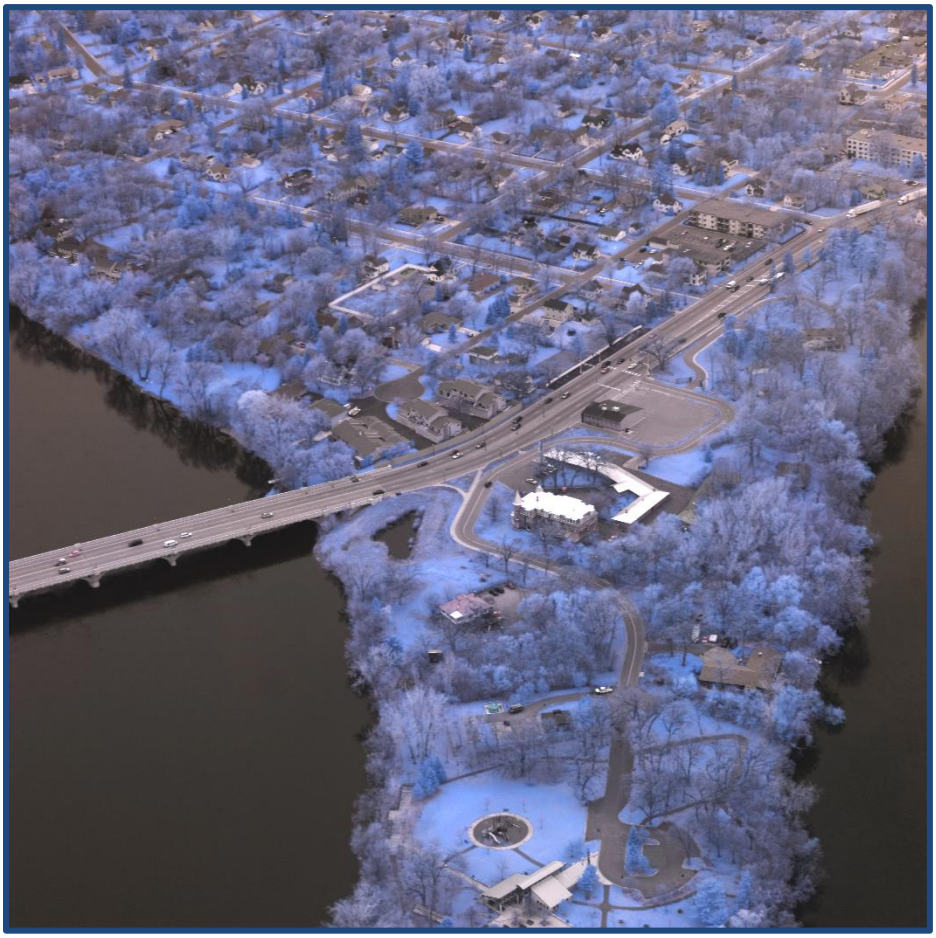

Mississippi River
Stormwater Retrofit Analysis

Prepared by:

ANOKA CONSERVATION DISTRICT

for the

CITY OF ANOKA, CITY OF COON RAPIDS, AND

LOWER RUM RIVER WATERSHED MANAGEMENT ORGANIZATION

Mississippi River Stormwater Retrofit Analysis: 2024

Prepared for the City of Anoka, the City of Coon Rapids, and the Lower Rum River Watershed Management Organization (LRRWMO) by:
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Acknowledgements

The authors would like to thank staff at the City of Anoka and the City of Coon Rapids who aided with identification of potential retrofit sites and compiled information on existing stormwater infrastructure and stormwater control measures.

Funding provided in part by the Clean Water Fund from the Clean Water, Land, and Legacy Amendment

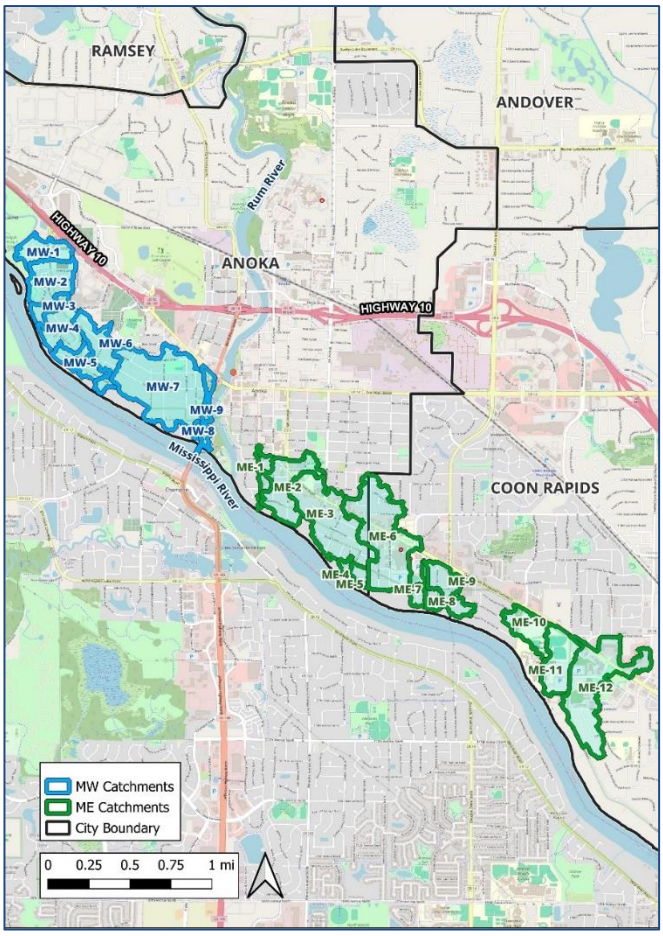
Suggested citation:
Anoka Conservation District. 2024. Mississippi River Stormwater Retrofit Analysis.

Disclaimer: At the time of printing, this report identifies and ranks potential BMPs for selected subwatersheds in the cities of Anoka and Coon Rapids that drain to the Mississippi River. This list of practices is not all-inclusive and does not preclude adding additional priority BMPs in the future. An updated copy of the report shall be housed at either Anoka Conservation District, the City of Anoka, or the City of Coon Rapids.

Cover photo: The confluence of the Rum River with the Mississippi River. Photo adapted from Minnesota DNR.

Abstract

Anoka Conservation District completed this stormwater retrofit analysis (SRA) for the purpose of identifying and ranking water quality improvement projects throughout areas draining directly to the Mississippi River. The target area consists of portions of the cities of Anoka, within the Lower Rum River Watershed Management Organization, and Coon Rapids, within the Coon Creek Watershed District.



This analysis is primarily intended to identify potential projects within the target areas to improve water quality in the Mississippi River through stormwater retrofits. In this SRA, both costs and pollutant reductions were estimated and used to calculate cost-effectiveness for each potential retrofit identified. Water quality benefits associated with the installation of each identified project were individually modeled using the Source Loading and Management Model for Windows (WinSLAMM). The volume and pollutant estimates in this report are not waste load allocations, nor does this report serve as a TMDL for the study area. The WinSLAMM model was not calibrated and was only used as an estimation tool to provide relative ranking across potential retrofit projects. The costs associated with project design, administration, promotion, land acquisition, opportunity costs, construction oversight, installation, and maintenance were estimated. The total costs over the assumed effective life of each project were then divided by the modeled benefits over the same time period to enable ranking by cost-effectiveness.

The 803-acre study area was divided into twenty-one catchments over two distinct areas west and east of the confluence with the Rum River. Each catchment includes a dedicated outfall to the Mississippi River. Nine catchments were identified upstream (west) of the Rum River (MW catchments), and twelve catchments were identified downstream (east) of the Rum River (ME catchments). A WinSLAMM model was created for each catchment except where noted in the Catchment Profile pages. Details of the volume and pollutant loading within each catchment are provided in the Catchment Profile pages. A variety of stormwater retrofit approaches were identified and potential projects are organized from most cost-effective to least based on pollutants removed. That said, cost-effective opportunities are limited in certain catchments due to the prevalence of existing treatment and limited space throughout the study area.

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Executive Summary

Anoka Conservation District (ACD) completed this stormwater retrofit analysis (SRA) for the purpose of identifying and ranking water quality improvement projects in selected subwatersheds that drain to the Mississippi River. The subwatersheds are located in the cities of Anoka and Coon Rapids, and the primary land uses are residential, commercial, and institutional. Total phosphorus (TP) and total suspended solids (TSS) were the target parameters analyzed. Volume was also documented as a model output.

This analysis is primarily intended to identify potential projects within the target areas to improve water quality in the Mississippi River through stormwater retrofits. Stormwater retrofits refer to best management practices (BMPs) that are added to an already developed landscape where little open space exists. The process is investigative and creative. Stormwater retrofits can be improperly judged by comparing the total number of projects installed or by comparing costs alone. Those approaches neglect to consider how much pollution is removed per dollar spent. In this report, both costs and pollutant reductions were estimated and used to calculate cost-effectiveness for each potential retrofit identified.

Water quality benefits associated with the installation of each identified project were individually modeled using the Source Loading and Management Model for Windows (WinSLAMM). WinSLAMM uses an abundance of stormwater data from the Upper-Midwest and elsewhere to quantify runoff volumes and pollutant loads from urban areas. It has detailed accounting of pollutant loading from various land uses and allows the user to build a model "landscape". WinSLAMM uses rainfall and temperature data from a typical year (1959 data from Minneapolis for this analysis), routing stormwater through the user's model for each storm.

WinSLAMM estimates volume and pollutant loading based on acreage, land use, and soils information. Therefore, the volume and pollutant estimates in this report are not waste load allocations, nor does this report serve as a TMDL for the study area. The WinSLAMM model was not calibrated and was only used as an estimation tool to provide relative ranking across potential retrofit projects. Specific model inputs (e.g. pollutant probability distribution, runoff coefficient, particulate solids concentration, particle residue delivery, and street delivery files) are detailed in Appendix A – Modeling Methods.

The costs associated with project design, administration, promotion, land acquisition, opportunity costs, construction oversight, installation, and maintenance were estimated. The total costs over the assumed effective life of each project were then divided by the modeled benefits over the same time period to enable ranking by cost-effectiveness.

A variety of stormwater retrofit approaches were identified. They included bioretention (bioinfiltration and biofiltration), enhanced street sweeping, hydrodynamic devices, and stormwater pond retrofits. Funding limitations and landowner interest will ultimately determine how many retrofits are installed. It is recommended that projects be installed in order of cost-effectiveness (pounds of pollution reduced per dollar spent). Other factors, including a project's educational value/visibility, construction timing, total cost, non-target pollutant reduction, or multiple benefits considerations also affect project installation decisions and should be considered by resource managers when pursuing projects.

For each type of recommended retrofit, conceptual siting is provided in the project profiles section. The intent of these figures is to provide an understanding of the approach. If a project is selected, site-specific designs must be prepared. In addition, some of the proposed retrofits (e.g. hydrodynamic devices) will require a more detailed feasibility analysis and engineered plan sets if selected. This

typically occurs after committed partnerships are formed to install the project. Committed partnerships must include willing landowners, both public and private.

The 803-acre study area was divided into twenty-one catchments over two distinct areas west and east of the confluence with the Rum River. Each catchment includes a dedicated outfall to the Mississippi River. Nine catchments were identified upstream (west) of the Rum River (MW catchments), and 12 catchments were identified downstream (east) of the Rum River (ME catchments). The tables in the Project Ranking and Selection section summarize potential projects ranked by cost-effectiveness with respect to both TP and TSS. Potential projects are organized from most cost-effective to least based on pollutants removed.

