:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S02:

See infiltration memo for method to calculate the static infiltration rate. 0.12 in/hr dynamic infiltration rate

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[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S09:

See infiltration memo for method to calculate the static infiltration rate. 0.12 in/hr dynamic infiltration rate

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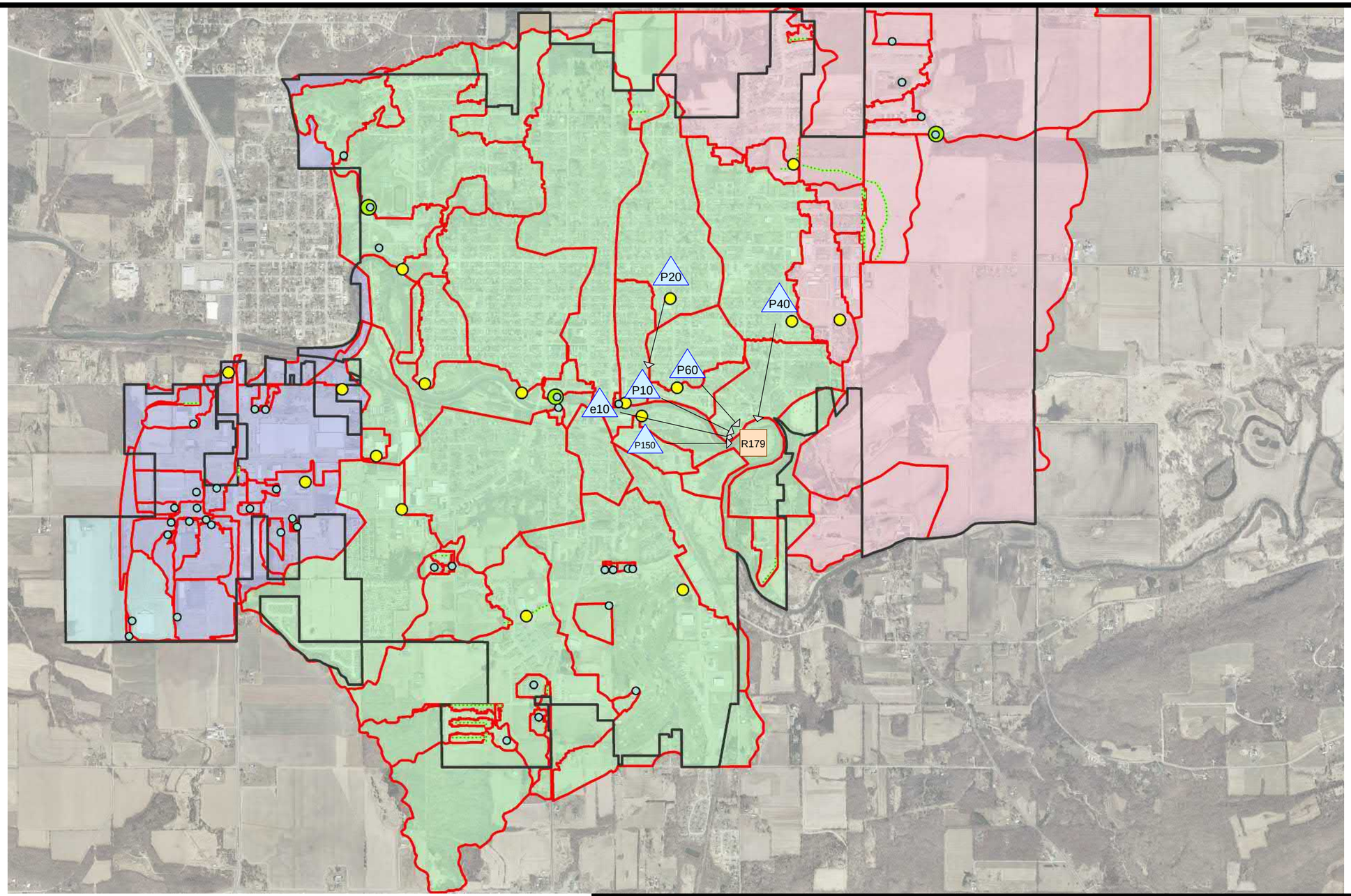
[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)



Subcat Reach Pond Link

Routing Diagram for Reach_179_Model_2of3_Central

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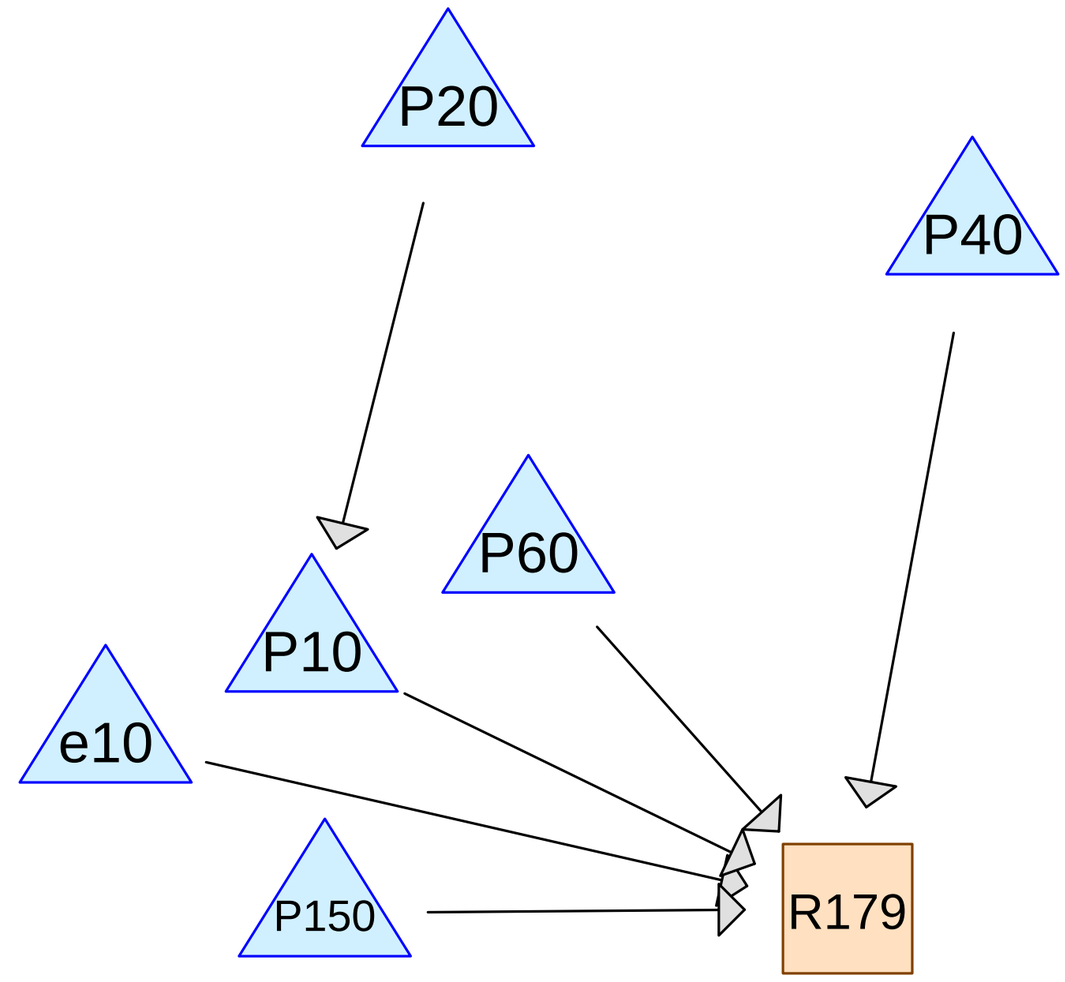

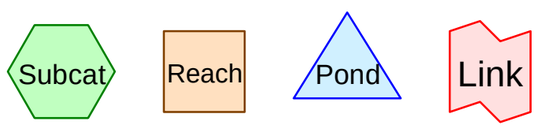

Routing Diagram for Reach_179_Model_2of3_Central
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Summary for Pond e10:

WinSLAMM data from SWMP

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.003 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	5.00 hrs,	Volume=	0.003 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 825.50' Surf.Area= 881 sf Storage= 859 cf
Peak Elev= 825.50' @ 5.00 hrs Surf.Area= 881 sf Storage= 859 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	822.00'	3,996 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
822.00	881	0.0	0	0
822.01	881	33.0	3	3
822.50	881	33.0	142	145
822.51	881	27.0	2	148
825.50	881	27.0	711	859
825.51	881	100.0	9	868
828.00	1,632	100.0	3,129	3,996

Device	Routing	Invert	Outlet Devices
#1	Primary	827.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	822.00'	**0.130 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=825.50' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=825.50' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P10:

[40] Hint: Not Described (Outflow=Inflow)

Routing by Stor-Ind method

Summary for Pond P150:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond P20:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond P40:

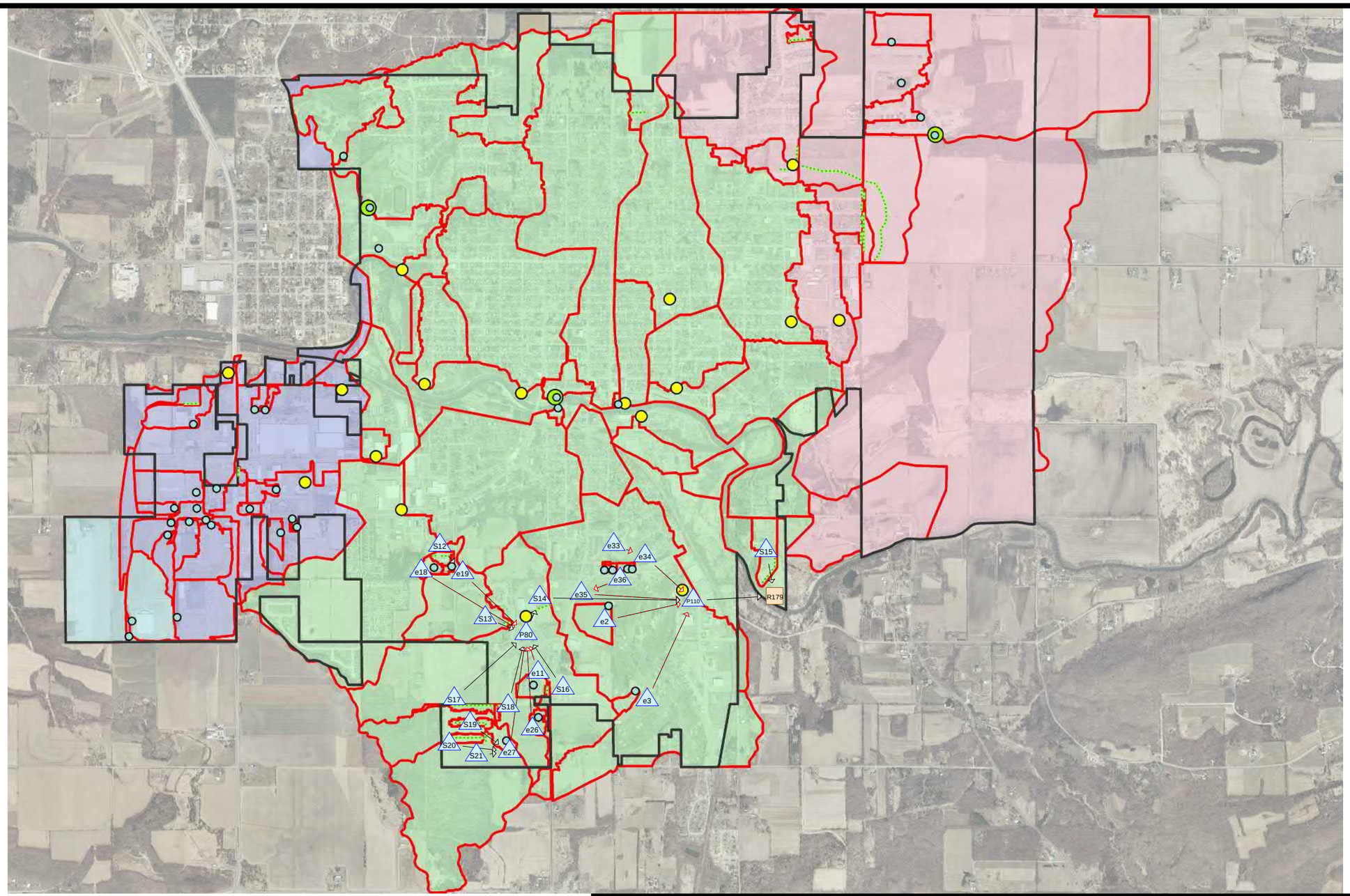
[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond P60:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)



Subcat Reach Pond Link

Routing Diagram for Reach_179_Model_3of3_South

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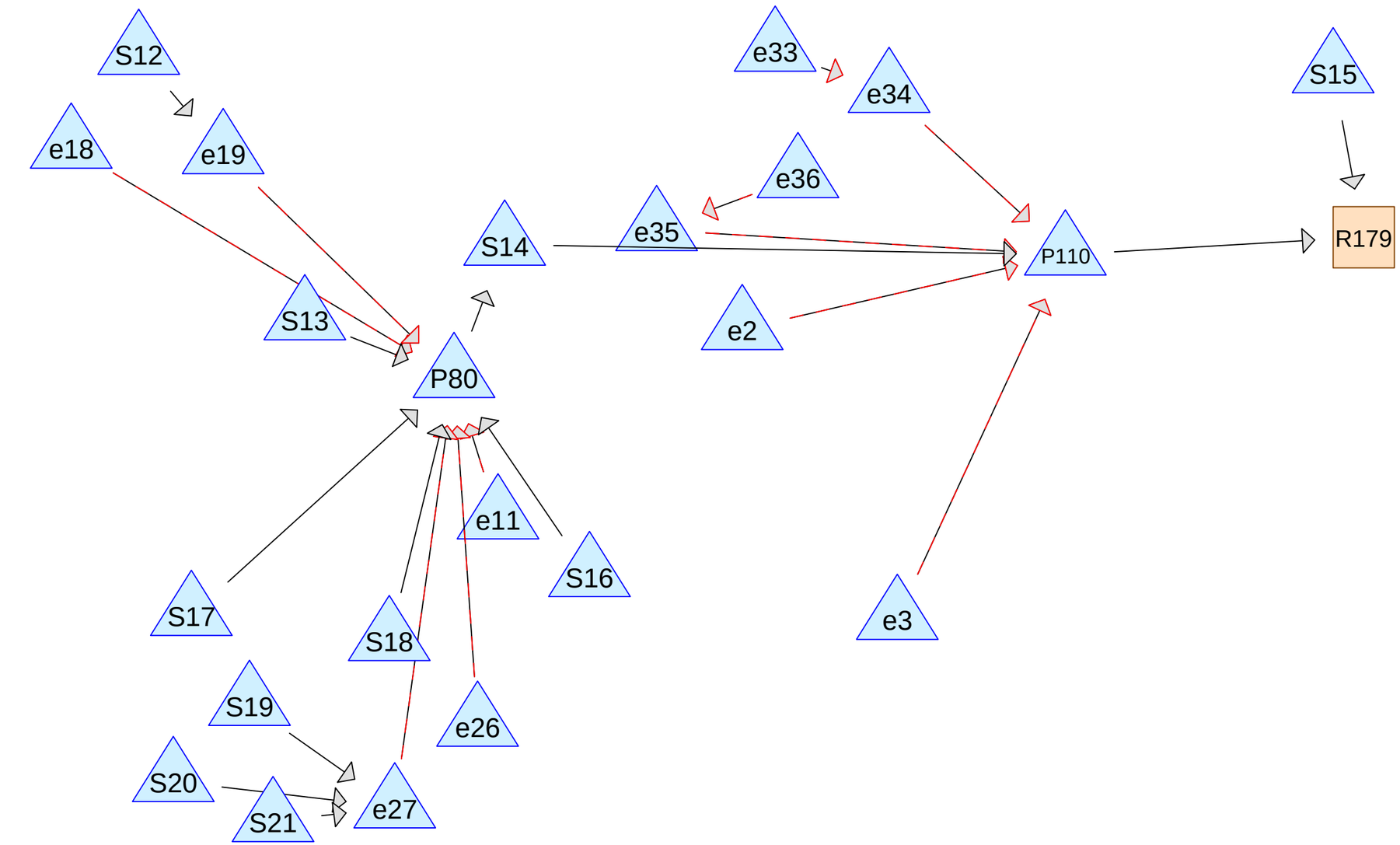

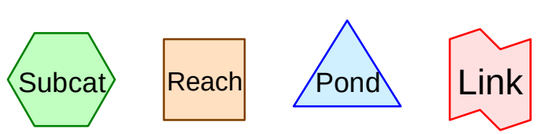

Routing Diagram for Reach_179_Model_3of3_South

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Summary for Pond e11:

Outlet details from SWMP. Emergency over flow is from LiDAR. Contours in plan do not match what was built 874 to 870 contours are from LIDAR. The 857 contour is a 4:1 offset of the 870 contour per the plans.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 868.00' Surf.Area= 23,804 sf Storage= 144,428 cf
Peak Elev= 868.00' @ 5.00 hrs Surf.Area= 23,804 sf Storage= 144,428 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	857.00'	341,508 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
857.00	2,456	0	0
870.00	27,685	195,917	195,917
872.00	32,101	59,786	255,703
874.00	38,088	70,189	325,892
874.41	38,088	15,616	341,508

Device	Routing	Invert	Outlet Devices
#1	Primary	869.36'	**30.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.61 (C= 3.26)
#2	Secondary	874.40'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=868.00' (Free Discharge)
└**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=868.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e18:

WinSLAMM data from SWMP

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	22.70 cfs @	5.00 hrs,	Volume=	0.615 af, Atten= 0%, Lag= 0.0 min
Primary	=	22.70 cfs @	5.00 hrs,	Volume=	0.615 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Starting Elev= 947.75' Surf.Area= 0.216 ac Storage= 0.818 af
Peak Elev= 947.75' @ 5.00 hrs Surf.Area= 0.216 ac Storage= 0.818 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	942.00'	2.508 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
942.00	0.084	0.000	0.000
943.00	0.102	0.093	0.093
946.00	0.164	0.399	0.492
947.00	0.187	0.176	0.667
952.00	0.378	1.412	2.080
953.00	0.478	0.428	2.508

Device	Routing	Invert	Outlet Devices
#1	Primary	942.75'	**1.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	943.75'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	945.55'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	951.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=22.70 cfs @ 5.00 hrs HW=947.75' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.06 cfs @ 10.72 fps)
└─**2=Orifice/Grate** (Orifice Controls 0.21 cfs @ 9.53 fps)
└─**3=Orifice/Grate** (Orifice Controls 22.44 cfs @ 7.14 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=947.75' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e19:

Data from SWMP. Emergency Over Flow details are from LiDAR

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[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	932.00'	21,296 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
932.00	0	0	0
933.00	166	83	83
934.00	324	245	328
935.00	515	420	748
936.00	749	632	1,380
937.00	1,024	887	2,266
938.00	2,475	1,750	4,016
939.00	3,386	2,931	6,946
940.00	4,424	3,905	10,851
941.00	5,336	4,880	15,731
942.00	5,794	5,565	21,296

Device	Routing	Invert	Outlet Devices
#1	Primary	938.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	940.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	940.60'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Orifice/Grate** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e2:

WinSLAMM data from SWMP

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 847.25' Surf.Area= 0.306 ac Storage= 1.248 af
Peak Elev= 847.25' @ 5.00 hrs Surf.Area= 0.306 ac Storage= 1.248 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	840.00'	2.258 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
840.00	0.097	0.000	0.000
841.00	0.112	0.105	0.105
842.00	0.128	0.120	0.225
843.00	0.144	0.136	0.361
844.00	0.161	0.152	0.513
845.00	0.178	0.169	0.682
846.00	0.254	0.216	0.898
847.00	0.295	0.275	1.173
848.00	0.338	0.317	1.489
849.00	0.384	0.361	1.850
850.00	0.432	0.408	2.258

Device	Routing	Invert	Outlet Devices
#1	Primary	847.25'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	847.50'	**2.7' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#3	Primary	849.25'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	849.50'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=847.25' (Free Discharge)
- **1=Orifice/Grate** (Controls 0.00 cfs)
- **2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=847.25' (Free Discharge)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e26:

Stage-storage areas above 887 are from the SWMP. Contours below 887 are digitized fromt he plans.
Outlet details are from the SWMP

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 887.00' Surf.Area= 0.102 ac Storage= 0.173 af
Peak Elev= 887.00' @ 5.00 hrs Surf.Area= 0.102 ac Storage= 0.173 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	882.00'	1.077 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
882.00	0.002	0.000	0.000
886.40	0.055	0.125	0.125
887.00	0.102	0.047	0.173
888.00	0.136	0.119	0.292
889.00	0.172	0.154	0.446
890.00	0.302	0.237	0.683
891.00	0.486	0.394	1.077

Device	Routing	Invert	Outlet Devices
#1	Primary	887.00'	**12.0" Round Culvert** L= 170.0' Ke= 0.500 Inlet / Outlet Invert= 887.00' / 885.00' S= 0.0118 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	890.00'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=887.00' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=887.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e27:

880 contour is from LiDAR. The 876 contour is a 12 foot offset of the 880 contour per the 3:1 slope and pond bottom of 876 called for in the plans. All contours above 880 are from LiDAR.
See infiltration memo for method to calculate the static infiltration rate.

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[43] Hint: Has no inflow (Outflow=Zero)

Discarded =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	876.00'	487,446 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
876.00	56,485	0	0
880.00	56,485	225,940	225,940
882.00	65,622	122,107	348,047
884.00	73,777	139,399	487,446

Device	Routing	Invert	Outlet Devices
#1	Primary	876.50'	**18.0" Round Culvert X 3.00** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 876.50' / 876.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	876.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	879.38'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	879.75'	**50.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#5	Discarded	876.00'	**0.030 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**5=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e3:

904 contour is from LiDAR. The 905 contour is an offset of the 904 contour by 4 feet per the 4:1 slope called for in the plans. The 906 contour is from LiDAR. The 907 contour is an offset of the 906 contour by 4 feet per the 4:1 slope called for in the plans. The 908 contour is from LiDAR. Outlet details are from plans.

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	904.00'	58,270 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
904.00	7,002	0	0
905.00	8,339	7,671	7,671
906.00	16,128	12,234	19,904
907.00	18,437	17,283	37,187
908.00	23,730	21,084	58,270

Device	Routing	Invert	Outlet Devices
#1	Primary	904.00'	**12.0" Round Culvert** L= 105.0' Ke= 0.500 Inlet / Outlet Invert= 904.00' / 902.50' S= 0.0143 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	904.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	904.75'	**1.0' long x 0.75' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	905.50'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	905.80'	**14.0' long x 41.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#6	Discarded	904.00'	**2.010 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**6=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  ├─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e33:

WinSLAMM data from SWMP
Appears as Pond C in SWMP.

Inflow	=	0.00 cfs @	5.00 hrs, Volume=	0.000 af	
Outflow	=	0.03 cfs @	5.00 hrs, Volume=	0.002 af,	Atten= 0%, Lag= 0.0 min
Discarded	=	0.03 cfs @	5.00 hrs, Volume=	0.002 af	
Primary	=	0.00 cfs @	5.00 hrs, Volume=	0.000 af	
Secondary	=	0.00 cfs @	5.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 100.00' Surf.Area= 380 sf Storage= 95 cf
Peak Elev= 100.00' @ 5.00 hrs Surf.Area= 380 sf Storage= 95 cf

Plug-Flow detention time= (not calculated: no plugs found)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	99.75'	3,500 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	380	0	0
100.00	380	95	95
101.00	880	630	725
102.00	1,390	1,135	1,860
103.00	1,890	1,640	3,500

Device	Routing	Invert	Outlet Devices
#1	Primary	99.75'	**12.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 99.75' / 99.60' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	100.00'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	102.25'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	99.75'	**3.600 in/hr Exfiltration over Surface area**
#5	Secondary	102.50'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.03 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 0.18 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e34:

WinSLAMM data from SWMP
Appears as Pond D in SWMP.

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[79] Warning: Submerged Pond e33 Primary device # 1 INLET by 0.25'

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.03 cfs @	5.00 hrs,	Volume=	0.002 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.03 cfs @	5.00 hrs,	Volume=	0.002 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Starting Elev= 100.00' Surf.Area= 380 sf Storage= 95 cf
Peak Elev= 100.00' @ 5.00 hrs Surf.Area= 380 sf Storage= 95 cf

Plug-Flow detention time= (not calculated: no plugs found)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	99.75'	3,496 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	380	0	0
100.00	380	95	95
101.00	880	630	725
102.00	1,386	1,133	1,858
103.00	1,890	1,638	3,496

Device	Routing	Invert	Outlet Devices
#1	Primary	99.75'	**12.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 99.75' / 99.60' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	100.00'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	102.25'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	99.75'	**3.600 in/hr Exfiltration over Surface area**
#5	Secondary	102.50'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.03 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 0.18 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e35:

WinSLAMM data from SWMP
Appears as Pond E in SWMP.

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[79] Warning: Submerged Pond e36 Primary device # 1 OUTLET by 0.15'

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 100.00' @ 5.00 hrs Surf.Area= 300 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	4,454 cf	**5.00'W x 60.00'L x 3.25'H Prismatoid Z=4.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**12.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 100.00' / 99.85' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	100.25'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	102.50'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	100.00'	**3.600 in/hr Exfiltration over Surface area**
#5	Secondary	102.50'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**4=Exfiltration** (Passes 0.00 cfs of 0.02 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=100.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e36:

WinSLAMM data from SWMP
Appears as Pond F in SWMP.

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[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	4,454 cf	**5.00'W x 60.00'L x 3.25'H Prismatoid Z=4.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**12.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 100.00' / 99.85' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	100.25'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	102.50'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	100.00'	**3.600 in/hr Exfiltration over Surface area**
#5	Secondary	102.50'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**4=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P110:

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	22.70 cfs @	5.00 hrs, Volume=	0.615 af	
Primary	=	22.70 cfs @	5.00 hrs, Volume=	0.615 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond P80:

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	22.70 cfs @	5.00 hrs, Volume=	0.615 af	
Primary	=	22.70 cfs @	5.00 hrs, Volume=	0.615 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond S12:

See infiltration memo for method to calculate the static infiltration rate. 1.05 in/hr dynamic infiltration rate

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[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S13:

See infiltration memo for method to calculate the static infiltration rate. 1.05 in/hr dynamic infiltration rate

---

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S14:

See infiltration memo for method to calculate the static infiltration rate. 1.05 in/hr dynamic infiltration rate

---

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	22.70 cfs @	5.00 hrs, Volume=	0.615 af	
Primary	=	22.70 cfs @	5.00 hrs, Volume=	0.615 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond S15:

See infiltration memo for method to calculate the static infiltration rate. 0.015 in/hr dynamic infiltration rate

---

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S16:

See infiltration memo for method to calculate the static infiltration rate. 0.015 in/hr dynamic infiltration rate

---

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S17:

See infiltration memo for method to calculate the static infiltration rate. 0.015 in/hr dynamic infiltration rate

---

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S18:

See infiltration memo for method to calculate the static infiltration rate. 0.015 in/hr dynamic infiltration rate

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[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S19:

See infiltration memo for method to calculate the static infiltration rate. 0.015 in/hr dynamic infiltration rate

---

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S20:

See infiltration memo for method to calculate the static infiltration rate. 0.015 in/hr dynamic infiltration rate

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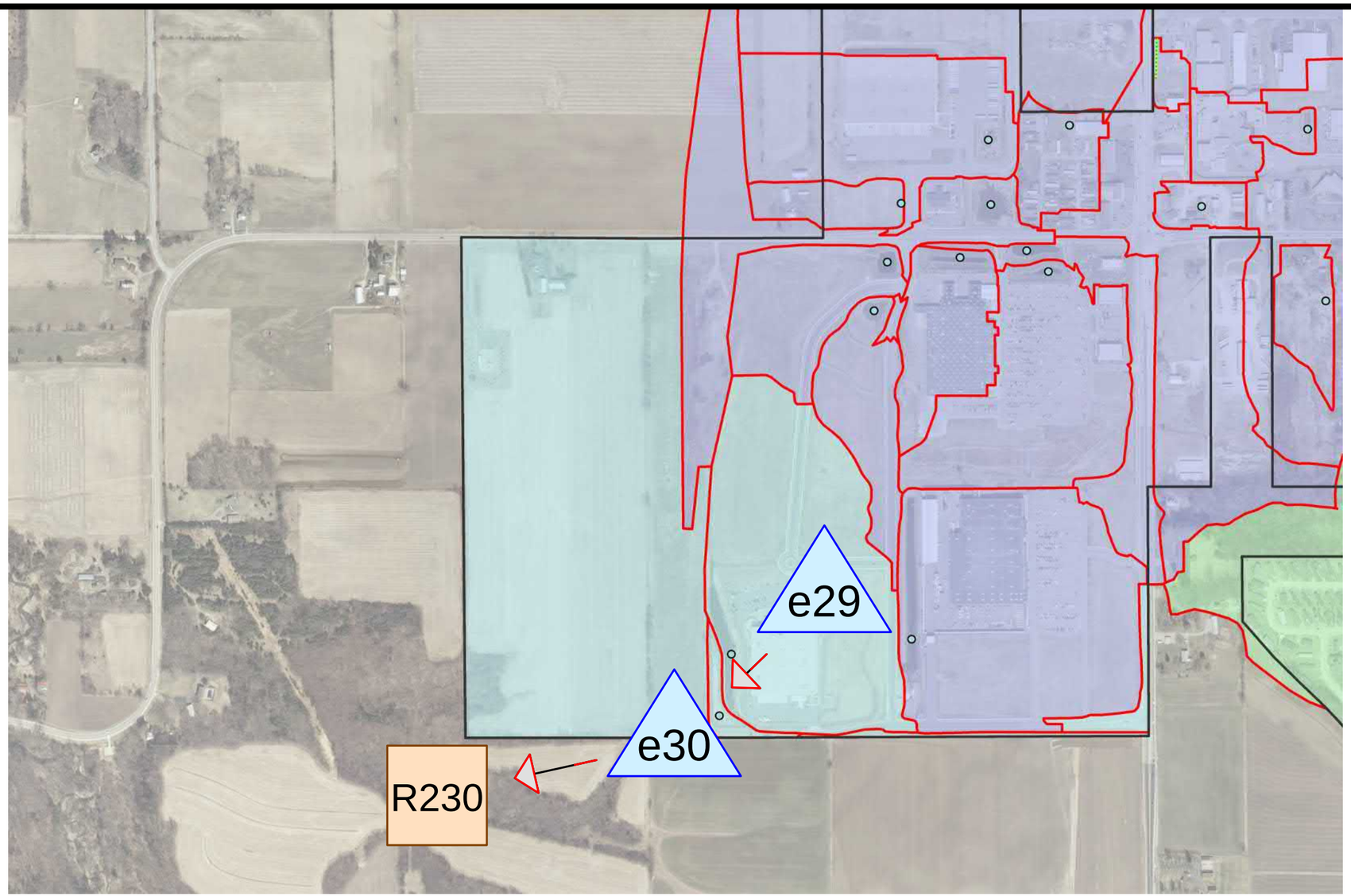
[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)

Summary for Pond S21:

[40] Hint: Not Described (Outflow=Inflow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Free Discharge)



Subcat Reach Pond Link

Routing Diagram for Reach_230

Prepared by MSA Professional Services, Inc., Printed 12/2/2020

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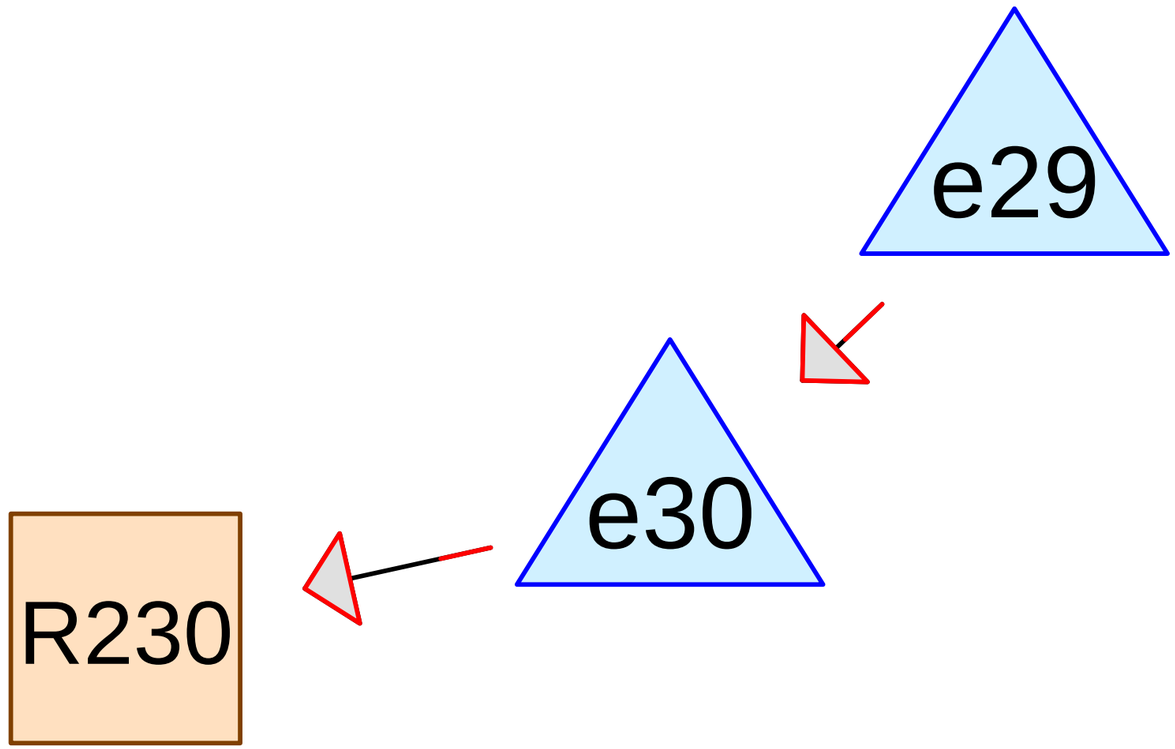

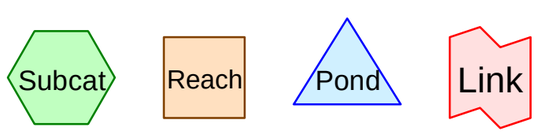

Routing Diagram for Reach_230

Prepared by MSA Professional Services, Inc., Printed 12/2/2020

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Summary for Pond e29:

The 982 contour is from LiDAR. The 981 contour is a 10 foot offset from the 982 contour per the 10:1 slop called in the plans. The 975 contour is a 21 foot offset of the 981 contour per the 3:1 slope and pond bottom elevation of 975 called for in the plan. The 984 contour is from LiDAR

Outlet details are form the plans.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 982.00' Surf.Area= 21,574 sf Storage= 44,922 cf
Peak Elev= 982.00' @ 5.00 hrs Surf.Area= 21,574 sf Storage= 44,922 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	975.00'	129,089 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
975.00	30	0	0
981.00	9,727	29,271	29,271
982.00	21,574	15,651	44,922
984.00	61,974	83,548	128,470
984.01	61,974	620	129,089

Device	Routing	Invert	Outlet Devices
#1	Secondary	984.00'	**17.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Primary	982.50'	**8.0" Round Culvert** L= 27.0' Ke= 0.500 Inlet / Outlet Invert= 982.50' / 981.00' S= 0.0556 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=982.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=982.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond e30:

982 contour is from LiDAR. The 981 contour is a 4 foot offset of the 982 contour per the plans at a 4 to one slope. The 983 contour is a 4 foot offset of the 982 contour. The 984 contour is from LiDAR

Outlet structure details are from the plans. Emergency over flow parameters are from LiDAR.
See infiltration memo for how infiltration rate was calculated.

Inflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Discarded	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af
Secondary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 981.00' @ 5.00 hrs Surf.Area= 23,154 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	981.00'	118,809 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
981.00	23,154	0	0
982.00	28,088	25,621	25,621
983.00	33,131	30,610	56,231
984.00	45,557	39,344	95,575
984.51	45,557	23,234	118,809

Device	Routing	Invert	Outlet Devices
#1	Primary	980.50'	**24.0" Round Culvert** L= 60.7' Ke= 0.500 Inlet / Outlet Invert= 980.50' / 980.20' S= 0.0049 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	981.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	983.00'	**36.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	984.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#5	Device 1	984.50'	**36.0" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	983.90'	**130.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#7	Discarded	981.00'	**0.030 in/hr Exfiltration over Surface area**

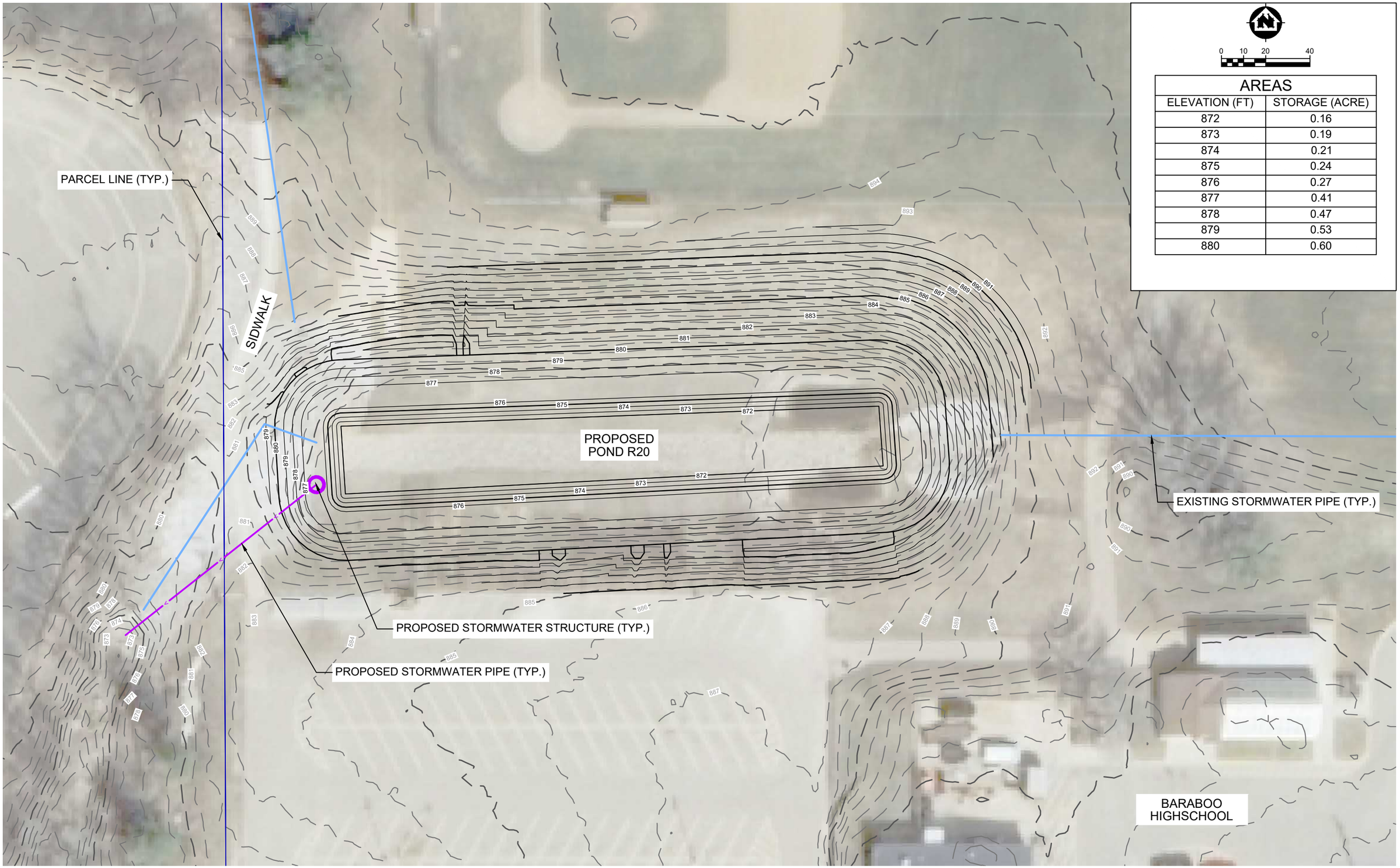
Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=981.00' (Free Discharge)
└─**7=Exfiltration** (Passes 0.00 cfs of 0.02 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=981.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 1.12 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  ├─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=981.00' (Free Discharge)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

APPENDIX D

New BMP Concept Plans



AREAS	
ELEVATION (FT)	STORAGE (ACRE)
872	0.16
873	0.19
874	0.21
875	0.24
876	0.27
877	0.41
878	0.47
879	0.53
880	0.60

		NO.	DATE	REVISION	BY
PROJECT DATE: .	DRAWN BY: RRS	.	.	.	.
	DESIGNED BY: RRS	.	.	.	.
	CHECKED BY: Init	.	.	.	.

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BARABOO WATER QUALITY MASTER PLAN
CITY OF BARABOO
CITY OF BARABOO, SAUK COUNTY, WISCONSIN

R20 - BARABOO HIGH SCHOOL POND RETROFIT

PROJECT NO. 00035104

SHEET 1

AREAS	
ELEVATION (FT)	STORAGE (ACRE)
856	0.47
857	0.49
858	0.52
859	0.55
860	0.58
861	0.73
862	0.79
863	0.86
864	0.93

			NO.	DATE	REVISION	BY
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	DESIGNED BY:	RRS	.	.	.	.
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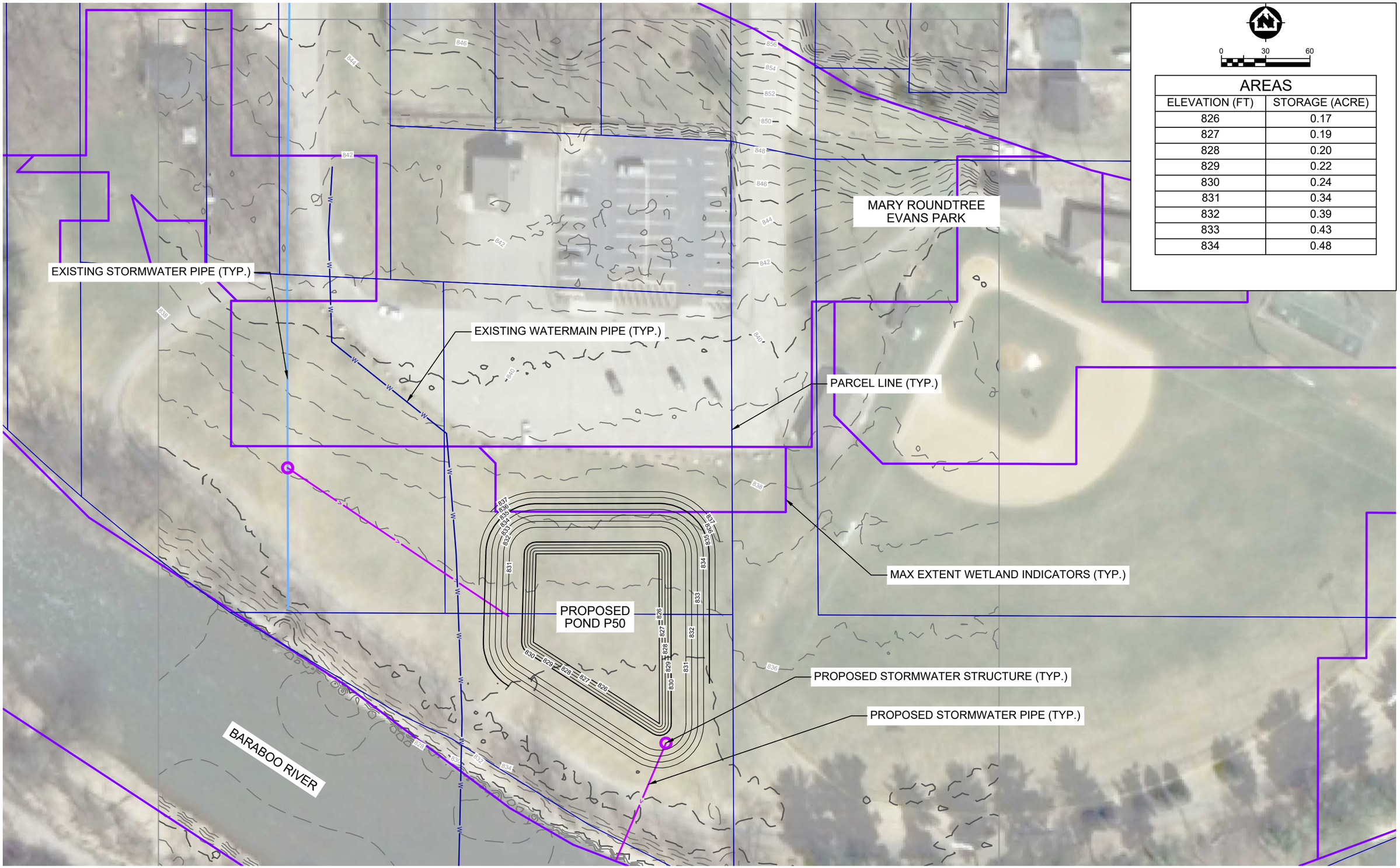
BARABOO WATER QUALITY MASTER PLAN
CITY OF BARABOO
CITY OF BARABOO, SAUK COUNTY, WISCONSIN

P40 - SAUK COUNTY FAIRGROUNDS POND

PROJECT NO. 00035104

SHEET 2



AREAS

ELEVATION (FT)	STORAGE (ACRE)
826	0.17
827	0.19
828	0.20
829	0.22
830	0.24
831	0.34
832	0.39
833	0.43
834	0.48

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BARABOO WATER QUALITY MASTER PLAN
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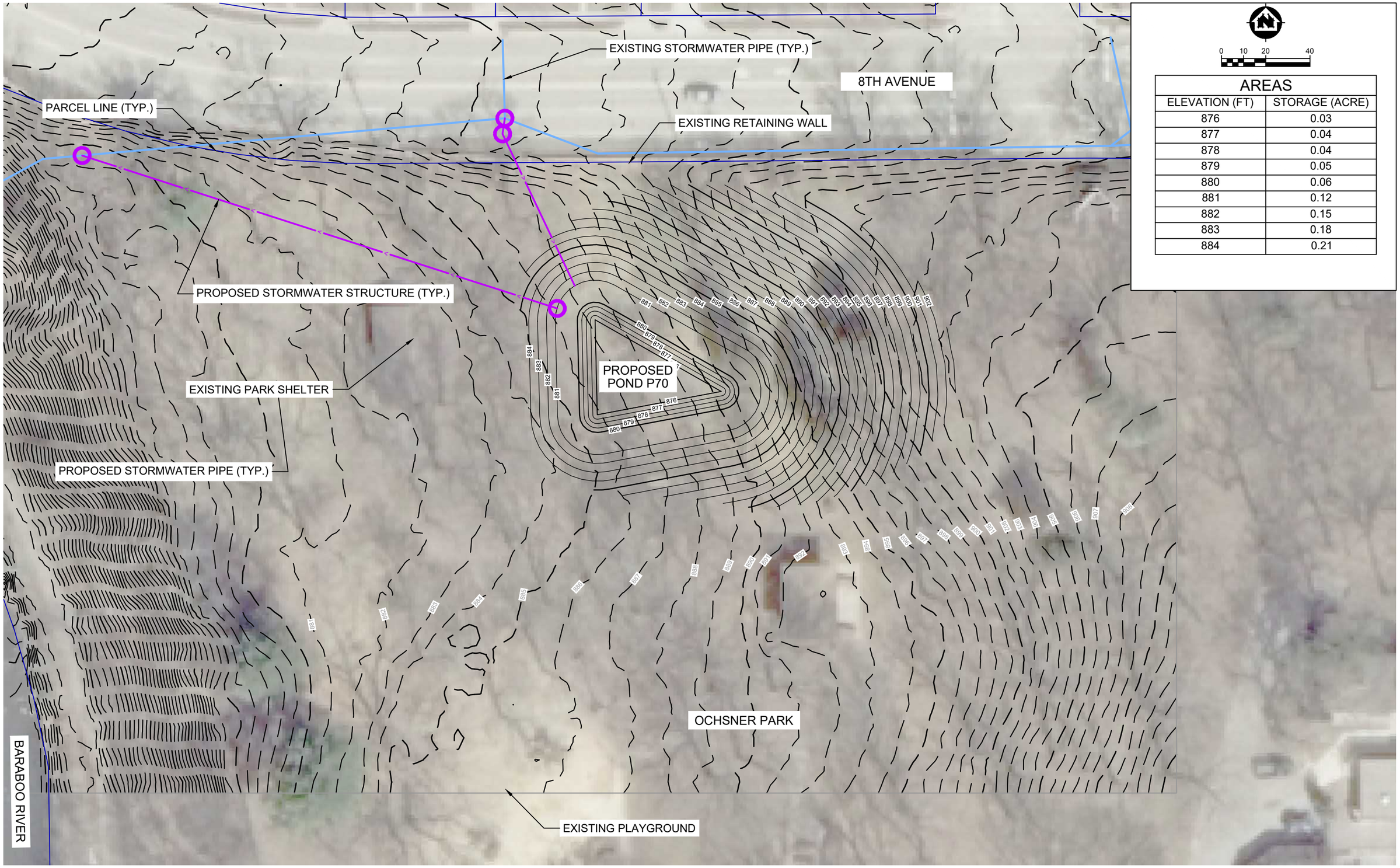
CITY OF BARABOO, SAUK COUNTY, WISCONSIN

P50 - MARY ROUNDTREE EVANS PARK POND

PROJECT NO. 00035104

SHEET 3



AREAS	
ELEVATION (FT)	STORAGE (ACRE)
876	0.03
877	0.04
878	0.04
879	0.05
880	0.06
881	0.12
882	0.15
883	0.18
884	0.21

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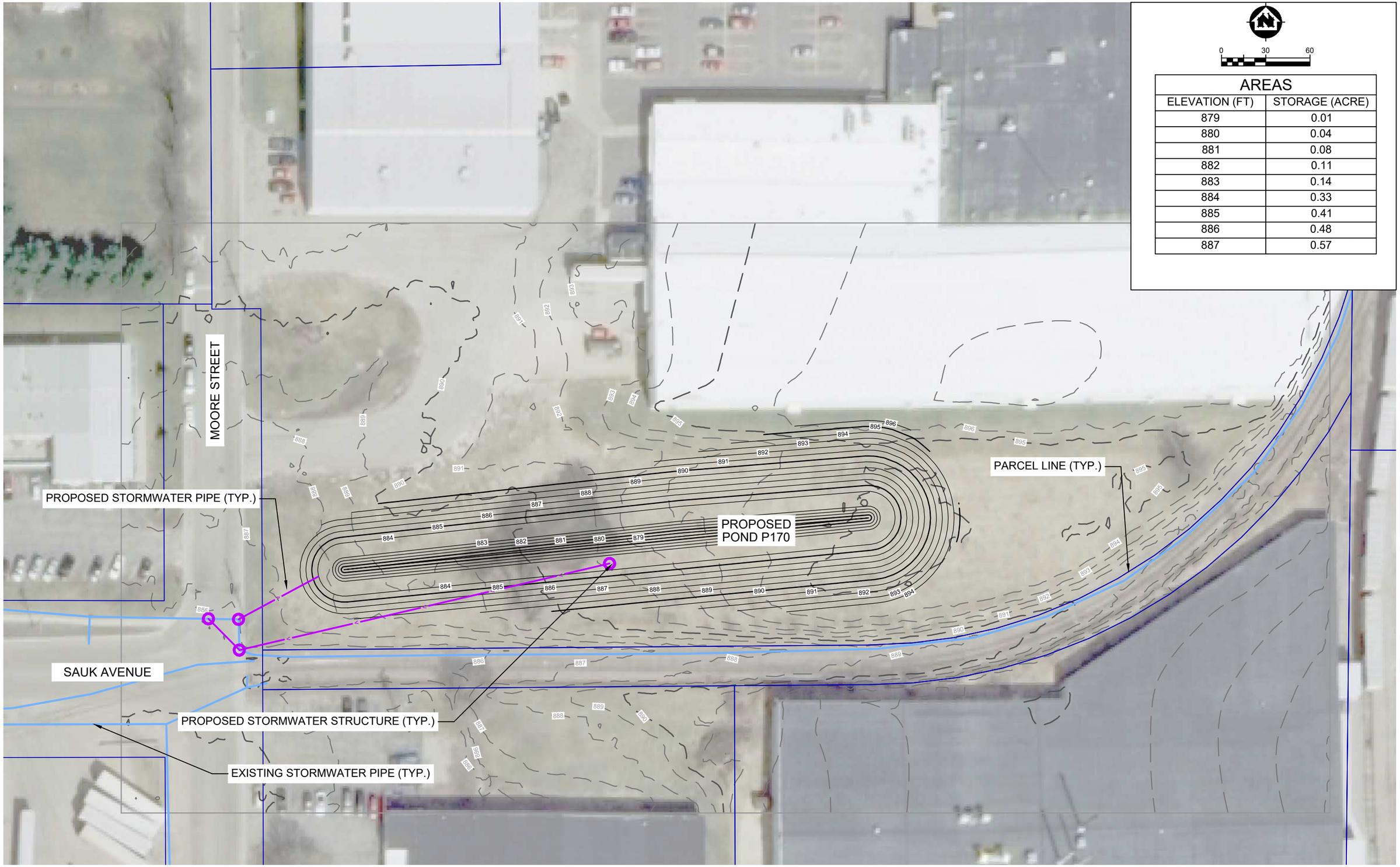
BARABOO WATER QUALITY MASTER PLAN
CITY OF BARABOO
CITY OF BARABOO, SAUK COUNTY, WISCONSIN

P70 - OCHSNER PARK POND

PROJECT NO. 00035104

SHEET 4



AREAS	
ELEVATION (FT)	STORAGE (ACRE)
879	0.01
880	0.04
881	0.08
882	0.11
883	0.14
884	0.33
885	0.41
886	0.48
887	0.57

		NO.	DATE	REVISION	BY
PROJECT DATE: .	DRAWN BY: RRS	.	.	.	.
	DESIGNED BY: RRS	.	.	.	.
	CHECKED BY: Init	.	.	.	.

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BARABOO WATER QUALITY MASTER PLAN
CITY OF BARABOO
CITY OF BARABOO, SAUK COUNTY, WISCONSIN

P170 - SAUK AVE MOORE ST POND

PROJECT NO. 00035104

SHEET 5

APPENDIX E

New BMP Construction Cost Estimates

R20 - Baraboo High School Pond Retrofit - Reach 179 Baraboo River

Landowner: School District of Baraboo

Project Cost Estimate Prepared by MSA Professional Services, Inc.

1-Dec-20

Item	Quantity	Unit	Unit Price	Total
GENERAL				
Mobilization, Bonds, Insurance	1	LS	$ 4,000.00	$ 4,000.00
Traffic Control	1	LS	$ 1,000.00	$ 1,000.00
Erosion Control	1	LS	$ 2,300.00	$ 2,300.00
Vehicle Tracking Pad	1	LS	$ 1,700.00	$ 1,700.00
Wetland Delineation	0	LS	$ 5,000.00	$ -
GRADING/REMOVALS				
Clearing & Grubbing	1	LS	$ 2,000.00	$ 2,000.00
Dewatering	1	LS	$ 3,000.00	$ 3,000.00
Common Fill (Hauled-On)	1137	CY	$ 12.00	$ 13,644.00
Tree Removal	0	EA	$ 1,000.00	$ -
Asphalt Pavement Removal	0	SY	$ 4.00	$ -
Concrete Curb and Gutter Removal	0	LF	$ 8.00	$ -
Concrete Sidewalk Removal	120	SF	$ 4.00	$ 480.00
36 Inch RCP Pipe Removal	120	LF	$ 40.00	$ 4,800.00
STORM SEWER				
Detention Basin Liner	20522	SF	$ 1.00	$ 20,522.07
Storm Manhole/Inlet (6 foot)	0	EA	$ 4,500.00	$ -
Storm Manhole Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
Street Inlet (2footx3foot)	0	EA	$ 2,300.00	$ -
24 Inch RCP Pipe	0	LF	$ 80.00	$ -
36 Inch RCP Pipe	110	LF	$ 100.00	$ 11,000.00
Medium Rip Rap with Fabric for Outlet	18	CY	$ 100.00	$ 1,800.00
Connect to Existing Storm Sewer	0	LS	$ 1,000.00	$ -
EW (AEW) 24"	0	EA	$ 2,000.00	$ -
EW (AEW) 36"	1	EA	$ 2,500.00	$ 2,500.00
Location of Existing Utilities	0	EA	$ 500.00	$ -
RESTORATION				
Topsoil, Seed, Fertilize	4600	SY	$ 5.00	$ 23,000.00
Erosion Control Mat, Class 1, Urban, Type B	4600	SY	$ 3.00	$ 13,800.00
Asphalt Trench Patch	0	SY	$ 50.00	$ -
Concrete Sidewalk	120	SF	$ 6.50	$ 780.00
Concrete Curb and Gutter	0	LF	$ 40.00	$ -
Fence	300	LF	$ 25.00	$ 7,500.00
Construction Total				$ 117,830.00
Contingency - 35%				$ 41,240.00
PRELIMINARY ESTIMATED COST OF CONSTRUCTION				$ 159,070.00
Engineering & CRS - 18%				$ 28,630.00
Estimated Land Acquisition	0.0	AC		$ -
PRELIMINARY ESTIMATED COST OF IMPROVEMENTS				**$ 187,700.00**

Notes / Assumptions

Cost Estimate Assumes No Bedrock

P40 - Sauk County Fairgrounds Pond - Reach 179 Baraboo River
Landowner: Sauk County Agricultural Society Inc
Project Cost Estimate Prepared by MSA Professional Services, Inc.
1-Dec-20

Item	Quantity	Unit	Unit Price	Total
GENERAL				
Mobilization, Bonds, Insurance	1	LS	$ 13,400.00	$ 13,400.00
Traffic Control	1	LS	$ 1,000.00	$ 1,000.00
Erosion Control	1	LS	$ 7,700.00	$ 7,700.00
Vehicle Tracking Pad	1	LS	$ 1,700.00	$ 1,700.00
Wetland Delineation	0	LS	$ 5,000.00	$ -
GRADING/REMOVALS				
Clearing & Grubbing	1	LS	$ 2,000.00	$ 2,000.00
Dewatering	1	LS	$ 3,000.00	$ 3,000.00
Common Excavation (Hauled-Off)	14212	CY	$ 12.00	$ 170,544.00
Tree Removal	0	EA	$ 1,000.00	$ -
Asphalt Pavement Removal	214	SY	$ 4.00	$ 856.00
Concrete Curb and Gutter Removal	80	LF	$ 8.00	$ 640.00
Concrete Sidewalk Removal	120	SF	$ 4.00	$ 480.00
24 Inch RCP Pipe Removal	118	LF	$ 40.00	$ 4,720.00
STORM SEWER				
Detention Basin Liner	55624	SF	$ 1.00	$ 55,624.49
Storm Manhole/Inlet (6 foot)	1	EA	$ 4,500.00	$ 4,500.00
Storm Manhole Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
Street Inlet (2footx3foot)	4	EA	$ 2,300.00	$ 9,200.00
24 Inch RCP Pipe	263	LF	$ 80.00	$ 21,040.00
36 Inch RCP Pipe	75	LF	$ 100.00	$ 7,500.00
Medium Rip Rap with Fabric for Outlet	29	CY	$ 100.00	$ 2,900.00
Connect to Existing Storm Sewer	1	LS	$ 1,000.00	$ 1,000.00
EW (AEW) 24"	1	EA	$ 2,000.00	$ 2,000.00
EW (AEW) 36"	1	EA	$ 2,500.00	$ 2,500.00
Storm Manhole/Inlet (6 foot)	2	EA	$ 9,000.00	$ 18,000.00
RESTORATION				
Topsoil, Seed, Fertilize	3700	SY	$ 5.00	$ 18,500.00
Erosion Control Mat, Class 1, Urban, Type B	3700	SY	$ 3.00	$ 11,100.00
Asphalt Trench Patch	214	SY	$ 50.00	$ 10,700.00
Concrete Sidewalk	120	SF	$ 6.50	$ 780.00
Concrete Curb and Gutter	80	LF	$ 40.00	$ 3,200.00
Fence	1002	LF	$ 25.00	$ 25,050.00
Construction Total				$ 403,630.00
Contingency - 35%				$ 141,270.00
PRELIMINARY ESTIMATED COST OF CONSTRUCTION				$ 544,900.00
Engineering & CRS - 18%				$ 98,080.00
Estimated Land Acquisition	0.0	AC		$ -
PRELIMINARY ESTIMATED COST OF IMPROVEMENTS				**$ 642,980.00**

Notes / Assumptions
Cost Estimate Assumes No Bedrock

P50 - Mary Roundtree Evans Park Pond - Reach 179 Baraboo River

Landowner: City of Baraboo

Project Cost Estimate Prepared by MSA Professional Services, Inc.

1-Dec-20

Item	Quantity	Unit	Unit Price	Total
GENERAL				
Mobilization, Bonds, Insurance	1	LS	$ 5,700.00	$ 5,700.00
Traffic Control	1	LS	$ 1,000.00	$ 1,000.00
Erosion Control	1	LS	$ 3,300.00	$ 3,300.00
Vehicle Tracking Pad	1	LS	$ 1,700.00	$ 1,700.00
Wetland Delineation	1	LS	$ 5,000.00	$ 5,000.00
GRADING/REMOVALS				
Clearing & Grubbing	1	LS	$ 2,000.00	$ 2,000.00
Dewatering	1	LS	$ 3,000.00	$ 3,000.00
Common Excavation (Hauled-Off)	5240	CY	$ 12.00	$ 62,880.00
Tree Removal	1	EA	$ 1,000.00	$ 1,000.00
Asphalt Pavement Removal	5	SY	$ 4.00	$ 20.00
Concrete Curb and Gutter Removal	0	LF	$ 8.00	$ -
Concrete Sidewalk Removal	0	SF	$ 4.00	$ -
36 Inch RCP Pipe Removal	0	LF	$ 60.00	$ -
STORM SEWER				
Detention Basin Liner	16858	SF	$ 1.00	$ 16,858.29
Storm Manhole/Inlet (6 foot)	1	EA	$ 4,500.00	$ 4,500.00
Storm Manhole Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
Street Inlet (2footx3foot)	0	EA	$ 2,300.00	$ -
24 Inch RCP Pipe	266	LF	$ 80.00	$ 21,280.00
36 Inch RCP Pipe	0	LF	$ 100.00	$ -
Medium Rip Rap with Fabric for Outlet	22	CY	$ 100.00	$ 2,200.00
Connect to Existing Storm Sewer	1	LS	$ 1,000.00	$ 1,000.00
EW (AEW) 24"	2	EA	$ 2,000.00	$ 4,000.00
Check Valve	1	EA	$ 5,000.00	$ 5,000.00
Location of Existing Utilities	0	EA	$ 500.00	$ -
RESTORATION				
Topsoil, Seed, Fertilize	3230	SY	$ 5.00	$ 16,150.00
Erosion Control Mat, Class 1, Urban, Type B	3230	SY	$ 3.00	$ 9,690.00
Asphalt Trench Patch	5	SY	$ 50.00	$ 250.00
Concrete Sidewalk	0	SF	$ 6.50	$ -
Concrete Curb and Gutter	0	LF	$ 40.00	$ -
Fence	0	LF	$ 25.00	$ -
Construction Total				$ 170,530.00
Contingency - 35%				$ 59,690.00
PRELIMINARY ESTIMATED COST OF CONSTRUCTION				$ 230,220.00
Engineering & CRS - 18%				$ 41,440.00
Estimated Land Acquisition	0.0	AC		$ -
PRELIMINARY ESTIMATED COST OF IMPROVEMENTS				**$ 271,660.00**

Notes / Assumptions

Cost Estimate Assumes No Bedrock

P70 - Oschner Park Pond - Reach 179 Baraboo River

Landowner: City of Baraboo

Project Cost Estimate Prepared by MSA Professional Services, Inc.

16-Dec-20

Item	Quantity	Unit	Unit Price	Total
GENERAL				
Mobilization, Bonds, Insurance	1	LS	$ 5,400.00	$ 5,400.00
Traffic Control	1	LS	$ 1,000.00	$ 1,000.00
Erosion Control	1	LS	$ 3,100.00	$ 3,100.00
Vehicle Tracking Pad	1	LS	$ 1,700.00	$ 1,700.00
Wetland Delineation	0	LS	$ 5,000.00	$ -
GRADING/REMOVALS				
Clearing & Grubbing	1	LS	$ 2,000.00	$ 2,000.00
Dewatering	1	LS	$ 3,000.00	$ 3,000.00
Common Fill (Hauled-On)	4710	CY	$ 12.00	$ 56,520.00
Tree Removal	13	EA	$ 1,000.00	$ 13,000.00
Asphalt Pavement Removal	50	SY	$ 4.00	$ 200.00
Concrete Curb and Gutter Removal	50	LF	$ 8.00	$ 400.00
Concrete Sidewalk Removal	0	SF	$ 4.00	$ -
36 Inch RCP Pipe Removal	0	LF	$ 40.00	$ -
STORM SEWER				
Detention Basin Liner	6367	SF	$ 1.00	$ 6,367.13
Storm Manhole/Inlet (6 foot)	3	EA	$ 4,500.00	$ 13,500.00
Storm Manhole Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
Street Inlet (2footx3foot)	1	EA	$ 2,300.00	$ 2,300.00
12 Inch RCP Pipe	309	LF	$ 60.00	$ 18,540.00
36 Inch RCP Pipe	0	LF	$ 100.00	$ -
Medium Rip Rap with Fabric for Outlet	6	CY	$ 100.00	$ 600.00
Connect to Existing Storm Sewer	1	LS	$ 1,000.00	$ 1,000.00
EW (AEW) 12"	1	EA	$ 1,500.00	$ 1,500.00
EW (AEW) 24"	0	EA	$ 2,000.00	$ -
Location of Existing Utilities	0	EA	$ 500.00	$ -
RESTORATION				
Topsoil, Seed, Fertilize	2970	SY	$ 5.00	$ 14,850.00
Erosion Control Mat, Class 1, Urban, Type B	2970	SY	$ 3.00	$ 8,910.00
Asphalt Trench Patch	50	SY	$ 50.00	$ 2,500.00
Concrete Sidewalk	0	SF	$ 6.50	$ -
Concrete Curb and Gutter	50	LF	$ 40.00	$ 2,000.00
Fence	0	LF	$ 25.00	$ -
Construction Total				$ 162,390.00
Contingency - 35%				$ 56,840.00
PRELIMINARY ESTIMATED COST OF CONSTRUCTION				$ 219,230.00
Engineering & CRS - 18%				$ 39,460.00
Estimated Land Acquisition	0.0	AC		$ -
PRELIMINARY ESTIMATED COST OF IMPROVEMENTS				**$ 258,690.00**

Notes / Assumptions

Cost Estimate Assumes No Bedrock

P170 - Sauk Ave Moore St Pond - Reach 179 Baraboo River

Landowner: Nordic Equity LLC

Project Cost Estimate Prepared by MSA Professional Services, Inc.

1-Dec-20

Item	Quantity	Unit	Unit Price	Total
GENERAL				
Mobilization, Bonds, Insurance	1	LS	$ 8,100.00	$ 8,100.00
Traffic Control	1	LS	$ 1,000.00	$ 1,000.00
Erosion Control	1	LS	$ 4,600.00	$ 4,600.00
Vehicle Tracking Pad	1	LS	$ 1,700.00	$ 1,700.00
Wetland Delineation	0	LS	$ 5,000.00	$ -
GRADING/REMOVALS				
Clearing & Grubbing	1	LS	$ 2,000.00	$ 2,000.00
Dewatering	1	LS	$ 3,000.00	$ 3,000.00
Common Excavation (Hauled-Off)	9117	CY	$ 12.00	$ 109,404.00
Tree Removal	1	EA	$ 1,000.00	$ 1,000.00
Asphalt Pavement Removal	83	SY	$ 4.00	$ 332.00
Concrete Curb and Gutter Removal	30	LF	$ 8.00	$ 240.00
Concrete Sidewalk Removal	0	SF	$ 4.00	$ -
24 Inch RCP Pipe Removal	20	LF	$ 20.00	$ 400.00
STORM SEWER				
Detention Basin Liner	17653	SF	$ 1.00	$ 17,652.58
Storm Manhole/Inlet (6 foot)	3	EA	$ 4,500.00	$ 13,500.00
Storm Manhole Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
Street Inlet (2footx3foot)	2	EA	$ 2,300.00	$ 4,600.00
12 Inch RCP Pipe	349	LF	$ 60.00	$ 20,940.00
36 Inch RCP Pipe	0	LF	$ 100.00	$ -
Medium Rip Rap with Fabric for Outlet	11	CY	$ 100.00	$ 1,100.00
Connect to Existing Storm Sewer	1	LS	$ 1,000.00	$ 1,000.00
EW (AEW) 24"	1	EA	$ 2,000.00	$ 2,000.00
EW (AEW) 36"	0	EA	$ 2,500.00	$ -
Location of Existing Utilities	1	EA	$ 500.00	$ 500.00
RESTORATION				
Topsoil, Seed, Fertilize	4970	SY	$ 5.00	$ 24,850.00
Erosion Control Mat, Class 1, Urban, Type B	4970	SY	$ 3.00	$ 14,910.00
Asphalt Trench Patch	83	SY	$ 50.00	$ 4,150.00
Concrete Sidewalk	0	SF	$ 6.50	$ -
Concrete Curb and Gutter	30	LF	$ 40.00	$ 1,200.00
Fence	0	LF	$ 25.00	$ -
Construction Total				$ 242,180.00
Contingency - 35%				$ 84,760.00
PRELIMINARY ESTIMATED COST OF CONSTRUCTION				$ 326,940.00
Engineering & CRS - 18%				$ 58,850.00
Estimated Land Acquisition	1.3	AC		$ 25,658.84
PRELIMINARY ESTIMATED COST OF IMPROVEMENTS				**$ 411,448.84**

Notes / Assumptions

Cost Estimate Assumes No Bedrock

APPENDIX F

Summary Data

Reach5 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Existing

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multiplied by 5 to Convert to 5 Years	e01	Autozone and Kwik Trip	2.577	2.577	5-e01-U-N-I-C	7840	7840	0	0.0%	5-e01	7840	5-e01-C	1964	5877	75.0%
	e06	Baraboo Ops (Alliant)	0.006	15.587	5-e06-U-X-O-C	10	10	0	0.0%	5-e06-U-X-O-C	10	5-e06-U-X-O-C	0	10	100.0%
			6.459		5-e06-U-X-I-C	2860	2860	0	0.0%	5-e06-U-X-I-C	2860	5-e06-U-X-I-C	0	2860	100.0%
			9.122		5-e06-U-N-I-C	16400	16400	0	0.0%	5-e06	19005	5-e06-C	16435	2570	13.5%
	e12	Gateway Business Park OL 1	8.923	8.923	5-e12-U-N-I-C	4680	4680	0	0.0%	5-e12	4680	5-e12-C	705	3975	84.9%
	e13	Gateway Business Park OL 2	11.089	11.089	5-e13-U-N-I-C	5815	5815	0	0.0%	5-e13	5815	5-e13-C	1110	4705	80.9%
	e15	Golden Buffet West	5.527	5.720	5-e15-U-N-I-C	16805	16805	0	0.0%	5-e15	16805	5-e15-C	8430	8375	49.8%
			0.193		5-e15-U-X-O-C	603	603	0	0.0%	5-e15-U-X-O-C	603	5-e15-U-X-O-C	0	603	100.0%
	e16	Menards	34.862	34.862	5-e16-U-N-I-C	66685	66685	0	0.0%	5-e16	66685	5-e16-C	30505	36180	54.3%
	e25	Slumberland Distribution	15.596	22.161	5-e25-U-N-I-C	46005	46005	0	0.0%	5-e25	119490	5-e25-C	103950	15540	13.0%
			6.565		5-e25-U-X-O-C	3127	3127	0	0.0%	5-e25-U-X-O-C	3127	5-e25-U-X-O-C	0	3127	100.0%
	e28	Summit Credit Union East	14.292	22.846	5-e28-U-N-I-C	13610	13610	0	0.0%	5-e28	81085	5-e28-C	73485	7600	9.4%
			8.554		5-e28-U-X-O-C	4533	4533	0	0.0%	5-e28-U-X-O-C	4533	5-e28-U-X-O-C	0	4533	100.0%
	e31	VA Baraboo	2.439	4.217	5-e31-U-N-I-C	619	619	0	0.0%	5-e31	619	5-e31-C	18	601	97.0%
			1.778		5-e31-U-X-O-C	936	936	0	0.0%	5-e31-U-X-O-C	936	5-e31-U-X-O-C	0	936	100.0%
	e37	Walmart East	9.555	10.353	5-e37-U-N-I-C	19645	19645	0	0.0%	5-e37	19645	5-e37-C	9555	10090	51.4%
			0.798		5-e37-U-X-O-C	743	743	0	0.0%	5-e37-U-X-O-C	743	5-e37-U-X-O-C	0	743	100.0%
	e38	Walmart South	22.623	22.623	5-e38-U-N-I-C	33925	33925	0	0.0%	5-e38	33925	5-e38-C	23320	10605	31.3%
	e39	Walmart West	9.767	9.767	5-e39-U-N-I-C	23245	23245	0	0.0%	5-e39	46555	5-e39-C	25615	20940	45.0%
5 year model	e07	Dez Indoor Shooting Range East	0.714	0.714	5-e07-U-N-I-C	472	472	0	0.0%	5-e07	472	5-e07-C	14	458	97.1%
	e08	Dez Indoor Shooting Range North	0.253	0.253	5-e08-U-N-I-C	169	169	0	0.0%	5-e08	169	5-e08-C	10	159	94.3%
	e14	Glacier Valley Ford	4.586	4.586	5-e14-U-N-I-C	2063	2063	0	0.0%	5-e14	2063	5-e14-C	1937	126	6.1%
	e17	N. of Lange Court & W. of Sauk Co Parking Lot	5.146	5.146	5-e17-U-N-I-C	16209	16209	0	0.0%	5-e17	16209	5-e17-C	14937	1272	7.8%
	e40	West Fork Ph III Sediment Basin	1.856	1.856	5-e40-U-N-I-C	2709	2709	0	0.0%	5-e40	2718	5-e40-C	2247	471	17.3%
	e41	West Fork Ph III SW Infilt - 2005	2.797	2.797	5-e41-U-N-I-C	3423	3423	0	0.0%	5-e41	3423	5-e41-C	8	3415	99.8%
	NoBMP	No BMP	36.086	145.528	5-NoBMP-SM(U)-N-I-C	72136	68724	3412	4.7%	5-NoBMP-SM(U)-N-I-C	68724	5-NoBMP-SM(U)-N-I-C	68724	0	0.0%
			7.13		5-NoBMP-U-N-I-C	8563	8563	0	0.0%	5-NoBMP-U-N-I-C	8563	5-NoBMP-U-N-I-C	8563	0	0.0%
			68.976		5-NoBMP-U-X-I-C	64727	64727	0	0.0%	5-NoBMP-U-X-I-C	64727	5-NoBMP-U-X-I-C	0	64727	100.0%
			33.336		5-NoBMP-U-X-O-C	47787	47787	0	0.0%	5-NoBMP-U-X-O-C	47787	5-NoBMP-U-X-O-C	0	47787	100.0%
	P100	P100	34.788	70.756	5-P100-SM-N-I-C	71022	66943	4079	5.7%	5-P100-SM-N-I-C	66943	5-P100-SM-N-I-C	66943	0	0.0%
			8.503		5-P100-SW-N-I-C	18949	16893	2056	10.9%	5-P100-SW-N-I-C	16893	5-P100-SW-N-I-C	16893	0	0.0%
			4.393		5-P100-U-N-I-C	6894	6894	0	0.0%	5-P100-U-N-I-C	6894	5-P100-U-N-I-C	6894	0	0.0%
			23.072		5-P100-U-X-O-C	25724	25724	0	0.0%	5-P100-U-X-O-C	25724	5-P100-U-X-O-C	0	25724	100.0%
	P120	P120	95.862	137.850	5-P120-SM-N-I-C	243894	230890	13004	5.3%	5-P120-SM-N-I-C	230890	5-P120-SM-N-I-C	230890	0	0.0%
			3.997		5-P120-SW-N-I-C	9462	8087	1375	14.5%	5-P120-SW-N-I-C	8087	5-P120-SW-N-I-C	8087	0	0.0%
			8.781		5-P120-U-N-I-C	14125	14125	0	0.0%	5-P120-U-N-I-C	14125	5-P120-U-N-I-C	14125	0	0.0%
			29.21		5-P120-U-X-O-C	48376	48376	0	0.0%	5-P120-U-X-O-C	48376	5-P120-U-X-O-C	0	48376	100.0%
	P140	P140	0.58	4.729	5-P140-SM-N-I-C	152	135	18	11.7%	5-P140-SM-N-I-C	135	5-P140-SM-N-I-C	135	0	0.0%
			2.639		5-P140-U-N-I-C	1207	1207	0	0.0%	5-P140-U-N-I-C	1207	5-P140-U-N-I-C	1207	0	0.0%
			1.51		5-P140-U-X-O-C	3943	3943	0	0.0%	5-P140-U-X-O-C	3943	5-P140-U-X-O-C	0	3943	100.0%
	S10	S10	3.918	4.382	5-S10-U-N-I-C	2882	2882	0	0.0%	5-S10	2882	5-S10-C	2612	270	9.4%
			0.464		5-S10-U-X-I-C	212	212	0	0.0%	5-S10-U-X-I-C	212	5-S10-U-X-I-C	0	212	100.0%
	S11	S11	1.348	1.349	5-S11-U-N-I-C	4169	4169	0	0.0%	5-S11	4169	5-S11-C	3795	374	9.0%
			0.001		5-S11-U-X-I-C	3	3	0	0.0%	5-S11-U-X-I-C	3	5-S11-U-X-I-C	0	3	100.0%

BMP Number	Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
	Node	Value	Sweeping			Node	Value	Node	Value		
e01	5-e01-U-N-I-C	15.605	15.6	0.0	0.0%	5-e01	15.6	5-e01-C	6.8	8.8	56.3%
e06	5-e06-U-X-O-C	0.028195	0.0	0.0	0.0%	5-e06-U-X-O-C	0.0	5-e06-U-X-O-C	0.0	0.0	100.0%
	5-e06-U-X-I-C	20.585	20.6	0.0	0.0%	5-e06-U-X-I-C	20.6	5-e06-U-X-I-C	0.0	20.6	100.0%
	5-e06-U-N-I-C	41.38	41.4	0.0	0.0%	5-e06	55.9	5-e06-C	49.6	6.2	11.2%
e12	5-e12-U-N-I-C	20.61	20.6	0.0	0.0%	5-e12	20.6	5-e12-C	13.6	7.0	34.1%
e13	5-e13-U-N-I-C	39.12	39.1	0.0	0.0%	5-e13	39.1	5-e13-C	19.9	19.2	49.1%
e15	5-e15-U-N-I-C	32.28	32.3	0.0	0.0%	5-e15	32.3	5-e15-C	18.8	13.5	41.8%
	5-e15-U-X-O-C	1.1	1.1	0.0	0.0%	5-e15-U-X-O-C	1.1	5-e15-U-X-O-C	0.0	1.1	100.0%
e16	5-e16-U-N-I-C	148.5	148.5	0.0	0.0%	5-e16	148.5	5-e16-C	99.9	48.6	32.7%
e25	5-e25-U-N-I-C	86	86.0	0.0	0.0%	5-e25	370.1	5-e25-C	340.6	29.5	8.0%
	5-e25-U-X-O-C	22.505	22.5	0.0	0.0%	5-e25-U-X-O-C	22.5	5-e25-U-X-O-C	0.0	22.5	100.0%
e28	5-e28-U-N-I-C	56.45	56.5	0.0	0.0%	5-e28	296.4	5-e28-C	282.9	13.6	4.6%
	5-e28-U-X-O-C	32.635	32.6	0.0	0.0%	5-e28-U-X-O-C	32.6	5-e28-U-X-O-C	0.0	32.6	100.0%
e31	5-e31-U-N-I-C	4.41	4.4	0.0	0.0%	5-e31	4.4	5-e31-C	1.2	3.2	72.0%
	5-e31-U-X-O-C	6.735	6.7	0.0	0.0%	5-e31-U-X-O-C	6.7	5-e31-U-X-O-C	0.0	6.7	100.0%
e37	5-e37-U-N-I-C	44.525	44.5	0.0	0.0%	5-e37	44.5	5-e37-C	27.6	17.0	38.1%
	5-e37-U-X-O-C	2.4515	2.5	0.0	0.0%	5-e37-U-X-O-C	2.5	5-e37-U-X-O-C	0.0	2.5	100.0%
e38	5-e38-U-N-I-C	86.25	86.3	0.0	0.0%	5-e38	86.3	5-e38-C	66.9	19.4	22.5%
e39	5-e39-U-N-I-C	50.3	50.3	0.0	0.0%	5-e39	117.2	5-e39-C	79.0	38.2	32.6%
e07	5-e07-U-N-I-C	2.502	2.5	0.0	0.0%	5-e07	2.5	5-e07-C	0.2	2.3	90.8%
e08	5-e08-U-N-I-C	0.8981	0.9	0.0	0.0%	5-e08	0.9	5-e08-C	0.2	0.7	82.3%
e14	5-e14-U-N-I-C	12.86	12.9	0.0	0.0%	5-e14	12.9	5-e14-C	12.3	0.5	4.1%
e17	5-e17-U-N-I-C	30.51	30.5	0.0	0.0%	5-e17	30.5	5-e17-C	28.6	1.9	6.3%
e40	5-e40-U-N-I-C	10.52	10.5	0.0	0.0%	5-e40	10.6	5-e40-C	8.8	1.8	16.9%
e41	5-e41-U-N-I-C	14.02	14.0	0.0	0.0%	5-e41	14.0	5-e41-C	0.1	14.0	99.6%
NoBMP	5-NoBMP-SM(U)-N-I-C	163.3	158.2	5.1	3.1%	5-NoBMP-SM(U)-N-I-C	158.2	5-NoBMP-SM(U)-N-I-C	158.2	0.0	0.0%
	5-NoBMP-U-N-I-C	26.37	26.4	0.0	0.0%	5-NoBMP-U-N-I-C	26.4	5-NoBMP-U-N-I-C	26.4	0.0	0.0%
	5-NoBMP-U-X-I-C	234.8	234.8	0.0	0.0%	5-NoBMP-U-X-I-C	234.8	5-NoBMP-U-X-I-C	0.0	234.8	100.0%
	5-NoBMP-U-X-O-C	136.4	136.4	0.0	0.0%	5-NoBMP-U-X-O-C	136.4	5-NoBMP-U-X-O-C	0.0	136.4	100.0%
P100	5-P100-SM-N-I-C	154.9	149.2	5.7	3.7%	5-P100-SM-N-I-C	149.2	5-P100-SM-N-I-C	149.2	0.0	0.0%
	5-P100-SW-N-I-C	42.26	39.3	2.9	7.0%	5-P100-SW-N-I-C	39.3	5-P100-SW-N-I-C	39.3	0.0	0.0%
	5-P100-U-N-I-C	22.09	22.1	0.0	0.0%	5-P100-U-N-I-C	22.1	5-P100-U-N-I-C	22.1	0.0	0.0%
	5-P100-U-X-O-C	94.67	94.7	0.0	0.0%	5-P100-U-X-O-C	94.7	5-P100-U-X-O-C	0.0	94.7	100.0%
P120	5-P120-SM-N-I-C	502.2	484.6	17.6	3.5%	5-P120-SM-N-I-C	484.6	5-P120-SM-N-I-C	484.6	0.0	0.0%
	5-P120-SW-N-I-C	20.46	18.4	2.1	10.0%	5-P120-SW-N-I-C	18.4	5-P120-SW-N-I-C	18.4	0.0	0.0%
	5-P120-U-N-I-C	38.65	38.7	0.0	0.0%	5-P120-U-N-I-C	38.7	5-P120-U-N-I-C	38.7	0.0	0.0%
	5-P120-U-X-O-C	130.3	130.3	0.0	0.0%	5-P120-U-X-O-C	130.3	5-P120-U-X-O-C	0.0	130.3	100.0%
P140	5-P140-SM-N-I-C	1.029	1.0	0.0	4.0%	5-P140-SM-N-I-C	1.0	5-P140-SM-N-I-C	1.0	0.0	0.0%
	5-P140-U-N-I-C	8.455	8.5	0.0	0.0%	5-P140-U-N-I-C	8.5	5-P140-U-N-I-C	8.5	0.0	0.0%
	5-P140-U-X-O-C	8.87	8.9	0.0	0.0%	5-P140-U-X-O-C	8.9	5-P140-U-X-O-C	0.0	8.9	100.0%
S10	5-S10-U-N-I-C	15.46	15.5	0.0	0.0%	5-S10	15.5	5-S10-C	14.5	1.0	6.3%
	5-S10-U-X-I-C	1.5275	1.5	0.0	0.0%	5-S10-U-X-I-C	1.5	5-S10-U-X-I-C	0.0	1.5	100.0%
S11	5-S11-U-N-I-C	8.01	8.0	0.0	0.0%	5-S11	8.0	5-S11-C	7.5	0.5	6.6%
	5-S11-U-X-I-C	0.00585	0.0	0.0	0.0%	5-S11-U-X-I-C	0.0	5-S11-U-X-I-C	0.0	0.0	100.0%