In summary, 110 projects were identified throughout the 21 catchments. Project types included bioretention (94, 86% of total), hydrodynamic devices (14, 13% of total), stormwater pond expansions (2, 2% of total), and an underground structure (1, 1% of total). Enhanced street cleaning was also identified throughout the study area. The limited amount of available space throughout most of the study area restricted the opportunities for large, regional practices. There are multiple catchments that discharge directly to the river without some form of existing water quality treatment.

Overall, cost-effectiveness for TP removal ranged from $214/lb-TP to $362,955/lb-TP. The most cost-effective projects for TP removal are bioinfiltration basins and modifications to existing bioinfiltration basins. Cost-effectiveness for TSS removal ranged from $607/1,000 lbs-TSS to $362,955/1,000 lbs-TSS. Similar to TP, the most cost-effective projects for TSS removal are bioinfiltration basins and modifications to existing bioinfiltration basins. Cost-effectiveness values for enhanced street cleaning have been developed and are included in the Project Ranking tables, however, the values from WinSLAMM were found to be very conservative. An alternative for calculating reductions and cost-effectiveness from enhanced street cleaning has been included in Appendix E – Enhanced Street Cleaning Calculator.

Installation of projects in series will result in lower total treatment than the simple sum of treatment achieved by the individual projects due to treatment train effects. Reported treatment levels are dependent upon optimal site selection and sizing. More detail about each project is available in the catchment profile pages of this report. Projects deemed infeasible due to prohibitive size, number, or expense were not included in this report.

Document Organization

This document is organized into five sections, plus references and appendices. Each section is briefly discussed below.

Background

The background section provides a brief description of the landscape characteristics within the study area.

Analytical Process and Elements

The analytical process and elements section overviews the procedures that were followed when analyzing the subwatershed. It explains the processes of retrofit scoping, desktop analysis, field investigation, modeling, cost/treatment analysis, project ranking, and project selection. Refer to Appendix A – Modeling Methods for a detailed description of the modeling methods.

Project Ranking and Selection

The project ranking and selection section describes the methods and rationale for how projects were ranked. Local resource management professionals will be responsible to select and pursue projects, taking into consideration the many possible ways to prioritize projects. Several considerations in addition to project cost-effectiveness for prioritizing installation are included. Project funding opportunities may play a large role in project selection, design, and installation.

This section also ranks stormwater retrofit projects across all catchments to create a prioritized project list. The list is sorted by the amount of pollutant removed by each project over 30 years. The final cost per pound treatment value includes installation and maintenance costs over the estimated life of the project. If a practice's effective life was expected to be less than 30 years, rehabilitation or reinstallation costs were included in the cost estimate. There are many possible ways to prioritize projects, and the list provided in this report is merely a starting point.

BMP Descriptions

For each type of project included in this report, there is a description of the rationale for including that type of project, the modeling method employed, and the cost calculations used to estimate associated installation and maintenance expenses.

Catchment Profiles

The drainage area for this analysis was divided into 21 catchments and assigned unique identification numbers. For each catchment, the following information is detailed:

Catchment Description

Within each catchment profile is a table that summarizes basic catchment information including acres, land cover, parcels, and estimated annual pollutant and volume loads under existing conditions. Existing conditions included notable stormwater treatment practices for which information was available from either the City of Anoka or the City of Coon Rapids. Small, site-specific practices (e.g. rain-leader disconnect rain gardens) were not included in the existing conditions model. A brief description of the land cover, stormwater infrastructure, and any other important general information is also described in this section. Notable existing stormwater practices are explained and their estimated effectiveness presented.

Retrofit Opportunities

Retrofit opportunities are presented for each catchment on “Project ID” pages and include a description of the proposed BMP, cost-effectiveness table including modeled volume and pollutant reductions, and an overview map showing the contributing drainage area for each BMP.

References

This section identifies various sources of information synthesized to produce the protocol used in this analysis.

Appendices

This section provides supplemental information and/or data used during the analysis.

Background

Many factors are considered when choosing which subwatersheds to analyze for stormwater retrofits. Water quality monitoring data, non-degradation report modeling, and TMDL studies are just a few of the resources available to help determine which water bodies are a priority. Stormwater retrofit analyses supported by a Local Government Unit with sufficient capacity (staff, funding, available GIS data, etc.) to greater facilitate the process also rank highly. For some communities a stormwater retrofit analysis complements their MS4 stormwater permit. The focus is always on a high priority waterbody.

The target area studied for this analysis is located in the cities of Anoka and Coon Rapids – within the Lower Rum River Watershed Management Organization (LRRWMO) and Coon Creek Watershed District (CCWD) – and drains to the Mississippi River via a variety of outfalls. The 803-acre study area was divided into 21 catchments over two distinct areas, upstream and downstream of the Rum River's confluence with the Mississippi River (Figure 1). Nine catchments were identified upstream of the confluence, and 12 catchments were identified downstream of the confluence. The selected catchments of the Mississippi River subwatershed are heavily urbanized, with the exception of Catchment ME-10 that includes a significant portion of the Anoka-Ramsey Community College natural habitat area. Development throughout the cities of Anoka and Coon Rapids has resulted in the installation of subsurface drainage systems (i.e. stormwater infrastructure) to convey stormwater runoff, which increased due to the coverage of impervious surfaces throughout the catchments.

The runoff generated within the subwatershed is still conveyed to the Mississippi River, as it was historically. However, the runoff is now captured by catch basins and directed underground before being discharged via stormwater pipes. This, along with the impervious surfaces, has caused increased volume and pollutant loading to the Mississippi River relative to natural, historical conditions. Stormwater runoff from impervious surfaces can carry a variety of pollutants. Existing stormwater treatment to remove these pollutants is present in some areas of the subwatershed, primarily in the form of bioretention (bioinfiltration and biofiltration), stormwater ponds, and hydrodynamic devices.

ACD completed this SRA for the purpose of identifying and analyzing projects to improve the quality of stormwater runoff from contributing drainage areas to the Mississippi River. Overall subwatershed loading of TP, TSS, and stormwater volume were estimated for catchments throughout the subwatershed. Proposed retrofits were modeled to estimate each practice's capability for removing pollutants and reducing volume. Finally, each project was ranked based on the estimated cost-effectiveness of the project to reduce pollutants.

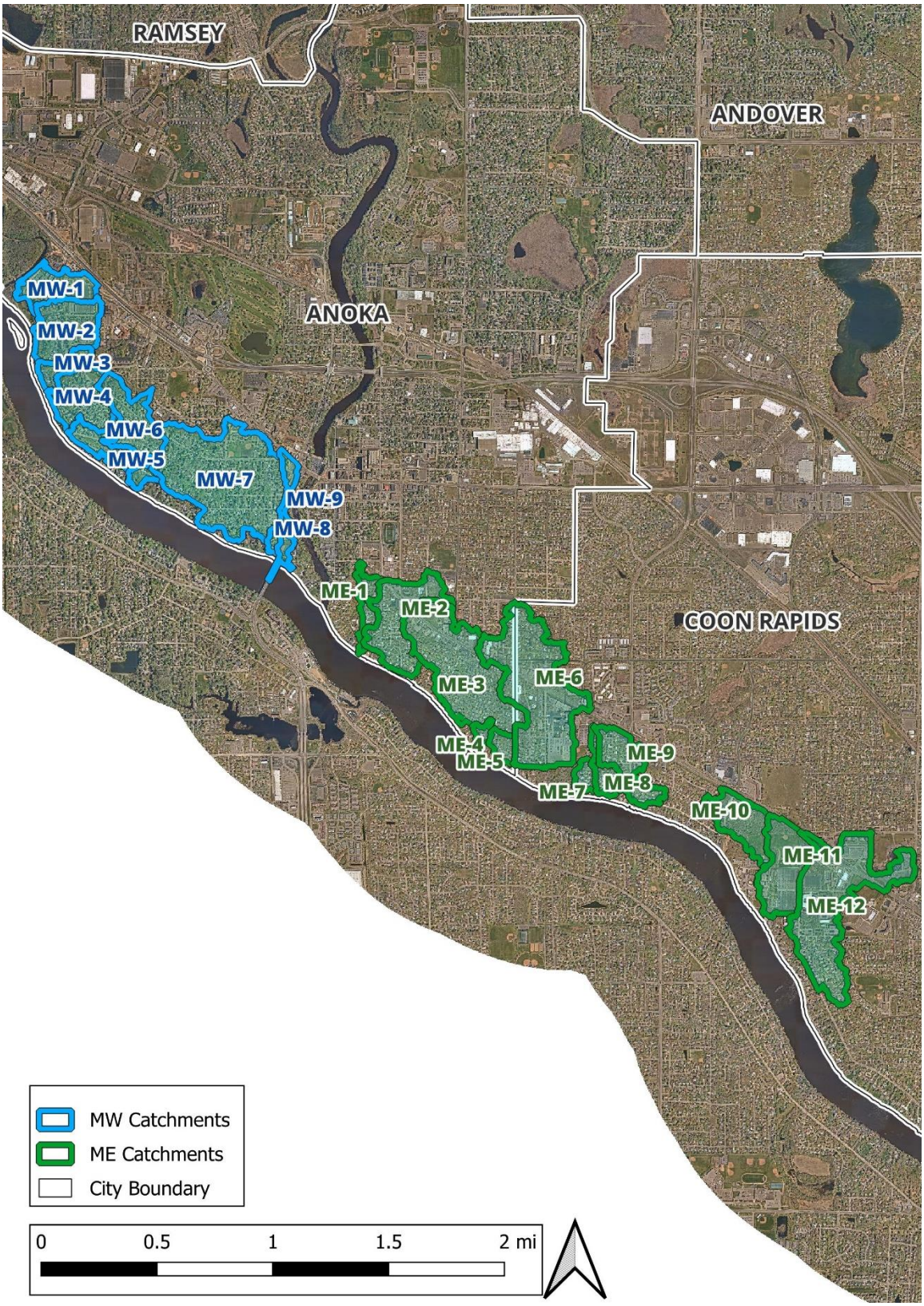


Figure 1: Mississippi River Subwatershed (803 acres)

Analytical Process and Elements

This stormwater retrofit analysis is a watershed management tool to identify and prioritize potential stormwater retrofit projects by performance and cost-effectiveness. This process helps maximize the value of each dollar spent. The process used for this analysis is outlined in the following pages and was modified from the Center for Watershed Protection's Urban Stormwater Retrofit Practices, Manuals 2 and 3 (Schueler & Kitchell, 2005 and Schueler et al. 2007). Locally relevant design considerations were also incorporated into the process (Technical Documents, Minnesota Stormwater Manual, 2024).

Scoping includes determining the objectives of the retrofits (volume reduction, target pollutant, etc.) and the level of treatment desired. It involves meeting with local stormwater managers, city staff, and watershed management organization members to determine the issues in the subwatershed. This step also helps to define preferred retrofit treatment options and retrofit performance criteria. In order to create a manageable area to analyze in large subwatersheds, a focus area may be determined.

In this analysis, the focus areas were the contributing drainage areas to storm sewer outfalls that discharge directly into the target water body (i.e. the Mississippi River). Included are areas of residential, commercial, industrial, and institutional land uses. The focus area was divided into 21 catchments using a combination of existing subwatershed mapping data, stormwater infrastructure maps, and observed topography.

The targeted pollutants for this study were TP and TSS, though volume was also estimated and reported. Volume of stormwater was tracked throughout this study because it is necessary for pollutant loading calculations and potential retrofit project considerations. Table 1 describes the target pollutants and their role in water quality degradation. Projects that effectively reduce loading of multiple target pollutants can provide greater immediate and long-term benefits.

Table 1: Target Pollutants

Target Pollutant	Description
Total Suspended Solids (TSS)	Very small mineral and organic particles that can be dispersed into the water column due to turbulent mixing. TSS loading can create turbid and cloudy water conditions and carry particulate phosphorus (PP). As such, reductions in TSS will also result in TP reductions.
Total Phosphorus (TP)	Phosphorus is a nutrient essential to plant growth and is commonly the factor that limits the growth of plants in surface water bodies. TP is a combination of PP, which is bound to sediment and organic debris, and dissolved phosphorus (DP), which is in solution and readily available for plant growth (active).
Volume	Higher runoff volumes and velocities can carry greater amounts of TSS to receiving water bodies. It can also exacerbate in-stream erosion, thereby increasing TSS loading. As such, reductions in volume may reduce TSS loading and, by extension, TP loading.

Desktop analysis involves computer-based scanning of the subwatershed for potential retrofit catchments and/or specific sites. This step also identifies areas that do not need to be analyzed because of existing stormwater treatment or disconnection from the target water body. Accurate GIS data are extremely valuable in conducting the desktop retrofit analysis. Some of the most important GIS layers include 2-foot or finer topography (Light Detection and Ranging [LiDAR] was used for this analysis), surface hydrology, soils, watershed/subwatershed boundaries, parcel boundaries, high-resolution aerial photography, and the stormwater drainage infrastructure (with invert elevations).

Field investigation is conducted after potential retrofits are identified in the desktop analysis to evaluate each site and identify additional opportunities. During the investigation, the drainage area and surface stormwater infrastructure mapping data were verified in areas where the available GIS data were insufficient. Site constraints were assessed to determine the most feasible retrofit options as well as eliminate sites from consideration. The field investigation may have also revealed additional retrofit opportunities that could have gone unnoticed during the desktop search.

Modeling involves assessing multiple scenarios to estimate pollutant loading and potential reductions by proposed retrofits. WinSLAMM (version 10.5.0), which allows routing of multiple catchments and stormwater treatment practices, was used for this analysis. This is important for estimating treatment train effects associated with multiple BMPs in series. Furthermore, it allows for estimation of volume and pollutant loading at the outfall point to the waterbody, which is the primary point of interest in this type of study.

WinSLAMM estimates volume and pollutant loading based on acreage, land use, and soils information. Therefore, the volume and pollutant estimates in this report are not waste load allocations, nor does this report serve as a TMDL for the study area. The WinSLAMM model was not calibrated and was only used as an estimation tool to provide relative ranking across potential retrofit projects. Specific model inputs (e.g. pollutant probability distribution, runoff coefficient, particulate solids concentration, particle residue delivery, and street delivery files) are detailed in Appendix A – Modeling Methods.

The initial step was to create a “base” model, which estimates pollutant loading from each catchment in its present-day state without taking into consideration any existing stormwater treatment. Drainage area delineations were used to model the land uses in each catchment. The drainage areas were consolidated into catchments using geographic information systems (specifically, ArcMap). Land use data (based on 2020 Metropolitan Council land use file) were used to calculate acreages of each land use type within each catchment. Each land use polygon classification was compared with high-resolution 2023 aerial photography, the most recent available at the time of this analysis, as well as ground truthing, and corrected if land use had changed since 2020. This process addressed recent development throughout the study area by reclassifying land use types accordingly. Soil types throughout the study area were predominantly silt based on information available in the Anoka County soil survey and associated assumptions were made for soils listed as ‘cut and fill.’ Entering the acreages, land use, and soil data into WinSLAMM ultimately resulted in a model that included estimates of the acreage of each type of source area (roof, road, lawn, etc.) in each catchment.

Once the “base” model was established, an “existing conditions” model was created by incorporating notable existing stormwater treatment practices in the catchment for which data were available from the City of Anoka and the City of Coon Rapids (Figure 2 and Figure 3). For example, street cleaning, stormwater treatment ponds, hydrodynamic devices, and others were included in the “existing conditions” model if information was available.

Finally, each proposed stormwater retrofit practice was added individually to the “existing conditions” model and pollutant reductions were estimated. Because neither a detailed design of each practice nor in-depth site investigation was completed, a generalized design for each practice was used. Whenever possible, site-specific parameters were included. Design parameters were modified to obtain various levels of treatment. It is worth noting that each practice was modeled individually, and the benefits of projects may not be additive, especially if serving the same area (i.e. treatment train effects). Reported treatment levels are dependent upon optimal site selection and sizing. Additional information on the WinSLAMM models can be found in Appendix A – Modeling Methods.

Cost estimating is essential for the comparison and ranking of projects, development of work plans, and pursuit of grants and other funds. All estimates were developed using 2024 dollars. Costs throughout this report were estimated using a multitude of sources. Costs were derived from The Center for Watershed Protection's Urban Subwatershed Restoration Manuals (Schueler & Kitchell, 2005 and Schueler et al. 2007), recent installation costs, and cost estimates provided to the ACD by personal contacts. Cost estimates were annualized costs that incorporated the elements listed below over a 30-year period.

> **Project promotion and administration** includes local staff efforts to reach out to landowners, administer related grants, and complete necessary administrative tasks.
>
> **Design** includes site surveying, engineering, and construction oversight.
>
> **Land or easement acquisition** covers the cost of purchasing property or the cost of obtaining necessary utility and access easements from landowners.
>
> **Construction** calculations are project-specific and may include all or some of the following: grading, erosion control, vegetation management, structures, mobilization, traffic control, equipment, soil disposal, and rock or other materials.
>
> **Maintenance** includes annual inspections and minor site remediation such as vegetation management, structural outlet repair and cleaning, and washout repair.

In cases where promotion to landowners is important, such as rain gardens, those costs were included as well. In cases where multiple, similar projects are proposed in the same locality, promotion and administration costs were estimated using a non-linear relationship that accounted for savings with scale. Design assistance from an engineer is assumed for practices in-line with the stormwater conveyance system, involving complex stormwater treatment interactions, or posing a risk for upstream flooding. It should be understood that no site-specific construction investigations were done as part of this stormwater retrofit analysis, and therefore cost estimates account for only general site considerations. Detailed feasibility analyses may be necessary for some projects.

Project ranking is essential to identify which projects could be pursued to achieve water quality goals. Project ranking tables are presented based on cost per 1,000 pounds of TSS and cost per pound of TP removed.

Project selection involves considerations other than project ranking, including but not limited to total cost, treatment train effects, social acceptability, landowner interest, and political feasibility.

Figure 2: Mississippi River (West) subwatershed existing BMPs included in the WinSLAMM model. Street sweeping is not shown on the map but was included throughout the study area.

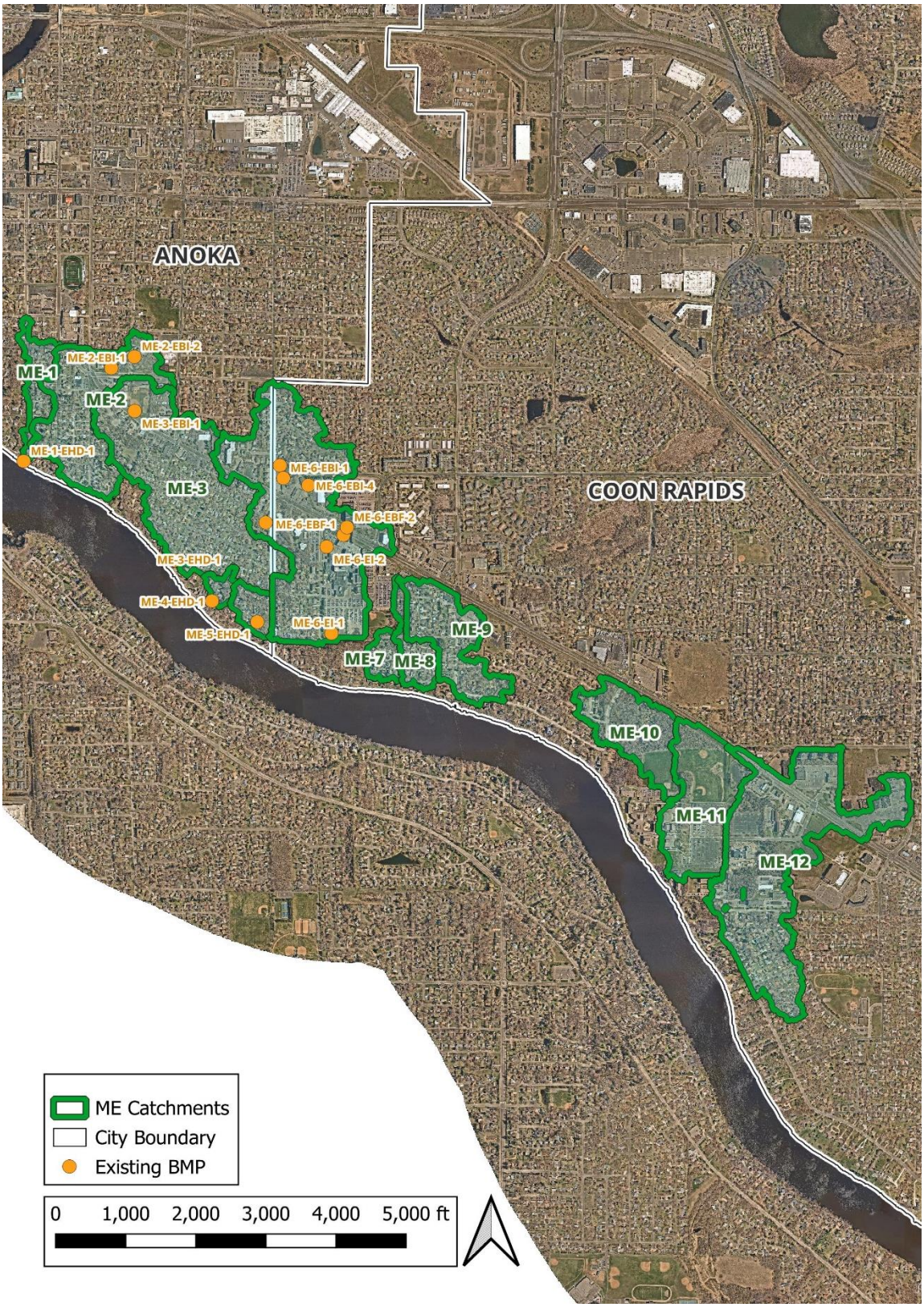


Figure 3: Mississippi River (East) subwatershed existing BMPs included in the WinSLAMM model. Street sweeping is not shown on the map but was included throughout the study area.

Project Ranking and Selection

The intent of this analysis is to provide the information necessary to enable local natural resource managers to secure funding for the most cost-effective projects to achieve water quality goals. This analysis ranks potential projects by cost-effectiveness to facilitate project selection. There are many possible ways to prioritize projects, and the list provided in this report is merely a starting point. Local resource management professionals will be responsible to select projects to pursue. Several considerations in addition to project cost-effectiveness for prioritizing installation are included.

Figure 4 and Figure 5 show an overview of all proposed retrofit locations and types. Figure 6 and Figure 7 show portions of the drainage area that are currently treated by existing BMPs as well as the areas that could be treated with the retrofit opportunities identified in this report.

Project Ranking

The tables on the following pages rank all modeled projects by cost-effectiveness.

Projects were ranked in two ways:

1) Cost per pound of total phosphorus removed, and
2) Cost per 1,000 pounds of total suspended solids removed.