Total Area (ac)	550.67	
Regulated Area (ac)	369.75	

Total TSS	937355.7	lbs/5-yr	Regulated TSS Trapped by Sweeping		
In City TSS	801574.9	lbs/5-yr	23943.8	lbs/5-yr	
Regulated TSS	733773.1	lbs/5-yr	3.3%		
Total TSS	93.7	Tons/yr			
In City TSS	80.2	Tons/yr			
Regulated TSS	73.4	Tons/yr			

Regulated TSS Trapped by Existing Structural BMPs	133601.9	lbs/5-yr
Total Regulated TSS Trapped by All Existing BMPs	157545.7	lbs/5-yr
Total Regulated TSS Trapped by All Existing BMPs	21.5%	
REQUIRED =	20.0%	
Total Regulated TSS Trapped by All Existing BMPs	15.8	Tons/yr
TSS Reduction Required	14.7	Tons/yr
Additional TSS Reduction Required	-1.1	Tons/yr

Total TP	2392.5	lbs/5-yr	Regulated TP Trapped by Sweeping		
In City TP	1956.8	lbs/5-yr	33.4	lbs/5-yr	
Regulated TP	1699.9	lbs/5-yr	2.0%		
Regulated TP	340.0	lbs/yr			

Regulated TP Trapped by Existing Structural BMPs	246.9	lbs/5-yr
Total Regulated TP Trapped by All Existing BMPs	280.3	lbs/5-yr
Total Regulated TP Trapped by All Existing BMPs	16.5%	
REQUIRED =	15.0%	
Total Regulated TP Trapped by All Existing BMPs	56.1	lbs/yr
TP Reduction Required	51.0	lbs/yr
Additional TP Reduction Required	-5.1	lbs/yr

Reach137 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Existing

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multiplied by 5 to Convert to 5 Years	e20	Pleasant View 1st Addition OL 2	10.75	10.750	137-e20-U-N-I-C	12950	12950	0	0.0%	137-e20	12950	137-e20-C	6070	6880	53.1%
	e21	Pleasant View OL7	37.282	37.282	137-e21-U-N-I-C	32785	32785	0	0.0%	137-e21	34360	137-e21-C	0	34360	100.0%
	e22&R30	Pleasant View Subd Outlot 3	89.739	325.777	137-e22-U-X-O-C	45410	45410	0	0.0%	137-e22-U-X-O-C	45410	137-e22-U-X-O-C	0	45410	100.0%
			127.064		137-e22-U-X-I-C	56515	56515	0	0.0%	137-e22-U-X-I-C	56515	137-e22-U-X-I-C	0	56515	100.0%
			108.974		137-e22-U-N-I-C	69405	69405	0	0.0%	137-e22	75475	137-e22-C	45235	30240	40.1%
	e24	Rolling Meadows North OL 1	17.223	17.223	137-e24-U-N-I-C	8245	8245	0	0.0%	137-e24	8245	137-e24-C	1581	6664	80.8%
5 year model	NoBMP	No BMP	8.61	832.715	137-NoBMP-SM-N-I-C	22567	20942	1625	7.2%	137-NoBMP-SM-N-I-C	20942	137-NoBMP-SM-N-I-C	20942	0	0.0%
			2.737		137-NoBMP-SW-N-I-C	8167	6647	1520	18.6%	137-NoBMP-SW-N-I-C	6647	137-NoBMP-SW-N-I-C	6647	0	0.0%
			5.192		137-NoBMP-U-N-I-C	11961	11961	0	0.0%	137-NoBMP-U-N-I-C	11961	137-NoBMP-U-N-I-C	11961	0	0.0%
			646.683		137-NoBMP-U-X-I-C	283295	283295	0	0.0%	137-NoBMP-U-X-I-C	283295	33-NoBMP-U-E-O-C	0	283295	100.0%
			169.493		137-NoBMP-U-X-O-C	71779	71779	0	0.0%	137-NoBMP-U-X-O-C	71779	33-NoBMP-U-E-O-C	0	71779	100.0%
	P30	P30	55.22	63.835	137-P30-SM-N-I-C	105578	100294	5284	5.0%	137-P30-SM-N-I-C	5284	137-e21-C	5284	0	0.0%
			7.438		137-P30-SW-N-I-C	20087	16595	3492	17.4%	137-P30-SW-N-I-C	3492	137-e21-C	3492	0	0.0%
			1.177		137-P30-U-X-I-C	3174	3174	0	0.0%	137-P30-U-X-I-C	3174	33-NoBMP-U-E-O-C	0	3174	100.0%
1 Year Run Multiplied by 5 to Convert to 5 Years	S01	S01	2.799	2.799	137-S01-U-N-I-C	3093	3093	0	0.0%	137-S01	3093	137-S01-C	2803	291	9.4%
	S03&P130	S03&P130	83.914	190.728	137-S03&P130-U-N-I-C	104345	104345	0	0.0%	137-S03&P130	107140	137-S03&P130-C	106785	355	0.3%
			4.573		137-S03&P130-U-X-I-C	2034	2034	0	0.0%	137-S03&P130-U-X-I-C	2034	137-S03&P130-U-X-I-C	0	2034	100.0%
			102.241		137-S03&P130-U-X-O-C	49235	49235	0	0.0%	137-S03&P130-U-X-O-C	49235	137-S03&P130-U-X-O-C	0	49235	100.0%
	S04&P130	S04&P130	9.466	18.447	137-S04&P130-U-N-I-C	16400	16400	0	0.0%	137-S04&P130	16395	137-S04&P130-C	14490	1905	11.6%
			8.981		137-S04&P130-U-X-I-C	3995	3995	0	0.0%	137-S04&P130-U-X-I-C	3995	137-S04&P130-U-X-I-C	0	3995	100.0%
	S07	S07	1.463	4.539	137-S07-U-N-I-C	651	651	0	0.0%	137-S07	651	137-S07-C	594	57	8.8%
			3.076		137-S07-U-X-I-C	1368	1368	0	0.0%	137-S07-U-X-I-C	1368	137-S07-U-X-I-C	0	1368	100.0%
	S08	S08	14.042	18.863	137-S08-U-N-I-C	18620	18620	0	0.0%	137-S08	18620	137-S08-C	15845	2775	14.9%
			4.821		137-S08-U-X-I-C	2145	2145	0	0.0%	137-S08-U-X-I-C	2145	137-S08-U-X-I-C	0	2145	100.0%
	S05	S05	3.387	123.071	137-S05-U-N-I-C	2529	2529	0	0.0%	137-S05	123795	137-S05-C	123230	565	0.5%
			31.193		137-S05-U-X-I-C	13875	13875	0	0.0%	137-S05-U-X-I-C	13875	137-S05-U-X-I-C	0	13875	100.0%
			88.491		137-S05-U-X-O-C	39905	39905	0	0.0%	137-S05-U-X-O-C	39905	137-S05-U-X-O-C	0	39905	100.0%
	S06	S06	3.859	62.343	137-S06-U-N-I-C	3836	3836	0	0.0%	137-S06	127060	137-S06-C	125930	1130	0.9%
			58.484		137-S06-U-X-I-C	26005	26005	0	0.0%	137-S06-U-X-I-C	26005	137-S06-U-X-I-C	0	26005	100.0%

Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
Node	Value	Sweeping			Node	Value	Node	Value		
137-e20-U-N-I-C	51.7	51.7	0.0	0.0%	137-e20	51.7	137-e20-C	29.8	21.9	42.4%
137-e21-U-N-I-C	143.2	143.2	0.0	0.0%	137-e21	162.6	137-e21-C	0.0	162.6	100.0%
137-e22-U-X-O-C	294.55	294.6	0.0	0.0%	137-e22-U-X-O-C	294.6	137-e22-U-X-O-C	0.0	294.6	100.0%
137-e22-U-X-I-C	406.8	406.8	0.0	0.0%	137-e22-U-X-I-C	406.8	137-e22-U-X-I-C	0.0	406.8	100.0%
137-e22-U-N-I-C	390.1	390.1	0.0	0.0%	137-e22	419.8	137-e22-C	306.7	113.1	26.9%
137-e24-U-N-I-C	46.215	46.2	0.0	0.0%	137-e24	46.2	137-e24-C	19.4	26.8	58.1%
137-NoBMP-SM-N-I-C	51.53	48.9	2.6	5.0%	137-NoBMP-SM-N-I-C	48.9	137-NoBMP-SM-N-I-C	48.9	0.0	0.0%
137-NoBMP-SW-N-I-C	17.5	15.1	2.4	13.5%	137-NoBMP-SW-N-I-C	15.1	137-NoBMP-SW-N-I-C	15.1	0.0	0.0%
137-NoBMP-U-N-I-C	29.2	29.2	0.0	0.0%	137-NoBMP-U-N-I-C	29.2	137-NoBMP-U-N-I-C	29.2	0.0	0.0%
137-NoBMP-U-X-I-C	1999	1999.0	0.0	0.0%	137-NoBMP-U-X-I-C	1999.0	137-NoBMP-U-X-I-C	0.0	1999.0	100.0%
137-NoBMP-U-X-O-C	473	473.0	0.0	0.0%	137-NoBMP-U-X-O-C	473.0	137-NoBMP-U-X-O-C	0.0	473.0	100.0%
137-P30-SM-N-I-C	266.2	260.4	5.8	2.2%	137-P30-SM-N-I-C	260.4	137-e21-C	260.4	0.0	0.0%
137-P30-SW-N-I-C	45.14	39.7	5.4	12.0%	137-P30-SW-N-I-C	39.7	137-e21-C	39.7	0.0	0.0%
137-P30-U-X-I-C	7.139	7.1	0.0	0.0%	137-P30-U-X-I-C	7.1	137-P30-U-X-I-C	0.0	7.1	100.0%
137-S01-U-N-I-C	12.935	12.9	0.0	0.0%	137-S01	12.9	137-S01-C	12.1	0.9	6.8%
137-S03&P130-U-N-I-C	382.1	382.1	0.0	0.0%	137-S03&P130	394.0	137-S03&P130-C	393.2	0.9	0.2%
137-S03&P130-U-X-I-C	14.64	14.6	0.0	0.0%	137-S03&P130-U-X-I-C	14.6	137-S03&P130-U-X-I-C	0.0	14.6	100.0%
137-S03&P130-U-X-O-C	328.7	328.7	0.0	0.0%	137-S03&P130-U-X-O-C	328.7	137-S03&P130-U-X-O-C	0.0	328.7	100.0%
137-S04&P130-U-N-I-C	49.075	49.1	0.0	0.0%	137-S04&P130	49.1	137-S04&P130-C	44.7	4.3	8.8%
137-S04&P130-U-X-I-C	28.755	28.8	0.0	0.0%	137-S04&P130-U-X-I-C	28.8	137-S04&P130-U-X-I-C	0.0	28.8	100.0%
137-S07-U-N-I-C	4.683	4.7	0.0	0.0%	137-S07	4.7	137-S07-C	4.5	0.2	4.2%
137-S07-U-X-I-C	9.85	9.9	0.0	0.0%	137-S07-U-X-I-C	9.9	137-S07-U-X-I-C	0.0	9.9	100.0%
137-S08-U-N-I-C	72.55	72.6	0.0	0.0%	137-S08	72.6	137-S08-C	64.9	7.7	10.6%
137-S08-U-X-I-C	15.435	15.4	0.0	0.0%	137-S08-U-X-I-C	15.4	137-S08-U-X-I-C	0.0	15.4	100.0%
137-S05-U-N-I-C	12.89	12.9	0.0	0.0%	137-S05	450.7	137-S05-C	449.1	1.6	0.4%
137-S05-U-X-I-C	99.85	99.9	0.0	0.0%	137-S05-U-X-I-C	99.9	137-S05-U-X-I-C	0.0	99.9	100.0%
137-S05-U-X-O-C	284.4	284.4	0.0	0.0%	137-S05-U-X-O-C	284.4	137-S05-U-X-O-C	0.0	284.4	100.0%
137-S06-U-N-I-C	16.48	16.5	0.0	0.0%	137-S06	465.5	137-S06-C	462.2	3.3	0.7%
137-S06-U-X-I-C	187.25	187.3	0.0	0.0%	137-S06-U-X-I-C	187.3	137-S06-U-X-I-C	0.0	187.3	100.0%

Total Area (ac)	1,708.37	
Regulated Area (ac)	372.36	

Total TSS	1039952.0	lbs/5-yr	Regulated TSS Trapped by Sweeping	
In City TSS	833623.0	lbs/5-yr	11921.0	lbs/5-yr
Regulated TSS	441218.0	lbs/5-yr	2.7%	
Total TSS	104.0	Tons/yr		
In City TSS	83.4	Tons/yr		
Regulated TSS	44.1	Tons/yr		

Regulated TSS Trapped by Existing Structural BMPs	85221.5	lbs/5-yr
Total Regulated TSS Trapped by All Existing BMPs	97142.5	lbs/5-yr
Total Regulated TSS Trapped by All Existing BMPs	22.0%	
REQUIRED =	20.0%	
Total Regulated TSS Trapped by All Existing BMPs	9.7	Tons/yr
TSS Reduction Required	8.8	Tons/yr
Additional TSS Reduction Required	-0.9	Tons/yr

Total TP	5740.9	lbs/5-yr	Regulated TP Trapped by Sweeping	
In City TP	4360.2	lbs/5-yr	16.2	lbs/5-yr
Regulated TP	1591.5	lbs/5-yr	1.0%	
Regulated TP	318.3	lbs		

Regulated TP Trapped by Existing Structural BMPs	343.3	lbs/5-yr
Total Regulated TP Trapped by All Existing BMPs	359.5	lbs/5-yr
Total Regulated TP Trapped by All Existing BMPs	22.6%	
REQUIRED =	15.0%	
Total Regulated TP Trapped by All Existing BMPs	71.9	lbs/5-yr
TP Reduction Required	47.7	lbs/yr
Additional TP Reduction Required	-24.2	lbs/yr

Reach179 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Existing

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	e02	Balanced Rock Brewery	12.262	12.262	179-e02-U-N-I-C	5455	5455	0	0.0%	179-e02	5455	179-e02-C	908	4547	83.4%
	e03	Baraboo Country Club - Clubhouse South	3.511	3.511	179-e03-U-N-I-C	2729	2729	0	0.0%	179-e03	2728	179-e03-C	670	2058	75.4%
	e04&R20	Baraboo Highschool	182.227	200.972	179-e04&R20-U-N-I-C	232105	232105	0	0.0%	179-e04&R20	282290	179-e04&R20-C	245170	37120	13.1%
			18.745		179-e04&R20-U-X-O-C	9265	9265	0	0.0%	179-e04&R20-U-X-O-C	9265	179-e04&R20-U-X-O-C	0	9265	100.0%
	e05	Baraboo Municipal Building	1.779	1.779	179-e05-U-N-I-C	3952	3952	0	0.0%	179-e05	3951	179-e05-C	2950	1002	25.3%
	e09	Dominos	1.29	1.290	179-e09-U-N-I-C	19260	19260	0	0.0%	179-e09	19260	179-e09-C	1554	17706	91.9%
	e10	Driftless Glen Distillery	0.797	0.797	179-e10-U-N-I-C	1746	1746	0	0.0%	179-e10	1746	179-e10-C	1424	322	18.4%
	e11	Fox Point Pond West	6.122	6.541	179-e11-U-N-I-C	9665	9665	0	0.0%	179-e11	9955	179-e11-C	1343	8613	86.5%
			0.419		179-e11-U-X-O-C	291	291	0	0.0%	179-e11-U-X-O-C	291	179-e11-U-X-O-C	0	291	100.0%
	e18	Oak Park Place Pond 1	3.596	3.597	179-e18-U-N-I-C	6395	6395	0	0.0%	179-e18	6395	179-e18-C	31	6364	99.5%
			0.001		179-e18-U-X-I-C	0	0	0	0.0%	179-e18-U-X-I-C	0	179-e18-U-X-I-C	0	0	100.0%
	e19	Oak Park Place Pond 4	1.225	1.225	179-e19-U-N-I-C	1913	1913	0	0.0%	179-e19	4119	179-e19-C	79	4040	98.1%
	e23&R10	Riverwalk Park	8.888	10.662	179-e23&R10-U-N-I-C	16115	16115	0	0.0%	179-e23&R10	16115	179-e23&R10-C	8270	7845	48.7%
			1.774		179-e23&R10-U-X-I-C	3302	3302	0	0.0%	179-e23&R10-U-X-I-C	3302	179-e23&R10-U-X-I-C	3302	3302	100.0%
	e26	South Point Apts	3.569	3.569	179-e26-U-N-I-C	5110	5110	0	0.0%	179-e26	5105	179-e26-C	1484	3622	70.9%
	e27	Spruce Haven 2nd Add OL 2	14.883	43.887	179-e27-U-N-I-C	17730	17730	0	0.0%	179-e27	30315	179-e27-C	21845	8470	27.9%
			29.004		179-e27-U-X-O-C	1017	1017	0	0.0%	179-e27-U-X-O-C	1017	179-e27-U-X-O-C	1017	1017	100.0%
	e32	Villas Baraboo	53.244	53.317	179-e32-U-N-I-C	87195	87195	0	0.0%	179-e32	87190	179-e32-C	46080	41110	47.1%
			0.073		179-e32-U-X-O-C	26	26	0	0.0%	179-e32-U-X-O-C	26	179-e32-U-X-O-C	0	26	100.0%
	e33	Vintage Condominiums Biofilter C	1.082	1.082	179-e33-U-N-I-C	279	279	0	0.0%	179-e33	279	179-e33-C	66	213	76.4%
	e34	Vintage Condominiums Biofilter D	0.359	0.359	179-e34-U-N-I-C	91	91	0	0.0%	179-e34	157	179-e34-C	116	41	26.1%
	e35	Vintage Condominiums Biofilter E	0.765	0.765	179-e35-U-N-I-C	202	202	0	0.0%	179-e35	225	179-e35-C	58	168	74.5%
	e36	Vintage Condominiums Biofilter F	0.604	0.604	179-e36-U-N-I-C	161	161	0	0.0%	179-e36	32	179-e36-C	23	9	28.2%
5 year model	e09NoBMP	e09NoBMP	27.633	32.656	179-e09NoBMP-SM-N-I-C	49131	46174	2957	6.0%	179-e09NoBMP-SM-N-I-C	46174	179-e09NoBMP-SM-N-I-C	46174	0	0.0%
			3.166		179-e09NoBMP-SW-N-I-C	3229	2608	621	19.2%	179-e09NoBMP-SW-N-I-C	2608	179-e09NoBMP-SW-N-I-C	2608	0	0.0%
			0.073		179-e09NoBMP-U-N-I-C	5	5	0	0.0%	179-e09NoBMP-U-N-I-C	5	179-e09NoBMP-U-N-I-C	5	0	0.0%
			1.784		179-e09NoBMP-U-X-I-C	1657	1657	0	0.0%	179-e09NoBMP-U-X-I-C	1657	179-e09NoBMP-U-X-I-C	0	1657	100.0%
	NoBMP	No BMP	566.227	1,062.843	179-NoBMP-SM-N-I-C	789187	738381	50806	6.4%	179-NoBMP-SM-N-I-C	738381	179-NoBMP-SM-N-I-C	738381	0	0.0%
			70.547		179-NoBMP-SW-N-I-C	144471	117484	26987	18.7%	179-NoBMP-SW-N-I-C	117484	179-NoBMP-SW-N-I-C	117484	0	0.0%
			121.571		179-NoBMP-U-N-I-C	29064	29064	0	0.0%	179-NoBMP-U-N-I-C	29064	179-NoBMP-U-N-I-C	29064	0	0.0%
			233.285		179-NoBMP-U-X-I-C	43037	43037	0	0.0%	179-NoBMP-U-X-I-C	43037	179-NoBMP-U-X-I-C	0	43037	100.0%
			71.213		179-NoBMP-U-X-O-C	11191	11191	0	0.0%	179-NoBMP-U-X-O-C	11191	179-NoBMP-U-X-O-C	0	11191	100.0%
	P10	P10	38.617	42.226	179-P10-SM-N-I-C	66277	60622	5655	8.5%	179-P10-SM-N-I-C	60622	179-P10-SM-N-I-C	60622	0	0.0%
			2.704		179-P10-SW-N-I-C	6360	5099	1261	19.8%	179-P10-SW-N-I-C	5099	179-P10-SW-N-I-C	5099	0	0.0%
			0.004		179-P10-U-N-I-C	0	0	0	0.0%	179-P10-U-N-I-C	0	179-P10-U-N-I-C	0	0	0.0%
			0.901		179-P10-U-X-I-C	0	0	0	0.0%	179-P10-U-X-I-C	0	179-P10-U-X-I-C	0	0	100.0%
	P110	P110	185.863	394.354	179-P110-SM-N-I-C	277179	260958	16221	5.9%	179-P110-SM-N-I-C	260958	179-P110-SM-N-I-C	260958	0	0.0%
			0.487		179-P110-SW-N-I-C	290	236	55	18.9%	179-P110-SW-N-I-C	236	179-P110-SW-N-I-C	236	0	0.0%
			153.269		179-P110-U-N-I-C	134917	134917	0	0.0%	179-P110-U-N-I-C	134917	179-P110-U-N-I-C	134917	0	0.0%
			54.735		179-P110-U-X-O-C	31681	31681	0	0.0%	179-P110-U-X-O-C	31681	179-P110-U-X-O-C	31681	0	100.0%
	P150	P150	17.889	22.862	179-P150-SM-N-I-C	41779	39953	1826	4.4%	179-P150-SM-N-I-C	39953	179-P150-SM-N-I-C	39953	0	0.0%
			4.973		179-P150-U-N-I-C	15208	15208	0	0.0%	179-P150-U-N-I-C	15208	179-P150-U-N-I-C	15208	0	0.0%
	P160	P160	103.965	179.493	179-P160-SM-N-I-C	158335	144695	13640	8.6%	179-P160-SM-N-I-C	144695	179-P160-SM-N-I-C	144695	0	0.0%
			57.59		179-P160-SW-N-I-C	121081	94778	26303	21.7%	179-P160-SW-N-I-C	94778	179-P160-SW-N-I-C	94778	0	0.0%
			8.53		179-P160-U-N-I-C	7267	7267	0	0.0%	179-P160-U-N-I-C	7267	179-P160-U-N-I-C	7267	0	0.0%
			9.408		179-P160-U-X-I-C	19664	19664	0	0.0%	179-P160-U-X-I-C	19664	179-P160-U-X-I-C	19664	0	100.0%
	P170	P170	7.857	7.857	179-P170-SM-N-I-C	25006	24751	255	1.0%	179-P170-SM-N-I-C	24751	179-P170-SM-N-I-C	24751	0	0.0%
	P20	P20	125.441	145.642	179-P20-SM-N-I-C	185032	170045	14987	8.1%	179-P20-SM-N-I-C	170045	179-P20-SM-N-I-C	170045	0	0.0%
			13.911		179-P20-SW-N-I-C	21145	16152	4993	23.6%	179-P20-SW-N-I-C	16152	179-P20-SW-N-I-C	16152	0	0.0%
			1.857		179-P20-U-N-I-C	2599	2599	0	0.0%	179-P20-U-N-I-C	2599	179-P20-U-N-I-C	2599	0	0.0%
			3.506		179-P20-U-X-I-C	0	0	0	0.0%	179-P20-U-X-I-C	0	179-P20-U-X-I-C	0	0	100.0%
			0.927		179-P20-U-X-O-C	0	0	0	0.0%	179-P20-U-X-O-C	0	179-P20-U-X-O-C	0	0	100.0%
	P40	P40	148.265	162.542	179-P40-SM-N-I-C	249040	229706	19334	7.8%	179-P40-SM-N-I-C	229706	179-P40-SM-N-I-C	229706	0	0.0%
			10.381		179-P40-SW-N-I-C	25935	21140	4795	18.5%	179-P40-SW-N-I-C	21140	179-P40-SW-N-I-C	21140	0	0.0%
			3.896		179-P40-U-X-I-C	0	0	0	0.0%	179-P40-U-X-I-C	0	179-P40-U-X-I-C	0	0	100.0%
	P50	P50	36.654	39.847	179-P50-SM-N-I-C	53156	49148	4008	7.5%	179-P50-SM-N-I-C	49148	179-P50-SM-N-I-C	49148	0	0.0%
			3.193		179-P50-U-N-I-C	3153	3153	0	0.0%	179-P50-U-N-I-C	3153	179-P50-U-N-I-C	3153	0	0.0%
	P60	P60	55.684	57.065	179-P60-SM-N-I-C	87279	80540	6739	7.7%	179-P60-SM-N-I-C	80540	179-P60-SM-N-I-C	80540	0	0.0%
			1.381		179-P60-U-N-I-C	2925	2925	0	0.0%	179-P60-U-N-I-C	2925	179-P60-U-N-I-C	2925	0	0.0%
	P70	P70	19.432	25.256	179-P70-SM-N-I-C	25679	23738	1941	7.6%	179-P70-SM-N-I-C	23738	179-P70-SM-N-I-C	23738	0	0.0%
			4.479		179-P70-SW-N-I-C	5276	4136	1140	21.6%	179-P70-SW-N-I-C	4136	179-P70-SW-N-I-C	4136	0	0.0%
			1.345		179-P70-U-X-I-C	1406	1406	0	0.0%	179-P70-U-X-I-C	1406	179-P70-U-X-I-C	0	1406	100.0%
	P90	P90	46.265	229.104	179-P90-SM-N-I-C	136903	128129	8774	6.4%	179-P90-SM-N-I-C	128129	179-P90-SM-N-I-C	128129	0	0.0%
			8.222		179-P90-SW-N-I-C	25579	22042	3537	13.8%	179-P90-SW-N-I-C	22042	179-P90-SW-N-I-C	22042	0	0.0%
			90.247		179-P90-U-N-I-C	144393	144393	0	0.0%	179-P90-U-N-I-C	144393	179-P90-U-N-I-C	144393	0	0.0%
			11.029		179-P90-U-X-I-C	4609	4609	0	0.0%	179-P90-U-X-I-C	4609	179-P90-U-X-I-C	0	4609	100.0%
			73.341		179-P90-U-X-O-C	37038	37038	0	0.0%	179-P90-U-X-O-C	37038	179-P90-U-X-O-C	0	37038	100.0%
	S02	S02	12.401	53.906	179-S02-U-N-I-C	15975	15975	0	0.0%	179-S02	15975	179-S02-C	12970	3005	18.8%
			41.505		179-S02-U-X-O-C	3705	3705	0	0.0%	179-S02-U-X-O-C	3705	179-S02-U-X-O-C	0	3705	100.0%
	S09	S09	46.241	69.457	179-S09-U-N-I-C	50555	50555	0	0.0%	179-S09	50550	179-S09-C	50215	335	0.7%
			23.216		179-S09-U-X-O-C	9010	9010	0	0.0%	179-S09-U-X-O-C	9010	179-S09-U-X-O-C	9010	9010	100.0%
	S12	S12	2.414	2.414	179-S12-U-N-I-C	3531	3531	0	0.0%	179-S12	3531	179-S12-C	2206	1325	37.5%
	S13	S13	16.827	54.114	179-S13-U-N-I-C	18405	18405	0	0.0%	179-S13	18405	179-S13-C	15870	2535	13.8%
			37.264		179-S13-U-X-I-C	16570	16570	0	0.0%	179-S13-U-X-I-C	16570	179-S13-U-X-I-C	0	16570	100.0%
			0.023		179-S13-U-X-O-C	15	15	0	0.0%	179-S13-U-X-O-C	15	179-S13-U-X-O-C	0	15	100.0%
	S14&P80	S14&P80	119.418	245.671	179-S14&P80-U-N-I-C	150795	150795	0	0.0%	179-S14&P80	199040	179-S14&P80-C	189230	9810	4.9%
			16.865		179-S14&P80-U-X-I-C	7500	7500	0	0.0%	179-S14&P80-U-X-I-C	7500	179-S14&P80-U-X-I-C	0	7500	100.0%
			109.388		179-S14&P80-U-X-O-C	51460	51460	0	0.0%	179-S14&P80-U-X-O-C	51460	179-S14&P80-U-X-O-C	0	51460	100.0%
	S15	S15	13.695	13.695	179-S15-U-N-I-C	24225	24225	0	0.0%	179-S15	24220	179-S15-C	20520	3700	15.3%
	S16	S16	2.859	9.016	179-S16-U-N-I-C	3245	3245	0	0.0%	179-S16	3245	179-S16-C	2806	439	13.5%
			6.157		179-S16-U-X-O-C	5635	5635	0	0.0%	179-S16-U-X-O-C	5635	179-S16-U-X-O-C	0	5635	100.0%
	S17	S17	3.04	3.747	179-S17-U-N-I-C	4294	4294	0	0.0%	179-S17	4294	179-S17-C	3550	744	17.3%
			0.707		179-S17-U-X-O-C	64	64	0	0.0%	179-S17-U-X-O-C	64	179-S17-U-X-O-C	0	64	100.0%
	S18	S18	0.863	0.863	179-S18-U-N-I-C	1347	1347	0	0.0%	179-S18	1347	179-S18-C	1133	214	15.9%
	S19	S19	3.197	3.197	179-S19-U-N-I-C	4760	4760	0	0.0%	179-S19	4759	179-S19-C	3945	815	17.1%
	S20	S20	3.034	3.034	179-S20-U-N-I-C	2410	2410	0	0.0%	179-S20	2409	179-S20-C	1975	435	18.0%
	S21	S21	24.706	137.992	179-S21-U-N-I-C	7530	7530	0	0.0%	179-S21	7530	179-S21-C	6670	860	11.4%
			113.286		179-S21-U-X-O-C	26090	26090	0	0.0%	179-S21-U-X-O-C	26090	179-S21-U-X-O-C	0	26090	100.0%
					Total TSS	3818286.2	lbs/5-yr	Regulated TSS Trapped by Sweeping				Regulated TSS Trapped by Existing Structural BMPs		167462.4	lbs/5-yr
		Total Area (ac)	3,345.07		In City TSS	3631798.4	lbs/5-yr	216834.9	lbs/5-yr			Total Regulated TSS Trapped by All Existing BMPs		384297.3	lbs/5-yr
		Regulated Area (ac)	2,481.28		Regulated TSS	3534052.9	lbs/5-yr	6.1%				Total Regulated TSS Trapped by All Existing BMPs		10.9%	
													REQUIRED =	DNE	

BMP Number	Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
	Node	Value	Sweeping			Node	Value	Node	Value		
e02	179-e02-U-N-I-C	39.255	39.3	0.0	0.0%	179-e02	39.3	179-e02-C	18.8	20.5	52.2%
e03	179-e03-U-N-I-C	12.665	12.7	0.0	0.0%	179-e03	12.7	179-e03-C	2.5	10.2	80.5%
e04&R20	179-e04&R20-U-N-I-C	846.5	846.5	0.0	0.0%	179-e04&R20	1043.5	179-e04&R20-C	936.0	107.5	10.3%
	179-e04&R20-U-X-O-C	31.935	31.9	0.0	0.0%	179-e04&R20-U-X-O-C	31.9	179-e04&R20-U-X-O-C	0.0	31.9	100.0%
e05	179-e05-U-N-I-C	9.875	9.9	0.0	0.0%	179-e05	9.9	179-e05-C	7.8	2.1	21.4%
e09	179-e09-U-N-I-C	41.26	41.3	0.0	0.0%	179-e09	41.3	179-e09-C	3.8	37.5	90.9%
e10	179-e10-U-N-I-C	4.6865	4.7	0.0	0.0%	179-e10	4.7	179-e10-C	3.9	0.8	16.1%
e11	179-e11-U-N-I-C	34.345	34.3	0.0	0.0%	179-e11	35.9	179-e11-C	12.2	23.8	66.1%
	179-e11-U-X-O-C	1.596	1.6	0.0	0.0%	179-e11-U-X-O-C	1.6	179-e11-U-X-O-C	0.0	1.6	100.0%
e18	179-e18-U-N-I-C	19.115	19.1	0.0	0.0%	179-e18	19.1	179-e18-C	4.3	14.8	77.5%
	179-e18-U-X-I-C	0.003205	0.0	0.0	0.0%	179-e18-U-X-I-C	0.0	179-e18-U-X-I-C	0.0	0.0	100.0%
e19	179-e19-U-N-I-C	6.585	6.6	0.0	0.0%	179-e19	15.0	179-e19-C	4.1	10.9	72.6%
e23&R10	179-e23&R10-U-N-I-C	45.37	45.4	0.0	0.0%	179-e23&R10	45.4	179-e23&R10-C	25.0	20.4	44.9%
	179-e23&R10-U-X-I-C	8.745	8.7	0.0	0.0%	179-e23&R10-U-X-I-C	8.7	179-e23&R10-U-X-I-C	0.0	8.7	100.0%
e26	179-e26-U-N-I-C	18.275	18.3	0.0	0.0%	179-e26	18.3	179-e26-C	8.8	9.5	51.8%
e27	179-e27-U-N-I-C	71.6	71.6	0.0	0.0%	179-e27	147.0	179-e27-C	118.1	29.0	19.7%
	179-e27-U-X-O-C	35.52	35.5	0.0	0.0%	179-e27-U-X-O-C	35.5	179-e27-U-X-O-C	0.0	35.5	100.0%
e32	179-e32-U-N-I-C	248.05	248.1	0.0	0.0%	179-e32	248.0	179-e32-C	156.6	91.5	36.9%
	179-e32-U-X-O-C	0.0962	0.1	0.0	0.0%	179-e32-U-X-O-C	0.1	179-e32-U-X-O-C	0.0	0.1	100.0%
e33	179-e33-U-N-I-C	1.978	2.0	0.0	0.0%	179-e33	2.0	179-e33-C	1.3	0.7	34.0%
e34	179-e34-U-N-I-C	0.6535	0.7	0.0	0.0%	179-e34	2.0	179-e34-C	1.7	0.3	15.3%
e35	179-e35-U-N-I-C	1.414	1.4	0.0	0.0%	179-e35	2.0	179-e35-C	1.5	0.6	27.8%
e36	179-e36-U-N-I-C	1.121	1.1	0.0	0.0%	179-e36	1.1	179-e36-C	0.6	0.5	43.7%
e09NoBMP	179-e09NoBMP-SM-N-I-C	154	148.6	5.4	3.5%	179-e09NoBMP-SM-N-I-C	148.6	179-e09NoBMP-SM-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-SW-N-I-C	12.49	11.2	1.3	10.7%	179-e09NoBMP-SW-N-I-C	11.2	179-e09NoBMP-SW-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0	0.0%	179-e09NoBMP-U-N-I-C	0.0	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-U-X-I-C	5.6	5.6	0.0	0.0%	179-e09NoBMP-U-X-I-C	5.6	179-e09NoBMP-U-X-I-C	0.0	5.6	100.0%
NoBMP	179-NoBMP-SM-N-I-C	2646	2543.0	103.0	3.9%	179-NoBMP-SM-N-I-C	2543.0	179-NoBMP-SM-N-I-C	2543.0	0.0	0.0%
	179-NoBMP-SW-N-I-C	376	329.6	46.4	12.3%	179-NoBMP-SW-N-I-C	329.6	179-NoBMP-SW-N-I-C	329.6	0.0	0.0%
	179-NoBMP-U-N-I-C	85.69	85.7	0.0	0.0%	179-NoBMP-U-N-I-C	85.7	179-NoBMP-U-N-I-C	85.7	0.0	0.0%
	179-NoBMP-U-X-I-C	143.4	143.4	0.0	0.0%	179-NoBMP-U-X-I-C	143.4	179-NoBMP-U-X-I-C	0.0	143.4	100.0%
	179-NoBMP-U-X-O-C	46.86	46.9	0.0	0.0%	179-NoBMP-U-X-O-C	46.9	179-NoBMP-U-X-O-C	0.0	46.9	100.0%
P10	179-P10-SM-N-I-C	223.9	211.5	12.4	5.5%	179-P10-SM-N-I-C	211.5	179-P10-SM-N-I-C	211.5	0.0	0.0%
	179-P10-SW-N-I-C	15.09	13.0	2.1	13.7%	179-P10-SW-N-I-C	13.0	179-P10-SW-N-I-C	13.0	0.0	0.0%
	179-P10-U-N-I-C	0	0.0	0.0	0.0%	179-P10-U-N-I-C	0.0	179-P10-U-N-I-C	0.0	0.0	0.0%
	179-P10-U-X-I-C	0	0.0	0.0	0.0%	179-P10-U-X-I-C	0.0	179-P10-U-X-I-C	0.0	0.0	100.0%
P110	179-P110-SM-N-I-C	802.4	774.3	28.1	3.5%	179-P110-SM-N-I-C	774.3	179-P110-SM-N-I-C	774.3	0.0	0.0%
	179-P110-SW-N-I-C	1.484	1.4	0.1	8.6%	179-P110-SW-N-I-C	1.4	179-P110-SW-N-I-C	1.4	0.0	0.0%
	179-P110-U-N-I-C	547.4	547.4	0.0	0.0%	179-P110-U-N-I-C	547.4	179-P110-U-N-I-C	547.4	0.0	0.0%
	179-P110-U-X-O-C	167.7	167.7	0.0	0.0%	179-P110-U-X-O-C	167.7	179-P110-U-X-O-C	0.0	167.7	100.0%
P150	179-P150-SM-N-I-C	96.59	93.6	3.0	3.1%	179-P150-SM-N-I-C	93.6	179-P150-SM-N-I-C	93.6	0.0	0.0%
	179-P150-U-N-I-C	27.82	27.8	0.0	0.0%	179-P150-U-N-I-C	27.8	179-P150-U-N-I-C	27.8	0.0	0.0%
P160	179-P160-SM-N-I-C	565.2	534.5	30.7	5.4%	179-P160-SM-N-I-C	534.5	179-P160-SM-N-I-C	534.5	0.0	0.0%
	179-P160-SW-N-I-C	338.7	288.6	50.1	14.8%	179-P160-SW-N-I-C	288.6	179-P160-SW-N-I-C	288.6	0.0	0.0%
	179-P160-U-N-I-C	33.22	33.2	0.0	0.0%	179-P160-U-N-I-C	33.2	179-P160-U-N-I-C	33.2	0.0	0.0%
	179-P160-U-X-I-C	55.17	55.2	0.0	0.0%	179-P160-U-X-I-C	55.2	179-P160-U-X-I-C	0.0	55.2	100.0%
P170	179-P170-SM-N-I-C	44.82	44.5	0.3	0.7%	179-P170-SM-N-I-C	44.5	179-P170-SM-N-I-C	44.5	0.0	0.0%
P20	179-P20-SM-N-I-C	666.4	632.8	33.6	5.0%	179-P20-SM-N-I-C	632.8	179-P20-SM-N-I-C	632.8	0.0	0.0%
	179-P20-SW-N-I-C	74.26	63.1	11.2	15.0%	179-P20-SW-N-I-C	63.1	179-P20-SW-N-I-C	63.1	0.0	0.0%
	179-P20-U-N-I-C	8.379	8.4	0.0	0.0%	179-P20-U-N-I-C	8.4	179-P20-U-N-I-C	8.4	0.0	0.0%
	179-P20-U-X-I-C	0	0.0	0.0	0.0%	179-P20-U-X-I-C	0.0	179-P20-U-X-I-C	0.0	0.0	100.0%
	179-P20-U-X-O-C	0	0.0	0.0	0.0%	179-P20-U-X-O-C	0.0	179-P20-U-X-O-C	0.0	0.0	100.0%
P40	179-P40-SM-N-I-C	761.9	723.0	38.9	5.1%	179-P40-SM-N-I-C	723.0	179-P40-SM-N-I-C	723.0	0.0	0.0%
	179-P40-SW-N-I-C	60.88	53.1	7.8	12.8%	179-P40-SW-N-I-C	53.1	179-P40-SW-N-I-C	53.1	0.0	0.0%
	179-P40-U-X-I-C	0	0.0	0.0	0.0%	179-P40-U-X-I-C	0.0	179-P40-U-X-I-C	0.0	0.0	0.0%
P50	179-P50-SM-N-I-C	197.6	188.4	9.2	4.7%	179-P50-SM-N-I-C	188.4	179-P50-SM-N-I-C	188.4	0.0	0.0%
	179-P50-U-N-I-C	11.91	11.9	0.0	0.0%	179-P50-U-N-I-C	11.9	179-P50-U-N-I-C	11.9	0.0	0.0%
P60	179-P60-SM-N-I-C	308.9	293.9	15.0	4.9%	179-P60-SM-N-I-C	293.9	179-P60-SM-N-I-C	293.9	0.0	0.0%
	179-P60-U-N-I-C	7.833	7.8	0.0	0.0%	179-P60-U-N-I-C	7.8	179-P60-U-N-I-C	7.8	0.0	0.0%
P70	179-P70-SM-N-I-C	90.89	87.2	3.7	4.0%	179-P70-SM-N-I-C	87.2	179-P70-SM-N-I-C	87.2	0.0	0.0%
	179-P70-SW-N-I-C	20.49	17.9	2.6	12.7%	179-P70-SW-N-I-C	17.9	179-P70-SW-N-I-C	17.9	0.0	0.0%
	179-P70-U-X-I-C	5.467	5.5	0.0	0.0%	179-P70-U-X-I-C	5.5	179-P70-U-X-I-C	0.0	5.5	100.0%
P90	179-P90-SM-N-I-C	272.1	259.8	12.3	4.5%	179-P90-SM-N-I-C	259.8	179-P90-SM-N-I-C	259.8	0.0	0.0%
	179-P90-SW-N-I-C	51	46.0	5.0	9.9%	179-P90-SW-N-I-C	46.0	179-P90-SW-N-I-C	46.0	0.0	0.0%
	179-P90-U-N-I-C	444	444.0	0.0	0.0%	179-P90-U-N-I-C	444.0	179-P90-U-N-I-C	444.0	0.0	0.0%
	179-P90-U-X-I-C	33.18	33.2	0.0	0.0%	179-P90-U-X-I-C	33.2	179-P90-U-X-I-C	0.0	33.2	100.0%
	179-P90-U-X-O-C	221.1	221.1	0.0	0.0%	179-P90-U-X-O-C	221.1	179-P90-U-X-O-C	0.0	221.1	100.0%
S02	179-S02-U-N-I-C	50.6	50.6	0.0	0.0%	179-S02	50.6	179-S02-C	43.8	6.8	13.5%
	179-S02-U-X-O-C	26.6	26.6	0.0	0.0%	179-S02-U-X-O-C	26.6	179-S02-U-X-O-C	0.0	26.6	100.0%
S09	179-S09-U-N-I-C	198.2	198.2	0.0	0.0%	179-S09	198.2	179-S09-C	197.2	1.0	0.5%
	179-S09-U-X-O-C	53.4	53.4	0.0	0.0%	179-S09-U-X-O-C	53.4	179-S09-U-X-O-C	0.0	53.4	100.0%
S12	179-S12-U-N-I-C	12.505	12.5	0.0	0.0%	179-S12	12.5	179-S12-C	8.4	4.1	32.9%
S13	179-S13-U-N-I-C	77.7	77.7	0.0	0.0%	179-S13	77.7	179-S13-C	69.9	7.8	10.0%
	179-S13-U-X-I-C	119.3	119.3	0.0	0.0%	179-S13-U-X-I-C	119.3	179-S13-U-X-I-C	0.0	119.3	100.0%
	179-S13-U-X-O-C	0.08305	0.1	0.0	0.0%	179-S13-U-X-O-C	0.1	179-S13-U-X-O-C	0.0	0.1	100.0%
S14&P80	179-S14&P80-U-N-I-C	514	514.0	0.0	0.0%	179-S14&P80	763.0	179-S14&P80-C	730.5	32.5	4.3%
	179-S14&P80-U-X-I-C	54	54.0	0.0	0.0%	179-S14&P80-U-X-I-C	54.0	179-S14&P80-U-X-I-C	0.0	54.0	100.0%
	179-S14&P80-U-X-O-C	344.55	344.6	0.0	0.0%	179-S14&P80-U-X-O-C	344.6	179-S14&P80-U-X-O-C	0.0	344.6	100.0%
S15	179-S15-U-N-I-C	66.35	66.4	0.0	0.0%	179-S15	66.4	179-S15-C	58.7	7.6	11.5%
S16	179-S16-U-N-I-C	13.09	13.1	0.0	0.0%	179-S16	13.1	179-S16-C	11.9	1.2	9.4%
	179-S16-U-X-O-C	20.105	20.1	0.0	0.0%	179-S16-U-X-O-C	20.1	179-S16-U-X-O-C	0.0	20.1	100.0%
S17	179-S17-U-N-I-C	17.155	17.2	0.0	0.0%	179-S17	17.2	179-S17-C	15.0	2.1	12.5%
	179-S17-U-X-O-C	1.065	1.1	0.0	0.0%	179-S17-U-X-O-C	1.1	179-S17-U-X-O-C	0.0	1.1	100.0%
S18	179-S18-U-N-I-C	5.26	5.3	0.0	0.0%	179-S18	5.3	179-S18-C	4.7	0.6	11.4%
S19	179-S19-U-N-I-C	18.535	18.5	0.0	0.0%	179-S19	18.5	179-S19-C	16.2	2.3	12.4%
S20	179-S20-U-N-I-C	11.055	11.1	0.0	0.0%	179-S20	11.1	179-S20-C	9.8	1.2	11.0%
S21	179-S21-U-N-I-C	51.6	51.6	0.0	0.0%	179-S21	51.6	179-S21-C	49.4	2.2	4.3%
	179-S21-U-X-O-C	223.85	223.9	0.0	0.0%	179-S21-U-X-O-C	223.9	179-S21-U-X-O-C	0.0	223.9	100.0%
	Total TP	12985.5	lbs/5-yr	Regulated TP Trapped by Sweeping				Regulated TP Trapped by Existing Structural BMPs		449.9	lbs/5-yr
	In City TP	11811.0	lbs/5-yr	422.2	lbs/5-yr			Total Regulated TP Trapped by All Existing BMPs		872.1	lbs/5-yr
	Regulated TP	11386.2	lbs/5-yr	3.7%				Total Regulated TP Trapped by All Existing BMPs		7.7%	
									REQUIRED =	15.0%	