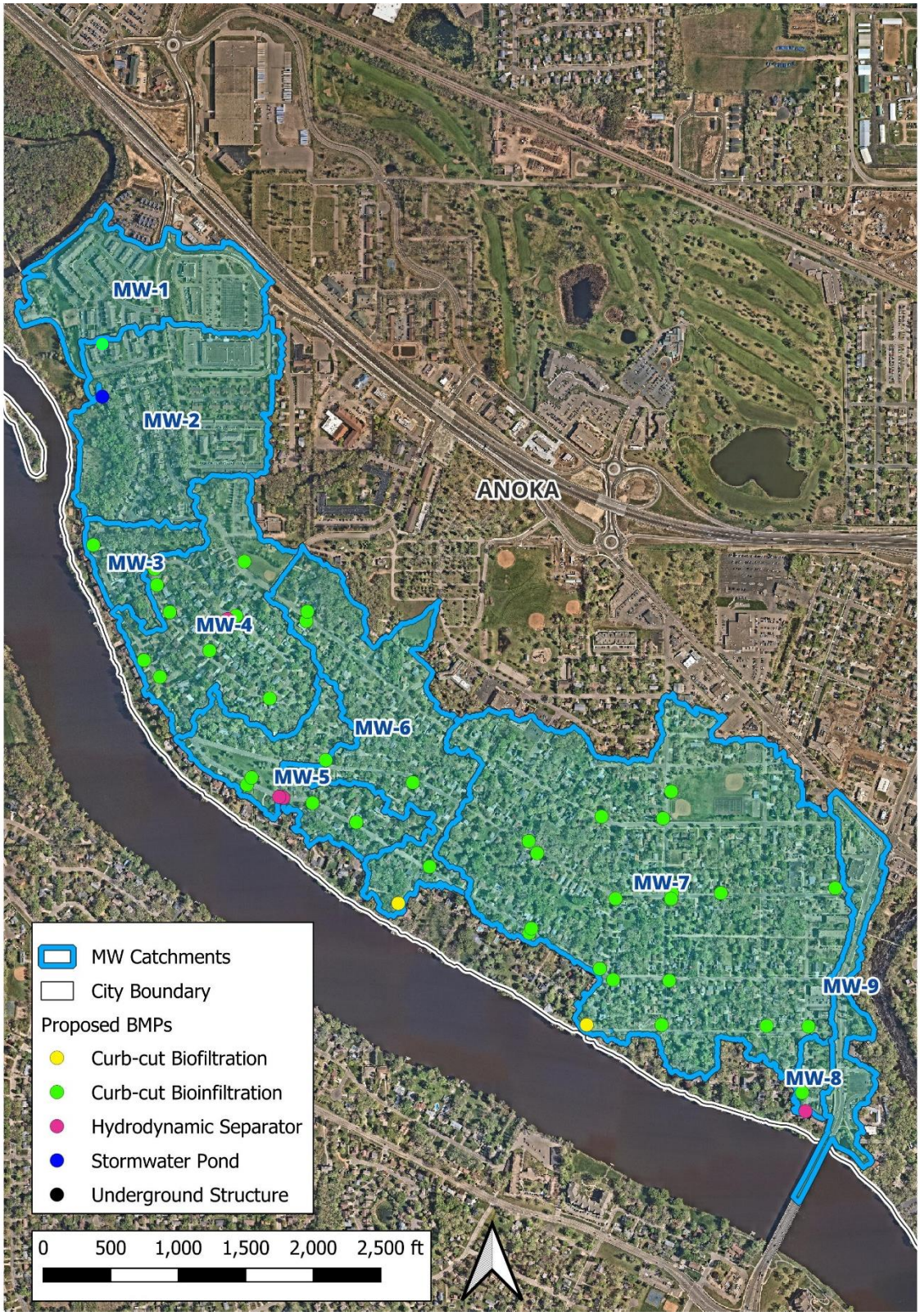


Figure 4: Mississippi River (West) subwatershed proposed retrofit opportunities overview.

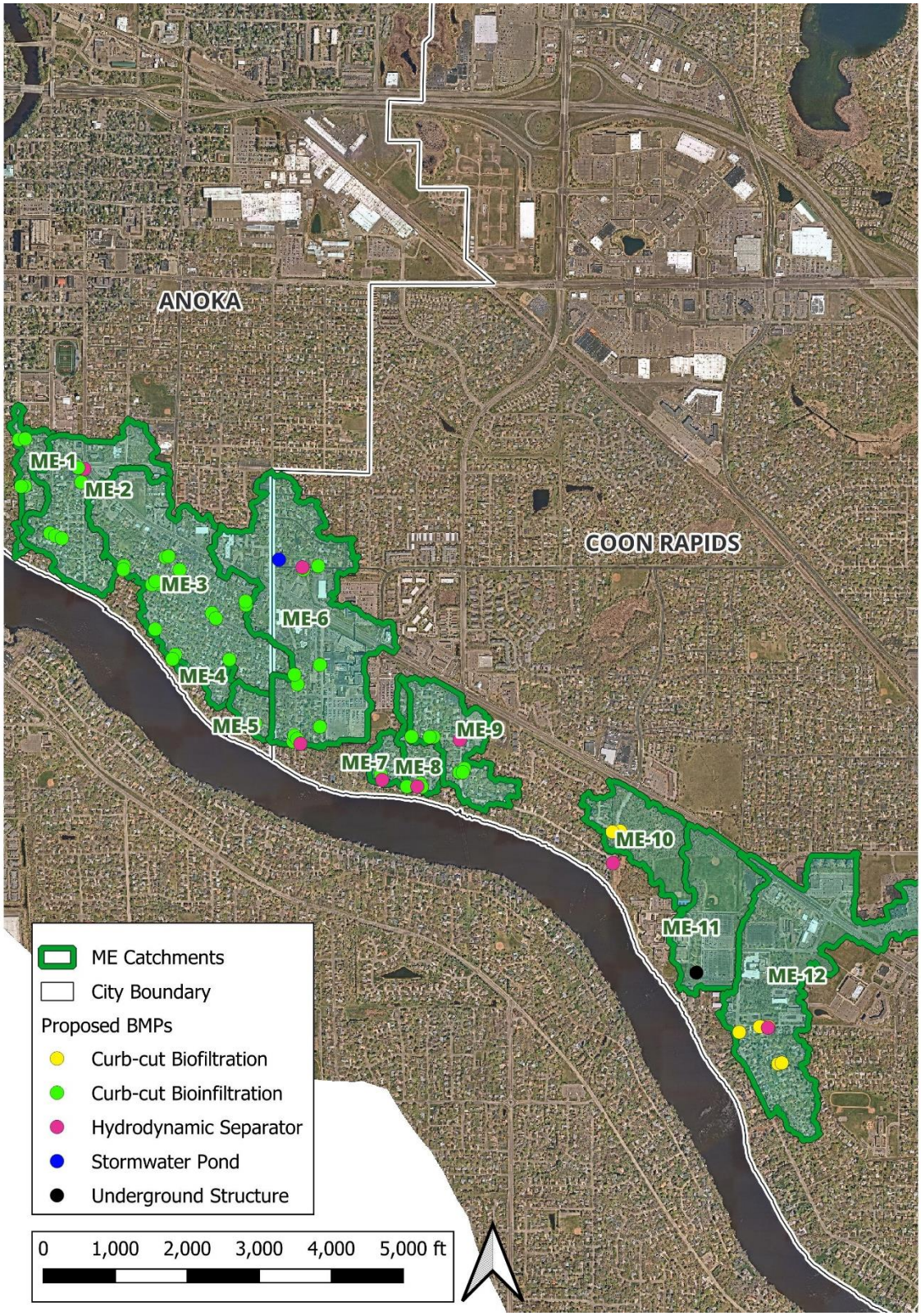


Figure 5: Mississippi River (East) subwatershed proposed retrofit opportunities overview.

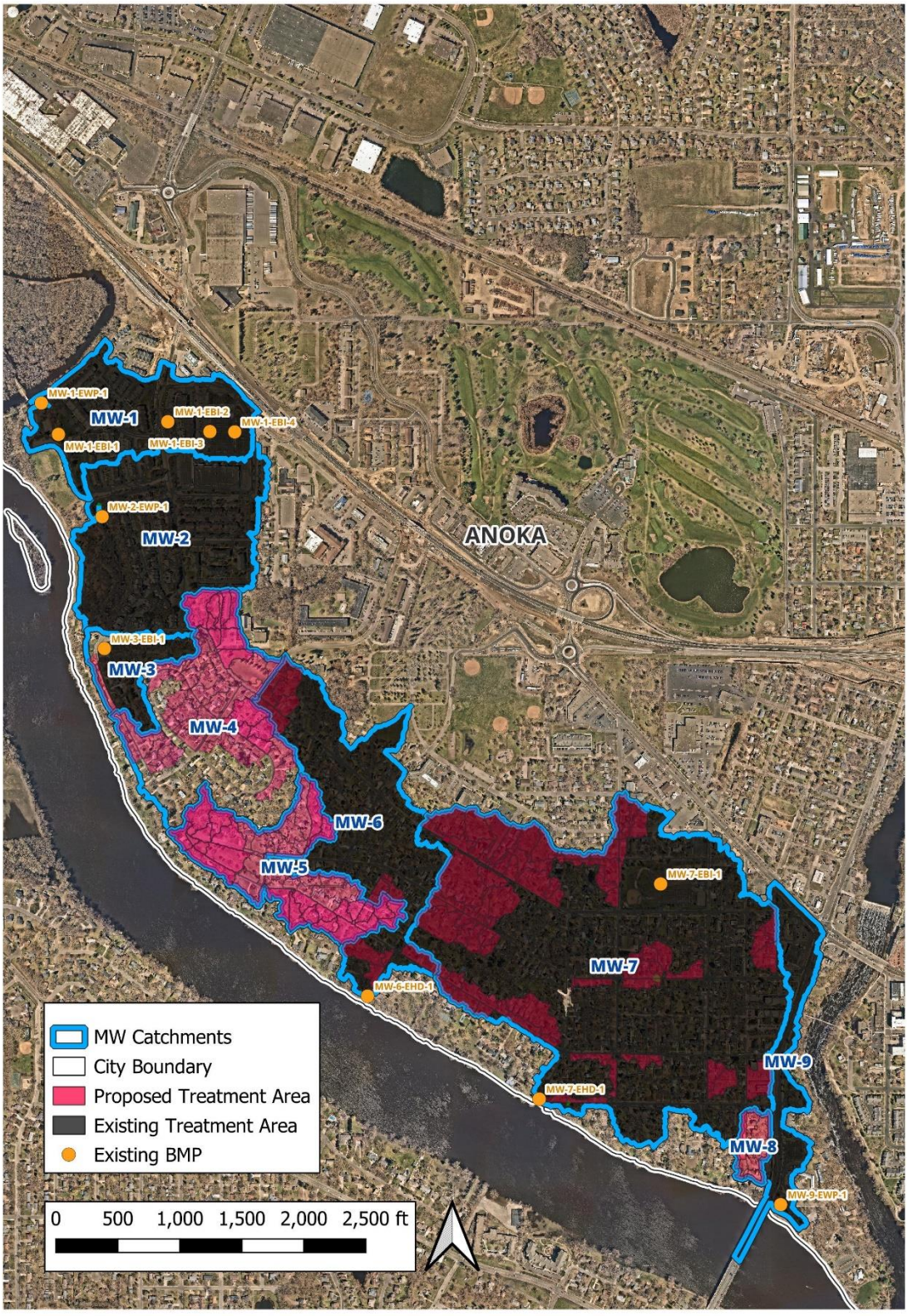


Figure 6: Mississippi River (West) subwatershed with water quality treatment from existing and proposed BMPs.