Reach179 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Proposed Option 1

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	e02	Balanced Rock Brewery	12.262	12.262	179-e02-U-N-I-C	5455	5455	0	0.0%	179-e02	5455	179-e02-C	908	4547	83.4%
	e03	Baraboo Country Club - Clubhouse South	3.511	3.511	179-e03-U-N-I-C	2729	2729	0	0.0%	179-e03	2728	179-e03-C	670	2058	75.4%
	e04&R20	Baraboo Highschool	182.227	200.972	179-e04&R20-U-N-I-C	232105	232105	0	0.0%	179-e04&R20	282290	179-e04&R20-C	143235	139055	49.3%
			18.745		179-e04&R20-U-X-O-C	9265	9265	0	0.0%	179-e04&R20-U-X-O-C	9265	179-e04&R20-U-X-O-C	0	9265	100.0%
	e05	Baraboo Municipal Building	1.779	1.779	179-e05-U-N-I-C	3952	3952	0	0.0%	179-e05	3951	179-e05-C	2950	1002	25.3%
	e09	Dominos	1.29	1.290	179-e09-U-N-I-C	19260	19260	0	0.0%	179-e09	19260	179-e09-C	1554	17706	91.9%
	e10	Driftless Glen Distillery	0.797	0.797	179-e10-U-N-I-C	1746	1746	0	0.0%	179-e10	1746	179-e10-C	1424	322	18.4%
	e11	Fox Point Pond West	6.122	6.541	179-e11-U-N-I-C	9665	9665	0	0.0%	179-e11	9955	179-e11-C	1343	8613	86.5%
			0.419		179-e11-U-X-O-C	291	291	0	0.0%	179-e11-U-X-O-C	291	179-e11-U-X-O-C	0	291	100.0%
	e18	Oak Park Place Pond 1	3.596	3.597	179-e18-U-N-I-C	6395	6395	0	0.0%	179-e18	6395	179-e18-C	31	6364	99.5%
			0.001		179-e18-U-X-I-C	0	0	0	0.0%	179-e18-U-X-I-C	0	179-e18-U-X-I-C	0	0	100.0%
	e19	Oak Park Place Pond 4	1.225	1.225	179-e19-U-N-I-C	1913	1913	0	0.0%	179-e19	4119	179-e19-C	79	4040	98.1%
	e23&R10	Riverwalk Park	8.888	10.662	179-e23&R10-U-N-I-C	16115	16115	0	0.0%	179-e23&R10	16115	179-e23&R10-C	8270	7845	48.7%
			1.774		179-e23&R10-U-X-I-C	3302	3302	0	0.0%	179-e23&R10-U-X-I-C	3302	179-e23&R10-U-X-I-C	3302	3302	100.0%
	e26	South Point Apts	3.569	3.569	179-e26-U-N-I-C	5110	5110	0	0.0%	179-e26	5105	179-e26-C	1484	3622	70.9%
	e27	Spruce Haven 2nd Add OL 2	14.883	43.887	179-e27-U-N-I-C	17730	17730	0	0.0%	179-e27	30315	179-e27-C	21845	8470	27.9%
			29.004		179-e27-U-X-O-C	1017	1017	0	0.0%	179-e27-U-X-O-C	1017	179-e27-U-X-O-C	1017	1017	100.0%
	e32	Villas Baraboo	53.244	53.317	179-e32-U-N-I-C	87195	87195	0	0.0%	179-e32	87190	179-e32-C	46080	41110	47.1%
			0.073		179-e32-U-X-O-C	26	26	0	0.0%	179-e32-U-X-O-C	26	179-e32-U-X-O-C	0	26	100.0%
	e33	Vintage Condominiums Biofilter C	1.082	1.082	179-e33-U-N-I-C	279	279	0	0.0%	179-e33	279	179-e33-C	66	213	76.4%
	e34	Vintage Condominiums Biofilter D	0.359	0.359	179-e34-U-N-I-C	91	91	0	0.0%	179-e34	157	179-e34-C	116	41	26.1%
	e35	Vintage Condominiums Biofilter E	0.765	0.765	179-e35-U-N-I-C	202	202	0	0.0%	179-e35	225	179-e35-C	58	168	74.5%
	e36	Vintage Condominiums Biofilter F	0.604	0.604	179-e36-U-N-I-C	161	161	0	0.0%	179-e36	32	179-e36-C	23	9	28.2%
5 year model	e09NoBMP	e09NoBMP	27.633	32.656	179-e09NoBMP-SM-N-I-C	49131	42042	7089	14.4%	179-e09NoBMP-SM-N-I-C	46174	179-e09NoBMP-SM-N-I-C	46174	0	0.0%
			3.166		179-e09NoBMP-SW-N-I-C	3229	2608	621	19.2%	179-e09NoBMP-SW-N-I-C	2608	179-e09NoBMP-SW-N-I-C	2608	0	0.0%
			0.073		179-e09NoBMP-U-N-I-C	5	5	0	0.0%	179-e09NoBMP-U-N-I-C	5	179-e09NoBMP-U-N-I-C	5	0	0.0%
			1.784		179-e09NoBMP-U-X-I-C	1657	1657	0	0.0%	179-e09NoBMP-U-X-I-C	1657	179-e09NoBMP-U-X-I-C	0	1657	100.0%
	NoBMP	No BMP	566.227	1,062.843	179-NoBMP-SM-N-I-C	789187	650122	139065	17.6%	179-NoBMP-SM-N-I-C	650122	179-NoBMP-SM-N-I-C	650122	0	0.0%
			70.547		179-NoBMP-SW-N-I-C	144471	117495	26976	18.7%	179-NoBMP-SW-N-I-C	117495	179-NoBMP-SW-N-I-C	117495	0	0.0%
			121.571		179-NoBMP-U-N-I-C	29064	29064	0	0.0%	179-NoBMP-U-N-I-C	29064	179-NoBMP-U-N-I-C	29064	0	0.0%
			233.285		179-NoBMP-U-X-I-C	43037	43037	0	0.0%	179-NoBMP-U-X-I-C	43037	179-NoBMP-U-X-I-C	0	43037	100.0%
			71.213		179-NoBMP-U-X-O-C	11191	11191	0	0.0%	179-NoBMP-U-X-O-C	11191	179-NoBMP-U-X-O-C	0	11191	100.0%
	P10	P10	38.617	42.226	179-P10-SM-N-I-C	66277	50128	16149	24.4%	179-P10-SM-N-I-C	60622	179-P10-SM-N-I-C	60622	0	0.0%
			2.704		179-P10-SW-N-I-C	6360	5099	1261	19.8%	179-P10-SW-N-I-C	5099	179-P10-SW-N-I-C	5099	0	0.0%
			0.004		179-P10-U-N-I-C	0	0	0	0.0%	179-P10-U-N-I-C	0	179-P10-U-N-I-C	0	0	0.0%
			0.901		179-P10-U-X-I-C	0	0	0	0.0%	179-P10-U-X-I-C	0	179-P10-U-X-I-C	0	0	100.0%
	P110	P110	185.863	394.354	179-P110-SM-N-I-C	277179	237269	39910	14.4%	179-P110-SM-N-I-C	237269	179-P110-SM-N-I-C	237269	0	0.0%
			0.487		179-P110-SW-N-I-C	290	236	55	18.9%	179-P110-SW-N-I-C	236	179-P110-SW-N-I-C	236	0	0.0%
			153.269		179-P110-U-N-I-C	134917	134917	0	0.0%	179-P110-U-N-I-C	134917	179-P110-U-N-I-C	134917	0	0.0%
			54.735		179-P110-U-X-O-C	31681	31681	0	0.0%	179-P110-U-X-O-C	31681	179-P110-U-X-O-C	31681	0	100.0%
	P150	P150	17.889	22.862	179-P150-SM-N-I-C	41779	37571	4208	10.1%	179-P150-SM-N-I-C	37571	179-P150-SM-N-I-C	37571	0	0.0%
			4.973		179-P150-U-N-I-C	15208	15208	0	0.0%	179-P150-U-N-I-C	15208	179-P150-U-N-I-C	15208	0	0.0%
	P160	P160	103.965	179.493	179-P160-SM-N-I-C	158335	118441	39894	25.2%	179-P160-SM-N-I-C	118441	179-P160-SM-N-I-C	118441	0	0.0%
			57.59		179-P160-SW-N-I-C	121081	94778	26303	21.7%	179-P160-SW-N-I-C	94778	179-P160-SW-N-I-C	94778	0	0.0%
			8.53		179-P160-U-N-I-C	7267	7267	0	0.0%	179-P160-U-N-I-C	7267	179-P160-U-N-I-C	7267	0	0.0%
			9.408		179-P160-U-X-I-C	19664	19664	0	0.0%	179-P160-U-X-I-C	19664	179-P160-U-X-I-C	19664	0	100.0%
	P170	P170	7.857	7.857	179-P170-SM-N-I-C	25006	24441	565	2.3%	179-P170-SM-N-I-C	24751	179-P170-SM-N-I-C	24751	0	0.0%
	P20	P20	125.441	145.642	179-P20-SM-N-I-C	185032	141315	43717	23.6%	179-P20-SM-N-I-C	141315	179-P20-SM-N-I-C	141315	0	0.0%
			13.911		179-P20-SW-N-I-C	21145	16152	4993	23.6%	179-P20-SW-N-I-C	16152	179-P20-SW-N-I-C	16152	0	0.0%
			1.857		179-P20-U-N-I-C	2599	2599	0	0.0%	179-P20-U-N-I-C	2599	179-P20-U-N-I-C	2599	0	0.0%
			3.506		179-P20-U-X-I-C	0	0	0	0.0%	179-P20-U-X-I-C	0	179-P20-U-X-I-C	0	0	100.0%
			0.927		179-P20-U-X-O-C	0	0	0	0.0%	179-P20-U-X-O-C	0	179-P20-U-X-O-C	0	0	100.0%
	P40	P40	158.646	162.542	179-P40-U-N-I-C	274975	274975	0	0.0%	179-P40	266885	179-P40-C	109895	156990	58.8%
			3.896		179-P40-U-X-I-C	0	0	0	0.0%	179-P40-U-X-I-C	0	179-P40-U-X-I-C	0	0	100.0%
	P50	P50	39.847	39.847	179-P50-U-N-I-C	56309	56309	0	0.0%	179-P50	55445	179-P50-C	15480	39965	72.1%
5 year model	P60	P60	55.684	57.065	179-P60-SM-N-I-C	87279	78527	8752	10.0%	179-P60-SM-N-I-C	78527	179-P60-SM-N-I-C	78527	0	0.0%
			1.381		179-P60-U-N-I-C	2925	2925	0	0.0%	179-P60-U-N-I-C	2925	179-P60-U-N-I-C	2925	0	0.0%
	P70	P70	23.911	25.256	179-P70-U-N-I-C	30955	30955	0	0.0%	179-P70	30955	179-P70-C	30955	0	0.0%
			1.345		179-P70-U-X-I-C	1406	1406	0	0.0%	179-P70-U-X-I-C	1406	179-P70-U-X-I-C	0	1406	100.0%
5 year model	P90	P90	46.265	229.104	179-P90-SM-N-I-C	136903	118432	18471	13.5%	179-P90-SM-N-I-C	118432	179-P90-SM-N-I-C	118432	0	0.0%
			8.222		179-P90-SW-N-I-C	25579	22042	3537	13.8%	179-P90-SW-N-I-C	22042	179-P90-SW-N-I-C	22042	0	0.0%
			90.247		179-P90-U-N-I-C	144393	144393	0	0.0%	179-P90-U-N-I-C	144393	179-P90-U-N-I-C	144393	0	0.0%
			11.029		179-P90-U-X-I-C	4609	4609	0	0.0%	179-P90-U-X-I-C	4609	179-P90-U-X-I-C	0	4609	100.0%
			73.341		179-P90-U-X-O-C	37038	37038	0	0.0%	179-P90-U-X-O-C	37038	179-P90-U-X-O-C	0	37038	100.0%
	S02	S02	12.401	53.906	179-S02-U-N-I-C	15975	15975	0	0.0%	179-S02	15975	179-S02-C	12970	3005	18.8%
			41.505		179-S02-U-X-O-C	3705	3705	0	0.0%	179-S02-U-X-O-C	3705	179-S02-U-X-O-C	0	3705	100.0%
	S09	S09	46.241	69.457	179-S09-U-N-I-C	50555	50555	0	0.0%	179-S09	50550	179-S09-C	50215	335	0.7%
			23.216		179-S09-U-X-O-C	9010	9010	0	0.0%	179-S09-U-X-O-C	9010	179-S09-U-X-O-C	9010	9010	100.0%
	S12	S12	2.414	2.414	179-S12-U-N-I-C	3531	3531	0	0.0%	179-S12	3531	179-S12-C	2206	1325	37.5%
	Leaf	Leaf Collection							Leaf Collection					0	
	S13	S13	16.827	54.114	179-S13-U-N-I-C	18405	18405	0	0.0%	179-S13	18405	179-S13-C	15870	2535	13.8%
			37.264		179-S13-U-X-I-C	16570	16570	0	0.0%	179-S13-U-X-I-C	16570	179-S13-U-X-I-C	0	16570	100.0%
			0.023		179-S13-U-X-O-C	15	15	0	0.0%	179-S13-U-X-O-C	15	179-S13-U-X-O-C	0	15	100.0%
	S14&P80	S14&P80	119.418	245.671	179-S14&P80-U-N-I-C	150795	150795	0	0.0%	179-S14&P80	199040	179-S14&P80-C	189230	9810	4.9%
			16.865		179-S14&P80-U-X-I-C	7500	7500	0	0.0%	179-S14&P80-U-X-I-C	7500	179-S14&P80-U-X-I-C	0	7500	100.0%
			109.388		179-S14&P80-U-X-O-C	51460	51460	0	0.0%	179-S14&P80-U-X-O-C	51460	179-S14&P80-U-X-O-C	0	51460	100.0%
	S15	S15	13.695	13.695	179-S15-U-N-I-C	24225	24225	0	0.0%	179-S15	24220	179-S15-C	20520	3700	15.3%
	S16	S16	2.859	9.016	179-S16-U-N-I-C	3245	3245	0	0.0%	179-S16	3245	179-S16-C	2806	439	13.5%
			6.157		179-S16-U-X-O-C	5635	5635	0	0.0%	179-S16-U-X-O-C	5635	179-S16-U-X-O-C	0	5635	100.0%
	S17	S17	3.04	3.747	179-S17-U-N-I-C	4294	4294	0	0.0%	179-S17	4294	179-S17-C	3550	744	17.3%
			0.707		179-S17-U-X-O-C	64	64	0	0.0%	179-S17-U-X-O-C	64	179-S17-U-X-O-C	0	64	100.0%
	S18	S18	0.863	0.863	179-S18-U-N-I-C	1347	1347	0	0.0%	179-S18	1347	179-S18-C	1133	214	15.9%
	S19	S19	3.197	3.197	179-S19-U-N-I-C	4760	4760	0	0.0%	179-S19	4759	179-S19-C	3945	815	17.1%
	S20	S20	3.034	3.034	179-S20-U-N-I-C	2410	2410	0	0.0%	179-S20	2409	179-S20-C	1975	435	18.0%
	S21	S21	24.706	137.992	179-S21-U-N-I-C	7530	7530	0	0.0%	179-S21	7530	179-S21-C	6670	860	11.4%
			113.286		179-S21-U-X-O-C	26090	26090	0	0.0%	179-S21-U-X-O-C	26090	179-S21-U-X-O-C	0	26090	100.0%

Total Area (ac) 3,345.07
Regulated Area (ac) 2,481.28

Total TSS	3818286.2	lbs/5-yr	Regulated TSS Trapped by Sweeping		Regulated TSS Trapped by Existing Structural BMPs	466352.4	lbs/5-yr
In City TSS	3631798.4	lbs/5-yr	381565.9	lbs/5-yr	Total Regulated TSS Trapped by All Existing BMPs	847918.3	lbs/5-yr
Regulated TSS	3534052.9	lbs/5-yr	10.8%		Total Regulated TSS Trapped by All Existing BMPs	24.0%	
					REQUIRED =	DNE	

BMP Number	Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
	Node	Value	Sweeping			Node	Value	Node	Value		
e02	179-e02-U-N-I-C	39.255	39.3	0.0	0.0%	179-e02	39.3	179-e02-C	18.8	20.5	52.2%
e03	179-e03-U-N-I-C	12.665	12.7	0.0	0.0%	179-e03	12.7	179-e03-C	2.5	10.2	80.5%
e04&R20	179-e04&R20-U-N-I-C	846.5	846.5	0.0	0.0%	179-e04&R20	1043.5	179-e04&R20-C	686.5	357.0	34.2%
	179-e04&R20-U-X-O-C	31.935	31.9	0.0	0.0%	179-e04&R20-U-X-O-C	31.9	179-e04&R20-U-X-O-C	0.0	31.9	100.0%
e05	179-e05-U-N-I-C	9.875	9.9	0.0	0.0%	179-e05	9.9	179-e05-C	7.8	2.1	21.4%
e09	179-e09-U-N-I-C	41.26	41.3	0.0	0.0%	179-e09	41.3	179-e09-C	3.8	37.5	90.9%
e10	179-e10-U-N-I-C	4.6865	4.7	0.0	0.0%	179-e10	4.7	179-e10-C	3.9	0.8	16.1%
e11	179-e11-U-N-I-C	34.345	34.3	0.0	0.0%	179-e11	35.9	179-e11-C	12.2	23.8	66.1%
	179-e11-U-X-O-C	1.596	1.6	0.0	0.0%	179-e11-U-X-O-C	1.6	179-e11-U-X-O-C	0.0	1.6	100.0%
e18	179-e18-U-N-I-C	19.115	19.1	0.0	0.0%	179-e18	19.1	179-e18-C	4.3	14.8	77.5%
	179-e18-U-X-I-C	0.003205	0.0	0.0	0.0%	179-e18-U-X-I-C	0.0	179-e18-U-X-I-C	0.0	0.0	100.0%
e19	179-e19-U-N-I-C	6.585	6.6	0.0	0.0%	179-e19	15.0	179-e19-C	4.1	10.9	72.6%
e23&R10	179-e23&R10-U-N-I-C	45.37	45.4	0.0	0.0%	179-e23&R10	45.4	179-e23&R10-C	25.0	20.4	44.9%
	179-e23&R10-U-X-I-C	8.745	8.7	0.0	0.0%	179-e23&R10-U-X-I-C	8.7	179-e23&R10-U-X-I-C	0.0	8.7	100.0%
e26	179-e26-U-N-I-C	18.275	18.3	0.0	0.0%	179-e26	18.3	179-e26-C	8.8	9.5	51.8%
e27	179-e27-U-N-I-C	71.6	71.6	0.0	0.0%	179-e27	147.0	179-e27-C	118.1	29.0	19.7%
	179-e27-U-X-O-C	35.52	35.5	0.0	0.0%	179-e27-U-X-O-C	35.5	179-e27-U-X-O-C	0.0	35.5	100.0%
e32	179-e32-U-N-I-C	248.05	248.1	0.0	0.0%	179-e32	248.0	179-e32-C	156.6	91.5	36.9%
	179-e32-U-X-O-C	0.0962	0.1	0.0	0.0%	179-e32-U-X-O-C	0.1	179-e32-U-X-O-C	0.0	0.1	100.0%
e33	179-e33-U-N-I-C	1.978	2.0	0.0	0.0%	179-e33	2.0	179-e33-C	1.3	0.7	34.0%
e34	179-e34-U-N-I-C	0.6535	0.7	0.0	0.0%	179-e34	2.0	179-e34-C	1.7	0.3	15.3%
e35	179-e35-U-N-I-C	1.414	1.4	0.0	0.0%	179-e35	2.0	179-e35-C	1.5	0.6	27.8%
e36	179-e36-U-N-I-C	1.121	1.1	0.0	0.0%	179-e36	1.1	179-e36-C	0.6	0.5	43.7%
e09NoBMP	179-e09NoBMP-SM-N-I-C	154	140.6	13.4	8.7%	179-e09NoBMP-SM-N-I-C	140.6	179-e09NoBMP-SM-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-SW-N-I-C	12.49	11.2	1.3	10.7%	179-e09NoBMP-SW-N-I-C	11.2	179-e09NoBMP-SW-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0	0.0%	179-e09NoBMP-U-N-I-C	0.0	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-U-X-I-C	5.6	5.6	0.0	0.0%	179-e09NoBMP-U-X-I-C	5.6	179-e09NoBMP-U-X-I-C	0.0	5.6	100.0%
NoBMP	179-NoBMP-SM-N-I-C	2646	2354.0	292.0	11.0%	179-NoBMP-SM-N-I-C	2354.0	179-NoBMP-SM-N-I-C	2354.0	0.0	0.0%
	179-NoBMP-SW-N-I-C	376	329.6	46.4	12.3%	179-NoBMP-SW-N-I-C	329.6	179-NoBMP-SW-N-I-C	329.6	0.0	0.0%
	179-NoBMP-U-N-I-C	85.69	85.7	0.0	0.0%	179-NoBMP-U-N-I-C	85.7	179-NoBMP-U-N-I-C	85.7	0.0	0.0%
	179-NoBMP-U-X-I-C	143.4	143.4	0.0	0.0%	179-NoBMP-U-X-I-C	143.4	179-NoBMP-U-X-I-C	0.0	143.4	100.0%
	179-NoBMP-U-X-O-C	46.86	46.9	0.0	0.0%	179-NoBMP-U-X-O-C	46.9	179-NoBMP-U-X-O-C	0.0	46.9	100.0%
P10	179-P10-SM-N-I-C	223.9	188.1	35.8	16.0%	179-P10-SM-N-I-C	211.5	179-P10-SM-N-I-C	211.5	0.0	0.0%
	179-P10-SW-N-I-C	15.09	13.0	2.1	13.7%	179-P10-SW-N-I-C	13.0	179-P10-SW-N-I-C	13.0	0.0	0.0%
	179-P10-U-N-I-C	0	0.0	0.0	0.0%	179-P10-U-N-I-C	0.0	179-P10-U-N-I-C	0.0	0.0	0.0%
	179-P10-U-X-I-C	0	0.0	0.0	0.0%	179-P10-U-X-I-C	0.0	179-P10-U-X-I-C	0.0	0.0	100.0%
P110	179-P110-SM-N-I-C	802.4	729.5	72.9	9.1%	179-P110-SM-N-I-C	729.5	179-P110-SM-N-I-C	729.5	0.0	0.0%
	179-P110-SW-N-I-C	1.484	1.4	0.1	8.6%	179-P110-SW-N-I-C	1.4	179-P110-SW-N-I-C	1.4	0.0	0.0%
	179-P110-U-N-I-C	547.4	547.4	0.0	0.0%	179-P110-U-N-I-C	547.4	179-P110-U-N-I-C	547.4	0.0	0.0%
	179-P110-U-X-O-C	167.7	167.7	0.0	0.0%	179-P110-U-X-O-C	167.7	179-P110-U-X-O-C	0.0	167.7	100.0%
P150	179-P150-SM-N-I-C	96.59	89.5	7.1	7.3%	179-P150-SM-N-I-C	89.5	179-P150-SM-N-I-C	89.5	0.0	0.0%
	179-P150-U-N-I-C	27.82	27.8	0.0	0.0%	179-P150-U-N-I-C	27.8	179-P150-U-N-I-C	27.8	0.0	0.0%
P160	179-P160-SM-N-I-C	565.2	474.9	90.3	16.0%	179-P160-SM-N-I-C	474.9	179-P160-SM-N-I-C	474.9	0.0	0.0%
	179-P160-SW-N-I-C	338.7	288.6	50.1	14.8%	179-P160-SW-N-I-C	288.6	179-P160-SW-N-I-C	288.6	0.0	0.0%
	179-P160-U-N-I-C	33.22	33.2	0.0	0.0%	179-P160-U-N-I-C	33.2	179-P160-U-N-I-C	33.2	0.0	0.0%
	179-P160-U-X-I-C	55.17	55.2	0.0	0.0%	179-P160-U-X-I-C	55.2	179-P160-U-X-I-C	0.0	55.2	100.0%
P170	179-P170-SM-N-I-C	44.82	44.2	0.6	1.5%	179-P170-SM-N-I-C	44.5	179-P170-SM-N-I-C	44.5	0.0	0.0%
P20	179-P20-SM-N-I-C	666.4	567.6	98.8	14.8%	179-P20-SM-N-I-C	567.6	179-P20-SM-N-I-C	567.6	0.0	0.0%
	179-P20-SW-N-I-C	74.26	63.1	11.2	15.0%	179-P20-SW-N-I-C	63.1	179-P20-SW-N-I-C	63.1	0.0	0.0%
	179-P20-U-N-I-C	8.379	8.4	0.0	0.0%	179-P20-U-N-I-C	8.4	179-P20-U-N-I-C	8.4	0.0	0.0%
	179-P20-U-X-I-C	0	0.0	0.0	0.0%	179-P20-U-X-I-C	0.0	179-P20-U-X-I-C	0.0	0.0	100.0%
	179-P20-U-X-O-C	0	0.0	0.0	0.0%	179-P20-U-X-O-C	0.0	179-P20-U-X-O-C	0.0	0.0	100.0%
P40	179-P40-U-N-I-C	822.78	822.8	0.0	0.0%	179-P40	818.0	179-P40-C	460.2	357.9	43.7%
	179-P40-U-X-I-C	0	0.0	0.0	0.0%	179-P40-U-X-I-C	0.0	179-P40-U-X-I-C	0.0	0.0	0.0%
P50	179-P50-U-N-I-C	209.51	209.5	0.0	0.0%	179-P50	211.0	179-P50-C	102.2	108.8	51.6%
P60	179-P60-SM-N-I-C	308.9	293.9	15.0	4.9%	179-P60-SM-N-I-C	293.9	179-P60-SM-N-I-C	293.9	0.0	0.0%
	179-P60-U-N-I-C	7.833	7.8	0.0	0.0%	179-P60-U-N-I-C	7.8	179-P60-U-N-I-C	7.8	0.0	0.0%
P70	179-P70-U-N-I-C	111.38	111.4	0.0	0.0%	179-P70	112.3	179-P70-C	112.3	0.0	0.0%
	179-P70-U-X-I-C	5.467	5.5	0.0	0.0%	179-P70-U-X-I-C	5.5	179-P70-U-X-I-C	0.0	5.5	100.0%
P90	179-P90-SM-N-I-C	272.1	246.0	26.1	9.6%	179-P90-SM-N-I-C	246.0	179-P90-SM-N-I-C	246.0	0.0	0.0%
	179-P90-SW-N-I-C	51	46.0	5.0	9.9%	179-P90-SW-N-I-C	46.0	179-P90-SW-N-I-C	46.0	0.0	0.0%
	179-P90-U-N-I-C	444	444.0	0.0	0.0%	179-P90-U-N-I-C	444.0	179-P90-U-N-I-C	444.0	0.0	0.0%
	179-P90-U-X-I-C	33.18	33.2	0.0	0.0%	179-P90-U-X-I-C	33.2	179-P90-U-X-I-C	0.0	33.2	100.0%
	179-P90-U-X-O-C	221.1	221.1	0.0	0.0%	179-P90-U-X-O-C	221.1	179-P90-U-X-O-C	0.0	221.1	100.0%
S02	179-S02-U-N-I-C	50.6	50.6	0.0	0.0%	179-S02	50.6	179-S02-C	43.8	6.8	13.5%
	179-S02-U-X-O-C	26.6	26.6	0.0	0.0%	179-S02-U-X-O-C	26.6	179-S02-U-X-O-C	0.0	26.6	100.0%
S09	179-S09-U-N-I-C	198.2	198.2	0.0	0.0%	179-S09	198.2	179-S09-C	197.2	1.0	0.5%
	179-S09-U-X-O-C	53.4	53.4	0.0	0.0%	179-S09-U-X-O-C	53.4	179-S09-U-X-O-C	0.0	53.4	100.0%
S12	179-S12-U-N-I-C	12.505	12.5	0.0	0.0%	179-S12	12.5	179-S12-C	8.4	4.1	32.9%
Leaf					Leaf Collection					0.0	
S13	179-S13-U-N-I-C	77.7	77.7	0.0	0.0%	179-S13	77.7	179-S13-C	69.9	7.8	10.0%
	179-S13-U-X-I-C	119.3	119.3	0.0	0.0%	179-S13-U-X-I-C	119.3	179-S13-U-X-I-C	0.0	119.3	100.0%
	179-S13-U-X-O-C	0.08305	0.1	0.0	0.0%	179-S13-U-X-O-C	0.1	179-S13-U-X-O-C	0.0	0.1	100.0%
S14&P80	179-S14&P80-U-N-I-C	514	514.0	0.0	0.0%	179-S14&P80	763.0	179-S14&P80-C	730.5	32.5	4.3%
	179-S14&P80-U-X-I-C	54	54.0	0.0	0.0%	179-S14&P80-U-X-I-C	54.0	179-S14&P80-U-X-I-C	0.0	54.0	100.0%
	179-S14&P80-U-X-O-C	344.55	344.6	0.0	0.0%	179-S14&P80-U-X-O-C	344.6	179-S14&P80-U-X-O-C	0.0	344.6	100.0%
S15	179-S15-U-N-I-C	66.35	66.4	0.0	0.0%	179-S15	66.4	179-S15-C	58.7	7.6	11.5%
S16	179-S16-U-N-I-C	13.09	13.1	0.0	0.0%	179-S16	13.1	179-S16-C	11.9	1.2	9.4%
	179-S16-U-X-O-C	20.105	20.1	0.0	0.0%	179-S16-U-X-O-C	20.1	179-S16-U-X-O-C	0.0	20.1	100.0%
S17	179-S17-U-N-I-C	17.155	17.2	0.0	0.0%	179-S17	17.2	179-S17-C	15.0	2.1	12.5%
	179-S17-U-X-O-C	1.065	1.1	0.0	0.0%	179-S17-U-X-O-C	1.1	179-S17-U-X-O-C	0.0	1.1	100.0%
S18	179-S18-U-N-I-C	5.26	5.3	0.0	0.0%	179-S18	5.3	179-S18-C	4.7	0.6	11.4%
S19	179-S19-U-N-I-C	18.535	18.5	0.0	0.0%	179-S19	18.5	179-S19-C	16.2	2.3	12.4%
S20	179-S20-U-N-I-C	11.055	11.1	0.0	0.0%	179-S20	11.1	179-S20-C	9.8	1.2	11.0%
S21	179-S21-U-N-I-C	51.6	51.6	0.0	0.0%	179-S21	51.6	179-S21-C	49.4	2.2	4.3%
	179-S21-U-X-O-C	223.85	223.9	0.0	0.0%	179-S21-U-X-O-C	223.9	179-S21-U-X-O-C	0.0	223.9	100.0%

Total TP	12985.5	lbs/5-yr	Regulated TP Trapped by Sweeping		Regulated TP Trapped by Existing Structural BMPs	1166.0	lbs/5-yr
In City TP	11811.0	lbs/5-yr	768.3	lbs/5-yr	Total Regulated TP Trapped by All Existing BMPs	1934.3	lbs/5-yr
Regulated TP	11386.2	lbs/5-yr	6.7%		Total Regulated TP Trapped by All Existing BMPs	17.0%	
					REQUIRED =	15.0%	

Reach179 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Proposed Option 2

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	e02	Balanced Rock Brewery	12.262	12.262	179-e02-U-N-I-C	5455	5455	0	0.0%	179-e02	5455	179-e02-C	908	4547	83.4%
	e03	Baraboo Country Club - Clubhouse South	3.511	3.511	179-e03-U-N-I-C	2729	2729	0	0.0%	179-e03	2728	179-e03-C	670	2058	75.4%
	e04&R20	Baraboo Highschool	182.227	200.972	179-e04&R20-U-N-I-C	232105	232105	0	0.0%	179-e04&R20	282290	179-e04&R20-C	143235	139055	49.3%
			18.745		179-e04&R20-U-X-O-C	9265	9265	0	0.0%	179-e04&R20-U-X-O-C	9265	179-e04&R20-U-X-O-C	0	9265	100.0%
	e05	Baraboo Municipal Building	1.779	1.779	179-e05-U-N-I-C	3952	3952	0	0.0%	179-e05	3951	179-e05-C	2950	1002	25.3%
	e09	Dominos	1.29	1.290	179-e09-U-N-I-C	19260	19260	0	0.0%	179-e09	19260	179-e09-C	1554	17706	91.9%
	e10	Driftless Glen Distillery	0.797	0.797	179-e10-U-N-I-C	1746	1746	0	0.0%	179-e10	1746	179-e10-C	1424	322	18.4%
	e11	Fox Point Pond West	6.122	6.541	179-e11-U-N-I-C	9665	9665	0	0.0%	179-e11	9955	179-e11-C	1343	8613	86.5%
			0.419		179-e11-U-X-O-C	291	291	0	0.0%	179-e11-U-X-O-C	291	179-e11-U-X-O-C	0	291	100.0%
	e18	Oak Park Place Pond 1	3.596	3.597	179-e18-U-N-I-C	6395	6395	0	0.0%	179-e18	6395	179-e18-C	31	6364	99.5%
			0.001		179-e18-U-X-I-C	0	0	0	0.0%	179-e18-U-X-I-C	0	179-e18-U-X-I-C	0	0	100.0%
	e19	Oak Park Place Pond 4	1.225	1.225	179-e19-U-N-I-C	1913	1913	0	0.0%	179-e19	4119	179-e19-C	79	4040	98.1%
	e23&R10	Riverwalk Park	8.888	10.662	179-e23&R10-U-N-I-C	16115	16115	0	0.0%	179-e23&R10	16115	179-e23&R10-C	8270	7845	48.7%
			1.774		179-e23&R10-U-X-I-C	3302	3302	0	0.0%	179-e23&R10-U-X-I-C	3302	179-e23&R10-U-X-I-C	3302	3302	100.0%
	e26	South Point Apts	3.569	3.569	179-e26-U-N-I-C	5110	5110	0	0.0%	179-e26	5105	179-e26-C	1484	3622	70.9%
	e27	Spruce Haven 2nd Add OL 2	14.883	43.887	179-e27-U-N-I-C	17730	17730	0	0.0%	179-e27	30315	179-e27-C	21845	8470	27.9%
			29.004		179-e27-U-X-O-C	1017	1017	0	0.0%	179-e27-U-X-O-C	1017	179-e27-U-X-O-C	1017	1017	100.0%
	e32	Villas Baraboo	53.244	53.317	179-e32-U-N-I-C	87195	87195	0	0.0%	179-e32	87190	179-e32-C	46080	41110	47.1%
			0.073		179-e32-U-X-O-C	26	26	0	0.0%	179-e32-U-X-O-C	26	179-e32-U-X-O-C	0	26	100.0%
	e33	Vintage Condominiums Biofilter C	1.082	1.082	179-e33-U-N-I-C	279	279	0	0.0%	179-e33	279	179-e33-C	66	213	76.4%
	e34	Vintage Condominiums Biofilter D	0.359	0.359	179-e34-U-N-I-C	91	91	0	0.0%	179-e34	157	179-e34-C	116	41	26.1%
	e35	Vintage Condominiums Biofilter E	0.765	0.765	179-e35-U-N-I-C	202	202	0	0.0%	179-e35	225	179-e35-C	58	168	74.5%
	e36	Vintage Condominiums Biofilter F	0.604	0.604	179-e36-U-N-I-C	161	161	0	0.0%	179-e36	32	179-e36-C	23	9	28.2%
5 year model	e09NoBMP	e09NoBMP	27.633	32.656	179-e09NoBMP-SM-N-I-C	49131	40065	9066	18.5%	179-e09NoBMP-SM-N-I-C	46174	179-e09NoBMP-SM-N-I-C	46174	0	0.0%
			3.166		179-e09NoBMP-SW-N-I-C	3229	2444	785	24.3%	179-e09NoBMP-SW-N-I-C	2608	179-e09NoBMP-SW-N-I-C	2608	0	0.0%
			0.073		179-e09NoBMP-U-N-I-C	5	5	0	0.0%	179-e09NoBMP-U-N-I-C	5	179-e09NoBMP-U-N-I-C	5	0	0.0%
			1.784		179-e09NoBMP-U-X-I-C	1657	1657	0	0.0%	179-e09NoBMP-U-X-I-C	1657	179-e09NoBMP-U-X-I-C	0	1657	100.0%
	NoBMP	No BMP	566.227	1,062.843	179-NoBMP-SM-N-I-C	789187	612102	177085	22.4%	179-NoBMP-SM-N-I-C	612102	179-NoBMP-SM-N-I-C	612102	0	0.0%
			70.547		179-NoBMP-SW-N-I-C	144471	111231	33240	23.0%	179-NoBMP-SW-N-I-C	111231	179-NoBMP-SW-N-I-C	111231	0	0.0%
			121.571		179-NoBMP-U-N-I-C	29064	29064	0	0.0%	179-NoBMP-U-N-I-C	29064	179-NoBMP-U-N-I-C	29064	0	0.0%
			233.285		179-NoBMP-U-X-I-C	43037	43037	0	0.0%	179-NoBMP-U-X-I-C	43037	179-NoBMP-U-X-I-C	0	43037	100.0%
			71.213		179-NoBMP-U-X-O-C	11191	11191	0	0.0%	179-NoBMP-U-X-O-C	11191	179-NoBMP-U-X-O-C	0	11191	100.0%
	P10	P10	38.617	42.226	179-P10-SM-N-I-C	66277	45723	20554	31.0%	179-P10-SM-N-I-C	60622	179-P10-SM-N-I-C	60622	0	0.0%
			2.704		179-P10-SW-N-I-C	6360	4882	1478	23.2%	179-P10-SW-N-I-C	5099	179-P10-SW-N-I-C	5099	0	0.0%
			0.004		179-P10-U-N-I-C	0	0	0	0.0%	179-P10-U-N-I-C	0	179-P10-U-N-I-C	0	0	0.0%
			0.901		179-P10-U-X-I-C	0	0	0	0.0%	179-P10-U-X-I-C	0	179-P10-U-X-I-C	0	0	100.0%
	P110	P110	185.863	394.354	179-P110-SM-N-I-C	277179	226580	50599	18.3%	179-P110-SM-N-I-C	226580	179-P110-SM-N-I-C	226580	0	0.0%
			0.487		179-P110-SW-N-I-C	290	221	69	23.8%	179-P110-SW-N-I-C	221	179-P110-SW-N-I-C	221	0	0.0%
			153.269		179-P110-U-N-I-C	134917	134917	0	0.0%	179-P110-U-N-I-C	134917	179-P110-U-N-I-C	134917	0	0.0%
			54.735		179-P110-U-X-O-C	31681	31681	0	0.0%	179-P110-U-X-O-C	31681	179-P110-U-X-O-C	31681	0	100.0%
	P150	P150	17.889	22.862	179-P150-SM-N-I-C	41779	36469	5310	12.7%	179-P150-SM-N-I-C	36469	179-P150-SM-N-I-C	36469	0	0.0%
			4.973		179-P150-U-N-I-C	15208	15208	0	0.0%	179-P150-U-N-I-C	15208	179-P150-U-N-I-C	15208	0	0.0%
	P160	P160	103.965	179.493	179-P160-SM-N-I-C	158335	106986	51349	32.4%	179-P160-SM-N-I-C	106986	179-P160-SM-N-I-C	106986	0	0.0%
			57.59		179-P160-SW-N-I-C	121081	88245	32836	27.1%	179-P160-SW-N-I-C	88245	179-P160-SW-N-I-C	88245	0	0.0%
			8.53		179-P160-U-N-I-C	7267	7267	0	0.0%	179-P160-U-N-I-C	7267	179-P160-U-N-I-C	7267	0	0.0%
			9.408		179-P160-U-X-I-C	19664	19664	0	0.0%	179-P160-U-X-I-C	19664	179-P160-U-X-I-C	19664	0	100.0%
	P170	P170	7.857	7.857	179-P170-SM-N-I-C	25006	24349	657	2.6%	179-P170-SM-N-I-C	24751	179-P170-SM-N-I-C	24751	0	0.0%
	P20	P20	125.441	145.642	179-P20-SM-N-I-C	185032	129013	56019	30.3%	179-P20-SM-N-I-C	129013	179-P20-SM-N-I-C	129013	0	0.0%
			13.911		179-P20-SW-N-I-C	21145	15293	5852	27.7%	179-P20-SW-N-I-C	15293	179-P20-SW-N-I-C	15293	0	0.0%
			1.857		179-P20-U-N-I-C	2599	2599	0	0.0%	179-P20-U-N-I-C	2599	179-P20-U-N-I-C	2599	0	0.0%
			3.506		179-P20-U-X-I-C	0	0	0	0.0%	179-P20-U-X-I-C	0	179-P20-U-X-I-C	0	0	100.0%
			0.927		179-P20-U-X-O-C	0	0	0	0.0%	179-P20-U-X-O-C	0	179-P20-U-X-O-C	0	0	100.0%
	P40	P40	158.646	162.542	179-P40-U-N-I-C	274975	274975	0	0.0%	179-P40	266885	179-P40-C	266885	0	0.0%
			3.896		179-P40-U-X-I-C	0	0	0	0.0%	179-P40-U-X-I-C	0	179-P40-U-X-I-C	0	0	100.0%
	P50	P50	39.847	39.847	179-P50-U-N-I-C	56309	56309	0	0.0%	179-P50	55445	179-P50-C	15480	39965	72.1%
5 year model	P60	P60	55.684	57.065	179-P60-SM-N-I-C	87279	78527	8752	10.0%	179-P60-SM-N-I-C	78527	179-P60-SM-N-I-C	78527	0	0.0%
			1.381		179-P60-U-N-I-C	2925	2925	0	0.0%	179-P60-U-N-I-C	2925	179-P60-U-N-I-C	2925	0	0.0%
	P70	P70	23.911	25.256	179-P70-U-N-I-C	30955	30955	0	0.0%	179-P70	30955	179-P70-C	30955	0	0.0%
			1.345		179-P70-U-X-I-C	1406	1406	0	0.0%	179-P70-U-X-I-C	1406	179-P70-U-X-I-C	0	1406	100.0%
5 year model	P90	P90	46.265	229.104	179-P90-SM-N-I-C	136903	113678	23225	17.0%	179-P90-SM-N-I-C	113678	179-P90-SM-N-I-C	113678	0	0.0%
			8.222		179-P90-SW-N-I-C	25579	21146	4433	17.3%	179-P90-SW-N-I-C	21146	179-P90-SW-N-I-C	21146	0	0.0%
			90.247		179-P90-U-N-I-C	144393	144393	0	0.0%	179-P90-U-N-I-C	144393	179-P90-U-N-I-C	144393	0	0.0%
			11.029		179-P90-U-X-I-C	4609	4609	0	0.0%	179-P90-U-X-I-C	4609	179-P90-U-X-I-C	0	4609	100.0%
			73.341		179-P90-U-X-O-C	37038	37038	0	0.0%	179-P90-U-X-O-C	37038	179-P90-U-X-O-C	0	37038	100.0%
	S02	S02	12.401	53.906	179-S02-U-N-I-C	15975	15975	0	0.0%	179-S02	15975	179-S02-C	12970	3005	18.8%
			41.505		179-S02-U-X-O-C	3705	3705	0	0.0%	179-S02-U-X-O-C	3705	179-S02-U-X-O-C	0	3705	100.0%
	S09	S09	46.241	69.457	179-S09-U-N-I-C	50555	50555	0	0.0%	179-S09	50550	179-S09-C	50215	335	0.7%
			23.216		179-S09-U-X-O-C	9010	9010	0	0.0%	179-S09-U-X-O-C	9010	179-S09-U-X-O-C	9010	9010	100.0%
	S12	S12	2.414	2.414	179-S12-U-N-I-C	3531	3531	0	0.0%	179-S12	3531	179-S12-C	2206	1325	37.5%
	Leaf	Leaf Collection							Leaf Collection					0	
	S13	S13	16.827	54.114	179-S13-U-N-I-C	18405	18405	0	0.0%	179-S13	18405	179-S13-C	15870	2535	13.8%
			37.264		179-S13-U-X-I-C	16570	16570	0	0.0%	179-S13-U-X-I-C	16570	179-S13-U-X-I-C	0	16570	100.0%
			0.023		179-S13-U-X-O-C	15	15	0	0.0%	179-S13-U-X-O-C	15	179-S13-U-X-O-C	0	15	100.0%
	S14&P80	S14&P80	119.418	245.671	179-S14&P80-U-N-I-C	150795	150795	0	0.0%	179-S14&P80	199040	179-S14&P80-C	189230	9810	4.9%
			16.865		179-S14&P80-U-X-I-C	7500	7500	0	0.0%	179-S14&P80-U-X-I-C	7500	179-S14&P80-U-X-I-C	0	7500	100.0%
			109.388		179-S14&P80-U-X-O-C	51460	51460	0	0.0%	179-S14&P80-U-X-O-C	51460	179-S14&P80-U-X-O-C	0	51460	100.0%
	S15	S15	13.695	13.695	179-S15-U-N-I-C	24225	24225	0	0.0%	179-S15	24220	179-S15-C	20520	3700	15.3%
	S16	S16	2.859	9.016	179-S16-U-N-I-C	3245	3245	0	0.0%	179-S16	3245	179-S16-C	2806	439	13.5%
			6.157		179-S16-U-X-O-C	5635	5635	0	0.0%	179-S16-U-X-O-C	5635	179-S16-U-X-O-C	0	5635	100.0%
	S17	S17	3.04	3.747	179-S17-U-N-I-C	4294	4294	0	0.0%	179-S17	4294	179-S17-C	3550	744	17.3%
			0.707		179-S17-U-X-O-C	64	64	0	0.0%	179-S17-U-X-O-C	64	179-S17-U-X-O-C	0	64	100.0%
	S18	S18	0.863	0.863	179-S18-U-N-I-C	1347	1347	0	0.0%	179-S18	1347	179-S18-C	1133	214	15.9%
	S19	S19	3.197	3.197	179-S19-U-N-I-C	4760	4760	0	0.0%	179-S19	4759	179-S19-C	3945	815	17.1%
	S20	S20	3.034	3.034	179-S20-U-N-I-C	2410	2410	0	0.0%	179-S20	2409	179-S20-C	1975	435	18.0%
	S21	S21	24.706	137.992	179-S21-U-N-I-C	7530	7530	0	0.0%	179-S21	7530	179-S21-C	6670	860	11.4%
			113.286		179-S21-U-X-O-C	26090	26090	0	0.0%	179-S21-U-X-O-C	26090	179-S21-U-X-O-C	0	26090	100.0%

BMP Number	Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
	Node	Value	Sweeping			Node	Value	Node	Value		
e02	179-e02-U-N-I-C	39.255	39.3	0.0	0.0%	179-e02	39.3	179-e02-C	18.8	20.5	52.2%
e03	179-e03-U-N-I-C	12.665	12.7	0.0	0.0%	179-e03	12.7	179-e03-C	2.5	10.2	80.5%
e04&R20	179-e04&R20-U-N-I-C	846.5	846.5	0.0	0.0%	179-e04&R20	1043.5	179-e04&R20-C	686.5	357.0	34.2%
	179-e04&R20-U-X-O-C	31.935	31.9	0.0	0.0%	179-e04&R20-U-X-O-C	31.9	179-e04&R20-U-X-O-C	0.0	31.9	100.0%
e05	179-e05-U-N-I-C	9.875	9.9	0.0	0.0%	179-e05	9.9	179-e05-C	7.8	2.1	21.4%
e09	179-e09-U-N-I-C	41.26	41.3	0.0	0.0%	179-e09	41.3	179-e09-C	3.8	37.5	90.9%
e10	179-e10-U-N-I-C	4.6865	4.7	0.0	0.0%	179-e10	4.7	179-e10-C	3.9	0.8	16.1%
e11	179-e11-U-N-I-C	34.345	34.3	0.0	0.0%	179-e11	35.9	179-e11-C	12.2	23.8	66.1%
	179-e11-U-X-O-C	1.596	1.6	0.0	0.0%	179-e11-U-X-O-C	1.6	179-e11-U-X-O-C	0.0	1.6	100.0%
e18	179-e18-U-N-I-C	19.115	19.1	0.0	0.0%	179-e18	19.1	179-e18-C	4.3	14.8	77.5%
	179-e18-U-X-I-C	0.003205	0.0	0.0	0.0%	179-e18-U-X-I-C	0.0	179-e18-U-X-I-C	0.0	0.0	100.0%
e19	179-e19-U-N-I-C	6.585	6.6	0.0	0.0%	179-e19	15.0	179-e19-C	4.1	10.9	72.6%
e23&R10	179-e23&R10-U-N-I-C	45.37	45.4	0.0	0.0%	179-e23&R10	45.4	179-e23&R10-C	25.0	20.4	44.9%
	179-e23&R10-U-X-I-C	8.745	8.7	0.0	0.0%	179-e23&R10-U-X-I-C	8.7	179-e23&R10-U-X-I-C	0.0	8.7	100.0%
e26	179-e26-U-N-I-C	18.275	18.3	0.0	0.0%	179-e26	18.3	179-e26-C	8.8	9.5	51.8%
e27	179-e27-U-N-I-C	71.6	71.6	0.0	0.0%	179-e27	147.0	179-e27-C	118.1	29.0	19.7%
	179-e27-U-X-O-C	35.52	35.5	0.0	0.0%	179-e27-U-X-O-C	35.5	179-e27-U-X-O-C	0.0	35.5	100.0%
e32	179-e32-U-N-I-C	248.05	248.1	0.0	0.0%	179-e32	248.0	179-e32-C	156.6	91.5	36.9%
	179-e32-U-X-O-C	0.0962	0.1	0.0	0.0%	179-e32-U-X-O-C	0.1	179-e32-U-X-O-C	0.0	0.1	100.0%
e33	179-e33-U-N-I-C	1.978	2.0	0.0	0.0%	179-e33	2.0	179-e33-C	1.3	0.7	34.0%
e34	179-e34-U-N-I-C	0.6535	0.7	0.0	0.0%	179-e34	2.0	179-e34-C	1.7	0.3	15.3%
e35	179-e35-U-N-I-C	1.414	1.4	0.0	0.0%	179-e35	2.0	179-e35-C	1.5	0.6	27.8%
e36	179-e36-U-N-I-C	1.121	1.1	0.0	0.0%	179-e36	1.1	179-e36-C	0.6	0.5	43.7%
e09NoBMP	179-e09NoBMP-SM-N-I-C	154	136.9	17.1	11.1%	179-e09NoBMP-SM-N-I-C	136.9	179-e09NoBMP-SM-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-SW-N-I-C	12.49	10.8	1.7	13.6%	179-e09NoBMP-SW-N-I-C	10.8	179-e09NoBMP-SW-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0	0.0%	179-e09NoBMP-U-N-I-C	0.0	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-U-X-I-C	5.6	5.6	0.0	0.0%	179-e09NoBMP-U-X-I-C	5.6	179-e09NoBMP-U-X-I-C	0.0	5.6	100.0%
NoBMP	179-NoBMP-SM-N-I-C	2646	2275.0	371.0	14.0%	179-NoBMP-SM-N-I-C	2275.0	179-NoBMP-SM-N-I-C	2275.0	0.0	0.0%
	179-NoBMP-SW-N-I-C	376	318.7	57.3	15.2%	179-NoBMP-SW-N-I-C	318.7	179-NoBMP-SW-N-I-C	318.7	0.0	0.0%
	179-NoBMP-U-N-I-C	85.69	85.7	0.0	0.0%	179-NoBMP-U-N-I-C	85.7	179-NoBMP-U-N-I-C	85.7	0.0	0.0%
	179-NoBMP-U-X-I-C	143.4	143.4	0.0	0.0%	179-NoBMP-U-X-I-C	143.4	179-NoBMP-U-X-I-C	0.0	143.4	100.0%
	179-NoBMP-U-X-O-C	46.86	46.9	0.0	0.0%	179-NoBMP-U-X-O-C	46.9	179-NoBMP-U-X-O-C	0.0	46.9	100.0%
P10	179-P10-SM-N-I-C	223.9	178.3	45.6	20.4%	179-P10-SM-N-I-C	211.5	179-P10-SM-N-I-C	211.5	0.0	0.0%
	179-P10-SW-N-I-C	15.09	12.6	2.5	16.8%	179-P10-SW-N-I-C	13.0	179-P10-SW-N-I-C	13.0	0.0	0.0%
	179-P10-U-N-I-C	0	0.0	0.0	0.0%	179-P10-U-N-I-C	0.0	179-P10-U-N-I-C	0.0	0.0	0.0%
	179-P10-U-X-I-C	0	0.0	0.0	0.0%	179-P10-U-X-I-C	0.0	179-P10-U-X-I-C	0.0	0.0	100.0%
P110	179-P110-SM-N-I-C	802.4	710.5	91.9	11.5%	179-P110-SM-N-I-C	710.5	179-P110-SM-N-I-C	710.5	0.0	0.0%
	179-P110-SW-N-I-C	1.484	1.3	0.2	10.8%	179-P110-SW-N-I-C	1.3	179-P110-SW-N-I-C	1.3	0.0	0.0%
	179-P110-U-N-I-C	547.4	547.4	0.0	0.0%	179-P110-U-N-I-C	547.4	179-P110-U-N-I-C	547.4	0.0	0.0%
	179-P110-U-X-O-C	167.7	167.7	0.0	0.0%	179-P110-U-X-O-C	167.7	179-P110-U-X-O-C	0.0	167.7	100.0%
P150	179-P150-SM-N-I-C	96.59	87.7	8.9	9.2%	179-P150-SM-N-I-C	87.7	179-P150-SM-N-I-C	87.7	0.0	0.0%
	179-P150-U-N-I-C	27.82	27.8	0.0	0.0%	179-P150-U-N-I-C	27.8	179-P150-U-N-I-C	27.8	0.0	0.0%
P160	179-P160-SM-N-I-C	565.2	448.9	116.3	20.6%	179-P160-SM-N-I-C	448.9	179-P160-SM-N-I-C	448.9	0.0	0.0%
	179-P160-SW-N-I-C	338.7	275.8	62.9	18.6%	179-P160-SW-N-I-C	275.8	179-P160-SW-N-I-C	275.8	0.0	0.0%
	179-P160-U-N-I-C	33.22	33.2	0.0	0.0%	179-P160-U-N-I-C	33.2	179-P160-U-N-I-C	33.2	0.0	0.0%
	179-P160-U-X-I-C	55.17	55.2	0.0	0.0%	179-P160-U-X-I-C	55.2	179-P160-U-X-I-C	0.0	55.2	100.0%
P170	179-P170-SM-N-I-C	44.82	44.1	0.8	1.7%	179-P170-SM-N-I-C	44.5	179-P170-SM-N-I-C	44.5	0.0	0.0%
P20	179-P20-SM-N-I-C	666.4	539.7	126.7	19.0%	179-P20-SM-N-I-C	539.7	179-P20-SM-N-I-C	539.7	0.0	0.0%
	179-P20-SW-N-I-C	74.26	61.1	13.1	17.7%	179-P20-SW-N-I-C	61.1	179-P20-SW-N-I-C	61.1	0.0	0.0%
	179-P20-U-N-I-C	8.379	8.4	0.0	0.0%	179-P20-U-N-I-C	8.4	179-P20-U-N-I-C	8.4	0.0	0.0%
	179-P20-U-X-I-C	0	0.0	0.0	0.0%	179-P20-U-X-I-C	0.0	179-P20-U-X-I-C	0.0	0.0	100.0%
	179-P20-U-X-O-C	0	0.0	0.0	0.0%	179-P20-U-X-O-C	0.0	179-P20-U-X-O-C	0.0	0.0	100.0%
P40	179-P40-U-N-I-C	822.78	822.8	0.0	0.0%	179-P40	818.0	179-P40-C	818.0	0.0	0.0%
	179-P40-U-X-I-C	0	0.0	0.0	0.0%	179-P40-U-X-I-C	0.0	179-P40-U-X-I-C	0.0	0.0	0.0%
P50	179-P50-U-N-I-C	209.51	209.5	0.0	0.0%	179-P50	211.0	179-P50-C	102.2	108.8	51.6%
P60	179-P60-SM-N-I-C	308.9	293.9	15.0	4.9%	179-P60-SM-N-I-C	293.9	179-P60-SM-N-I-C	293.9	0.0	0.0%
	179-P60-U-N-I-C	7.833	7.8	0.0	0.0%	179-P60-U-N-I-C	7.8	179-P60-U-N-I-C	7.8	0.0	0.0%
P70	179-P70-U-N-I-C	111.38	111.4	0.0	0.0%	179-P70	112.3	179-P70-C	112.3	0.0	0.0%
	179-P70-U-X-I-C	5.467	5.5	0.0	0.0%	179-P70-U-X-I-C	5.5	179-P70-U-X-I-C	0.0	5.5	100.0%
P90	179-P90-SM-N-I-C	272.1	239.5	32.6	12.0%	179-P90-SM-N-I-C	239.5	179-P90-SM-N-I-C	239.5	0.0	0.0%
	179-P90-SW-N-I-C	51	44.7	6.3	12.3%	179-P90-SW-N-I-C	44.7	179-P90-SW-N-I-C	44.7	0.0	0.0%
	179-P90-U-N-I-C	444	444.0	0.0	0.0%	179-P90-U-N-I-C	444.0	179-P90-U-N-I-C	444.0	0.0	0.0%
	179-P90-U-X-I-C	33.18	33.2	0.0	0.0%	179-P90-U-X-I-C	33.2	179-P90-U-X-I-C	0.0	33.2	100.0%
	179-P90-U-X-O-C	221.1	221.1	0.0	0.0%	179-P90-U-X-O-C	221.1	179-P90-U-X-O-C	0.0	221.1	100.0%
S02	179-S02-U-N-I-C	50.6	50.6	0.0	0.0%	179-S02	50.6	179-S02-C	43.8	6.8	13.5%
	179-S02-U-X-O-C	26.6	26.6	0.0	0.0%	179-S02-U-X-O-C	26.6	179-S02-U-X-O-C	0.0	26.6	100.0%
S09	179-S09-U-N-I-C	198.2	198.2	0.0	0.0%	179-S09	198.2	179-S09-C	197.2	1.0	0.5%
	179-S09-U-X-O-C	53.4	53.4	0.0	0.0%	179-S09-U-X-O-C	53.4	179-S09-U-X-O-C	0.0	53.4	100.0%
S12	179-S12-U-N-I-C	12.505	12.5	0.0	0.0%	179-S12	12.5	179-S12-C	8.4	4.1	32.9%
Leaf					Leaf Collection					0.0	
S13	179-S13-U-N-I-C	77.7	77.7	0.0	0.0%	179-S13	77.7	179-S13-C	69.9	7.8	10.0%
	179-S13-U-X-I-C	119.3	119.3	0.0	0.0%	179-S13-U-X-I-C	119.3	179-S13-U-X-I-C	0.0	119.3	100.0%
	179-S13-U-X-O-C	0.08305	0.1	0.0	0.0%	179-S13-U-X-O-C	0.1	179-S13-U-X-O-C	0.0	0.1	100.0%
S14&P80	179-S14&P80-U-N-I-C	514	514.0	0.0	0.0%	179-S14&P80	763.0	179-S14&P80-C	730.5	32.5	4.3%
	179-S14&P80-U-X-I-C	54	54.0	0.0	0.0%	179-S14&P80-U-X-I-C	54.0	179-S14&P80-U-X-I-C	0.0	54.0	100.0%
	179-S14&P80-U-X-O-C	344.55	344.6	0.0	0.0%	179-S14&P80-U-X-O-C	344.6	179-S14&P80-U-X-O-C	0.0	344.6	100.0%
S15	179-S15-U-N-I-C	66.35	66.4	0.0	0.0%	179-S15	66.4	179-S15-C	58.7	7.6	11.5%
S16	179-S16-U-N-I-C	13.09	13.1	0.0	0.0%	179-S16	13.1	179-S16-C	11.9	1.2	9.4%
	179-S16-U-X-O-C	20.105	20.1	0.0	0.0%	179-S16-U-X-O-C	20.1	179-S16-U-X-O-C	0.0	20.1	100.0%
S17	179-S17-U-N-I-C	17.155	17.2	0.0	0.0%	179-S17	17.2	179-S17-C	15.0	2.1	12.5%
	179-S17-U-X-O-C	1.065	1.1	0.0	0.0%	179-S17-U-X-O-C	1.1	179-S17-U-X-O-C	0.0	1.1	100.0%
S18	179-S18-U-N-I-C	5.26	5.3	0.0	0.0%	179-S18	5.3	179-S18-C	4.7	0.6	11.4%
S19	179-S19-U-N-I-C	18.535	18.5	0.0	0.0%	179-S19	18.5	179-S19-C	16.2	2.3	12.4%
S20	179-S20-U-N-I-C	11.055	11.1	0.0	0.0%	179-S20	11.1	179-S20-C	9.8	1.2	11.0%
S21	179-S21-U-N-I-C	51.6	51.6	0.0	0.0%	179-S21	51.6	179-S21-C	49.4	2.2	4.3%
	179-S21-U-X-O-C	223.85	223.9	0.0	0.0%	179-S21-U-X-O-C	223.9	179-S21-U-X-O-C	0.0	223.9	100.0%

Total Area (ac) 3,345.07
Regulated Area (ac) 2,481.28

Total TSS 3818286.2 lbs/5-yr
In City TSS 3631798.4 lbs/5-yr
Regulated TSS 3534052.9 lbs/5-yr

Regulated TSS Trapped by Sweeping
481309.0 lbs/5-yr
13.6%

Regulated TSS Trapped by Existing Structural BMPs 309362.4 lbs/5-yr
Total Regulated TSS Trapped by All Existing BMPs 790671.4 lbs/5-yr
Total Regulated TSS Trapped by All Existing BMPs 22.4%
REQUIRED = DNE

Total TP 12985.5 lbs/5-yr
In City TP 11811.0 lbs/5-yr
Regulated TP 11386.2 lbs/5-yr

Regulated TP Trapped by Sweeping
969.9 lbs/5-yr
8.5%

Regulated TP Trapped by Existing Structural BMPs 808.2 lbs/5-yr
Total Regulated TP Trapped by All Existing BMPs 1778.1 lbs/5-yr
Total Regulated TP Trapped by All Existing BMPs 15.6%
REQUIRED = 15.0%

Reach179 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Proposed Option 3

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load Node	Direct TSS Base Load Value	Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP Node	Cumulative TSS Base Load to BMP Value	TSS Discharge from BMP Node	TSS Discharge from BMP Value	TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	e02	Balanced Rock Brewery	12.262	12.262	179-e02-U-N-I-C	5455	5455	0	0.0%	179-e02	5455	179-e02-C	908	4547	83.4%
	e03	Baraboo Country Club - Clubhouse South	3.511	3.511	179-e03-U-N-I-C	2729	2729	0	0.0%	179-e03	2728	179-e03-C	670	2058	75.4%
	e04&R20	Baraboo Highschool	182.227	200.972	179-e04&R20-U-N-I-C	232105	232105	0	0.0%	179-e04&R20	282290	179-e04&R20-C	143235	139055	49.3%
			18.745		179-e04&R20-U-X-O-C	9265	9265	0	0.0%	179-e04&R20-U-X-O-C	9265	179-e04&R20-U-X-O-C	0	9265	100.0%
	e05	Baraboo Municipal Building	1.779	1.779	179-e05-U-N-I-C	3952	3952	0	0.0%	179-e05	3951	179-e05-C	2950	1002	25.3%
	e09	Dominos	1.29	1.290	179-e09-U-N-I-C	19260	19260	0	0.0%	179-e09	19260	179-e09-C	1554	17706	91.9%
	e10	Driftless Glen Distillery	0.797	0.797	179-e10-U-N-I-C	1746	1746	0	0.0%	179-e10	1746	179-e10-C	1424	322	18.4%
	e11	Fox Point Pond West	6.122	6.541	179-e11-U-N-I-C	9665	9665	0	0.0%	179-e11	9955	179-e11-C	1343	8613	86.5%
			0.419		179-e11-U-X-O-C	291	291	0	0.0%	179-e11-U-X-O-C	291	179-e11-U-X-O-C	0	291	100.0%
	e18	Oak Park Place Pond 1	3.596	3.597	179-e18-U-N-I-C	6395	6395	0	0.0%	179-e18	6395	179-e18-C	31	6364	99.5%
			0.001		179-e18-U-X-I-C	0	0	0	0.0%	179-e18-U-X-I-C	0	179-e18-U-X-I-C	0	0	100.0%
	e19	Oak Park Place Pond 4	1.225	1.225	179-e19-U-N-I-C	1913	1913	0	0.0%	179-e19	4119	179-e19-C	79	4040	98.1%
	e23&R10	Riverwalk Park	8.888	10.662	179-e23&R10-U-N-I-C	16115	16115	0	0.0%	179-e23&R10	16115	179-e23&R10-C	8270	7845	48.7%
			1.774		179-e23&R10-U-X-I-C	3302	3302	0	0.0%	179-e23&R10-U-X-I-C	3302	179-e23&R10-U-X-I-C	3302	3302	100.0%
	e26	South Point Apts	3.569	3.569	179-e26-U-N-I-C	5110	5110	0	0.0%	179-e26	5105	179-e26-C	1484	3622	70.9%
	e27	Spruce Haven 2nd Add OL 2	14.883	43.887	179-e27-U-N-I-C	17730	17730	0	0.0%	179-e27	30315	179-e27-C	21845	8470	27.9%
			29.004		179-e27-U-X-O-C	1017	1017	0	0.0%	179-e27-U-X-O-C	1017	179-e27-U-X-O-C	1017	1017	100.0%
	e32	Villas Baraboo	53.244	53.317	179-e32-U-N-I-C	87195	87195	0	0.0%	179-e32	87190	179-e32-C	46080	41110	47.1%
			0.073		179-e32-U-X-O-C	26	26	0	0.0%	179-e32-U-X-O-C	26	179-e32-U-X-O-C	0	26	100.0%
	e33	Vintage Condominiums Biofilter C	1.082	1.082	179-e33-U-N-I-C	279	279	0	0.0%	179-e33	279	179-e33-C	66	213	76.4%
	e34	Vintage Condominiums Biofilter D	0.359	0.359	179-e34-U-N-I-C	91	91	0	0.0%	179-e34	157	179-e34-C	116	41	26.1%
	e35	Vintage Condominiums Biofilter E	0.765	0.765	179-e35-U-N-I-C	202	202	0	0.0%	179-e35	225	179-e35-C	58	168	74.5%
	e36	Vintage Condominiums Biofilter F	0.604	0.604	179-e36-U-N-I-C	161	161	0	0.0%	179-e36	32	179-e36-C	23	9	28.2%
5 year model	e09NoBMP	e09NoBMP	27.633	32.656	179-e09NoBMP-SM-N-I-C	49131	40065	9066	18.5%	179-e09NoBMP-SM-N-I-C	46174	179-e09NoBMP-SM-N-I-C	46174	0	0.0%
			3.166		179-e09NoBMP-SW-N-I-C	3229	2444	785	24.3%	179-e09NoBMP-SW-N-I-C	2608	179-e09NoBMP-SW-N-I-C	2608	0	0.0%
			0.073		179-e09NoBMP-U-N-I-C	5	5	0	0.0%	179-e09NoBMP-U-N-I-C	5	179-e09NoBMP-U-N-I-C	5	0	0.0%
			1.784		179-e09NoBMP-U-X-I-C	1657	1657	0	0.0%	179-e09NoBMP-U-X-I-C	1657	179-e09NoBMP-U-X-I-C	0	1657	100.0%
	NoBMP	No BMP	566.227	1,062.843	179-NoBMP-SM-N-I-C	789187	612102	177085	22.4%	179-NoBMP-SM-N-I-C	612102	179-NoBMP-SM-N-I-C	612102	0	0.0%
			70.547		179-NoBMP-SW-N-I-C	144471	111231	33240	23.0%	179-NoBMP-SW-N-I-C	111231	179-NoBMP-SW-N-I-C	111231	0	0.0%
			121.571		179-NoBMP-U-N-I-C	29064	29064	0	0.0%	179-NoBMP-U-N-I-C	29064	179-NoBMP-U-N-I-C	29064	0	0.0%
			233.285		179-NoBMP-U-X-I-C	43037	43037	0	0.0%	179-NoBMP-U-X-I-C	43037	179-NoBMP-U-X-I-C	0	43037	100.0%
			71.213		179-NoBMP-U-X-O-C	11191	11191	0	0.0%	179-NoBMP-U-X-O-C	11191	179-NoBMP-U-X-O-C	0	11191	100.0%
	P10	P10	38.617	42.226	179-P10-SM-N-I-C	66277	45723	20554	31.0%	179-P10-SM-N-I-C	60622	179-P10-SM-N-I-C	60622	0	0.0%
			2.704		179-P10-SW-N-I-C	6360	4882	1478	23.2%	179-P10-SW-N-I-C	5099	179-P10-SW-N-I-C	5099	0	0.0%
			0.004		179-P10-U-N-I-C	0	0	0	0.0%	179-P10-U-N-I-C	0	179-P10-U-N-I-C	0	0	0.0%
			0.901		179-P10-U-X-I-C	0	0	0	0.0%	179-P10-U-X-I-C	0	179-P10-U-X-I-C	0	0	100.0%
	P110	P110	185.863	394.354	179-P110-SM-N-I-C	277179	226580	50599	18.3%	179-P110-SM-N-I-C	226580	179-P110-SM-N-I-C	226580	0	0.0%
			0.487		179-P110-SW-N-I-C	290	221	69	23.8%	179-P110-SW-N-I-C	221	179-P110-SW-N-I-C	221	0	0.0%
			153.269		179-P110-U-N-I-C	134917	134917	0	0.0%	179-P110-U-N-I-C	134917	179-P110-U-N-I-C	134917	0	0.0%
			54.735		179-P110-U-X-O-C	31681	31681	0	0.0%	179-P110-U-X-O-C	31681	179-P110-U-X-O-C	31681	0	100.0%
	P150	P150	17.889	22.862	179-P150-SM-N-I-C	41779	36469	5310	12.7%	179-P150-SM-N-I-C	36469	179-P150-SM-N-I-C	36469	0	0.0%
			4.973		179-P150-U-N-I-C	15208	15208	0	0.0%	179-P150-U-N-I-C	15208	179-P150-U-N-I-C	15208	0	0.0%
	P160	P160	103.965	179.493	179-P160-SM-N-I-C	158335	106986	51349	32.4%	179-P160-SM-N-I-C	106986	179-P160-SM-N-I-C	106986	0	0.0%
			57.59		179-P160-SW-N-I-C	121081	88245	32836	27.1%	179-P160-SW-N-I-C	88245	179-P160-SW-N-I-C	88245	0	0.0%
			8.53		179-P160-U-N-I-C	7267	7267	0	0.0%	179-P160-U-N-I-C	7267	179-P160-U-N-I-C	7267	0	0.0%
			9.408		179-P160-U-X-I-C	19664	19664	0	0.0%	179-P160-U-X-I-C	19664	179-P160-U-X-I-C	19664	0	100.0%
	P170	P170	7.857	7.857	179-P170-SM-N-I-C	25006	24349	657	2.6%	179-P170-SM-N-I-C	24751	179-P170-SM-N-I-C	24751	0	0.0%
	P20	P20	125.441	145.642	179-P20-SM-N-I-C	185032	129013	56019	30.3%	179-P20-SM-N-I-C	129013	179-P20-SM-N-I-C	129013	0	0.0%
			13.911		179-P20-SW-N-I-C	21145	15293	5852	27.7%	179-P20-SW-N-I-C	15293	179-P20-SW-N-I-C	15293	0	0.0%
			1.857		179-P20-U-N-I-C	2599	2599	0	0.0%	179-P20-U-N-I-C	2599	179-P20-U-N-I-C	2599	0	0.0%
			3.506		179-P20-U-X-I-C	0	0	0	0.0%	179-P20-U-X-I-C	0	179-P20-U-X-I-C	0	0	100.0%
			0.927		179-P20-U-X-O-C	0	0	0	0.0%	179-P20-U-X-O-C	0	179-P20-U-X-O-C	0	0	100.0%
	P40	P40	158.646	162.542	179-P40-U-N-I-C	274975	274975	0	0.0%	179-P40	266885	179-P40-C	109895	156990	58.8%
			3.896		179-P40-U-X-I-C	0	0	0	0.0%	179-P40-U-X-I-C	0	179-P40-U-X-I-C	0	0	100.0%
	P50	P50	39.847	39.847	179-P50-U-N-I-C	56309	56309	0	0.0%	179-P50	55445	179-P50-C	55445	0	0.0%
5 year model	P60	P60	55.684	57.065	179-P60-SM-N-I-C	87279	78527	8752	10.0%	179-P60-SM-N-I-C	78527	179-P60-SM-N-I-C	78527	0	0.0%
			1.381		179-P60-U-N-I-C	2925	2925	0	0.0%	179-P60-U-N-I-C	2925	179-P60-U-N-I-C	2925	0	0.0%
	P70	P70	23.911	25.256	179-P70-U-N-I-C	30955	30955	0	0.0%	179-P70	30955	179-P70-C	30955	0	0.0%
			1.345		179-P70-U-X-I-C	1406	1406	0	0.0%	179-P70-U-X-I-C	1406	179-P70-U-X-I-C	0	1406	100.0%
5 year model	P90	P90	46.265	229.104	179-P90-SM-N-I-C	136903	113678	23225	17.0%	179-P90-SM-N-I-C	113678	179-P90-SM-N-I-C	113678	0	0.0%
			8.222		179-P90-SW-N-I-C	25579	21146	4433	17.3%	179-P90-SW-N-I-C	21146	179-P90-SW-N-I-C	21146	0	0.0%
			90.247		179-P90-U-N-I-C	144393	144393	0	0.0%	179-P90-U-N-I-C	144393	179-P90-U-N-I-C	144393	0	0.0%
			11.029		179-P90-U-X-I-C	4609	4609	0	0.0%	179-P90-U-X-I-C	4609	179-P90-U-X-I-C	0	4609	100.0%
			73.341		179-P90-U-X-O-C	37038	37038	0	0.0%	179-P90-U-X-O-C	37038	179-P90-U-X-O-C	0	37038	100.0%
	S02	S02	12.401	53.906	179-S02-U-N-I-C	15975	15975	0	0.0%	179-S02	15975	179-S02-C	12970	3005	18.8%
			41.505		179-S02-U-X-O-C	3705	3705	0	0.0%	179-S02-U-X-O-C	3705	179-S02-U-X-O-C	0	3705	100.0%
	S09	S09	46.241	69.457	179-S09-U-N-I-C	50555	50555	0	0.0%	179-S09	50550	179-S09-C	50215	335	0.7%
			23.216		179-S09-U-X-O-C	9010	9010	0	0.0%	179-S09-U-X-O-C	9010	179-S09-U-X-O-C	9010	9010	100.0%
	S12	S12	2.414	2.414	179-S12-U-N-I-C	3531	3531	0	0.0%	179-S12	3531	179-S12-C	2206	1325	37.5%
	Leaf	Leaf Collection							Leaf Collection					0	
	S13	S13	16.827	54.114	179-S13-U-N-I-C	18405	18405	0	0.0%	179-S13	18405	179-S13-C	15870	2535	13.8%
			37.264		179-S13-U-X-I-C	16570	16570	0	0.0%	179-S13-U-X-I-C	16570	179-S13-U-X-I-C	0	16570	100.0%
			0.023		179-S13-U-X-O-C	15	15	0	0.0%	179-S13-U-X-O-C	15	179-S13-U-X-O-C	0	15	100.0%
	S14&P80	S14&P80	119.418	245.671	179-S14&P80-U-N-I-C	150795	150795	0	0.0%	179-S14&P80	199040	179-S14&P80-C	189230	9810	4.9%
			16.865		179-S14&P80-U-X-I-C	7500	7500	0	0.0%	179-S14&P80-U-X-I-C	7500	179-S14&P80-U-X-I-C	0	7500	100.0%
			109.388		179-S14&P80-U-X-O-C	51460	51460	0	0.0%	179-S14&P80-U-X-O-C	51460	179-S14&P80-U-X-O-C	0	51460	100.0%
	S15	S15	13.695	13.695	179-S15-U-N-I-C	24225	24225	0	0.0%	179-S15	24220	179-S15-C	20520	3700	15.3%
	S16	S16	2.859	9.016	179-S16-U-N-I-C	3245	3245	0	0.0%	179-S16	3245	179-S16-C	2806	439	13.5%
			6.157		179-S16-U-X-O-C	5635	5635	0	0.0%	179-S16-U-X-O-C	5635	179-S16-U-X-O-C	0	5635	100.0%
	S17	S17	3.04	3.747	179-S17-U-N-I-C	4294	4294	0	0.0%	179-S17	4294	179-S17-C	3550	744	17.3%
			0.707		179-S17-U-X-O-C	64	64	0	0.0%	179-S17-U-X-O-C	64	179-S17-U-X-O-C	0	64	100.0%
	S18	S18	0.863	0.863	179-S18-U-N-I-C	1347	1347	0	0.0%	179-S18	1347	179-S18-C	1133	214	15.9%
	S19	S19	3.197	3.197	179-S19-U-N-I-C	4760	4760	0	0.0%	179-S19	4759	179-S19-C	3945	815	17.1%
	S20	S20	3.034	3.034	179-S20-U-N-I-C	2410	2410	0	0.0%	179-S20	2409	179-S20-C	1975	435	18.0%
	S21	S21	24.706	137.992	179-S21-U-N-I-C	7530	7530	0	0.0%	179-S21	7530	179-S21-C	6670	860	11.4%
			113.286		179-S21-U-X-O-C	26090	26090	0	0.0%	179-S21-U-X-O-C	26090	179-S21-U-X-O-C	0	26090	100.0%