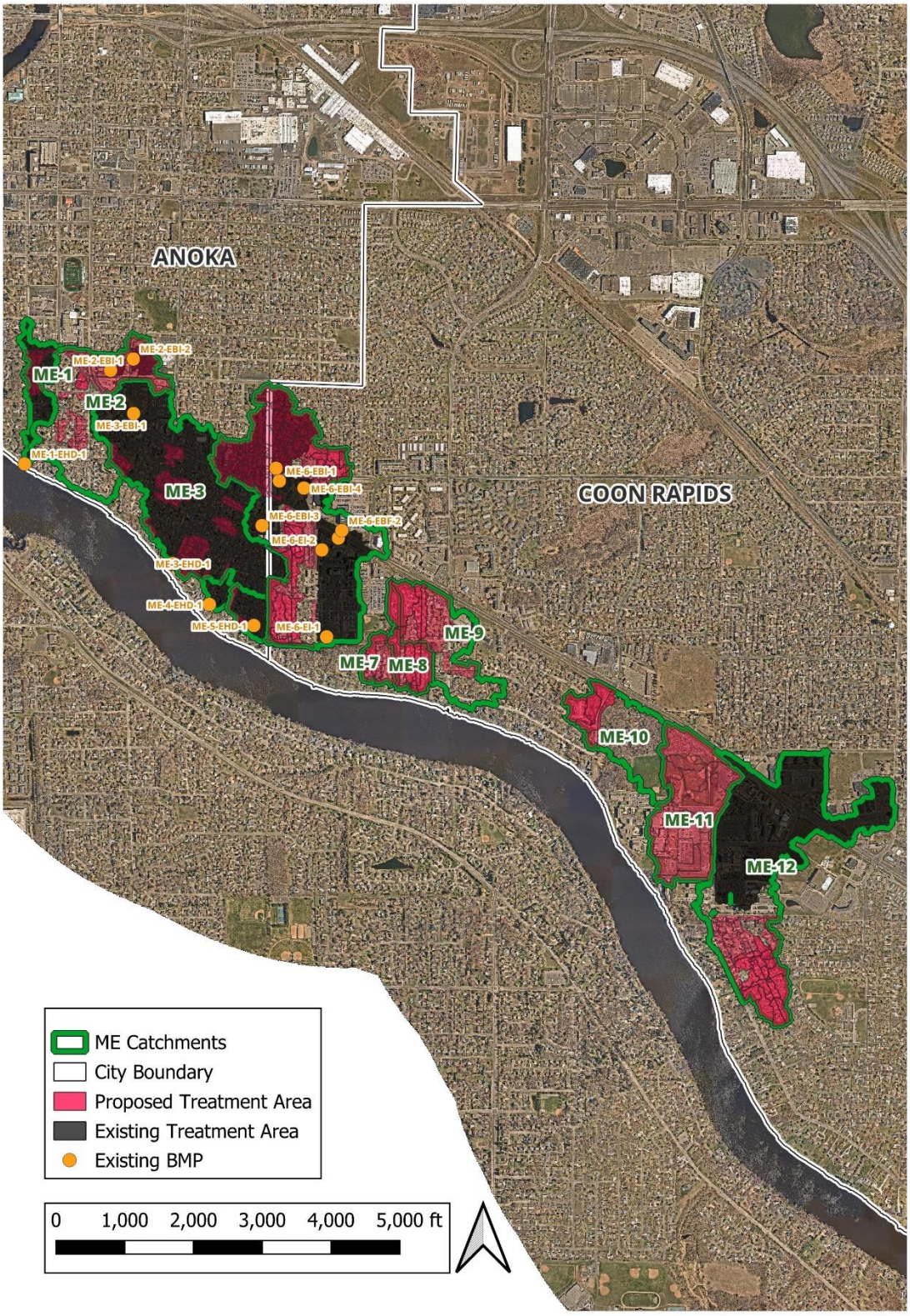


Figure 7: Mississippi River (East) subwatershed with water quality treatment from existing and proposed BMPs.

Table 2: Cost-effectiveness of MW retrofits with respect to TP reduction. Projects ranked 1 - 54 are shown on this table. TSS and volume reductions are also shown. For more information on each project refer to either the Catchment Profile or BMP Descriptions pages in this report. Volume and pollutant reduction benefits cannot be summed with other projects that provide treatment for the same source area.

Project Rank	Project ID	Page Number	Retrofit Type	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost	Estimated Annual Operations & Maintenance	Estimated cost/ 1,000lb-TP/year (30-year)[1]
1	MW-5-PBI-2	63	Bioinfiltration Basin	MW-5	0.92	297.00	0.69	$16,984	$225	$857
2	MW-5-PBI-3	64	Bioinfiltration Basin	MW-5	0.92	290.00	0.69	$16,984	$225	$863
3	MW-4-PBI-9	57	Bioinfiltration Basin	MW-4	0.87	407.00	0.92	$16,984	$225	$909
4	MW-7-PBI-10	90	Bioinfiltration Basin	MW-7	0.62	209.00	0.53	$10,484	$225	$927
5	MW-7-PBI-9	89	Bioinfiltration Basin	MW-7	0.61	190.00	0.48	$10,484	$225	$942
6	MW-7-PBI-8	88	Bioinfiltration Basin	MW-7	0.56	176.00	0.46	$10,484	$225	$1,026
7	MW-4-PBI-8	56	Bioinfiltration Basin	MW-4	0.54	174.00	0.41	$10,484	$225	$1,064
8	MW-4-PBI-7	55	Bioinfiltration Basin	MW-4	0.53	172.00	0.42	$10,484	$225	$1,084
9	MW-4-PBI-2	50	Bioinfiltration Basin	MW-4	0.52	165.00	0.39	$10,484	$225	$1,105
10	MW-4-PBI-5	53	Bioinfiltration Basin	MW-4	0.52	165.00	0.39	$10,484	$225	$1,105
11	MW-5-PBI-4	65	Bioinfiltration Basin	MW-5	0.52	166.00	0.39	$10,484	$225	$1,105
12	MW-7-PBI-3	83	Bioinfiltration Basin	MW-7	0.52	163.00	0.41	$10,484	$225	$1,105
13	MW-7-PBI-11	91	Bioinfiltration Basin	MW-7	0.51	162.00	0.41	$10,484	$225	$1,126
14	MW-4-PBI-3	51	Bioinfiltration Basin	MW-4	0.50	159.00	0.38	$10,484	$225	$1,149
15	MW-4-PBI-4	52	Bioinfiltration Basin	MW4	0.49	155.00	0.37	$10,484	$225	$1,172
16	MW-6-PBI-4	76	Bioinfiltration Basin	MW-6	0.47	143.00	0.37	$10,484	$225	$1,222
17	MW-7-PBI-13	93	Bioinfiltration Basin	MW-7	0.47	149.00	0.39	$10,484	$225	$1,222
18	MW-7-PBI-12	92	Bioinfiltration Basin	MW-7	0.63	217.00	0.67	$16,984	$225	$1,256
19	MW-5-PBI-5	66	Bioinfiltration Basin	MW-5	0.43	137.00	0.32	$10,484	$225	$1,336
20	MW-5-PBI-1	62	Bioinfiltration Basin	MW-5	0.41	129.00	0.31	$10,484	$225	$1,401
21	MW-7-PBI-16	96	Bioinfiltration Basin	MW-7	0.38	118.00	0.30	$10,484	$225	$1,512
22	MW-7-PBI-18	98	Bioinfiltration Basin	MW-7	0.38	132.00	0.44	$10,484	$225	$1,512
23	MW-8 Enhanced SC	33	Street Cleaning	MW-8	0.035	15.1	N/A	$54	$0	$1,542
24	MW-7-PBI-4	84	Bioinfiltration Basin	MW-7	0.37	114.00	0.30	$10,484	$225	$1,553
25	MW-7-PBI-5	85	Bioinfiltration Basin	MW-7	0.37	117.00	0.30	$10,484	$225	$1,553
26	MW-7-PBI-17	97	Bioinfiltration Basin	MW-7	0.36	133.00	0.41	$10,484	$225	$1,596
27	MW-4-PBI-1	49	Bioinfiltration Basin	MW-4	0.32	96.00	0.23	$10,484	$225	$1,795
28	MW-4-PBI-6	54	Bioinfiltration Basin	MW-4	0.32	103.00	0.25	$10,484	$225	$1,795
29	MW-6-PBI-2	74	Bioinfiltration Basin	MW-6	0.32	96.00	0.26	$10,484	$225	$1,795

Table continued below.

Table 2: Cost-effectiveness of MW retrofits with respect to TP reduction (continued).

Project Rank	Project ID	Page Number	Retrofit Type	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost	Estimated Annual Operations & Maintenance	Estimated cost/ 1,000lb-TP/year (30-year)[1]
30	MW-4 Enhanced SC	33	Street Cleaning	MW-4	0.38	172	N/A	$694	$0	$1,826
31	MW-6-PBI-1	73	Bioinfiltration Basin	MW-6	0.29	88.00	0.23	$10,484	$225	$1,981
32	MW-6-PBI-3	75	Bioinfiltration Basin	MW-6	0.28	83.00	0.22	$10,484	$225	$2,052
33	MW-5 Enhanced SC	33	Street Cleaning	MW-5	0.21	93	N/A	$460	$0	$2,190
34	MW-3-PBI-1	45	Bioinfiltration Basin	MW-3	0.26	72.10	0.17	$10,484	$225	$2,235
35	MW-8-PBI-1	103	Bioinfiltration Basin	MW-8	0.25	78.90	0.19	$10,484	$225	$2,262
36	MW-7-PBI-6	86	Bioinfiltration Basin	MW-7	0.24	72.00	0.18	$10,484	$225	$2,394
37	MW-7-PBI-15	95	Bioinfiltration Basin	MW-7	0.24	74.00	0.18	$10,484	$225	$2,394
38	MW-7-PBI-14	94	Bioinfiltration Basin	MW-7	0.23	72.00	0.18	$10,484	$225	$2,498
39	MW-7-PBI-2	82	Bioinfiltration Basin	MW-7	0.20	63.00	0.16	$10,484	$225	$2,872
40	MW-7-PBI-7	87	Bioinfiltration Basin	MW-7	0.20	62.00	0.16	$10,484	$225	$2,872
41	MW-3 Enhanced SC	33	Street Cleaning	MW-3	0.022	9.7	N/A	$78	$0	$3,523
42	MW-7-PBI-1	81	Bioinfiltration Basin	MW-7	0.16	51.00	0.14	$10,484	$225	$3,590
43	MW-7 Enhanced SC	33	Street Cleaning	MW-7	0.62	285	N/A	$2,417	$0	$3,899
44	MW-6-PBF-1	77	Biofiltration Basin	MW-6	0.26	91.00	0.10	$23,984	$295	$4,209
45	MW-2-EWP-1 Expansion	41	Wet Pond	MW-2	2.30	1037	0.00	$302,252.00	$1,100.00	$4,859
46	MW-7-PBF-1	99	Biofiltration Basin	MW-7	0.22	78.00	0.09	$23,984	$295	$4,975
47	MW-5-PHD-1	67	Hydrodynamic Device	MW-5	0.36	146.00	N/A	$57,750	$210	$5,931
48	MW-6 Enhanced SC	33	Street Cleaning	MW-6	0.11	52	N/A	$745	$0	$6,769
49	MW-4-PHD-1	58	Hydrodynamic Device	MW-4	0.71	335.00	N/A	$153,750	$210	$7,514
50	MW-8-PHD-1	104	Hydrodynamic Device	MW-8	0.21	85.90	N/A	$41,250	$210	$7,620
51	MW-5-PHD-2	68	Hydrodynamic Device	MW-5	0.60	241.00	N/A	$153,750	$210	$8,892
52	MW-5-PHD-3	69	Hydrodynamic Device	MW-5	0.47	191.00	N/A	$153,750	$210	$11,351
53	MW-2 Enhanced SC	33	Street Cleaning	MW-2	0.02	7	N/A	$633	$0	$31,636
54	MW-9 Enhanced SC	33	Street Cleaning	MW-9	0.001	1	N/A	$363	$0	$362,955

[1][(Probable Project Cost) + 30*(Annual O&M)] / [30*(Annual TP Reduction)]; enhanced street cleaning is [Probable Project Cost] / [Annual TP Reduction]

Table 3: Cost-effectiveness of MW retrofits with respect to TSS reduction. Projects ranked 1 - 54 are shown on this table. TP and volume reductions are also shown. For more information on each project refer to either the Catchment Profile or BMP Descriptions pages in this report. Volume and pollutant reduction benefits cannot be summed with other projects that provide treatment for the same source area.