BMP Number	Direct TP Base Load Node	Direct TP Base Load Value	Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP Node	Cumulative TP Base Load to BMP Value	TP Discharge from BMP Node	TP Discharge from BMP Value	TP Trapped by BMP	TP Reduction (BMP)
	Node	Value	Sweeping			Node	Value	Node	Value		
e02	179-e02-U-N-I-C	39.255	39.3	0.0	0.0%	179-e02	39.3	179-e02-C	18.8	20.5	52.2%
e03	179-e03-U-N-I-C	12.665	12.7	0.0	0.0%	179-e03	12.7	179-e03-C	2.5	10.2	80.5%
e04&R20	179-e04&R20-U-N-I-C	846.5	846.5	0.0	0.0%	179-e04&R20	1043.5	179-e04&R20-C	686.5	357.0	34.2%
	179-e04&R20-U-X-O-C	31.935	31.9	0.0	0.0%	179-e04&R20-U-X-O-C	31.9	179-e04&R20-U-X-O-C	0.0	31.9	100.0%
e05	179-e05-U-N-I-C	9.875	9.9	0.0	0.0%	179-e05	9.9	179-e05-C	7.8	2.1	21.4%
e09	179-e09-U-N-I-C	41.26	41.3	0.0	0.0%	179-e09	41.3	179-e09-C	3.8	37.5	90.9%
e10	179-e10-U-N-I-C	4.6865	4.7	0.0	0.0%	179-e10	4.7	179-e10-C	3.9	0.8	16.1%
e11	179-e11-U-N-I-C	34.345	34.3	0.0	0.0%	179-e11	35.9	179-e11-C	12.2	23.8	66.1%
	179-e11-U-X-O-C	1.596	1.6	0.0	0.0%	179-e11-U-X-O-C	1.6	179-e11-U-X-O-C	0.0	1.6	100.0%
e18	179-e18-U-N-I-C	19.115	19.1	0.0	0.0%	179-e18	19.1	179-e18-C	4.3	14.8	77.5%
	179-e18-U-X-I-C	0.003205	0.0	0.0	0.0%	179-e18-U-X-I-C	0.0	179-e18-U-X-I-C	0.0	0.0	100.0%
e19	179-e19-U-N-I-C	6.585	6.6	0.0	0.0%	179-e19	15.0	179-e19-C	4.1	10.9	72.6%
e23&R10	179-e23&R10-U-N-I-C	45.37	45.4	0.0	0.0%	179-e23&R10	45.4	179-e23&R10-C	25.0	20.4	44.9%
	179-e23&R10-U-X-I-C	8.745	8.7	0.0	0.0%	179-e23&R10-U-X-I-C	8.7	179-e23&R10-U-X-I-C	0.0	8.7	100.0%
e26	179-e26-U-N-I-C	18.275	18.3	0.0	0.0%	179-e26	18.3	179-e26-C	8.8	9.5	51.8%
e27	179-e27-U-N-I-C	71.6	71.6	0.0	0.0%	179-e27	147.0	179-e27-C	118.1	29.0	19.7%
	179-e27-U-X-O-C	35.52	35.5	0.0	0.0%	179-e27-U-X-O-C	35.5	179-e27-U-X-O-C	0.0	35.5	100.0%
e32	179-e32-U-N-I-C	248.05	248.1	0.0	0.0%	179-e32	248.0	179-e32-C	156.6	91.5	36.9%
	179-e32-U-X-O-C	0.0962	0.1	0.0	0.0%	179-e32-U-X-O-C	0.1	179-e32-U-X-O-C	0.0	0.1	100.0%
e33	179-e33-U-N-I-C	1.978	2.0	0.0	0.0%	179-e33	2.0	179-e33-C	1.3	0.7	34.0%
e34	179-e34-U-N-I-C	0.6535	0.7	0.0	0.0%	179-e34	2.0	179-e34-C	1.7	0.3	15.3%
e35	179-e35-U-N-I-C	1.414	1.4	0.0	0.0%	179-e35	2.0	179-e35-C	1.5	0.6	27.8%
e36	179-e36-U-N-I-C	1.121	1.1	0.0	0.0%	179-e36	1.1	179-e36-C	0.6	0.5	43.7%
e09NoBMP	179-e09NoBMP-SM-N-I-C	154	136.9	17.1	11.1%	179-e09NoBMP-SM-N-I-C	136.9	179-e09NoBMP-SM-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-SW-N-I-C	12.49	10.8	1.7	13.6%	179-e09NoBMP-SW-N-I-C	10.8	179-e09NoBMP-SW-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0	0.0%	179-e09NoBMP-U-N-I-C	0.0	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0%
	179-e09NoBMP-U-X-I-C	5.6	5.6	0.0	0.0%	179-e09NoBMP-U-X-I-C	5.6	179-e09NoBMP-U-X-I-C	0.0	5.6	100.0%
NoBMP	179-NoBMP-SM-N-I-C	2646	2275.0	371.0	14.0%	179-NoBMP-SM-N-I-C	2275.0	179-NoBMP-SM-N-I-C	2275.0	0.0	0.0%
	179-NoBMP-SW-N-I-C	376	318.7	57.3	15.2%	179-NoBMP-SW-N-I-C	318.7	179-NoBMP-SW-N-I-C	318.7	0.0	0.0%
	179-NoBMP-U-N-I-C	85.69	85.7	0.0	0.0%	179-NoBMP-U-N-I-C	85.7	179-NoBMP-U-N-I-C	85.7	0.0	0.0%
	179-NoBMP-U-X-I-C	143.4	143.4	0.0	0.0%	179-NoBMP-U-X-I-C	143.4	179-NoBMP-U-X-I-C	0.0	143.4	100.0%
	179-NoBMP-U-X-O-C	46.86	46.9	0.0	0.0%	179-NoBMP-U-X-O-C	46.9	179-NoBMP-U-X-O-C	0.0	46.9	100.0%
P10	179-P10-SM-N-I-C	223.9	178.3	45.6	20.4%	179-P10-SM-N-I-C	211.5	179-P10-SM-N-I-C	211.5	0.0	0.0%
	179-P10-SW-N-I-C	15.09	12.6	2.5	16.8%	179-P10-SW-N-I-C	13.0	179-P10-SW-N-I-C	13.0	0.0	0.0%
	179-P10-U-N-I-C	0	0.0	0.0	0.0%	179-P10-U-N-I-C	0.0	179-P10-U-N-I-C	0.0	0.0	0.0%
	179-P10-U-X-I-C	0	0.0	0.0	0.0%	179-P10-U-X-I-C	0.0	179-P10-U-X-I-C	0.0	0.0	100.0%
P110	179-P110-SM-N-I-C	802.4	710.5	91.9	11.5%	179-P110-SM-N-I-C	710.5	179-P110-SM-N-I-C	710.5	0.0	0.0%
	179-P110-SW-N-I-C	1.484	1.3	0.2	10.8%	179-P110-SW-N-I-C	1.3	179-P110-SW-N-I-C	1.3	0.0	0.0%
	179-P110-U-N-I-C	547.4	547.4	0.0	0.0%	179-P110-U-N-I-C	547.4	179-P110-U-N-I-C	547.4	0.0	0.0%
	179-P110-U-X-O-C	167.7	167.7	0.0	0.0%	179-P110-U-X-O-C	167.7	179-P110-U-X-O-C	0.0	167.7	100.0%
P150	179-P150-SM-N-I-C	96.59	87.7	8.9	9.2%	179-P150-SM-N-I-C	87.7	179-P150-SM-N-I-C	87.7	0.0	0.0%
	179-P150-U-N-I-C	27.82	27.8	0.0	0.0%	179-P150-U-N-I-C	27.8	179-P150-U-N-I-C	27.8	0.0	0.0%
P160	179-P160-SM-N-I-C	565.2	448.9	116.3	20.6%	179-P160-SM-N-I-C	448.9	179-P160-SM-N-I-C	448.9	0.0	0.0%
	179-P160-SW-N-I-C	338.7	275.8	62.9	18.6%	179-P160-SW-N-I-C	275.8	179-P160-SW-N-I-C	275.8	0.0	0.0%
	179-P160-U-N-I-C	33.22	33.2	0.0	0.0%	179-P160-U-N-I-C	33.2	179-P160-U-N-I-C	33.2	0.0	0.0%
	179-P160-U-X-I-C	55.17	55.2	0.0	0.0%	179-P160-U-X-I-C	55.2	179-P160-U-X-I-C	0.0	55.2	100.0%
P170	179-P170-SM-N-I-C	44.82	44.1	0.8	1.7%	179-P170-SM-N-I-C	44.5	179-P170-SM-N-I-C	44.5	0.0	0.0%
P20	179-P20-SM-N-I-C	666.4	539.7	126.7	19.0%	179-P20-SM-N-I-C	539.7	179-P20-SM-N-I-C	539.7	0.0	0.0%
	179-P20-SW-N-I-C	74.26	61.1	13.1	17.7%	179-P20-SW-N-I-C	61.1	179-P20-SW-N-I-C	61.1	0.0	0.0%
	179-P20-U-N-I-C	8.379	8.4	0.0	0.0%	179-P20-U-N-I-C	8.4	179-P20-U-N-I-C	8.4	0.0	0.0%
	179-P20-U-X-I-C	0	0.0	0.0	0.0%	179-P20-U-X-I-C	0.0	179-P20-U-X-I-C	0.0	0.0	100.0%
	179-P20-U-X-O-C	0	0.0	0.0	0.0%	179-P20-U-X-O-C	0.0	179-P20-U-X-O-C	0.0	0.0	100.0%
P40	179-P40-U-N-I-C	822.78	822.8	0.0	0.0%	179-P40	818.0	179-P40-C	460.2	357.9	43.7%
	179-P40-U-X-I-C	0	0.0	0.0	0.0%	179-P40-U-X-I-C	0.0	179-P40-U-X-I-C	0.0	0.0	0.0%
P50	179-P50-U-N-I-C	209.51	209.5	0.0	0.0%	179-P50	211.0	179-P50-C	211.0	0.0	0.0%
P60	179-P60-SM-N-I-C	308.9	293.9	15.0	4.9%	179-P60-SM-N-I-C	293.9	179-P60-SM-N-I-C	293.9	0.0	0.0%
	179-P60-U-N-I-C	7.833	7.8	0.0	0.0%	179-P60-U-N-I-C	7.8	179-P60-U-N-I-C	7.8	0.0	0.0%
P70	179-P70-U-N-I-C	111.38	111.4	0.0	0.0%	179-P70	112.3	179-P70-C	112.3	0.0	0.0%
	179-P70-U-X-I-C	5.467	5.5	0.0	0.0%	179-P70-U-X-I-C	5.5	179-P70-U-X-I-C	0.0	5.5	100.0%
P90	179-P90-SM-N-I-C	272.1	239.5	32.6	12.0%	179-P90-SM-N-I-C	239.5	179-P90-SM-N-I-C	239.5	0.0	0.0%
	179-P90-SW-N-I-C	51	44.7	6.3	12.3%	179-P90-SW-N-I-C	44.7	179-P90-SW-N-I-C	44.7	0.0	0.0%
	179-P90-U-N-I-C	444	444.0	0.0	0.0%	179-P90-U-N-I-C	444.0	179-P90-U-N-I-C	444.0	0.0	0.0%
	179-P90-U-X-I-C	33.18	33.2	0.0	0.0%	179-P90-U-X-I-C	33.2	179-P90-U-X-I-C	0.0	33.2	100.0%
	179-P90-U-X-O-C	221.1	221.1	0.0	0.0%	179-P90-U-X-O-C	221.1	179-P90-U-X-O-C	0.0	221.1	100.0%
S02	179-S02-U-N-I-C	50.6	50.6	0.0	0.0%	179-S02	50.6	179-S02-C	43.8	6.8	13.5%
	179-S02-U-X-O-C	26.6	26.6	0.0	0.0%	179-S02-U-X-O-C	26.6	179-S02-U-X-O-C	0.0	26.6	100.0%
S09	179-S09-U-N-I-C	198.2	198.2	0.0	0.0%	179-S09	198.2	179-S09-C	197.2	1.0	0.5%
	179-S09-U-X-O-C	53.4	53.4	0.0	0.0%	179-S09-U-X-O-C	53.4	179-S09-U-X-O-C	0.0	53.4	100.0%
S12	179-S12-U-N-I-C	12.505	12.5	0.0	0.0%	179-S12	12.5	179-S12-C	8.4	4.1	32.9%
Leaf					Leaf Collection					0.0	
S13	179-S13-U-N-I-C	77.7	77.7	0.0	0.0%	179-S13	77.7	179-S13-C	69.9	7.8	10.0%
	179-S13-U-X-I-C	119.3	119.3	0.0	0.0%	179-S13-U-X-I-C	119.3	179-S13-U-X-I-C	0.0	119.3	100.0%
	179-S13-U-X-O-C	0.08305	0.1	0.0	0.0%	179-S13-U-X-O-C	0.1	179-S13-U-X-O-C	0.0	0.1	100.0%
S14&P80	179-S14&P80-U-N-I-C	514	514.0	0.0	0.0%	179-S14&P80	763.0	179-S14&P80-C	730.5	32.5	4.3%
	179-S14&P80-U-X-I-C	54	54.0	0.0	0.0%	179-S14&P80-U-X-I-C	54.0	179-S14&P80-U-X-I-C	0.0	54.0	100.0%
	179-S14&P80-U-X-O-C	344.55	344.6	0.0	0.0%	179-S14&P80-U-X-O-C	344.6	179-S14&P80-U-X-O-C	0.0	344.6	100.0%
S15	179-S15-U-N-I-C	66.35	66.4	0.0	0.0%	179-S15	66.4	179-S15-C	58.7	7.6	11.5%
S16	179-S16-U-N-I-C	13.09	13.1	0.0	0.0%	179-S16	13.1	179-S16-C	11.9	1.2	9.4%
	179-S16-U-X-O-C	20.105	20.1	0.0	0.0%	179-S16-U-X-O-C	20.1	179-S16-U-X-O-C	0.0	20.1	100.0%
S17	179-S17-U-N-I-C	17.155	17.2	0.0	0.0%	179-S17	17.2	179-S17-C	15.0	2.1	12.5%
	179-S17-U-X-O-C	1.065	1.1	0.0	0.0%	179-S17-U-X-O-C	1.1	179-S17-U-X-O-C	0.0	1.1	100.0%
S18	179-S18-U-N-I-C	5.26	5.3	0.0	0.0%	179-S18	5.3	179-S18-C	4.7	0.6	11.4%
S19	179-S19-U-N-I-C	18.535	18.5	0.0	0.0%	179-S19	18.5	179-S19-C	16.2	2.3	12.4%
S20	179-S20-U-N-I-C	11.055	11.1	0.0	0.0%	179-S20	11.1	179-S20-C	9.8	1.2	11.0%
S21	179-S21-U-N-I-C	51.6	51.6	0.0	0.0%	179-S21	51.6	179-S21-C	49.4	2.2	4.3%
	179-S21-U-X-O-C	223.85	223.9	0.0	0.0%	179-S21-U-X-O-C	223.9	179-S21-U-X-O-C	0.0	223.9	100.0%

Total Area (ac) 3,345.07
Regulated Area (ac) 2,481.28

Total TSS	3818286.2	lbs/5-yr	Regulated TSS Trapped by Sweeping		Regulated TSS Trapped by Existing Structural BMPs	426387.4	lbs/5-yr
In City TSS	3631798.4	lbs/5-yr	481309.0	lbs/5-yr	Total Regulated TSS Trapped by All Existing BMPs	907696.4	lbs/5-yr
Regulated TSS	3534052.9	lbs/5-yr	13.6%		Total Regulated TSS Trapped by All Existing BMPs	25.7%	
					REQUIRED =	DNE	

Total TP	12985.5	lbs/5-yr	Regulated TP Trapped by Sweeping		Regulated TP Trapped by Existing Structural BMPs	1057.3	lbs/5-yr
In City TP	11811.0	lbs/5-yr	969.9	lbs/5-yr	Total Regulated TP Trapped by All Existing BMPs	2027.2	lbs/5-yr
Regulated TP	11386.2	lbs/5-yr	8.5%		Total Regulated TP Trapped by All Existing BMPs	17.8%	
					REQUIRED =	15.0%	

Reach179 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Proposed Option 4

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	e02	Balanced Rock Brewery	12.262	12.262	179-e02-U-N-I-C	5455	5455	0	0.0%	179-e02	5455	179-e02-C	908	4547	83.4%
	e03	Baraboo Country Club - Clubhouse South	3.511	3.511	179-e03-U-N-I-C	2729	2729	0	0.0%	179-e03	2728	179-e03-C	670	2058	75.4%
	e04&R20	Baraboo Highschool	182.227	200.972	179-e04&R20-U-N-I-C	232105	232105	0	0.0%	179-e04&R20	282290	179-e04&R20-C	245170	37120	13.1%
			18.745		179-e04&R20-U-X-O-C	9265	9265	0	0.0%	179-e04&R20-U-X-O-C	9265	179-e04&R20-U-X-O-C	0	9265	100.0%
	e05	Baraboo Municipal Building	1.779	1.779	179-e05-U-N-I-C	3952	3952	0	0.0%	179-e05	3951	179-e05-C	2950	1002	25.3%
	e09	Dominos	1.29	1.290	179-e09-U-N-I-C	19260	19260	0	0.0%	179-e09	19260	179-e09-C	1554	17706	91.9%
	e10	Driftless Glen Distillery	0.797	0.797	179-e10-U-N-I-C	1746	1746	0	0.0%	179-e10	1746	179-e10-C	1424	322	18.4%
	e11	Fox Point Pond West	6.122	6.541	179-e11-U-N-I-C	9665	9665	0	0.0%	179-e11	9955	179-e11-C	1343	8613	86.5%
			0.419		179-e11-U-X-O-C	291	291	0	0.0%	179-e11-U-X-O-C	291	179-e11-U-X-O-C	0	291	100.0%
	e18	Oak Park Place Pond 1	3.596	3.597	179-e18-U-N-I-C	6395	6395	0	0.0%	179-e18	6395	179-e18-C	31	6364	99.5%
			0.001		179-e18-U-X-I-C	0	0	0	0.0%	179-e18-U-X-I-C	0	179-e18-U-X-I-C	0	0	100.0%
	e19	Oak Park Place Pond 4	1.225	1.225	179-e19-U-N-I-C	1913	1913	0	0.0%	179-e19	4119	179-e19-C	79	4040	98.1%
	e23&R10	Riverwalk Park	8.888	10.662	179-e23&R10-U-N-I-C	16115	16115	0	0.0%	179-e23&R10	16115	179-e23&R10-C	8270	7845	48.7%
			1.774		179-e23&R10-U-X-I-C	3302	3302	0	0.0%	179-e23&R10-U-X-I-C	3302	179-e23&R10-U-X-I-C	3302	3302	100.0%
	e26	South Point Apts	3.569	3.569	179-e26-U-N-I-C	5110	5110	0	0.0%	179-e26	5105	179-e26-C	1484	3622	70.9%
	e27	Spruce Haven 2nd Add OL 2	14.883	43.887	179-e27-U-N-I-C	17730	17730	0	0.0%	179-e27	30315	179-e27-C	21845	8470	27.9%
			29.004		179-e27-U-X-O-C	1017	1017	0	0.0%	179-e27-U-X-O-C	1017	179-e27-U-X-O-C	1017	1017	100.0%
	e32	Villas Baraboo	53.244	53.317	179-e32-U-N-I-C	87195	87195	0	0.0%	179-e32	87190	179-e32-C	46080	41110	47.1%
			0.073		179-e32-U-X-O-C	26	26	0	0.0%	179-e32-U-X-O-C	26	179-e32-U-X-O-C	0	26	100.0%
	e33	Vintage Condominiums Biofilter C	1.082	1.082	179-e33-U-N-I-C	279	279	0	0.0%	179-e33	279	179-e33-C	66	213	76.4%
	e34	Vintage Condominiums Biofilter D	0.359	0.359	179-e34-U-N-I-C	91	91	0	0.0%	179-e34	157	179-e34-C	116	41	26.1%
	e35	Vintage Condominiums Biofilter E	0.765	0.765	179-e35-U-N-I-C	202	202	0	0.0%	179-e35	225	179-e35-C	58	168	74.5%
	e36	Vintage Condominiums Biofilter F	0.604	0.604	179-e36-U-N-I-C	161	161	0	0.0%	179-e36	32	179-e36-C	23	9	28.2%
5 year model	e09NoBMP	e09NoBMP	27.633	32.656	179-e09NoBMP-SM-N-I-C	49131	40065	9066	18.5%	179-e09NoBMP-SM-N-I-C	46174	179-e09NoBMP-SM-N-I-C	46174	0	0.0%
			3.166		179-e09NoBMP-SW-N-I-C	3229	2444	785	24.3%	179-e09NoBMP-SW-N-I-C	2608	179-e09NoBMP-SW-N-I-C	2608	0	0.0%
			0.073		179-e09NoBMP-U-N-I-C	5	5	0	0.0%	179-e09NoBMP-U-N-I-C	5	179-e09NoBMP-U-N-I-C	5	0	0.0%
			1.784		179-e09NoBMP-U-X-I-C	1657	1657	0	0.0%	179-e09NoBMP-U-X-I-C	1657	179-e09NoBMP-U-X-I-C	0	1657	100.0%
	NoBMP	No BMP	566.227	1,062.843	179-NoBMP-SM-N-I-C	789187	612102	177085	22.4%	179-NoBMP-SM-N-I-C	612102	179-NoBMP-SM-N-I-C	612102	0	0.0%
			70.547		179-NoBMP-SW-N-I-C	144471	111231	33240	23.0%	179-NoBMP-SW-N-I-C	111231	179-NoBMP-SW-N-I-C	111231	0	0.0%
			121.571		179-NoBMP-U-N-I-C	29064	29064	0	0.0%	179-NoBMP-U-N-I-C	29064	179-NoBMP-U-N-I-C	29064	0	0.0%
			233.285		179-NoBMP-U-X-I-C	43037	43037	0	0.0%	179-NoBMP-U-X-I-C	43037	179-NoBMP-U-X-I-C	0	43037	100.0%
			71.213		179-NoBMP-U-X-O-C	11191	11191	0	0.0%	179-NoBMP-U-X-O-C	11191	179-NoBMP-U-X-O-C	0	11191	100.0%
	P10	P10	38.617	42.226	179-P10-SM-N-I-C	66277	45723	20554	31.0%	179-P10-SM-N-I-C	60622	179-P10-SM-N-I-C	60622	0	0.0%
			2.704		179-P10-SW-N-I-C	6360	4882	1478	23.2%	179-P10-SW-N-I-C	5099	179-P10-SW-N-I-C	5099	0	0.0%
			0.004		179-P10-U-N-I-C	0	0	0	0.0%	179-P10-U-N-I-C	0	179-P10-U-N-I-C	0	0	0.0%
			0.901		179-P10-U-X-I-C	0	0	0	0.0%	179-P10-U-X-I-C	0	179-P10-U-X-I-C	0	0	100.0%
	P110	P110	185.863	394.354	179-P110-SM-N-I-C	277179	226580	50599	18.3%	179-P110-SM-N-I-C	226580	179-P110-SM-N-I-C	226580	0	0.0%
			0.487		179-P110-SW-N-I-C	290	221	69	23.8%	179-P110-SW-N-I-C	221	179-P110-SW-N-I-C	221	0	0.0%
			153.269		179-P110-U-N-I-C	134917	134917	0	0.0%	179-P110-U-N-I-C	134917	179-P110-U-N-I-C	134917	0	0.0%
			54.735		179-P110-U-X-O-C	31681	31681	0	0.0%	179-P110-U-X-O-C	31681	179-P110-U-X-O-C	31681	0	100.0%
	P150	P150	17.889	22.862	179-P150-SM-N-I-C	41779	36469	5310	12.7%	179-P150-SM-N-I-C	36469	179-P150-SM-N-I-C	36469	0	0.0%
			4.973		179-P150-U-N-I-C	15208	15208	0	0.0%	179-P150-U-N-I-C	15208	179-P150-U-N-I-C	15208	0	0.0%
	P160	P160	103.965	179.493	179-P160-SM-N-I-C	158335	106986	51349	32.4%	179-P160-SM-N-I-C	106986	179-P160-SM-N-I-C	106986	0	0.0%
			57.59		179-P160-SW-N-I-C	121081	88245	32836	27.1%	179-P160-SW-N-I-C	88245	179-P160-SW-N-I-C	88245	0	0.0%
			8.53		179-P160-U-N-I-C	7267	7267	0	0.0%	179-P160-U-N-I-C	7267	179-P160-U-N-I-C	7267	0	0.0%
			9.408		179-P160-U-X-I-C	19664	19664	0	0.0%	179-P160-U-X-I-C	19664	179-P160-U-X-I-C	19664	0	100.0%
	P170	P170	7.857	7.857	179-P170-SM-N-I-C	25006	24349	657	2.6%	179-P170-SM-N-I-C	24751	179-P170-SM-N-I-C	24751	0	0.0%
	P20	P20	125.441	145.642	179-P20-SM-N-I-C	185032	129013	56019	30.3%	179-P20-SM-N-I-C	129013	179-P20-SM-N-I-C	129013	0	0.0%
			13.911		179-P20-SW-N-I-C	21145	15293	5852	27.7%	179-P20-SW-N-I-C	15293	179-P20-SW-N-I-C	15293	0	0.0%
			1.857		179-P20-U-N-I-C	2599	2599	0	0.0%	179-P20-U-N-I-C	2599	179-P20-U-N-I-C	2599	0	0.0%
			3.506		179-P20-U-X-I-C	0	0	0	0.0%	179-P20-U-X-I-C	0	179-P20-U-X-I-C	0	0	100.0%
			0.927		179-P20-U-X-O-C	0	0	0	0.0%	179-P20-U-X-O-C	0	179-P20-U-X-O-C	0	0	100.0%
	P40	P40	158.646	162.542	179-P40-U-N-I-C	274975	274975	0	0.0%	179-P40	266885	179-P40-C	109895	156990	58.8%
			3.896		179-P40-U-X-I-C	0	0	0	0.0%	179-P40-U-X-I-C	0	179-P40-U-X-I-C	0	0	100.0%
	P50	P50	39.847	39.847	179-P50-U-N-I-C	56309	56309	0	0.0%	179-P50	55445	179-P50-C	15480	39965	72.1%
5 year model	P60	P60	55.684	57.065	179-P60-SM-N-I-C	87279	78527	8752	10.0%	179-P60-SM-N-I-C	78527	179-P60-SM-N-I-C	78527	0	0.0%
			1.381		179-P60-U-N-I-C	2925	2925	0	0.0%	179-P60-U-N-I-C	2925	179-P60-U-N-I-C	2925	0	0.0%
	P70	P70	23.911	25.256	179-P70-U-N-I-C	30955	30955	0	0.0%	179-P70	30955	179-P70-C	30955	0	0.0%
			1.345		179-P70-U-X-I-C	1406	1406	0	0.0%	179-P70-U-X-I-C	1406	179-P70-U-X-I-C	0	1406	100.0%
5 year model	P90	P90	46.265	229.104	179-P90-SM-N-I-C	136903	113678	23225	17.0%	179-P90-SM-N-I-C	113678	179-P90-SM-N-I-C	113678	0	0.0%
			8.222		179-P90-SW-N-I-C	25579	21146	4433	17.3%	179-P90-SW-N-I-C	21146	179-P90-SW-N-I-C	21146	0	0.0%
			90.247		179-P90-U-N-I-C	144393	144393	0	0.0%	179-P90-U-N-I-C	144393	179-P90-U-N-I-C	144393	0	0.0%
			11.029		179-P90-U-X-I-C	4609	4609	0	0.0%	179-P90-U-X-I-C	4609	179-P90-U-X-I-C	0	4609	100.0%
			73.341		179-P90-U-X-O-C	37038	37038	0	0.0%	179-P90-U-X-O-C	37038	179-P90-U-X-O-C	0	37038	100.0%
	S02	S02	12.401	53.906	179-S02-U-N-I-C	15975	15975	0	0.0%	179-S02	15975	179-S02-C	12970	3005	18.8%
			41.505		179-S02-U-X-O-C	3705	3705	0	0.0%	179-S02-U-X-O-C	3705	179-S02-U-X-O-C	0	3705	100.0%
	S09	S09	46.241	69.457	179-S09-U-N-I-C	50555	50555	0	0.0%	179-S09	50550	179-S09-C	50215	335	0.7%
			23.216		179-S09-U-X-O-C	9010	9010	0	0.0%	179-S09-U-X-O-C	9010	179-S09-U-X-O-C	9010	9010	100.0%
	S12	S12	2.414	2.414	179-S12-U-N-I-C	3531	3531	0	0.0%	179-S12	3531	179-S12-C	2206	1325	37.5%
	Leaf	Leaf Collection							Leaf Collection					0	
	S13	S13	16.827	54.114	179-S13-U-N-I-C	18405	18405	0	0.0%	179-S13	18405	179-S13-C	15870	2535	13.8%
			37.264		179-S13-U-X-I-C	16570	16570	0	0.0%	179-S13-U-X-I-C	16570	179-S13-U-X-I-C	0	16570	100.0%
			0.023		179-S13-U-X-O-C	15	15	0	0.0%	179-S13-U-X-O-C	15	179-S13-U-X-O-C	0	15	100.0%
	S14&P80	S14&P80	119.418	245.671	179-S14&P80-U-N-I-C	150795	150795	0	0.0%	179-S14&P80	199040	179-S14&P80-C	189230	9810	4.9%
			16.865		179-S14&P80-U-X-I-C	7500	7500	0	0.0%	179-S14&P80-U-X-I-C	7500	179-S14&P80-U-X-I-C	0	7500	100.0%
			109.388		179-S14&P80-U-X-O-C	51460	51460	0	0.0%	179-S14&P80-U-X-O-C	51460	179-S14&P80-U-X-O-C	0	51460	100.0%
	S15	S15	13.695	13.695	179-S15-U-N-I-C	24225	24225	0	0.0%	179-S15	24220	179-S15-C	20520	3700	15.3%
	S16	S16	2.859	9.016	179-S16-U-N-I-C	3245	3245	0	0.0%	179-S16	3245	179-S16-C	2806	439	13.5%
			6.157		179-S16-U-X-O-C	5635	5635	0	0.0%	179-S16-U-X-O-C	5635	179-S16-U-X-O-C	0	5635	100.0%
	S17	S17	3.04	3.747	179-S17-U-N-I-C	4294	4294	0	0.0%	179-S17	4294	179-S17-C	3550	744	17.3%
			0.707		179-S17-U-X-O-C	64	64	0	0.0%	179-S17-U-X-O-C	64	179-S17-U-X-O-C	0	64	100.0%
	S18	S18	0.863	0.863	179-S18-U-N-I-C	1347	1347	0	0.0%	179-S18	1347	179-S18-C	1133	214	15.9%
	S19	S19	3.197	3.197	179-S19-U-N-I-C	4760	4760	0	0.0%	179-S19	4759	179-S19-C	3945	815	17.1%
	S20	S20	3.034	3.034	179-S20-U-N-I-C	2410	2410	0	0.0%	179-S20	2409	179-S20-C	1975	435	18.0%
	S21	S21	24.706	137.992	179-S21-U-N-I-C	7530	7530	0	0.0%	179-S21	7530	179-S21-C	6670	860	11.4%
			113.286		179-S21-U-X-O-C	26090	26090	0	0.0%	179-S21-U-X-O-C	26090	179-S21-U-X-O-C	0	26090	100.0%

Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
Node	Value	Sweeping			Node	Value	Node	Value		
179-e02-U-N-I-C	39.255	39.3	0.0	0.0%	179-e02	39.3	179-e02-C	18.8	20.5	52.2%
179-e03-U-N-I-C	12.665	12.7	0.0	0.0%	179-e03	12.7	179-e03-C	2.5	10.2	80.5%
179-e04&R20-U-N-I-C	846.5	846.5	0.0	0.0%	179-e04&R20	1043.5	179-e04&R20-C	936.0	107.5	10.3%
179-e04&R20-U-X-O-C	31.935	31.9	0.0	0.0%	179-e04&R20-U-X-O-C	31.9	179-e04&R20-U-X-O-C	0.0	31.9	100.0%
179-e05-U-N-I-C	9.875	9.9	0.0	0.0%	179-e05	9.9	179-e05-C	7.8	2.1	21.4%
179-e09-U-N-I-C	41.26	41.3	0.0	0.0%	179-e09	41.3	179-e09-C	3.8	37.5	90.9%
179-e10-U-N-I-C	4.6865	4.7	0.0	0.0%	179-e10	4.7	179-e10-C	3.9	0.8	16.1%
179-e11-U-N-I-C	34.345	34.3	0.0	0.0%	179-e11	35.9	179-e11-C	12.2	23.8	66.1%
179-e11-U-X-O-C	1.596	1.6	0.0	0.0%	179-e11-U-X-O-C	1.6	179-e11-U-X-O-C	0.0	1.6	100.0%
179-e18-U-N-I-C	19.115	19.1	0.0	0.0%	179-e18	19.1	179-e18-C	4.3	14.8	77.5%
179-e18-U-X-I-C	0.003205	0.0	0.0	0.0%	179-e18-U-X-I-C	0.0	179-e18-U-X-I-C	0.0	0.0	100.0%
179-e19-U-N-I-C	6.585	6.6	0.0	0.0%	179-e19	15.0	179-e19-C	4.1	10.9	72.6%
179-e23&R10-U-N-I-C	45.37	45.4	0.0	0.0%	179-e23&R10	45.4	179-e23&R10-C	25.0	20.4	44.9%
179-e23&R10-U-X-I-C	8.745	8.7	0.0	0.0%	179-e23&R10-U-X-I-C	8.7	179-e23&R10-U-X-I-C	0.0	8.7	100.0%
179-e26-U-N-I-C	18.275	18.3	0.0	0.0%	179-e26	18.3	179-e26-C	8.8	9.5	51.8%
179-e27-U-N-I-C	71.6	71.6	0.0	0.0%	179-e27	147.0	179-e27-C	118.1	29.0	19.7%
179-e27-U-X-O-C	35.52	35.5	0.0	0.0%	179-e27-U-X-O-C	35.5	179-e27-U-X-O-C	0.0	35.5	100.0%
179-e32-U-N-I-C	248.05	248.1	0.0	0.0%	179-e32	248.0	179-e32-C	156.6	91.5	36.9%
179-e32-U-X-O-C	0.0962	0.1	0.0	0.0%	179-e32-U-X-O-C	0.1	179-e32-U-X-O-C	0.0	0.1	100.0%
179-e33-U-N-I-C	1.978	2.0	0.0	0.0%	179-e33	2.0	179-e33-C	1.3	0.7	34.0%
179-e34-U-N-I-C	0.6535	0.7	0.0	0.0%	179-e34	2.0	179-e34-C	1.7	0.3	15.3%
179-e35-U-N-I-C	1.414	1.4	0.0	0.0%	179-e35	2.0	179-e35-C	1.5	0.6	27.8%
179-e36-U-N-I-C	1.121	1.1	0.0	0.0%	179-e36	1.1	179-e36-C	0.6	0.5	43.7%
179-e09NoBMP-SM-N-I-C	154	136.9	17.1	11.1%	179-e09NoBMP-SM-N-I-C	136.9	179-e09NoBMP-SM-N-I-C	0.0	0.0	0.0%
179-e09NoBMP-SW-N-I-C	12.49	10.8	1.7	13.6%	179-e09NoBMP-SW-N-I-C	10.8	179-e09NoBMP-SW-N-I-C	0.0	0.0	0.0%
179-e09NoBMP-U-N-I-C	0.0	0.0	0.0	0.0%	179-e09NoBMP-U-N-I-C	0.0	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0%
179-e09NoBMP-U-X-I-C	5.6	5.6	0.0	0.0%	179-e09NoBMP-U-X-I-C	5.6	179-e09NoBMP-U-X-I-C	0.0	5.6	100.0%
179-NoBMP-SM-N-I-C	2646	2275.0	371.0	14.0%	179-NoBMP-SM-N-I-C	2275.0	179-NoBMP-SM-N-I-C	2275.0	0.0	0.0%
179-NoBMP-SW-N-I-C	376	318.7	57.3	15.2%	179-NoBMP-SW-N-I-C	318.7	179-NoBMP-SW-N-I-C	318.7	0.0	0.0%
179-NoBMP-U-N-I-C	85.69	85.7	0.0	0.0%	179-NoBMP-U-N-I-C	85.7	179-NoBMP-U-N-I-C	85.7	0.0	0.0%
179-NoBMP-U-X-I-C	143.4	143.4	0.0	0.0%	179-NoBMP-U-X-I-C	143.4	179-NoBMP-U-X-I-C	0.0	143.4	100.0%
179-NoBMP-U-X-O-C	46.86	46.9	0.0	0.0%	179-NoBMP-U-X-O-C	46.9	179-NoBMP-U-X-O-C	0.0	46.9	100.0%
179-P10-SM-N-I-C	223.9	178.3	45.6	20.4%	179-P10-SM-N-I-C	211.5	179-P10-SM-N-I-C	211.5	0.0	0.0%
179-P10-SW-N-I-C	15.09	12.6	2.5	16.8%	179-P10-SW-N-I-C	13.0	179-P10-SW-N-I-C	13.0	0.0	0.0%
179-P10-U-N-I-C	0	0.0	0.0	0.0%	179-P10-U-N-I-C	0.0	179-P10-U-N-I-C	0.0	0.0	0.0%
179-P10-U-X-I-C	0	0.0	0.0	0.0%	179-P10-U-X-I-C	0.0	179-P10-U-X-I-C	0.0	0.0	100.0%
179-P110-SM-N-I-C	802.4	710.5	91.9	11.5%	179-P110-SM-N-I-C	710.5	179-P110-SM-N-I-C	710.5	0.0	0.0%
179-P110-SW-N-I-C	1.484	1.3	0.2	10.8%	179-P110-SW-N-I-C	1.3	179-P110-SW-N-I-C	1.3	0.0	0.0%
179-P110-U-N-I-C	547.4	547.4	0.0	0.0%	179-P110-U-N-I-C	547.4	179-P110-U-N-I-C	547.4	0.0	0.0%
179-P110-U-X-O-C	167.7	167.7	0.0	0.0%	179-P110-U-X-O-C	167.7	179-P110-U-X-O-C	0.0	167.7	100.0%
179-P150-SM-N-I-C	96.59	87.7	8.9	9.2%	179-P150-SM-N-I-C	87.7	179-P150-SM-N-I-C	87.7	0.0	0.0%
179-P150-U-N-I-C	27.82	27.8	0.0	0.0%	179-P150-U-N-I-C	27.8	179-P150-U-N-I-C	27.8	0.0	0.0%
179-P160-SM-N-I-C	565.2	448.9	116.3	20.6%	179-P160-SM-N-I-C	448.9	179-P160-SM-N-I-C	448.9	0.0	0.0%
179-P160-SW-N-I-C	338.7	275.8	62.9	18.6%	179-P160-SW-N-I-C	275.8	179-P160-SW-N-I-C	275.8	0.0	0.0%
179-P160-U-N-I-C	33.22	33.2	0.0	0.0%	179-P160-U-N-I-C	33.2	179-P160-U-N-I-C	33.2	0.0	0.0%
179-P160-U-X-I-C	55.17	55.2	0.0	0.0%	179-P160-U-X-I-C	55.2	179-P160-U-X-I-C	0.0	55.2	100.0%
179-P170-SM-N-I-C	44.82	44.1	0.8	1.7%	179-P170-SM-N-I-C	44.5	179-P170-SM-N-I-C	44.5	0.0	0.0%
179-P20-SM-N-I-C	666.4	539.7	126.7	19.0%	179-P20-SM-N-I-C	539.7	179-P20-SM-N-I-C	539.7	0.0	0.0%
179-P20-SW-N-I-C	74.26	61.1	13.1	17.7%	179-P20-SW-N-I-C	61.1	179-P20-SW-N-I-C	61.1	0.0	0.0%
179-P20-U-N-I-C	8.379	8.4	0.0	0.0%	179-P20-U-N-I-C	8.4	179-P20-U-N-I-C	8.4	0.0	0.0%
179-P20-U-X-I-C	0	0.0	0.0	0.0%	179-P20-U-X-I-C	0.0	179-P20-U-X-I-C	0.0	0.0	100.0%
179-P20-U-X-O-C	0	0.0	0.0	0.0%	179-P20-U-X-O-C	0.0	179-P20-U-X-O-C	0.0	0.0	100.0%
179-P40-U-N-I-C	822.78	822.8	0.0	0.0%	179-P40	818.0	179-P40-C	460.2	357.9	43.7%
179-P40-U-X-I-C	0	0.0	0.0	0.0%	179-P40-U-X-I-C	0.0	179-P40-U-X-I-C	0.0	0.0	0.0%
179-P50-U-N-I-C	209.51	209.5	0.0	0.0%	179-P50	211.0	179-P50-C	102.2	108.8	51.6%
179-P60-SM-N-I-C	308.9	293.9	15.0	4.9%	179-P60-SM-N-I-C	293.9	179-P60-SM-N-I-C	293.9	0.0	0.0%
179-P60-U-N-I-C	7.833	7.8	0.0	0.0%	179-P60-U-N-I-C	7.8	179-P60-U-N-I-C	7.8	0.0	0.0%
179-P70-U-N-I-C	111.38	111.4	0.0	0.0%	179-P70	112.3	179-P70-C	112.3	0.0	0.0%
179-P70-U-X-I-C	5.467	5.5	0.0	0.0%	179-P70-U-X-I-C	5.5	179-P70-U-X-I-C	0.0	5.5	100.0%
179-P90-SM-N-I-C	272.1	239.5	32.6	12.0%	179-P90-SM-N-I-C	239.5	179-P90-SM-N-I-C	239.5	0.0	0.0%
179-P90-SW-N-I-C	51	44.7	6.3	12.3%	179-P90-SW-N-I-C	44.7	179-P90-SW-N-I-C	44.7	0.0	0.0%
179-P90-U-N-I-C	444	444.0	0.0	0.0%	179-P90-U-N-I-C	444.0	179-P90-U-N-I-C	444.0	0.0	0.0%
179-P90-U-X-I-C	33.18	33.2	0.0	0.0%	179-P90-U-X-I-C	33.2	179-P90-U-X-I-C	0.0	33.2	100.0%
179-P90-U-X-O-C	221.1	221.1	0.0	0.0%	179-P90-U-X-O-C	221.1	179-P90-U-X-O-C	0.0	221.1	100.0%
179-S02-U-N-I-C	50.6	50.6	0.0	0.0%	179-S02	50.6	179-S02-C	43.8	6.8	13.5%
179-S02-U-X-O-C	26.6	26.6	0.0	0.0%	179-S02-U-X-O-C	26.6	179-S02-U-X-O-C	0.0	26.6	100.0%
179-S09-U-N-I-C	198.2	198.2	0.0	0.0%	179-S09	198.2	179-S09-C	197.2	1.0	0.5%
179-S09-U-X-O-C	53.4	53.4	0.0	0.0%	179-S09-U-X-O-C	53.4	179-S09-U-X-O-C	0.0	53.4	100.0%
179-S12-U-N-I-C	12.505	12.5	0.0	0.0%	179-S12	12.5	179-S12-C	8.4	4.1	32.9%
				Leaf Collection					0.0	
179-S13-U-N-I-C	77.7	77.7	0.0	0.0%	179-S13	77.7	179-S13-C	69.9	7.8	10.0%
179-S13-U-X-I-C	119.3	119.3	0.0	0.0%	179-S13-U-X-I-C	119.3	179-S13-U-X-I-C	0.0	119.3	100.0%
179-S13-U-X-O-C	0.08305	0.1	0.0	0.0%	179-S13-U-X-O-C	0.1	179-S13-U-X-O-C	0.0	0.1	100.0%
179-S14&P80-U-N-I-C	514	514.0	0.0	0.0%	179-S14&P80	763.0	179-S14&P80-C	730.5	32.5	4.3%
179-S14&P80-U-X-I-C	54	54.0	0.0	0.0%	179-S14&P80-U-X-I-C	54.0	179-S14&P80-U-X-I-C	0.0	54.0	100.0%
179-S14&P80-U-X-O-C	344.55	344.6	0.0	0.0%	179-S14&P80-U-X-O-C	344.6	179-S14&P80-U-X-O-C	0.0	344.6	100.0%
179-S15-U-N-I-C	66.35	66.4	0.0	0.0%	179-S15	66.4	179-S15-C	58.7	7.6	11.5%
179-S16-U-N-I-C	13.09	13.1	0.0	0.0%	179-S16	13.1	179-S16-C	11.9	1.2	9.4%
179-S16-U-X-O-C	20.105	20.1	0.0	0.0%	179-S16-U-X-O-C	20.1	179-S16-U-X-O-C	0.0	20.1	100.0%
179-S17-U-N-I-C	17.155	17.2	0.0	0.0%	179-S17	17.2	179-S17-C	15.0	2.1	12.5%
179-S17-U-X-O-C	1.065	1.1	0.0	0.0%	179-S17-U-X-O-C	1.1	179-S17-U-X-O-C	0.0	1.1	100.0%
179-S18-U-N-I-C	5.26	5.3	0.0	0.0%	179-S18	5.3	179-S18-C	4.7	0.6	11.4%
179-S19-U-N-I-C	18.535	18.5	0.0	0.0%	179-S19	18.5	179-S19-C	16.2	2.3	12.4%
179-S20-U-N-I-C	11.055	11.1	0.0	0.0%	179-S20	11.1	179-S20-C	9.8	1.2	11.0%
179-S21-U-N-I-C	51.6	51.6	0.0	0.0%	179-S21	51.6	179-S21-C	49.4	2.2	4.3%
179-S21-U-X-O-C	223.85	223.9	0.0	0.0%	179-S21-U-X-O-C	223.9	179-S21-U-X-O-C	0.0	223.9	100.0%

Total Area (ac) 3,345.07
Regulated Area (ac) 2,481.28

Total TSS	3818286.2	lbs/5-yr	Regulated TSS Trapped by Sweeping		Regulated TSS Trapped by Existing Structural BMPs	364417.4	lbs/5-yr
In City TSS	3631798.4	lbs/5-yr	481309.0	lbs/5-yr	Total Regulated TSS Trapped by All Existing BMPs	845726.4	lbs/5-yr
Regulated TSS	3534052.9	lbs/5-yr	13.6%		Total Regulated TSS Trapped by All Existing BMPs	23.9%	
					REQUIRED =	DNE	

Total TP	12985.5	lbs/5-yr	Regulated TP Trapped by Sweeping		Regulated TP Trapped by Existing Structural BMPs	916.5	lbs/5-yr
In City TP	11811.0	lbs/5-yr	969.9	lbs/5-yr	Total Regulated TP Trapped by All Existing BMPs	1886.4	lbs/5-yr
Regulated TP	11386.2	lbs/5-yr	8.5%		Total Regulated TP Trapped by All Existing BMPs	16.6%	
					REQUIRED =	15.0%	

Reach179 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Proposed Option 5

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	e02	Balanced Rock Brewery	12.262	12.262	179-e02-U-N-I-C	5455	5455	0	0.0%	179-e02	5455	179-e02-C	908	4547	83.4%
	e03	Baraboo Country Club - Clubhouse South	3.511	3.511	179-e03-U-N-I-C	2729	2729	0	0.0%	179-e03	2728	179-e03-C	670	2058	75.4%
	e04&R20	Baraboo Highschool	182.227	200.972	179-e04&R20-U-N-I-C	232105	232105	0	0.0%	179-e04&R20	282290	179-e04&R20-C	143235	139055	49.3%
			18.745		179-e04&R20-U-X-O-C	9265	9265	0	0.0%	179-e04&R20-U-X-O-C	9265	179-e04&R20-U-X-O-C	0	9265	100.0%
	e05	Baraboo Municipal Building	1.779	1.779	179-e05-U-N-I-C	3952	3952	0	0.0%	179-e05	3951	179-e05-C	2950	1002	25.3%
	e09	Dominos	1.29	1.290	179-e09-U-N-I-C	19260	19260	0	0.0%	179-e09	19260	179-e09-C	1554	17706	91.9%
	e10	Driftless Glen Distillery	0.797	0.797	179-e10-U-N-I-C	1746	1746	0	0.0%	179-e10	1746	179-e10-C	1424	322	18.4%
	e11	Fox Point Pond West	6.122	6.541	179-e11-U-N-I-C	9665	9665	0	0.0%	179-e11	9955	179-e11-C	1343	8613	86.5%
			0.419		179-e11-U-X-O-C	291	291	0	0.0%	179-e11-U-X-O-C	291	179-e11-U-X-O-C	0	291	100.0%
	e18	Oak Park Place Pond 1	3.596	3.597	179-e18-U-N-I-C	6395	6395	0	0.0%	179-e18	6395	179-e18-C	31	6364	99.5%
			0.001		179-e18-U-X-I-C	0	0	0	0.0%	179-e18-U-X-I-C	0	179-e18-U-X-I-C	0	0	100.0%
	e19	Oak Park Place Pond 4	1.225	1.225	179-e19-U-N-I-C	1913	1913	0	0.0%	179-e19	4119	179-e19-C	79	4040	98.1%
	e23&R10	Riverwalk Park	8.888	10.662	179-e23&R10-U-N-I-C	16115	16115	0	0.0%	179-e23&R10	16115	179-e23&R10-C	8270	7845	48.7%
			1.774		179-e23&R10-U-X-I-C	3302	3302	0	0.0%	179-e23&R10-U-X-I-C	3302	179-e23&R10-U-X-I-C	3302	3302	100.0%
	e26	South Point Apts	3.569	3.569	179-e26-U-N-I-C	5110	5110	0	0.0%	179-e26	5105	179-e26-C	1484	3622	70.9%
	e27	Spruce Haven 2nd Add OL 2	14.883	43.887	179-e27-U-N-I-C	17730	17730	0	0.0%	179-e27	30315	179-e27-C	21845	8470	27.9%
			29.004		179-e27-U-X-O-C	1017	1017	0	0.0%	179-e27-U-X-O-C	1017	179-e27-U-X-O-C	1017	1017	100.0%
	e32	Villas Baraboo	53.244	53.317	179-e32-U-N-I-C	87195	87195	0	0.0%	179-e32	87190	179-e32-C	46080	41110	47.1%
			0.073		179-e32-U-X-O-C	26	26	0	0.0%	179-e32-U-X-O-C	26	179-e32-U-X-O-C	0	26	100.0%
	e33	Vintage Condominiums Biofilter C	1.082	1.082	179-e33-U-N-I-C	279	279	0	0.0%	179-e33	279	179-e33-C	66	213	76.4%
	e34	Vintage Condominiums Biofilter D	0.359	0.359	179-e34-U-N-I-C	91	91	0	0.0%	179-e34	157	179-e34-C	116	41	26.1%
	e35	Vintage Condominiums Biofilter E	0.765	0.765	179-e35-U-N-I-C	202	202	0	0.0%	179-e35	225	179-e35-C	58	168	74.5%
	e36	Vintage Condominiums Biofilter F	0.604	0.604	179-e36-U-N-I-C	161	161	0	0.0%	179-e36	32	179-e36-C	23	9	28.2%
5 year model	e09NoBMP	e09NoBMP	27.633	32.656	179-e09NoBMP-SM-N-I-C	49131	40065	9066	18.5%	179-e09NoBMP-SM-N-I-C	46174	179-e09NoBMP-SM-N-I-C	46174	0	0.0%
			3.166		179-e09NoBMP-SW-N-I-C	3229	2444	785	24.3%	179-e09NoBMP-SW-N-I-C	2608	179-e09NoBMP-SW-N-I-C	2608	0	0.0%
			0.073		179-e09NoBMP-U-N-I-C	5	5	0	0.0%	179-e09NoBMP-U-N-I-C	5	179-e09NoBMP-U-N-I-C	5	0	0.0%
			1.784		179-e09NoBMP-U-X-I-C	1657	1657	0	0.0%	179-e09NoBMP-U-X-I-C	1657	179-e09NoBMP-U-X-I-C	0	1657	100.0%
	NoBMP	No BMP	566.227	1,062.843	179-NoBMP-SM-N-I-C	789187	612102	177085	22.4%	179-NoBMP-SM-N-I-C	612102	179-NoBMP-SM-N-I-C	612102	0	0.0%
			70.547		179-NoBMP-SW-N-I-C	144471	111231	33240	23.0%	179-NoBMP-SW-N-I-C	111231	179-NoBMP-SW-N-I-C	111231	0	0.0%
			121.571		179-NoBMP-U-N-I-C	29064	29064	0	0.0%	179-NoBMP-U-N-I-C	29064	179-NoBMP-U-N-I-C	29064	0	0.0%
			233.285		179-NoBMP-U-X-I-C	43037	43037	0	0.0%	179-NoBMP-U-X-I-C	43037	179-NoBMP-U-X-I-C	0	43037	100.0%
			71.213		179-NoBMP-U-X-O-C	11191	11191	0	0.0%	179-NoBMP-U-X-O-C	11191	179-NoBMP-U-X-O-C	0	11191	100.0%
	P10	P10	38.617	42.226	179-P10-SM-N-I-C	66277	45723	20554	31.0%	179-P10-SM-N-I-C	60622	179-P10-SM-N-I-C	60622	0	0.0%
			2.704		179-P10-SW-N-I-C	6360	4882	1478	23.2%	179-P10-SW-N-I-C	5099	179-P10-SW-N-I-C	5099	0	0.0%
			0.004		179-P10-U-N-I-C	0	0	0	0.0%	179-P10-U-N-I-C	0	179-P10-U-N-I-C	0	0	0.0%
			0.901		179-P10-U-X-I-C	0	0	0	0.0%	179-P10-U-X-I-C	0	179-P10-U-X-I-C	0	0	100.0%
	P110	P110	185.863	394.354	179-P110-SM-N-I-C	277179	226580	50599	18.3%	179-P110-SM-N-I-C	226580	179-P110-SM-N-I-C	226580	0	0.0%
			0.487		179-P110-SW-N-I-C	290	221	69	23.8%	179-P110-SW-N-I-C	221	179-P110-SW-N-I-C	221	0	0.0%
			153.269		179-P110-U-N-I-C	134917	134917	0	0.0%	179-P110-U-N-I-C	134917	179-P110-U-N-I-C	134917	0	0.0%
			54.735		179-P110-U-X-O-C	31681	31681	0	0.0%	179-P110-U-X-O-C	31681	179-P110-U-X-O-C	31681	0	100.0%
	P150	P150	17.889	22.862	179-P150-SM-N-I-C	41779	36469	5310	12.7%	179-P150-SM-N-I-C	36469	179-P150-SM-N-I-C	36469	0	0.0%
			4.973		179-P150-U-N-I-C	15208	15208	0	0.0%	179-P150-U-N-I-C	15208	179-P150-U-N-I-C	15208	0	0.0%
	P160	P160	103.965	179.493	179-P160-SM-N-I-C	158335	106986	51349	32.4%	179-P160-SM-N-I-C	106986	179-P160-SM-N-I-C	106986	0	0.0%
			57.59		179-P160-SW-N-I-C	121081	88245	32836	27.1%	179-P160-SW-N-I-C	88245	179-P160-SW-N-I-C	88245	0	0.0%
			8.53		179-P160-U-N-I-C	7267	7267	0	0.0%	179-P160-U-N-I-C	7267	179-P160-U-N-I-C	7267	0	0.0%
			9.408		179-P160-U-X-I-C	19664	19664	0	0.0%	179-P160-U-X-I-C	19664	179-P160-U-X-I-C	19664	0	100.0%
	P170	P170	7.857	7.857	179-P170-SM-N-I-C	25006	24349	657	2.6%	179-P170-SM-N-I-C	24751	179-P170-SM-N-I-C	24751	0	0.0%
	P20	P20	125.441	145.642	179-P20-SM-N-I-C	185032	129013	56019	30.3%	179-P20-SM-N-I-C	129013	179-P20-SM-N-I-C	129013	0	0.0%
			13.911		179-P20-SW-N-I-C	21145	15293	5852	27.7%	179-P20-SW-N-I-C	15293	179-P20-SW-N-I-C	15293	0	0.0%
			1.857		179-P20-U-N-I-C	2599	2599	0	0.0%	179-P20-U-N-I-C	2599	179-P20-U-N-I-C	2599	0	0.0%
			3.506		179-P20-U-X-I-C	0	0	0	0.0%	179-P20-U-X-I-C	0	179-P20-U-X-I-C	0	0	100.0%
			0.927		179-P20-U-X-O-C	0	0	0	0.0%	179-P20-U-X-O-C	0	179-P20-U-X-O-C	0	0	100.0%
	P40	P40	158.646	162.542	179-P40-U-N-I-C	274975	274975	0	0.0%	179-P40	266885	179-P40-C	266885	0	0.0%
			3.896		179-P40-U-X-I-C	0	0	0	0.0%	179-P40-U-X-I-C	0	179-P40-U-X-I-C	0	0	100.0%
	P50	P50	39.847	39.847	179-P50-U-N-I-C	56309	56309	0	0.0%	179-P50	55445	179-P50-C	55445	0	0.0%
5 year model	P60	P60	55.684	57.065	179-P60-SM-N-I-C	87279	78527	8752	10.0%	179-P60-SM-N-I-C	78527	179-P60-SM-N-I-C	78527	0	0.0%
			1.381		179-P60-U-N-I-C	2925	2925	0	0.0%	179-P60-U-N-I-C	2925	179-P60-U-N-I-C	2925	0	0.0%
	P70	P70	23.911	25.256	179-P70-U-N-I-C	30955	30955	0	0.0%	179-P70	30955	179-P70-C	12090	18865	60.9%
			1.345		179-P70-U-X-I-C	1406	1406	0	0.0%	179-P70-U-X-I-C	1406	179-P70-U-X-I-C	0	1406	100.0%
5 year model	P90	P90	46.265	229.104	179-P90-SM-N-I-C	136903	113678	23225	17.0%	179-P90-SM-N-I-C	113678	179-P90-SM-N-I-C	113678	0	0.0%
			8.222		179-P90-SW-N-I-C	25579	21146	4433	17.3%	179-P90-SW-N-I-C	21146	179-P90-SW-N-I-C	21146	0	0.0%
			90.247		179-P90-U-N-I-C	144393	144393	0	0.0%	179-P90-U-N-I-C	144393	179-P90-U-N-I-C	144393	0	0.0%
			11.029		179-P90-U-X-I-C	4609	4609	0	0.0%	179-P90-U-X-I-C	4609	179-P90-U-X-I-C	0	4609	100.0%
			73.341		179-P90-U-X-O-C	37038	37038	0	0.0%	179-P90-U-X-O-C	37038	179-P90-U-X-O-C	0	37038	100.0%
	S02	S02	12.401	53.906	179-S02-U-N-I-C	15975	15975	0	0.0%	179-S02	15975	179-S02-C	12970	3005	18.8%
			41.505		179-S02-U-X-O-C	3705	3705	0	0.0%	179-S02-U-X-O-C	3705	179-S02-U-X-O-C	0	3705	100.0%
	S09	S09	46.241	69.457	179-S09-U-N-I-C	50555	50555	0	0.0%	179-S09	50550	179-S09-C	50215	335	0.7%
			23.216		179-S09-U-X-O-C	9010	9010	0	0.0%	179-S09-U-X-O-C	9010	179-S09-U-X-O-C	9010	9010	100.0%
	S12	S12	2.414	2.414	179-S12-U-N-I-C	3531	3531	0	0.0%	179-S12	3531	179-S12-C	2206	1325	37.5%
	Leaf	Leaf Collection							Leaf Collection					0	
	S13	S13	16.827	54.114	179-S13-U-N-I-C	18405	18405	0	0.0%	179-S13	18405	179-S13-C	15870	2535	13.8%
			37.264		179-S13-U-X-I-C	16570	16570	0	0.0%	179-S13-U-X-I-C	16570	179-S13-U-X-I-C	0	16570	100.0%
			0.023		179-S13-U-X-O-C	15	15	0	0.0%	179-S13-U-X-O-C	15	179-S13-U-X-O-C	0	15	100.0%
	S14&P80	S14&P80	119.418	245.671	179-S14&P80-U-N-I-C	150795	150795	0	0.0%	179-S14&P80	199040	179-S14&P80-C	189230	9810	4.9%
			16.865		179-S14&P80-U-X-I-C	7500	7500	0	0.0%	179-S14&P80-U-X-I-C	7500	179-S14&P80-U-X-I-C	0	7500	100.0%
			109.388		179-S14&P80-U-X-O-C	51460	51460	0	0.0%	179-S14&P80-U-X-O-C	51460	179-S14&P80-U-X-O-C	0	51460	100.0%
	S15	S15	13.695	13.695	179-S15-U-N-I-C	24225	24225	0	0.0%	179-S15	24220	179-S15-C	20520	3700	15.3%
	S16	S16	2.859	9.016	179-S16-U-N-I-C	3245	3245	0	0.0%	179-S16	3245	179-S16-C	2806	439	13.5%
			6.157		179-S16-U-X-O-C	5635	5635	0	0.0%	179-S16-U-X-O-C	5635	179-S16-U-X-O-C	0	5635	100.0%
	S17	S17	3.04	3.747	179-S17-U-N-I-C	4294	4294	0	0.0%	179-S17	4294	179-S17-C	3550	744	17.3%
			0.707		179-S17-U-X-O-C	64	64	0	0.0%	179-S17-U-X-O-C	64	179-S17-U-X-O-C	0	64	100.0%
	S18	S18	0.863	0.863	179-S18-U-N-I-C	1347	1347	0	0.0%	179-S18	1347	179-S18-C	1133	214	15.9%
	S19	S19	3.197	3.197	179-S19-U-N-I-C	4760	4760	0	0.0%	179-S19	4759	179-S19-C	3945	815	17.1%
	S20	S20	3.034	3.034	179-S20-U-N-I-C	2410	2410	0	0.0%	179-S20	2409	179-S20-C	1975	435	18.0%
	S21	S21	24.706	137.992	179-S21-U-N-I-C	7530	7530	0	0.0%	179-S21	7530	179-S21-C	6670	860	11.4%
			113.286		179-S21-U-X-O-C	26090	26090	0	0.0%	179-S21-U-X-O-C	26090	179-S21-U-X-O-C	0	26090	100.0%

Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
Node	Value	Sweeping			Node	Value	Node	Value		
179-e02-U-N-I-C	39.255	39.3	0.0	0.0%	179-e02	39.3	179-e02-C	18.8	20.5	52.2%
179-e03-U-N-I-C	12.665	12.7	0.0	0.0%	179-e03	12.7	179-e03-C	2.5	10.2	80.5%
179-e04&R20-U-N-I-C	846.5	846.5	0.0	0.0%	179-e04&R20	1043.5	179-e04&R20-C	686.5	357.0	34.2%
179-e04&R20-U-X-O-C	31.935	31.9	0.0	0.0%	179-e04&R20-U-X-O-C	31.9	179-e04&R20-U-X-O-C	0.0	31.9	100.0%
179-e05-U-N-I-C	9.875	9.9	0.0	0.0%	179-e05	9.9	179-e05-C	7.8	2.1	21.4%
179-e09-U-N-I-C	41.26	41.3	0.0	0.0%	179-e09	41.3	179-e09-C	3.8	37.5	90.9%
179-e10-U-N-I-C	4.6865	4.7	0.0	0.0%	179-e10	4.7	179-e10-C	3.9	0.8	16.1%
179-e11-U-N-I-C	34.345	34.3	0.0	0.0%	179-e11	35.9	179-e11-C	12.2	23.8	66.1%
179-e11-U-X-O-C	1.596	1.6	0.0	0.0%	179-e11-U-X-O-C	1.6	179-e11-U-X-O-C	0.0	1.6	100.0%
179-e18-U-N-I-C	19.115	19.1	0.0	0.0%	179-e18	19.1	179-e18-C	4.3	14.8	77.5%
179-e18-U-X-I-C	0.003205	0.0	0.0	0.0%	179-e18-U-X-I-C	0.0	179-e18-U-X-I-C	0.0	0.0	100.0%
179-e19-U-N-I-C	6.585	6.6	0.0	0.0%	179-e19	15.0	179-e19-C	4.1	10.9	72.6%
179-e23&R10-U-N-I-C	45.37	45.4	0.0	0.0%	179-e23&R10	45.4	179-e23&R10-C	25.0	20.4	44.9%
179-e23&R10-U-X-I-C	8.745	8.7	0.0	0.0%	179-e23&R10-U-X-I-C	8.7	179-e23&R10-U-X-I-C	0.0	8.7	100.0%
179-e26-U-N-I-C	18.275	18.3	0.0	0.0%	179-e26	18.3	179-e26-C	8.8	9.5	51.8%
179-e27-U-N-I-C	71.6	71.6	0.0	0.0%	179-e27	147.0	179-e27-C	118.1	29.0	19.7%
179-e27-U-X-O-C	35.52	35.5	0.0	0.0%	179-e27-U-X-O-C	35.5	179-e27-U-X-O-C	0.0	35.5	100.0%
179-e32-U-N-I-C	248.05	248.1	0.0	0.0%	179-e32	248.0	179-e32-C	156.6	91.5	36.9%
179-e32-U-X-O-C	0.0962	0.1	0.0	0.0%	179-e32-U-X-O-C	0.1	179-e32-U-X-O-C	0.0	0.1	100.0%
179-e33-U-N-I-C	1.978	2.0	0.0	0.0%	179-e33	2.0	179-e33-C	1.3	0.7	34.0%
179-e34-U-N-I-C	0.6535	0.7	0.0	0.0%	179-e34	2.0	179-e34-C	1.7	0.3	15.3%
179-e35-U-N-I-C	1.414	1.4	0.0	0.0%	179-e35	2.0	179-e35-C	1.5	0.6	27.8%
179-e36-U-N-I-C	1.121	1.1	0.0	0.0%	179-e36	1.1	179-e36-C	0.6	0.5	43.7%
179-e09NoBMP-SM-N-I-C	154	136.9	17.1	11.1%	179-e09NoBMP-SM-N-I-C	136.9	179-e09NoBMP-SM-N-I-C	0.0	0.0	0.0%
179-e09NoBMP-SW-N-I-C	12.49	10.8	1.7	13.6%	179-e09NoBMP-SW-N-I-C	10.8	179-e09NoBMP-SW-N-I-C	0.0	0.0	0.0%
179-e09NoBMP-U-N-I-C	0.0	0.0	0.0	0.0%	179-e09NoBMP-U-N-I-C	0.0	179-e09NoBMP-U-N-I-C	0.0	0.0	0.0%
179-e09NoBMP-U-X-I-C	5.6	5.6	0.0	0.0%	179-e09NoBMP-U-X-I-C	5.6	179-e09NoBMP-U-X-I-C	0.0	5.6	100.0%
179-NoBMP-SM-N-I-C	2646	2275.0	371.0	14.0%	179-NoBMP-SM-N-I-C	2275.0	179-NoBMP-SM-N-I-C	2275.0	0.0	0.0%
179-NoBMP-SW-N-I-C	376	318.7	57.3	15.2%	179-NoBMP-SW-N-I-C	318.7	179-NoBMP-SW-N-I-C	318.7	0.0	0.0%
179-NoBMP-U-N-I-C	85.69	85.7	0.0	0.0%	179-NoBMP-U-N-I-C	85.7	179-NoBMP-U-N-I-C	85.7	0.0	0.0%
179-NoBMP-U-X-I-C	143.4	143.4	0.0	0.0%	179-NoBMP-U-X-I-C	143.4	179-NoBMP-U-X-I-C	0.0	143.4	100.0%
179-NoBMP-U-X-O-C	46.86	46.9	0.0	0.0%	179-NoBMP-U-X-O-C	46.9	179-NoBMP-U-X-O-C	0.0	46.9	100.0%
179-P10-SM-N-I-C	223.9	178.3	45.6	20.4%	179-P10-SM-N-I-C	211.5	179-P10-SM-N-I-C	211.5	0.0	0.0%
179-P10-SW-N-I-C	15.09	12.6	2.5	16.8%	179-P10-SW-N-I-C	13.0	179-P10-SW-N-I-C	13.0	0.0	0.0%
179-P10-U-N-I-C	0	0.0	0.0	0.0%	179-P10-U-N-I-C	0.0	179-P10-U-N-I-C	0.0	0.0	0.0%
179-P10-U-X-I-C	0	0.0	0.0	0.0%	179-P10-U-X-I-C	0.0	179-P10-U-X-I-C	0.0	0.0	100.0%
179-P110-SM-N-I-C	802.4	710.5	91.9	11.5%	179-P110-SM-N-I-C	710.5	179-P110-SM-N-I-C	710.5	0.0	0.0%
179-P110-SW-N-I-C	1.484	1.3	0.2	10.8%	179-P110-SW-N-I-C	1.3	179-P110-SW-N-I-C	1.3	0.0	0.0%
179-P110-U-N-I-C	547.4	547.4	0.0	0.0%	179-P110-U-N-I-C	547.4	179-P110-U-N-I-C	547.4	0.0	0.0%
179-P110-U-X-O-C	167.7	167.7	0.0	0.0%	179-P110-U-X-O-C	167.7	179-P110-U-X-O-C	0.0	167.7	100.0%
179-P150-SM-N-I-C	96.59	87.7	8.9	9.2%	179-P150-SM-N-I-C	87.7	179-P150-SM-N-I-C	87.7	0.0	0.0%
179-P150-U-N-I-C	27.82	27.8	0.0	0.0%	179-P150-U-N-I-C	27.8	179-P150-U-N-I-C	27.8	0.0	0.0%
179-P160-SM-N-I-C	565.2	448.9	116.3	20.6%	179-P160-SM-N-I-C	448.9	179-P160-SM-N-I-C	448.9	0.0	0.0%
179-P160-SW-N-I-C	338.7	275.8	62.9	18.6%	179-P160-SW-N-I-C	275.8	179-P160-SW-N-I-C	275.8	0.0	0.0%
179-P160-U-N-I-C	33.22	33.2	0.0	0.0%	179-P160-U-N-I-C	33.2	179-P160-U-N-I-C	33.2	0.0	0.0%
179-P160-U-X-I-C	55.17	55.2	0.0	0.0%	179-P160-U-X-I-C	55.2	179-P160-U-X-I-C	0.0	55.2	100.0%
179-P170-SM-N-I-C	44.82	44.1	0.8	1.7%	179-P170-SM-N-I-C	44.5	179-P170-SM-N-I-C	44.5	0.0	0.0%
179-P20-SM-N-I-C	666.4	539.7	126.7	19.0%	179-P20-SM-N-I-C	539.7	179-P20-SM-N-I-C	539.7	0.0	0.0%
179-P20-SW-N-I-C	74.26	61.1	13.1	17.7%	179-P20-SW-N-I-C	61.1	179-P20-SW-N-I-C	61.1	0.0	0.0%
179-P20-U-N-I-C	8.379	8.4	0.0	0.0%	179-P20-U-N-I-C	8.4	179-P20-U-N-I-C	8.4	0.0	0.0%
179-P20-U-X-I-C	0	0.0	0.0	0.0%	179-P20-U-X-I-C	0.0	179-P20-U-X-I-C	0.0	0.0	100.0%
179-P20-U-X-O-C	0	0.0	0.0	0.0%	179-P20-U-X-O-C	0.0	179-P20-U-X-O-C	0.0	0.0	100.0%
179-P40-U-N-I-C	822.78	822.8	0.0	0.0%	179-P40	818.0	179-P40-C	818.0	0.0	0.0%
179-P40-U-X-I-C	0	0.0	0.0	0.0%	179-P40-U-X-I-C	0.0	179-P40-U-X-I-C	0.0	0.0	0.0%
179-P50-U-N-I-C	209.51	209.5	0.0	0.0%	179-P50	211.0	179-P50-C	211.0	0.0	0.0%
179-P60-SM-N-I-C	308.9	293.9	15.0	4.9%	179-P60-SM-N-I-C	293.9	179-P60-SM-N-I-C	293.9	0.0	0.0%
179-P60-U-N-I-C	7.833	7.8	0.0	0.0%	179-P60-U-N-I-C	7.8	179-P60-U-N-I-C	7.8	0.0	0.0%
179-P70-U-N-I-C	111.38	111.4	0.0	0.0%	179-P70	112.3	179-P70-C	64.3	48.1	42.8%
179-P70-U-X-I-C	5.467	5.5	0.0	0.0%	179-P70-U-X-I-C	5.5	179-P70-U-X-I-C	0.0	5.5	100.0%
179-P90-SM-N-I-C	272.1	239.5	32.6	12.0%	179-P90-SM-N-I-C	239.5	179-P90-SM-N-I-C	239.5	0.0	0.0%
179-P90-SW-N-I-C	51	44.7	6.3	12.3%	179-P90-SW-N-I-C	44.7	179-P90-SW-N-I-C	44.7	0.0	0.0%
179-P90-U-N-I-C	444	444.0	0.0	0.0%	179-P90-U-N-I-C	444.0	179-P90-U-N-I-C	444.0	0.0	0.0%
179-P90-U-X-I-C	33.18	33.2	0.0	0.0%	179-P90-U-X-I-C	33.2	179-P90-U-X-I-C	0.0	33.2	100.0%
179-P90-U-X-O-C	221.1	221.1	0.0	0.0%	179-P90-U-X-O-C	221.1	179-P90-U-X-O-C	0.0	221.1	100.0%
179-S02-U-N-I-C	50.6	50.6	0.0	0.0%	179-S02	50.6	179-S02-C	43.8	6.8	13.5%
179-S02-U-X-O-C	26.6	26.6	0.0	0.0%	179-S02-U-X-O-C	26.6	179-S02-U-X-O-C	0.0	26.6	100.0%
179-S09-U-N-I-C	198.2	198.2	0.0	0.0%	179-S09	198.2	179-S09-C	197.2	1.0	0.5%
179-S09-U-X-O-C	53.4	53.4	0.0	0.0%	179-S09-U-X-O-C	53.4	179-S09-U-X-O-C	0.0	53.4	100.0%
179-S12-U-N-I-C	12.505	12.5	0.0	0.0%	179-S12	12.5	179-S12-C	8.4	4.1	32.9%
				Leaf Collection					30.3	
179-S13-U-N-I-C	77.7	77.7	0.0	0.0%	179-S13	77.7	179-S13-C	69.9	7.8	10.0%
179-S13-U-X-I-C	119.3	119.3	0.0	0.0%	179-S13-U-X-I-C	119.3	179-S13-U-X-I-C	0.0	119.3	100.0%
179-S13-U-X-O-C	0.08305	0.1	0.0	0.0%	179-S13-U-X-O-C	0.1	179-S13-U-X-O-C	0.0	0.1	100.0%
179-S14&P80-U-N-I-C	514	514.0	0.0	0.0%	179-S14&P80	763.0	179-S14&P80-C	730.5	32.5	4.3%
179-S14&P80-U-X-I-C	54	54.0	0.0	0.0%	179-S14&P80-U-X-I-C	54.0	179-S14&P80-U-X-I-C	0.0	54.0	100.0%
179-S14&P80-U-X-O-C	344.55	344.6	0.0	0.0%	179-S14&P80-U-X-O-C	344.6	179-S14&P80-U-X-O-C	0.0	344.6	100.0%
179-S15-U-N-I-C	66.35	66.4	0.0	0.0%	179-S15	66.4	179-S15-C	58.7	7.6	11.5%
179-S16-U-N-I-C	13.09	13.1	0.0	0.0%	179-S16	13.1	179-S16-C	11.9	1.2	9.4%
179-S16-U-X-O-C	20.105	20.1	0.0	0.0%	179-S16-U-X-O-C	20.1	179-S16-U-X-O-C	0.0	20.1	100.0%
179-S17-U-N-I-C	17.155	17.2	0.0	0.0%	179-S17	17.2	179-S17-C	15.0	2.1	12.5%
179-S17-U-X-O-C	1.065	1.1	0.0	0.0%	179-S17-U-X-O-C	1.1	179-S17-U-X-O-C	0.0	1.1	100.0%
179-S18-U-N-I-C	5.26	5.3	0.0	0.0%	179-S18	5.3	179-S18-C	4.7	0.6	11.4%
179-S19-U-N-I-C	18.535	18.5	0.0	0.0%	179-S19	18.5	179-S19-C	16.2	2.3	12.4%
179-S20-U-N-I-C	11.055	11.1	0.0	0.0%	179-S20	11.1	179-S20-C	9.8	1.2	11.0%
179-S21-U-N-I-C	51.6	51.6	0.0	0.0%	179-S21	51.6	179-S21-C	49.4	2.2	4.3%
179-S21-U-X-O-C	223.85	223.9	0.0	0.0%	179-S21-U-X-O-C	223.9	179-S21-U-X-O-C	0.0	223.9	100.0%

Total Area (ac) 3,345.07
Regulated Area (ac) 2,481.28

Total TSS	3818286.2	lbs/5-yr	Regulated TSS Trapped by Sweeping		Regulated TSS Trapped by Existing Structural BMPs	288262.4	lbs/5-yr
In City TSS	3631798.4	lbs/5-yr	481309.0	lbs/5-yr	Total Regulated TSS Trapped by All Existing BMPs	769571.4	lbs/5-yr
Regulated TSS	3534052.9	lbs/5-yr	13.6%		Total Regulated TSS Trapped by All Existing BMPs	21.8%	
					REQUIRED =	DNE	

Total TP	12985.5	lbs/5-yr	Regulated TP Trapped by Sweeping		Regulated TP Trapped by Existing Structural BMPs	777.8	lbs/5-yr
In City TP	11811.0	lbs/5-yr	969.9	lbs/5-yr	Total Regulated TP Trapped by All Existing BMPs	1747.7	lbs/5-yr
Regulated TP	11386.2	lbs/5-yr	8.5%		Total Regulated TP Trapped by All Existing BMPs	15.3%	
					REQUIRED =	15.0%	

Reach230 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Existing

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	e29	Teel Plastics, Inc North East	35.577	35.577	230-e29-U-N-I-C	67705	67705	0	0.0%	230-e29	67705	230-e29-C	13545	54160	80.0%
	e30	Teel Plastics, Inc South West	1.473	1.473	230-e30-U-N-I-C	4085	4085	0	0.0%	230-e30	17630	230-e30-C	15945	1685	9.6%
5 year model	NoBMP	No BMP	1.1	76.739	230-NoBMP-SM-I-C	298	265	34	11.3%	230-NoBMP-SM-I-C	265	230-NoBMP-SM-I-C	265	0	0.0%
			0.633		230-NoBMP-U-N-I-C	254	254	0	0.0%	230-NoBMP-U-N-I-C	254	230-NoBMP-U-N-I-C	254	0	0.0%
			75.006		230-NoBMP-U-X-I-C	39231	39231	0	0.0%	230-NoBMP-U-X-I-C	39231	33-NoBMP-U-E-O-C	0	39231	100.0%

	Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
	Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	230-e29-U-N-I-C	166.25	166.3	0.0	0.0%	230-e29	166.3	230-e29-C	81.5	84.8	51.0%
	230-e30-U-N-I-C	8.22	8.2	0.0	0.0%	230-e30	89.7	33-e05-C	83.4	6.3	7.0%
5 year model	230-NoBMP-SM-I-C	2.194	2.2	0.0	1.5%	230-NoBMP-SM-I-C	2.2	230-NoBMP-SM-I-C	2.2	0.0	0.0%
	230-NoBMP-U-N-I-C	1.835	1.8	0.0	0.0%	230-NoBMP-U-N-I-C	1.8	230-NoBMP-U-N-I-C	1.8	0.0	0.0%
	230-NoBMP-U-X-I-C	270.6	270.6	0.0	0.0%	230-NoBMP-U-X-I-C	270.6	230-NoBMP-U-X-I-C	0.0	270.6	100.0%

Total Area (ac)	113.79	
Regulated Area (ac)	38.78	

Total TSS	111573.8	lbs/5-yr	Regulated TSS Trapped by Sweeping	
In City TSS	111573.8	lbs/5-yr	33.7	lbs/5-yr
Regulated TSS	72342.8	lbs/5-yr	0.0%	
Total TSS	11.2	Tons/yr		
In City TSS	11.2	Tons/yr		
Regulated TSS	7.2	Tons/yr		

Regulated TSS Trapped by Existing Structural BMPs	55845.0	lbs/5-yr
Total Regulated TSS Trapped by All Existing BMPs	55878.7	lbs/5-yr
Total Regulated TSS Trapped by All Existing BMPs	77.2%	
REQUIRED =	20.0%	
Total Regulated TSS Trapped by All Existing BMPs	5.6	Tons/yr
TSS Reduction Required	1.4	Tons/yr
Additional TSS Reduction Required	-4.1	Tons/yr

Total TP	449.1	lbs/5-yr	Regulated TP Trapped by Sweeping	
In City TP	449.1	lbs/5-yr	0.0	lbs/5-yr
Regulated TP	178.5	lbs/5-yr	0.0%	
Regulated TP	35.7	lbs/yr		

Regulated TP Trapped by Existing Structural BMPs	91.1	lbs/5-yr
Total Regulated TP Trapped by All Existing BMPs	91.1	lbs/5-yr
Total Regulated TP Trapped by All Existing BMPs	51.0%	
REQUIRED =	31.2%	
Total Regulated TP Trapped by All Existing BMPs	18.2	lbs/yr
TP Reduction Required	11.1	lbs/yr
Additional TP Reduction Required	-7.1	lbs/yr

Reach234 - TMDL 21 TSS and TP Reduction WinSLAMM Model Results Existing

	BMP Number	BMP Name	BMP Direct Drainage Area (ac)	BMP Cumulative Drainage Area (ac)	Direct TSS Base Load		Base Load After Sweeping	TSS Trapped by Sweeping	TSS Reduction (Sweeping)	Cumulative TSS Base Load to BMP		TSS Discharge from BMP		TSS Trapped by BMP	TSS Reduction (BMP)
					Node	Value	Sweeping			Node	Value	Node	Value		
1 Year Run Multipied by 5 to Convert to 5 Years	NoBMP	NoBMP	140.814	154.218	234-NoBMP-U-X-I-C	61590	61590	0	0.0%	234-NoBMP-U-X-I-C	61590	234-NoBMP-U-X-I-C	0	61590	100.0%
			13.404		234-NoBMP-U-X-O-C	5925	5925	0	0.0%	234-NoBMP-U-X-O-C	5925	234-NoBMP-U-X-O-C	0	5925	100.0%

Total Area (ac)	154.22	Total TSS	67515.0	lbs/5-yr	Regulated TSS Trapped by Sweeping		
Regulated Area (ac)	0.00	In City TSS	61590.0	lbs/5-yr	0.0	lbs/5-yr	
		Regulated TSS	0.0	lbs/5-yr	#DIV/0!		
		Total TSS	6.8	Tons/yr			
		In City TSS	6.2	Tons/yr			
		Regulated TSS	0.0	Tons/yr			

Regulated TSS Trapped by Existing Structural BMPs	0.0	lbs/5-yr	
Total Regulated TSS Trapped by All Existing BMPs	0.0	lbs/5-yr	
Total Regulated TSS Trapped by All Existing BMPs	#DIV/0!		
REQUIRED =	20.0%		
Total Regulated TSS Trapped by All Existing BMPs	0.0	Tons/yr	
TSS Reduction Required	0.0	Tons/yr	

Direct TP Base Load		Base Load After Sweeping	TP Trapped by Sweeping	TP Reduction (Sweeping)	Cumulative TP Base Load to BMP		TP Discharge from BMP		TP Trapped by BMP	TP Reduction (BMP)
Node	Value	Sweeping			Node	Value	Node	Value		
234-NoBMP-U-X-I-C	443.35	443.4	0.0	0.0%	234-NoBMP-U-X-I-C	443.4	234-NoBMP-U-X-I-C	0.0	443.4	100.0%
234-NoBMP-U-X-O-C	35.56	35.6	0.0	0.0%	234-NoBMP-U-X-O-C	35.6	234-NoBMP-U-X-O-C	0.0	35.6	100.0%

Total TP	478.9	lbs/5-yr	Regulated TP Trapped by Sweeping				
In City TP	443.4	lbs/5-yr	0.0	lbs/5-yr			
Regulated TP	0.0	lbs/5-yr	#DIV/0!				
Regulated TP	0.0	lbs/yr					

Regulated TP Trapped by Existing Structural BMPs	0.0	lbs/5-yr	
Total Regulated TP Trapped by All Existing BMPs	0.0	lbs/5-yr	
Total Regulated TP Trapped by All Existing BMPs	#DIV/0!		
REQUIRED =	15.0%		
Total Regulated TP Trapped by All Existing BMPs	0.0	lbs/yr	
TP Reduction Required	0.0	lbs/yr	
Additional TP Reduction Required	0.0	lbs/yr	

APPENDIX G

Infiltration Data

Memo

To: City of Baraboo

From: Sean Thiboldeaux, Eric Thompson PE

Subject: Stormwater Quality Master Plan Update- Infiltrometer Tests

Date: December 3, 2020

INTRODUCTION

To create an updated Stormwater Quality Master Plan for the City of Baraboo, it is necessary to have some knowledge of the infiltration capacity of swales distributed throughout the city as the infiltration of stormwater into these channels can provide credit for total suspended solids (TSS) and total phosphorous (TP) treatment. MSA completed eight (8) infiltration tests in September 2020 on swales and dry ponds distributed throughout the City and the results of these tests will be used to apply infiltration rates to all swales within the City that are eligible for modeling. Eligibility was determined by the WDNR guidance, *Process to Assess and Model Grass Swales,*[1] which states that swales could have a slope no greater than 4% and no erosion or scouring.