Project Rank	Project ID	Page Number	Retrofit Type	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost	Estimated Annual Operations & Maintenance	Estimated cost/ 1,000lb-TSS/year (30-year)[1]
1	MW-4-PBI-9	57	Bioinfiltration Basin	MW-4	0.87	407.00	0.92	$16,984	$225	$1,944
2	MW-5-PBI-2	63	Bioinfiltration Basin	MW-5	0.92	297.00	0.69	$16,984	$225	$2,664
3	MW-5-PBI-3	64	Bioinfiltration Basin	MW-5	0.92	290.00	0.69	$16,984	$225	$2,728
4	MW-7-PBI-10	90	Bioinfiltration Basin	MW-7	0.62	209.00	0.53	$10,484	$225	$2,749
5	MW-7-PBI-9	89	Bioinfiltration Basin	MW-7	0.61	190.00	0.48	$10,484	$225	$3,024
6	MW-7-PBI-8	88	Bioinfiltration Basin	MW-7	0.56	176.00	0.46	$10,484	$225	$3,264
7	MW-4-PBI-8	56	Bioinfiltration Basin	MW-4	0.54	174.00	0.41	$10,484	$225	$3,302
8	MW-4-PBI-7	55	Bioinfiltration Basin	MW-4	0.53	172.00	0.42	$10,484	$225	$3,340
9	MW-5-PBI-4	65	Bioinfiltration Basin	MW-5	0.52	166.00	0.39	$10,484	$225	$3,461
10	MW-4-PBI-2	50	Bioinfiltration Basin	MW-4	0.52	165.00	0.39	$10,484	$225	$3,482
11	MW-4-PBI-5	53	Bioinfiltration Basin	MW-4	0.52	165.00	0.39	$10,484	$225	$3,482
12	MW-7-PBI-3	83	Bioinfiltration Basin	MW-7	0.52	163.00	0.41	$10,484	$225	$3,524
13	MW-7-PBI-11	91	Bioinfiltration Basin	MW-7	0.51	162.00	0.41	$10,484	$225	$3,546
14	MW-8 Enhanced SC	33	Street Cleaning	MW-8	0.035	15.1	N/A	$54	$0	$3,575
15	MW-4-PBI-3	51	Bioinfiltration Basin	MW-4	0.50	159.00	0.38	$10,484	$225	$3,613
16	MW-7-PBI-12	92	Bioinfiltration Basin	MW-7	0.63	217.00	0.67	$16,984	$225	$3,646
17	MW-4-PBI-4	52	Bioinfiltration Basin	MW4	0.49	155.00	0.37	$10,484	$225	$3,706
18	MW-7-PBI-13	93	Bioinfiltration Basin	MW-7	0.47	149.00	0.39	$10,484	$225	$3,855
19	MW-6-PBI-4	76	Bioinfiltration Basin	MW-6	0.47	143.00	0.37	$10,484	$225	$4,017
20	MW-4 Enhanced SC	33	Street Cleaning	MW-4	0.38	172	N/A	$694	$0	$4,034
21	MW-5-PBI-5	66	Bioinfiltration Basin	MW-5	0.43	137.00	0.32	$10,484	$225	$4,193
22	MW-7-PBI-17	97	Bioinfiltration Basin	MW-7	0.36	133.00	0.41	$10,484	$225	$4,319
23	MW-7-PBI-18	98	Bioinfiltration Basin	MW-7	0.38	132.00	0.44	$10,484	$225	$4,352
24	MW-5-PBI-1	62	Bioinfiltration Basin	MW-5	0.41	129.00	0.31	$10,484	$225	$4,453
25	MW-7-PBI-16	96	Bioinfiltration Basin	MW-7	0.38	118.00	0.30	$10,484	$225	$4,868
26	MW-7-PBI-5	85	Bioinfiltration Basin	MW-7	0.37	117.00	0.30	$10,484	$225	$4,910
27	MW-5 Enhanced SC	33	Street Cleaning	MW-5	0.21	93	N/A	$460	$0	$4,945
28	MW-7-PBI-4	84	Bioinfiltration Basin	MW-7	0.37	114.00	0.30	$10,484	$225	$5,039
29	MW-4-PBI-6	54	Bioinfiltration Basin	MW-4	0.32	103.00	0.25	$10,484	$225	$5,577

Table continued below.

Table 3: Cost-effectiveness of MW retrofits with respect to TSS reduction (continued)

Project Rank	Project ID	Page Number	Retrofit Type	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost	Estimated Annual Operations & Maintenance	Estimated cost/ 1,000lb-TSS/year (30-year)[1]
30	MW-4-PBI-1	49	Bioinfiltration Basin	MW-4	0.32	96.00	0.23	$10,484	$225	$5,984
31	MW-6-PBI-2	74	Bioinfiltration Basin	MW-6	0.32	96.00	0.26	$10,484	$225	$5,984
32	MW-6-PBI-1	73	Bioinfiltration Basin	MW-6	0.29	88.00	0.23	$10,484	$225	$6,528
33	MW-6-PBI-3	75	Bioinfiltration Basin	MW-6	0.28	83.00	0.22	$10,484	$225	$6,921
34	MW-8-PBI-1	103	Bioinfiltration Basin	MW-8	0.25	78.90	0.19	$10,484	$225	$7,281
35	MW-7-PBI-15	95	Bioinfiltration Basin	MW-7	0.24	74.00	0.18	$10,484	$225	$7,763
36	MW-3-PBI-1	45	Bioinfiltration Basin	MW-3	0.26	72.10	0.17	$10,484	$225	$7,968
37	MW-7-PBI-6	86	Bioinfiltration Basin	MW-7	0.24	72.00	0.18	$10,484	$225	$7,979
38	MW-7-PBI-14	94	Bioinfiltration Basin	MW-7	0.23	72.00	0.18	$10,484	$225	$7,979
39	MW-3 Enhanced SC	33	Street Cleaning	MW-3	0.022	9.7	N/A	$78	$0	$7,990
40	MW-7 Enhanced SC	33	Street Cleaning	MW-7	0.62	285	N/A	$2,417	$0	$8,482
41	MW-7-PBI-2	82	Bioinfiltration Basin	MW-7	0.20	63.00	0.16	$10,484	$225	$9,119
42	MW-7-PBI-7	87	Bioinfiltration Basin	MW-7	0.20	62.00	0.16	$10,484	$225	$9,266
43	MW-2-EWP-1 Expansion	41	Wet Pond	MW-2	2.30	1037	0.00	$302,252.00	$1,100.00	$10,776
44	MW-7-PBI-1	81	Bioinfiltration Basin	MW-7	0.16	51.00	0.14	$10,484	$225	$11,264
45	MW-6-PBF-1	77	Biofiltration Basin	MW-6	0.26	91.00	0.10	$23,984	$295	$12,027
46	MW-7-PBF-1	99	Biofiltration Basin	MW-7	0.22	78.00	0.09	$23,984	$295	$14,032
47	MW-6 Enhanced SC	33	Street Cleaning	MW-6	0.11	52	N/A	$745	$0	$14,318
48	MW-5-PHD-1	67	Hydrodynamic Device	MW-5	0.36	146.00	N/A	$57,750	$210	$14,623
49	MW-4-PHD-1	58	Hydrodynamic Device	MW-4	0.71	335.00	N/A	$153,750	$210	$15,925
50	MW-8-PHD-1	104	Hydrodynamic Device	MW-8	0.21	85.90	N/A	$41,250	$210	$18,452
51	MW-5-PHD-2	68	Hydrodynamic Device	MW-5	0.60	241.00	N/A	$153,750	$210	$22,137
52	MW-5-PHD-3	69	Hydrodynamic Device	MW-5	0.47	191.00	N/A	$153,750	$210	$27,932
53	MW-2 Enhanced SC	33	Street Cleaning	MW-2	0.02	7	N/A	$633	$0	$90,390
54	MW-9 Enhanced SC	33	Street Cleaning	MW-9	0.001	1	N/A	$363	$0	$362,955

[1][(Probable Project Cost) + 30*(Annual O&M)] / [30*(Annual TSS Reduction)]; enhanced street cleaning is [Probable Project Cost] / [Annual TSS Reduction]

Table 4: Cost-effectiveness of ME retrofits with respect to TP reduction. Projects ranked 1 - 69 are shown on this table. TSS and volume reductions are also shown. For more information on each project refer to either the Catchment Profile or BMP Descriptions pages in this report. Volume and pollutant reduction benefits cannot be summed with other projects that provide treatment for the same source area.

Project Rank	Project ID	Page Number	Retrofit Type	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost	Estimated Annual Operations & Maintenance	Estimated cost/ 1,000lb-TP/year (30-year)[1]
1	ME-6-EBI-2 Retrofit	164	Bioinfiltration Basin Retrofit	ME-6	10.76	3796.00	11.32	$55,780	$444	$214
2	ME-3-PBI-2	128	Bioinfiltration Basin	ME-3	0.97	303.00	0.76	$16,984	$225	$816
3	ME-6-PBI-1	155	Bioinfiltration Basin	ME-6	0.59	186.00	0.44	$10,484	$225	$974
4	ME-8-PBI-3	177	Bioinfiltration Basin	ME-8	0.56	187.00	0.46	$10,484	$225	$1,024
5	ME-8-PBI-2	176	Bioinfiltration Basin	ME-8	0.55	174.00	0.42	$10,484	$225	$1,041
6	ME-2-PBI-3	120	Bioinfiltration Basin	ME-2	0.55	174.00	0.41	$10,484	$225	$1,044
7	ME-6-PBI-9	163	Bioinfiltration Basin	ME-6	0.55	180.00	0.48	$10,484	$225	$1,044
8	ME-8-PBI-1	175	Bioinfiltration Basin	ME-8	0.52	164.00	0.40	$10,484	$225	$1,101
9	ME-3-PBI-10	136	Bioinfiltration Basin	ME-3	0.52	160.00	0.39	$10,484	$225	$1,105
10	ME-9-PBI-6	187	Bioinfiltration Basin	ME-9	0.51	178.00	0.44	$10,484	$225	$1,126
11	ME-6-PBI-5	159	Bioinfiltration Basin	ME-6	0.44	178.00	0.51	$10,484	$225	$1,306
12	ME-6-PBI-7	161	Bioinfiltration Basin	ME-6	0.43	182.00	0.48	$10,484	$225	$1,336
13	ME-3-PBI-13	139	Bioinfiltration Basin	ME-3	0.41	127.00	0.32	$10,484	$225	$1,401
14	ME-9-PBI-5	186	Bioinfiltration Basin	ME-9	0.40	143.00	0.36	$10,484	$225	$1,436
15	ME-6-PBI-2	156	Bioinfiltration Basin	ME-6	0.40	123.00	0.30	$10,484	$225	$1,436
16	ME-6-PBI-3	157	Bioinfiltration Basin	ME-6	0.40	123.00	0.30	$10,484	$225	$1,436
17	ME-6-PBI-6	160	Bioinfiltration Basin	ME-6	0.40	141.00	0.37	$10,484	$225	$1,436
18	ME-7-PBI-1	170	Bioinfiltration Basin	ME-7	0.39	123.60	0.30	$10,484	$225	$1,469
19	ME-9-PBI-4	185	Bioinfiltration Basin	ME-9	0.39	144.00	0.34	$10,484	$225	$1,473
20	ME-5-PBI-1	151	Bioinfiltration Basin	ME-5	0.38	117.10	0.31	$10,484	$225	$1,504
21	ME-1-PBI-4	114	Bioinfiltration Basin	ME-1	0.52	162.00	0.49	$16,984	$225	$1,524
22	ME-2-PBI-5	122	Bioinfiltration Basin	ME-2	0.36	142.00	0.34	$10,484	$225	$1,596
23	ME-2-PBI-1	118	Bioinfiltration Basin	ME-2	0.35	109.00	0.25	$10,484	$225	$1,641
24	ME-3-PBI-7	133	Bioinfiltration Basin	ME-3	0.33	101.00	0.25	$10,484	$225	$1,741
25	ME-9-PBI-3	184	Bioinfiltration Basin	ME-9	0.32	98.00	0.24	$10,484	$225	$1,795
26	ME-6-PBI-8	162	Bioinfiltration Basin	ME-6	0.32	158.00	0.48	$10,484	$225	$1,795
27	ME-1-PBI-2	112	Bioinfiltration Basin	ME-1	0.29	90.00	0.26	$10,484	$225	$1,961
28	ME-3-PBI-4	130	Bioinfiltration Basin	ME-3	0.29	87.00	0.23	$10,484	$225	$1,981
29	ME-3-PBI-8	134	Bioinfiltration Basin	ME-3	0.29	88.00	0.23	$10,484	$225	$1,981
30	ME-3-PBI-9	135	Bioinfiltration Basin	ME-3	0.29	88.00	0.23	$10,484	$225	$1,981
31	ME-2-PBI-4	121	Bioinfiltration Basin	ME-2	0.28	93.00	0.28	$10,484	$225	$2,052
32	ME-6-PBI-4	158	Bioinfiltration Basin	ME-6	0.28	89.00	0.23	$10,484	$225	$2,052
33	ME-9-PBI-2	183	Bioinfiltration Basin	ME-9	0.28	87.00	0.22	$10,484	$225	$2,052
34	ME-9-PBI-1	182	Bioinfiltration Basin	ME-9	0.26	81.00	0.20	$10,484	$225	$2,209
35	ME-3-PBI-1	127	Bioinfiltration Basin	ME-3	0.35	107.00	0.28	$16,984	$225	$2,260

Table continued below.

Table 4: Cost-effectiveness of ME retrofits with respect to TP reduction (continued)

Project Rank	Project ID	Page Number	Retrofit Type	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost	Estimated Annual Operations & Maintenance	Estimated cost/ 1,000lb-TP/year (30-year)[1]
36	ME-2 Enhanced SC	33	Street Cleaning	ME-2	0.41	193	N/A	$943	$0	$2,301
37	ME-11-PUG-1	198	Underground Structure	ME-11	20.56	8,757	36.50	$1,415,060	$280	$2,308
38	ME-1-PBI-3	113	Bioinfiltration Basin	ME-1	0.24	74.00	0.20	$10,484	$225	$2,345
39	ME-3-PBI-14	140	Bioinfiltration Basin	ME-3	0.24	108.00	0.37	$10,484	$225	$2,394
40	ME-3-PBI-15	141	Bioinfiltration Basin	ME-3	0.24	109.00	0.37	$10,484	$225	$2,394
41	ME-3-PBI-11	137	Bioinfiltration Basin	ME-3	0.23	69.00	0.18	$10,484	$225	$2,498
42	ME-12-PBF-2	203	Biofiltration Basin	ME-12	0.64	224.00	0.12	$43,984	$295	$2,752
43	ME-3-PBI-17	143	Bioinfiltration Basin	ME-3	0.20	61.00	0.16	$10,484	$225	$2,872
44	ME-3-PBI-6	132	Bioinfiltration Basin	ME-3	0.20	62.00	0.16	$10,484	$225	$2,872
45	ME-12-PBF-5	206	Biofiltration Basin	ME-12	0.38	134.00	0.07	$23,984	$295	$2,880
46	ME-12-PBF-4	205	Biofiltration Basin	ME-12	0.37	133.00	0.07	$23,984	$295	$2,958
47	ME-3-PBI-16	142	Bioinfiltration Basin	ME-3	0.19	57.00	0.14	$10,484	$225	$3,024
48	ME-3-PBI-18	144	Bioinfiltration Basin	ME-3	0.19	58.00	0.14	$10,484	$225	$3,024
49	ME-3-PBI-3	129	Bioinfiltration Basin	ME-3	0.19	58.00	0.14	$10,484	$225	$3,024
50	ME-1-PBI-1	111	Bioinfiltration Basin	ME-1	0.19	56.00	0.15	$10,484	$225	$3,089
51	ME-10-PBF-1	192	Biofiltration Basin	ME-10	0.35	132.00	0.07	$23,984	$295	$3,127
52	ME-3-PBI-12	138	Bioinfiltration Basin	ME-3	0.18	53.00	0.14	$10,484	$225	$3,191
53	ME-12-PBF-1	202	Biofiltration Basin	ME-12	0.33	116.00	0.06	$23,984	$295	$3,317
54	ME-12-PBF-3	204	Biofiltration Basin	ME-12	0.31	113.00	0.06	$23,984	$295	$3,531
55	ME-2-PBI-2	119	Bioinfiltration Basin	ME-2	0.15	47.00	0.11	$10,484	$225	$3,830
56	ME-3 Enhanced SC	33	Street Cleaning	ME-3	0.43	193	N/A	$1,748	$0	$4,064
57	ME-3-PBI-5	131	Bioinfiltration Basin	ME-3	0.14	41.00	0.11	$10,484	$225	$4,103
58	ME-4 Enhanced SC	33	Street Cleaning	ME-4	0.008	4.2	N/A	$38	$0	$4,759
59	ME-12-PHD-1	207	Hydrodynamic Device	ME-12	1.12	386.00	N/A	$153,750	$210	$4,763
60	ME-2-PHD-1	123	Hydrodynamic Device	ME-2	0.98	512.00	N/A	$153,750	$210	$5,444
61	ME-6-PHD-1	165	Hydrodynamic Device	ME-6	0.39	162.00	N/A	$57,750	$210	$5,474
62	ME-7-PHD-1	171	Hydrodynamic Device	ME-7	0.39	155.20	N/A	$57,750	$210	$5,531
63	ME-6-PHD-2	166	Hydrodynamic Device	ME-6	0.86	380.00	N/A	$153,750	$210	$6,203
64	ME-9-PHD-1	188	Hydrodynamic Device	ME-9	0.83	384.00	N/A	$153,750	$210	$6,428
65	ME-10-PBF-2	193	Biofiltration Basin	ME-10	0.14	49.00	0.03	$23,984	$295	$7,818
66	ME-8-PHD-1	178	Hydrodynamic Device	ME-8	0.64	263.00	N/A	$153,750	$210	$8,284
67	ME-10-PHD-1	194	Hydrodynamic Device	ME-10	0.59	216.00	N/A	$153,750	$210	$9,042
68	ME-1 Enhanced SC	33	Street Cleaning	ME-1	0.031	15	N/A	$283	$0	$9,142
69	ME-5 Enhanced SC	33	Street Cleaning	ME-5	0.019	9.7	N/A	$175	$0	$9,222

[1][(Probable Project Cost) + 30*(Annual O&M)] / [30*(Annual TP Reduction)]; enhanced street cleaning is [Probable Project Cost] / [Annual TP Reduction]

Table 5: Cost-effectiveness of ME retrofits with respect to TSS reduction. Projects ranked 1 - 69 are shown on this table. TP and volume reductions are also shown. For more information on each project refer to either the Catchment Profile or BMP Descriptions pages in this report. Volume and pollutant reduction benefits cannot be summed with other projects that provide treatment for the same source area.

Project Rank	Project ID	Page Number	Retrofit Type	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost	Estimated Annual Operations & Maintenance	Estimated cost/ 1,000lb-TSS/year (30-year)[1]
1	ME-6-EBI-2 Retrofit	164	Bioinfiltration Basin Retrofit	ME-6	10.76	3796.00	11.32	$55,780	$444	$607
2	ME-3-PBI-2	128	Bioinfiltration Basin	ME-3	0.97	303.00	0.76	$16,984	$225	$2,611
3	ME-8-PBI-3	177	Bioinfiltration Basin	ME-8	0.56	187.00	0.46	$10,484	$225	$3,072
4	ME-6-PBI-1	155	Bioinfiltration Basin	ME-6	0.59	186.00	0.44	$10,484	$225	$3,089
5	ME-6-PBI-7	161	Bioinfiltration Basin	ME-6	0.43	182.00	0.48	$10,484	$225	$3,156
6	ME-6-PBI-9	163	Bioinfiltration Basin	ME-6	0.55	180.00	0.48	$10,484	$225	$3,191
7	ME-6-PBI-5	159	Bioinfiltration Basin	ME-6	0.44	178.00	0.51	$10,484	$225	$3,227
8	ME-9-PBI-6	187	Bioinfiltration Basin	ME-9	0.51	178.00	0.44	$10,484	$225	$3,227
9	ME-2-PBI-3	120	Bioinfiltration Basin	ME-2	0.55	174.00	0.41	$10,484	$225	$3,302
10	ME-8-PBI-2	176	Bioinfiltration Basin	ME-8	0.55	174.00	0.42	$10,484	$225	$3,302
11	ME-8-PBI-1	175	Bioinfiltration Basin	ME-8	0.52	164.00	0.40	$10,484	$225	$3,503
12	ME-3-PBI-10	136	Bioinfiltration Basin	ME-3	0.52	160.00	0.39	$10,484	$225	$3,590
13	ME-6-PBI-8	162	Bioinfiltration Basin	ME-6	0.32	158.00	0.48	$10,484	$225	$3,636
14	ME-9-PBI-4	185	Bioinfiltration Basin	ME-9	0.39	144.00	0.34	$10,484	$225	$3,989
15	ME-9-PBI-5	186	Bioinfiltration Basin	ME-9	0.40	143.00	0.36	$10,484	$225	$4,017
16	ME-2-PBI-5	122	Bioinfiltration Basin	ME-2	0.36	142.00	0.34	$10,484	$225	$4,046
17	ME-6-PBI-6	160	Bioinfiltration Basin	ME-6	0.40	141.00	0.37	$10,484	$225	$4,074
18	ME-3-PBI-13	139	Bioinfiltration Basin	ME-3	0.41	127.00	0.32	$10,484	$225	$4,523
19	ME-7-PBI-1	170	Bioinfiltration Basin	ME-7	0.39	123.60	0.30	$10,484	$225	$4,648
20	ME-6-PBI-2	156	Bioinfiltration Basin	ME-6	0.40	123.00	0.30	$10,484	$225	$4,670
21	ME-6-PBI-3	157	Bioinfiltration Basin	ME-6	0.40	123.00	0.30	$10,484	$225	$4,670
22	ME-1-PBI-4	114	Bioinfiltration Basin	ME-1	0.52	162.00	0.49	$16,984	$225	$4,884
23	ME-2 Enhanced SC	33	Street Cleaning	ME-2	0.41	193	N/A	$943	$0	$4,888
24	ME-5-PBI-1	151	Bioinfiltration Basin	ME-5	0.38	117.10	0.31	$10,484	$225	$4,906
25	ME-2-PBI-1	118	Bioinfiltration Basin	ME-2	0.35	109.00	0.25	$10,484	$225	$5,270
26	ME-3-PBI-15	141	Bioinfiltration Basin	ME-3	0.24	109.00	0.37	$10,484	$225	$5,270
27	ME-3-PBI-14	140	Bioinfiltration Basin	ME-3	0.24	108.00	0.37	$10,484	$225	$5,319
28	ME-11-PUG-1	198	Underground Structure	ME-11	20.56	8,757	36.50	$1,415,060	$280	$5,418
29	ME-3-PBI-7	133	Bioinfiltration Basin	ME-3	0.33	101.00	0.25	$10,484	$225	$5,688
30	ME-9-PBI-3	184	Bioinfiltration Basin	ME-9	0.32	98.00	0.24	$10,484	$225	$5,862
31	ME-2-PBI-4	121	Bioinfiltration Basin	ME-2	0.28	93.00	0.28	$10,484	$225	$6,177
32	ME-1-PBI-2	112	Bioinfiltration Basin	ME-1	0.29	90.00	0.26	$10,484	$225	$6,383
33	ME-6-PBI-4	158	Bioinfiltration Basin	ME-6	0.28	89.00	0.23	$10,484	$225	$6,455
34	ME-3-PBI-8	134	Bioinfiltration Basin	ME-3	0.29	88.00	0.23	$10,484	$225	$6,528
35	ME-3-PBI-9	135	Bioinfiltration Basin	ME-3	0.29	88.00	0.23	$10,484	$225	$6,528

Table continued below.