SITE IDENTIFICATION AND INFILTRATION TESTING

Under Subtask 2.2 of the service contract, "MSA will conduct up to eight (8) double ring infiltrometer tests within the vegetated drainage systems (swales) serving City streets. MSA will conduct abbreviated two-hour infiltration tests as described/endorsed by the WNDR at the 'MSA roundtable' held in January 2011". After an initial desktop survey of the Village using contour data, satellite imagery, and *Google Street View*, our team identified swale locations within the municipal boundary. Eight (8) swales were identified along with two (2) dry ponds to be used as alternate test sites in the case that any of the swales were found to be unsuitable for testing.

During the dates of 9/1/2020- 9/3/2020, MSA staff preformed the double-ring infiltrometer tests. One of the locations (near 1249 Silver Dr.) was determined to be unsuitable due to standing water, so a dry pond site was used as an alternative for Test No. 8. See results for static infiltration rates in Table 1 below. Completed data for each test site can be found in Appendix A.

1 https://dnr.wi.gov/topic/Stormwater/documents/WTGrassSwales.pdf

Table 1: Summary of Infiltration Test Results

Test No.	Location	Static Infiltration Rate (in/hr)	Comments
1	Near 411 White Spruce Ave	0.03	No infiltration observed. 0.03 in/hr applied per WDNR guidance[2]
2	Near 1008 Parkside Ave	2.01	Lowest measured rate used per WDNR guidance[2]
3	Southern edge Steinhorst Park	0.03	No infiltration observed. 0.03 in/hr applied per WDNR guidance[2]
4	Western edge Steinhorst Park	0.03	No infiltration observed. 0.03 in/hr applied per WDNR guidance[2]
5	Walnut Hill Bible Church	0.24	Lowest measured rate used per WDNR guidance[2]
6	Ag Field, CTH T and STH 33	0.12	Lowest measured rate used per WDNR guidance[2]
7	Ag Field, CTH T	0.03	No infiltration observed. 0.03 in/hr applied per WDNR guidance[2]
8	Dry Pond Riverwalk Park	6.61	Lowest measured rate used per WDNR guidance[2]

ASSIGNING INFILTRATION RATES FOR MODELING

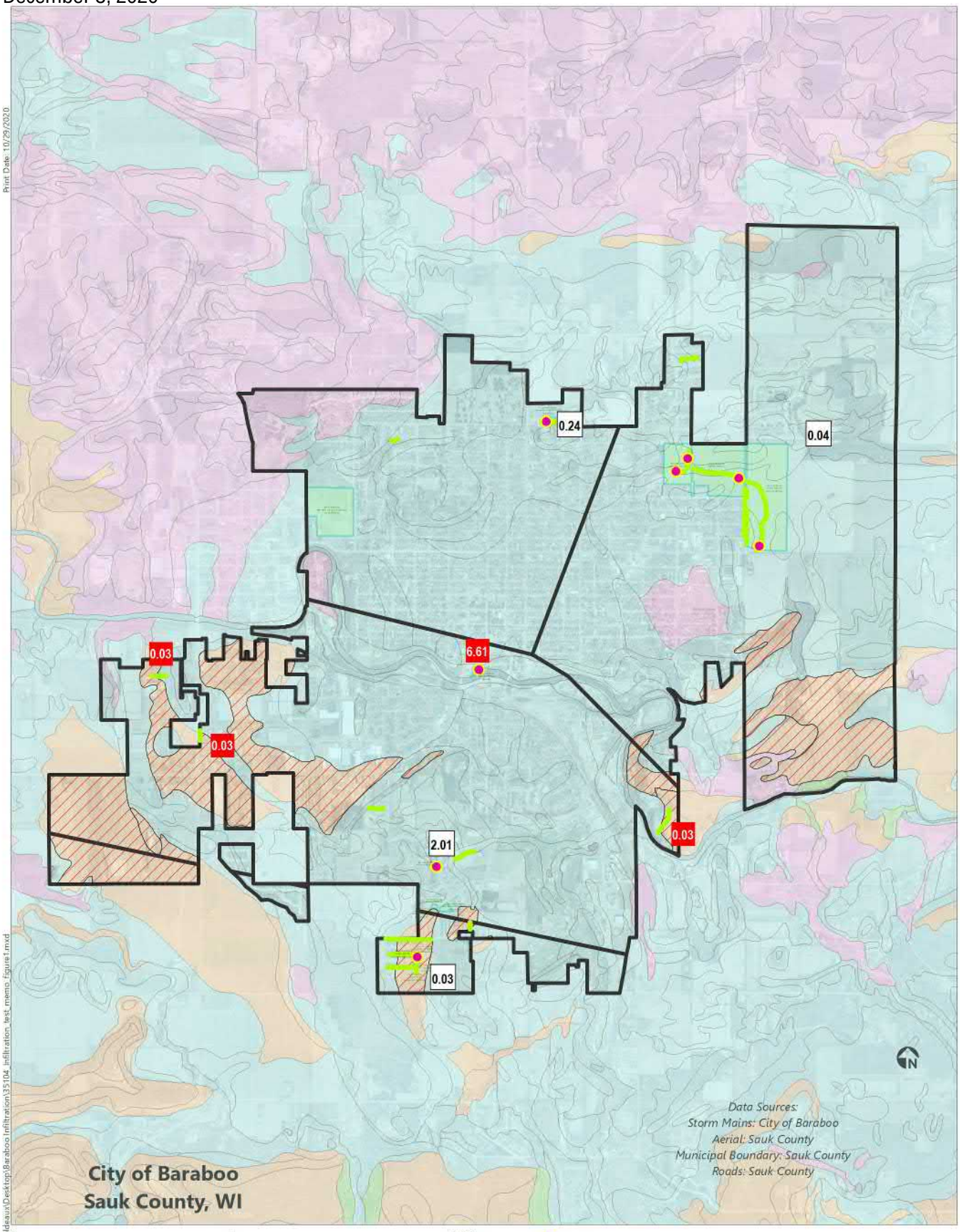
Thiessen polygons based on the test site locations were used to make standardized infiltration rates for different regions of the city. The BMPs chosen for modeling that fall under those regions will be referencing the static infiltration rate* specific to that region with the following exceptions:

1.) Multiple tests were taken in the swale system in the NE corner of the municipal boundary. The Thiessen regions surrounding those test sites were grouped together and the geometric mean of all the measured infiltration rates was applied to the entire region.
2.) Most of the City falls under hydrologic soil group (HSG) B, but there are significant areas with HSG C and there are several modeled BMPs that fall in these regions. In this instance, the infiltration rate of the closest test site with the same soil group type was chosen for that BMP's modeling rate.
3.) The dry pond that was chosen for the alternative test site was not used to create the Thiessen regions. The measured rate will be applied to that BMP for modeling, but the high rate was not extrapolated to the BMPs in the surrounding area.

The modified Thiessen regions, HSG values and BMP infiltration rate exceptions are shown in Figure 1 below.

**For modeling purposes, the dynamic infiltration rate will be used (dynamic infiltration rate = ½ static infiltration rates).*

2 https://dnr.wi.gov/topic/Stormwater/documents/WTGrassSwales.pdf



Static Infiltration Rates

Baraboo WQMP 2020
FIGURE 1

MSA

APPENDIX A

Field Data and Calculations

Test Location # 1

Near 411 White Spruce Ave

Date: 9/1/2020
Field Staff: Sean Thiboldeaux

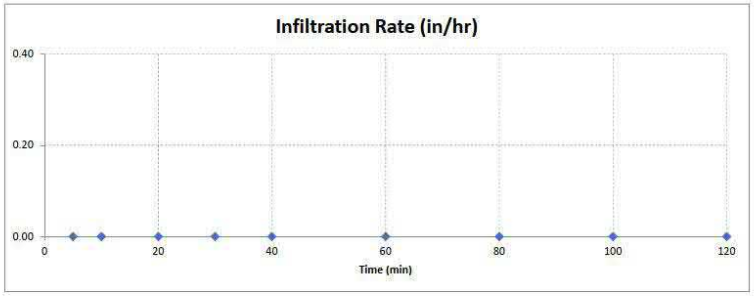
Swale Dimensions	C.S 1	C.S. 2	C.S. 3
Basewidth (ft):	12	12	12
Side Slopes:	5:2 and 3:1	3:1	4:1
Depth (ft):	3	3	3
Vegetation (in):	2	2	2

Outlet: 3 ft diameter plastic pipe

Double-Ring Infiltration Rate Test Results

Depth from Top Start (in)	Depth from Top End (in)	Time (min)	Change in Time	Water Level Change (ft)	Water Level Change (in)	Infiltration Rate (in/hr)
0.39	0.39	**5**	5	0.00	0.00	0.00
0.39	0.39	**10**	5	0.00	0.00	0.00
0.39	0.39	**20**	10	0.00	0.00	0.00
0.39	0.39	**30**	10	0.00	0.00	0.00
0.39	0.39	**40**	10	0.00	0.00	0.00
0.39	0.39	**60**	20	0.00	0.00	0.00
0.39	0.39	**80**	20	0.00	0.00	0.00
0.39	0.39	**100**	20	0.00	0.00	0.00
0.39	0.39	**120**	20	0.00	0.00	0.00

0.00 in/hr Average of last 40 mins.



Test Location # 2

Parkside Ave

Date: 9/1/2020
Field Staff: Sean Thiboldeaux

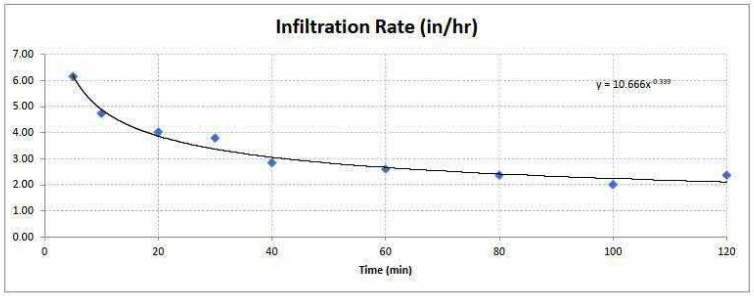
Swale Dimensions	C.S 1	C.S. 2	C.S. 3
Basewidth (ft):	8	9	9
Side Slopes:	4:1	4:1	4:1
Depth (ft):	4.5	4	4
Vegetation (in):	4	2	4

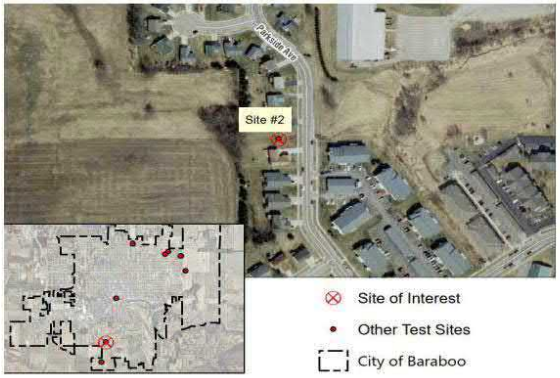
Outlet: 3ft diameter concrete pipe

Double-Ring Infiltration Rate Test Results

Depth from Top Start (in)	Depth from Top End (in)	Time (min)	Change in Time	Water Level Change (ft)	Water Level Change (in)	Infiltration Rate (in/hr)
0.79	1.30	**5**	5	0.04	0.51	6.15
1.30	1.69	**10**	5	0.03	0.39	4.73
1.69	2.36	**20**	10	0.06	0.67	4.02
2.36	2.99	**30**	10	0.05	0.63	3.78
2.99	3.47	**40**	10	0.04	0.47	2.84
1.73	2.60	**60**	20	0.07	0.87	2.60
2.60	3.39	**80**	20	0.07	0.79	2.36
3.39	4.06	**100**	20	0.06	0.67	2.01
4.06	4.85	**120**	20	0.07	0.79	2.36

2.19 in/hr Average of last 40 mins.
2.10 in/hr Curve value at 120 mins





Test Location # 3

Sothern edge of Steinhorst Park

Date: 9/2/2020
Field Staff: Sean Thiboldeaux

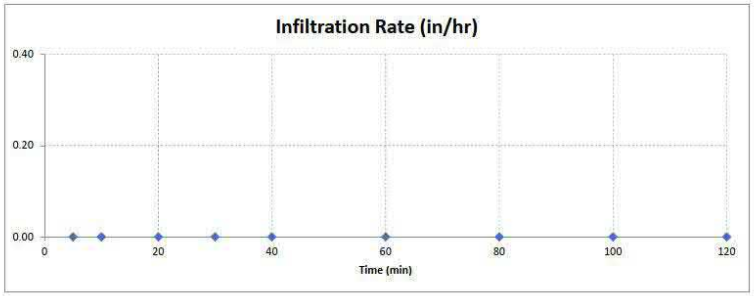
Swale Dimensions	C.S 1	C.S. 2	C.S. 3
Basewidth (ft):	35	35	35
Side Slopes:	3:1 and >10:1	3:1 and >10:2	3:1 and >10:3
Depth (ft):	1.5	1	1
Vegetation (in):	4	2	3

Outlet: 20 inch diameter CMP, damaged

Double-Ring Infiltration Rate Test Results

Depth from Top Start (in)	Depth from Top End (in)	Time (min)	Change in Time	Water Level Change (ft)	Water Level Change (in)	Infiltration Rate (in/hr)
0.91	0.91	**5**	5	0.00	0.00	0.00
0.91	0.91	**10**	5	0.00	0.00	0.00
0.91	0.91	**20**	10	0.00	0.00	0.00
0.91	0.91	**30**	10	0.00	0.00	0.00
0.91	0.91	**40**	10	0.00	0.00	0.00
0.91	0.91	**60**	20	0.00	0.00	0.00
0.91	0.91	**80**	20	0.00	0.00	0.00
0.91	0.91	**100**	20	0.00	0.00	0.00
0.91	0.91	**120**	20	0.00	0.00	0.00

0.00 in/hr Average of last 40 mins.



Test Location # 4

Western edge of Steinhorst Park

Date: 9/2/2020
Field Staff: Sean Thiboldeaux

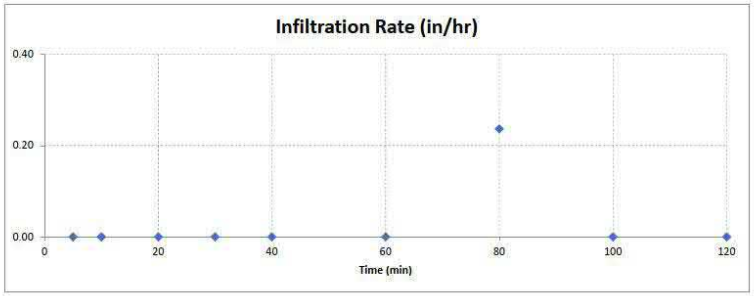
Swale Dimensions	C.S 1	C.S. 2	C.S. 3
Basewidth (ft):	3	6	8
Side Slopes:	4:1 and 10:1	3:1 and >10:1	4:1 and >10:1
Depth (ft):	1	1	1
Vegetation (in):	18	12	12

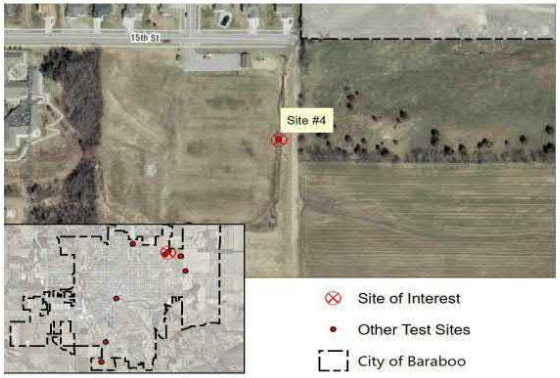
Outlet: 20 inch diameter CMP, damaged

Double-Ring Infiltration Rate Test Results

Depth from Top Start (in)	Depth from Top End (in)	Time (min)	Change in Time	Water Level Change (ft)	Water Level Change (in)	Infiltration Rate (in/hr)
1.54	1.54	**5**	5	0.00	0.00	0.00
1.54	1.54	**10**	5	0.00	0.00	0.00
1.54	1.54	**20**	10	0.00	0.00	0.00
1.54	1.54	**30**	10	0.00	0.00	0.00
1.54	1.54	**40**	10	0.00	0.00	0.00
1.54	1.54	**60**	20	0.00	0.00	0.00
1.54	1.62	**80**	20	0.01	0.08	0.24
1.62	1.62	**100**	20	0.00	0.00	0.00
1.62	1.62	**120**	20	0.00	0.00	0.00

0.00 in/hr Average of last 40 mins.





Test Location # 5

Walnut Hill Bible Church

Date: 9/2/2020
Field Staff: Sean Thiboldeaux

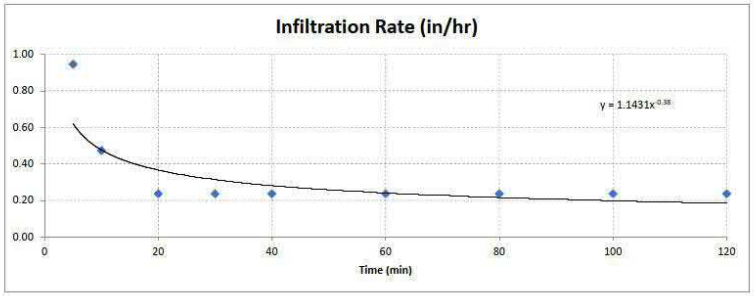
Swale Dimensions	C.S 1	C.S. 2	C.S. 3
Basewidth (ft):	12	12	12
Side Slopes:	4:1	4:1	4:1 and 3:1
Depth (ft):	4	4	3.5
Vegetation (in):	24	24	24

Oulet: N/A

Double-Ring Infiltration Rate Test Results

Depth from Top Start (in)	Depth from Top End (in)	Time (min)	Change in Time	Water Level Change (ft)	Water Level Change (in)	Infiltration Rate (in/hr)
1.22	1.30	**5**	5	0.01	0.08	0.94
1.30	1.34	**10**	5	0.00	0.04	0.47
1.34	1.38	**20**	10	0.00	0.04	0.24
1.38	1.42	**30**	10	0.00	0.04	0.24
1.42	1.46	**40**	10	0.00	0.04	0.24
1.46	1.54	**60**	20	0.01	0.08	0.24
1.54	1.61	**80**	20	0.01	0.08	0.24
1.61	1.69	**100**	20	0.01	0.08	0.24
1.69	1.77	**120**	20	0.01	0.08	0.24

0.24 in/hr — Average of last 40 mins.
0.19 in/hr — Curve value at 120 mins



Test Location # 6

Agricultural Field, CTH T and STH 33

Date: 9/3/2020
Field Staff: Sean Thiboldeaux

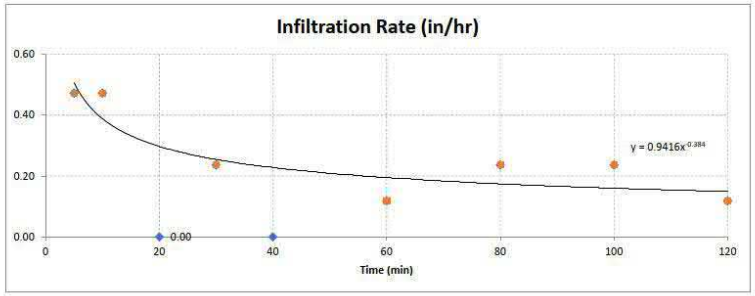
Swale Dimensions	C.S 1	C.S. 2	C.S. 3
Basewidth (ft):	15	20	20
Side Slopes:	10:1 and >10:1	10:1 and 5:1	10:1
Depth (ft):	1.5	1	2
Vegetation (in):	12	18	12

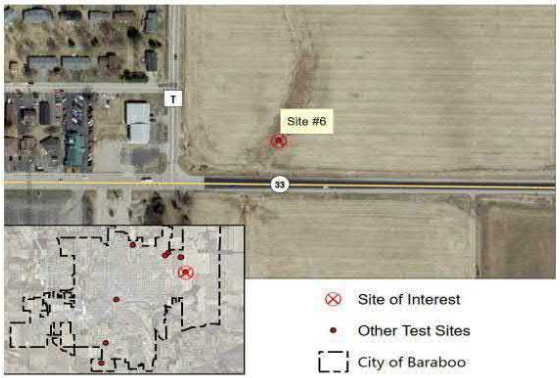
Outlet: 42 inch CMP x2

Double-Ring Infiltration Rate Test Results

Depth from Top Start (in)	Depth from Top End (in)	Time (min)	Change in Time	Water Level Change (ft)	Water Level Change (in)	Infiltration Rate (in/hr)
0.31	0.35	**5**	5	0.00	0.04	0.47
0.35	0.39	**10**	5	0.00	0.04	0.47
0.39	0.39	**20**	10	0.00	0.00	0.00
0.39	0.43	**30**	10	0.00	0.04	0.24
0.43	0.43	**40**	10	0.00	0.00	0.00
0.43	0.47	**60**	20	0.00	0.04	0.12
0.47	0.55	**80**	20	0.01	0.08	0.24
0.55	0.63	**100**	20	0.01	0.08	0.24
0.63	0.67	**120**	20	0.00	0.04	0.12

0.18 in/hr — Average of last 40 mins.
0.15 in/hr — Curve value at 120 mins





Test Location # 7

Agricultural Field, CTH T

Date: 9/3/2020
Field Staff: Sean Thiboldeaux

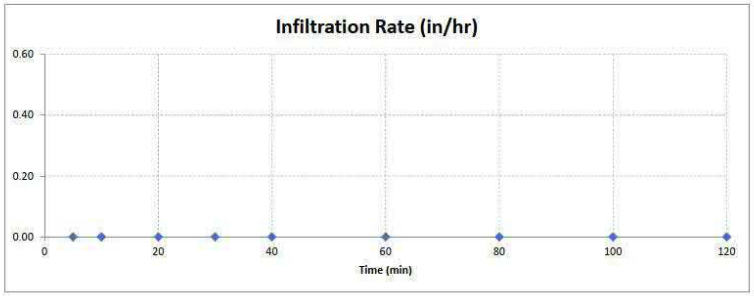
Swale Dimensions	C.S 1	C.S. 2	C.S. 3
Basewidth (ft):	8	10	8
Side Slopes:	10:1 and >10:1	7:1 and 8:1	8:1
Depth (ft):	N/A	N/A	N/A
Vegetation (in):	12	12	18

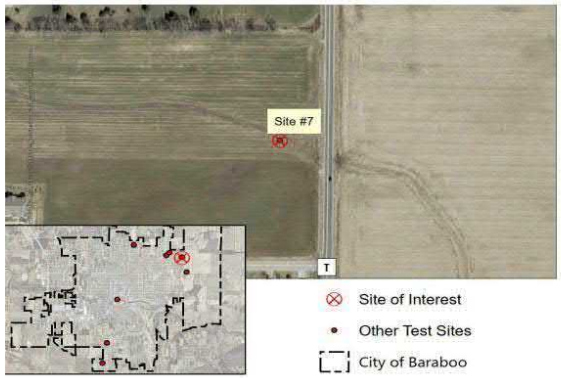
Outlet: 42 inch CMP

Double-Ring Infiltration Rate Test Results

Depth from Top Start (in)	Depth from Top End (in)	Time (min)	Change in Time	Water Level Change (ft)	Water Level Change (in)	Infiltration Rate (in/hr)
0.98	0.98	5	5	0.00	0.00	0.00
0.98	0.98	10	5	0.00	0.00	0.00
0.98	0.98	20	10	0.00	0.00	0.00
0.98	0.98	30	10	0.00	0.00	0.00
0.98	0.98	40	10	0.00	0.00	0.00
0.98	0.98	60	20	0.00	0.00	0.00
0.98	0.98	80	20	0.00	0.00	0.00
0.98	0.98	100	20	0.00	0.00	0.00
0.98	0.98	120	20	0.00	0.00	0.00

0.00 in/hr Average of last 40 mins.





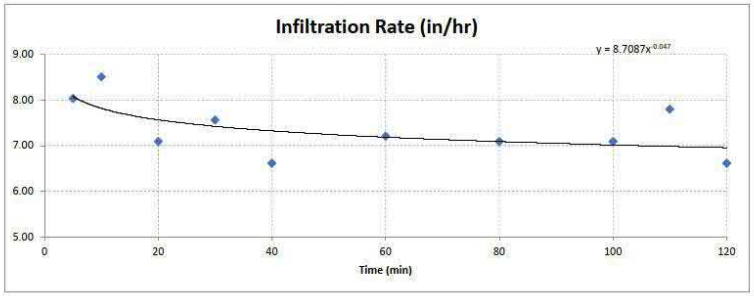
Test Location # 8
Dry Pond in Riverwalk Park

Date: 9/3/2020
Field Staff: Sean Thiboldeaux

Outlet: N/A

Double-Ring Infiltration Rate Test Results						
Depth from Top Start (in)	Depth from Top End (in)	Time (min)	Change in Time	Water Level Change (ft)	Water Level Change (in)	Infiltration Rate (in/hr)
0.98	1.65	**5**	5	0.06	0.67	8.03
1.65	2.36	**10**	5	0.06	0.71	8.50
2.36	3.54	**20**	10	0.10	1.18	7.09
0.91	2.17	**30**	10	0.10	1.26	7.56
2.17	3.27	**40**	10	0.09	1.10	6.61
0.51	2.91	**60**	20	0.20	2.40	7.20
0.39	2.76	**80**	20	0.20	2.36	7.09
0.67	3.03	**100**	20	0.20	2.36	7.09
3.03	4.33	**110**	10	0.11	1.30	7.80
2.36	3.46	**120**	10	0.09	1.10	6.61

7.20 in/hr — Average of last 40 mins.
6.95 in/hr — Curve value at 120 mins



ATTACHMENT "H"

CITY OF BARABOO

STORM SEWER SYSTEM MAPS (2.8)

Prepared by:
ENGINEERING DEPARTMENT
101 South Boulevard
Baraboo, WI 53913
Ph: (608)355-2730 Fax: (608)355-2719
www.cityofbaraboo.com

Origination Date: 03/05/2021
Revision Dates:

Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

Appendices

APPENDIX A: STORM SEWER SYSTEM MAPS A1

CITY OF BARABOO
STORM SEWER SYSTEM MAPS (2.8)

Goal: Maintain a comprehensive map of the storm sewer system; identifying storm sewer conveyances such as pipes and ditches, identify municipal stormwater facilities and lands, and also identify roads, streams and lakes.

Compliance Date: March 31, 2021 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

The city shall maintain its MS4 map. The storm sewer system map shall be updated annually as needed for changes occurring in the permitted area boundaries. The municipal storm sewer system map shall include:

2.8.1 Identification of waters of the state, name and classification of receiving waters, identification of whether the receiving water is an ORW, ERW or listed as an impaired water under s. 303(d) of the Clean Water Act, storm water drainage basin boundaries for each MS4 outfall, and the municipal separate storm sewer conveyance systems including direction of flow.

2.8.2 Identification of any known wetlands, endangered or threatened resources, and historical property, as defined in sections 1.6 through 1.8 of the permit, which might be affected.

2.8.3 Identification of all known MS4 outfalls discharging to waters of the state and other MS4s. Major outfalls shall be uniquely identified.

2.8.4 Location of any known discharge to the MS4 that has been issued WPDES permit coverage by the Department.

2.8.5 Location of municipally owned or operated structural storm water management facilities including detention basins, infiltration basins, and manufactured treatment devices.

2.8.6 Identification of publicly owned parks, recreational areas and other open lands.

2.8.7 Location of municipal garages, storage areas and other public works facilities.

2.8.8 Identification of streets.

WORK PLAN

☒ The Storm Sewer System Map was updated in 2021 and is included here as Figure H-1.

☒ The Storm System map will be updated annually, as needed, and included in the Annual Report.

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Appendix A

Storm Sewer System Maps

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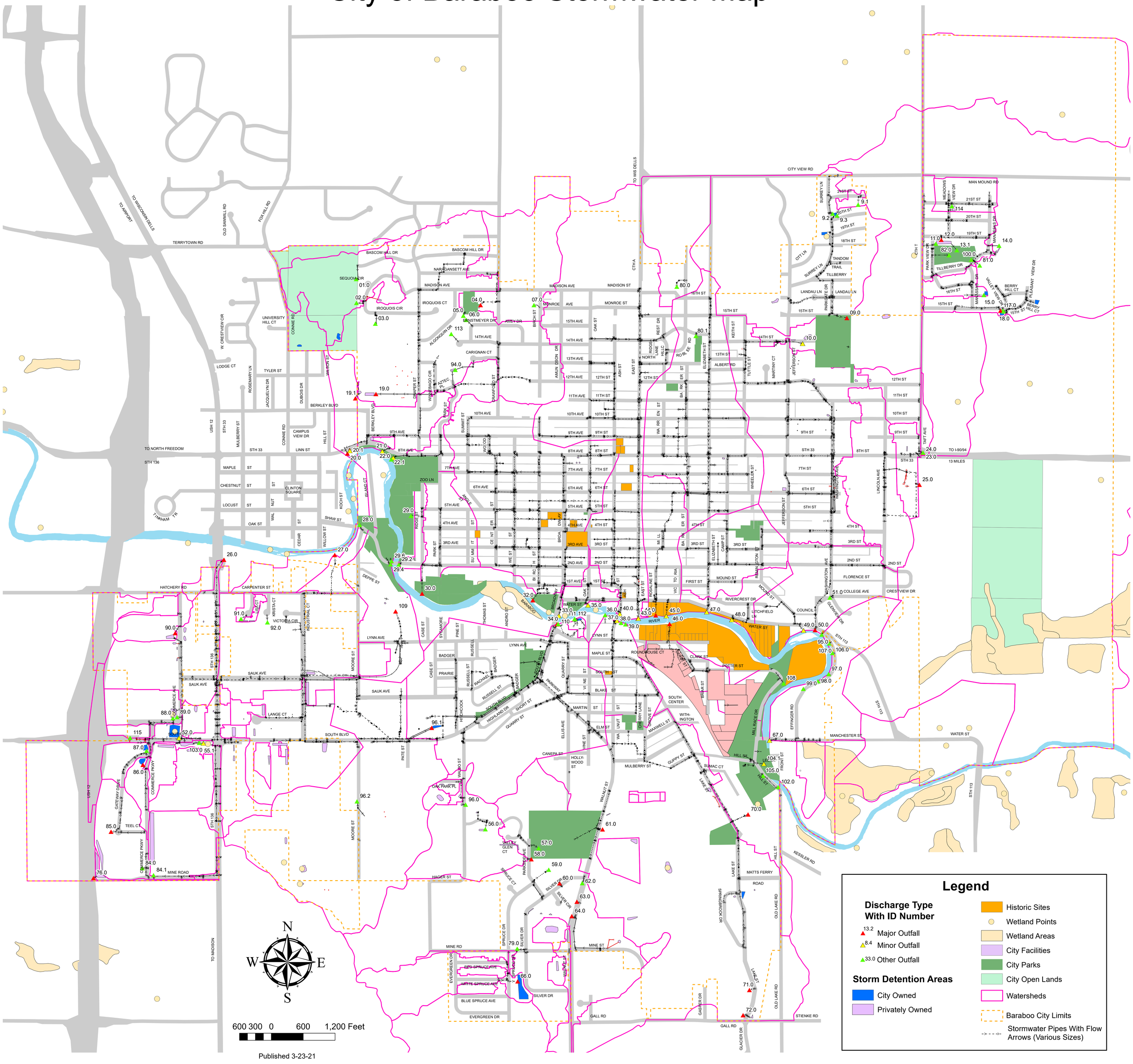
City of Baraboo Stormwater Map



ATTACHMENT "I"

CITY OF BARABOO

ANNUAL REPORTS (2.9)

Prepared by:
ENGINEERING DEPARTMENT
101 South Boulevard
Baraboo, WI 53913
Ph: (608)355-2730 Fax: (608)355-2719
www.cityofbaraboo.com

Origination Date: 03/05/2021
Revision Dates:

Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

CITY OF BARABOO
ANNUAL REPORTS (2.9)

Goal: Annually report on the status of permit requirements and a fiscal analysis on annual expenditures and proposed budget for program activities.

Compliance Date: By March 31 of each year Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

Submit an annual report for each calendar year to the Department by **March 31st of the following year**. The permittee shall invite the municipal governing body, interest groups and the general public to review and comment on the annual report. The annual report shall include:

2.9.1 The status of implementing the permit requirements, status of meeting measurable program goals and compliance with permit schedules.

2.9.2 A fiscal analysis which includes the annual expenditures and budget for the reporting year, and the budget for the next year.

2.9.3 A summary of the number and nature of inspections and enforcement actions conducted to ensure compliance with the required ordinances.

2.9.4 Identification of any known water quality improvements or degradation in the receiving water to which the permittee's MS4 discharges. Where degradation is identified, identify why and what actions are being taken to improve the water quality of the receiving water.

2.9.5 An evaluation of program compliance, the appropriateness of identified best management practices, and progress towards achieving identified measurable goals. Any program changes made as a result of this evaluation shall be identified and described in the annual report. For any identified deficiencies towards achieving the requirements under section 2 of this permit or lack of progress towards meeting a measureable goal, the permittee shall initiate program changes to improve their effectiveness.

2.9.6 If applicable, notice that the permittee is relying on another municipality to satisfy any of the permit requirements and a description of the arrangement where a permit requirement is being met in this manner.

2.9.7 A duly authorized representative of the permittee shall sign and certify the annual report and include a statement or resolution that the permittee's governing body or delegated representatives have reviewed or been apprised of the content of the annual report.

2.9.8 The annual report and other required reports, and permit compliance documents shall be submitted electronically through the Department's electronic reporting system.

WORK PLAN

☐ The Annual Report shall be completed and submitted by March 31 annually.

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ATTACHMENT "J"

CITY OF BARABOO

WISCONSIN RIVER BASIN TMDL IMPLEMENTATION (C4)

Prepared by:
ENGINEERING DEPARTMENT
101 South Boulevard
Baraboo, WI 53913
Ph: (608)355-2730 Fax: (608)355-2719
www.cityofbaraboo.com

Origination Date: 03/05/2021
Revision Dates:

Table of Contents

PROGRAM OBJECTIVES 1
WORK PLAN 1

Appendices

APPENDIX A: RESERVED FOR FUTURE A1

CITY OF BARABOO
TMDL IMPLEMENTATION (APPENDIX C)

Goal: Where the storm sewer system discharges a pollutant of concern to an impaired water, a plan shall be developed to reduce those pollutants.

Compliance Date: By April 26, 2022 Implementation Date: March 31, 2021

PROGRAM OBJECTIVES

The City shall do all the following to demonstrate progress towards achieving the total maximum daily load (TMDL) reductions stipulated in section C.2.2 and shall submit the following documentation:

C.4.1 Within 36 months (April 26, 2022) of the approval date of the TMDL, an updated storm sewer system map.

C.4.2 Within 36 months (April 26, 2022) of the approval date of the TMDL, the permittee shall submit a tabular summary that includes the following for each MS4 drainage boundary associated with each TMDL reachshed as identified under section C.4.1 and for each TMDL Wasteload Allocation (WLA).

C.4.3 Within 48 months (April 26, 2023) of the approval date of the TMDL, if the tabular summary required under section C.4.2 shows that the permittee is not achieving the applicable percent reductions needed to comply with its TMDL WLA for each TMDL reachshed, then the permittee shall submit a written TMDL Implementation Plan to the Department that describes how the permittee will make progress toward achieving compliance with the TMDL WLA.

C.5 Annual Reporting For requirements outlined under sections C.4 the permittee shall include a description and the status of progress toward implementing the identified actions and activities in their MS4 annual reports due by March 31 of each year.

WORK PLAN

☒ The City of Baraboo Stormwater Quality Plan was updated in 2020 and is hereby incorporated as an appendix into Attachment G. This plan contains the required elements of C.4.1 thru C.4.3.
☒ The City will update its storm sewer system map through Attachment H.
☐ The City will include an implementation update as part of its annual report starting in 2022.

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Appendix A

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