Table 5: Cost-effectiveness of ME retrofits with respect to TSS reduction (continued)

Project Rank	Project ID	Page Number	Retrofit Type	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost	Estimated Annual Operations & Maintenance	Estimated cost/ 1,000lb-TSS/year (30-year)[1]
36	ME-3-PBI-4	130	Bioinfiltration Basin	ME-3	0.29	87.00	0.23	$10,484	$225	$6,603
37	ME-9-PBI-2	183	Bioinfiltration Basin	ME-9	0.28	87.00	0.22	$10,484	$225	$6,603
38	ME-9-PBI-1	182	Bioinfiltration Basin	ME-9	0.26	81.00	0.20	$10,484	$225	$7,092
39	ME-3-PBI-1	127	Bioinfiltration Basin	ME-3	0.35	107.00	0.28	$16,984	$225	$7,394
40	ME-1-PBI-3	113	Bioinfiltration Basin	ME-1	0.24	74.00	0.20	$10,484	$225	$7,763
41	ME-12-PBF-2	203	Biofiltration Basin	ME-12	0.64	224.00	0.12	$43,984	$295	$7,862
42	ME-12-PBF-5	206	Biofiltration Basin	ME-12	0.38	134.00	0.07	$23,984	$295	$8,168
43	ME-12-PBF-4	205	Biofiltration Basin	ME-12	0.37	133.00	0.07	$23,984	$295	$8,229
44	ME-10-PBF-1	192	Biofiltration Basin	ME-10	0.35	132.00	0.07	$23,984	$295	$8,291
45	ME-3-PBI-11	137	Bioinfiltration Basin	ME-3	0.23	69.00	0.18	$10,484	$225	$8,326
46	ME-3 Enhanced SC	33	Street Cleaning	ME-3	0.43	193	N/A	$1,748	$0	$9,055
47	ME-4 Enhanced SC	33	Street Cleaning	ME-4	0.008	4.2	N/A	$38	$0	$9,064
48	ME-3-PBI-6	132	Bioinfiltration Basin	ME-3	0.20	62.00	0.16	$10,484	$225	$9,266
49	ME-3-PBI-17	143	Bioinfiltration Basin	ME-3	0.20	61.00	0.16	$10,484	$225	$9,417
50	ME-12-PBF-1	202	Biofiltration Basin	ME-12	0.33	116.00	0.06	$23,984	$295	$9,435
51	ME-12-PBF-3	204	Biofiltration Basin	ME-12	0.31	113.00	0.06	$23,984	$295	$9,686
52	ME-3-PBI-18	144	Bioinfiltration Basin	ME-3	0.19	58.00	0.14	$10,484	$225	$9,905
53	ME-3-PBI-3	129	Bioinfiltration Basin	ME-3	0.19	58.00	0.14	$10,484	$225	$9,905
54	ME-3-PBI-16	142	Bioinfiltration Basin	ME-3	0.19	57.00	0.14	$10,484	$225	$10,078
55	ME-1-PBI-1	111	Bioinfiltration Basin	ME-1	0.19	56.00	0.15	$10,484	$225	$10,258
56	ME-2-PHD-1	123	Hydrodynamic Device	ME-2	0.98	512.00	N/A	$153,750	$210	$10,420
57	ME-3-PBI-12	138	Bioinfiltration Basin	ME-3	0.18	53.00	0.14	$10,484	$225	$10,839
58	ME-2-PBI-2	119	Bioinfiltration Basin	ME-2	0.15	47.00	0.11	$10,484	$225	$12,223
59	ME-6-PHD-1	165	Hydrodynamic Device	ME-6	0.39	162.00	N/A	$57,750	$210	$13,179
60	ME-7-PHD-1	171	Hydrodynamic Device	ME-7	0.39	155.20	N/A	$57,750	$210	$13,756
61	ME-12-PHD-1	207	Hydrodynamic Device	ME-12	1.12	386.00	N/A	$153,750	$210	$13,821
62	ME-9-PHD-1	188	Hydrodynamic Device	ME-9	0.83	384.00	N/A	$153,750	$210	$13,893
63	ME-3-PBI-5	131	Bioinfiltration Basin	ME-3	0.14	41.00	0.11	$10,484	$225	$14,011
64	ME-6-PHD-2	166	Hydrodynamic Device	ME-6	0.86	380.00	N/A	$153,750	$210	$14,039
65	ME-5 Enhanced SC	33	Street Cleaning	ME-5	0.019	9.7	N/A	$175	$0	$18,065
66	ME-1 Enhanced SC	33	Street Cleaning	ME-1	0.031	15	N/A	$283	$0	$18,894
67	ME-8-PHD-1	178	Hydrodynamic Device	ME-8	0.64	263.00	N/A	$153,750	$210	$20,285
68	ME-10-PBF-2	193	Biofiltration Basin	ME-10	0.14	49.00	0.03	$23,984	$295	$22,336
69	ME-10-PHD-1	194	Hydrodynamic Device	ME-10	0.59	216.00	N/A	$153,750	$210	$24,699

[1][(Probable Project Cost) + 30*(Annual O&M)] / [30*(Annual TSS Reduction)]; enhanced street cleaning is [Probable Project Cost] / [Annual TSS Reduction]

Project Selection

The combination of projects selected for pursuit could strive to achieve TP and TSS reductions in the most cost-effective manner possible. Several other factors affecting project installation decisions could be weighed by resource managers when selecting projects to pursue. These factors include but are not limited to the following:

- Total project costs
- Cumulative treatment
- Availability of funding
- Economies of scale
- Landowner willingness
- Project combinations with treatment train effects
- Non-target pollutant reductions
- Timing coordination with other projects to achieve cost savings
- Stakeholder input
- Number of parcels (landowners) involved
- Project visibility
- Educational value
- Long-term impacts on property values and public infrastructure

BMP Descriptions

BMP types proposed throughout the target areas are detailed in this section. This was done to reduce duplicative reporting. For each BMP type, the method of modeling, assumptions made, and cost estimate considerations are described.

BMPs were proposed for a specific site within the research area. Each of these projects, including site location, size, and estimated cost and pollutant reduction potential are noted in detail in the Catchment Profiles section. Project types included in the following sections are:

- Bioretention
    - Curb-cut Rain Gardens
- Enhanced Street Sweeping
- Hydrodynamic Device

Bioretention

Bioretention BMPs utilize soil and vegetation to treat stormwater runoff from roads, driveways, rooftops, and other impervious surfaces. Differing levels of volume and/or pollutant reductions can be achieved depending on the type of bioretention selected.

Bioretention can function as either filtration (biofiltration) or infiltration (bioinfiltration). Biofiltration BMPs are designed with a buried perforated drain tile that allows water in the basin to discharge to the stormwater drainage system after having been filtered through the soil. Bioinfiltration BMPs have no underdrain, ensuring that all water that enters the basins will either infiltrate into the soil or be evapotranspired into the air. Bioinfiltration provides 100% retention and treatment of captured stormwater, whereas biofiltration basins provide excellent removal of particulate contaminants but limited removal of dissolved contaminants, such as DP.

Table 6 conveys the general efficacy of the two types of bioretention (biofiltration and bioinfiltration) in terms of the three most common pollutants, total suspended solids (TSS), particulate phosphorus (PP), dissolved phosphorus (DP), and stormwater volume.

Table 6: Matrix describing curb-cut rain garden efficacy for pollutant removal based on type.

Curb-cut Rain Garden Type	TSS Removal	PP Removal	DP Removal	Volume Reduction	Size of Area Treated	Site Selection and Design Notes
Bioinfiltration	High	High	High	High	High	Optimal sites are low enough in the landscape to capture most of the watershed but high enough to ensure adequate separation from the water table for treatment purposes. Higher soil infiltration rates allow for deeper basins and may eliminate the need for underdrains.
Biofiltration	High	Moderate	Low	Low	High	

The treatment efficacy of a particular bioretention project depends on many factors, including but not limited to the pollutant of concern, the quality of water entering the project, the intensity and duration of storm events, project size, position of the project in the landscape, existing downstream treatment, soil and vegetation characteristics, and project type (i.e. bioinfiltration or biofiltration). Optimally, new bioretention will capture water that would otherwise discharge into a priority waterbody untreated.

The volume and pollutant removal potential of each bioretention practice was estimated using WinSLAMM. In order to calculate cost-benefit, the cost of each project had to be estimated. To estimate the total cost of project installation, labor costs for project outreach and promotion, project design, project administration, and project maintenance over the anticipated life of the practice were considered in addition to actual construction costs. If multiple projects were installed, cost savings could be achieved on the administration and promotion costs (and possibly the construction costs for a large and competitive bid).

Curb-cut Rain Gardens (Biofiltration or Bioinfiltration)

Curb-cut rain gardens capture stormwater that is in roadside gutters and redirects it into shallow roadside basins. These curb-cut rain gardens can provide treatment for impervious surface runoff from one-to-many properties and can be located anywhere sufficient space is available. Because curb-cut rain gardens capture water that is already part of the stormwater drainage system, they are more likely to provide higher benefits. Generally, curb-cut rain gardens were proposed in areas without sufficient existing stormwater treatment and located immediately upgradient of a catch basin serving a large drainage area.

Figure 8: Rain garden before/after and during a rainfall event

All curb-cut rain gardens were presumed to have pretreatment, mulch, and perennial ornamental and native plants. The useful life of the project was assumed to be 30 years and so all costs are amortized over that time period. Additional costs were included for rehabilitation of the gardens at years 10 and 20. Rehabilitation includes removal of accumulated sediment and supplemental planting. Annual maintenance was assumed to be completed by the landowner of the property at which the rain garden could be installed.

Enhanced Street Sweeping

Street sweeping is a cost-effective way to reduce nutrient and sediment loads entering lakes, streams and wetlands from storm sewers. Sweeping is typically completed in the spring to remove accumulated sediment from winter road treatment, and again in the fall to reduce leaf litter. However, trees adjacent to roadways can be a significant contributor of nutrient loading throughout the year as they drop seeds, pollen, leaves, and other organic debris. Similarly, large gaps in traditional fall and spring sweeping schedules give these materials time to re-accumulate and flush into storm drains before they can be removed.

Figure 9: Roadway buffers, derived from MNDOT right-of-way widths, within which tree canopy cover was calculated.

Enhanced street sweeping is the incorporation of additional sweeping protocols, the timing and location of which are targeted to maximize water quality protection. One way to prioritize locations for enhanced sweeping is to quantify tree canopy cover overhanging and immediately adjacent to roadways; this is because tree canopy cover is highly correlated with the amount of recoverable organic materials on roadways (Kalinosky, 2015) and average total phosphorus concentrations in stormwater runoff (Janke et al. 2017). Tree canopy data can then be combined with stormwater infrastructure information to identify roadways likely contributing most to nutrient inputs derived from fallen tree materials.

Tree canopy cover within the study areas was analyzed following methodology in the *Tree Canopy Assessment Protocol for Enhanced Street Sweeping Prioritization*, produced by Emmons and Oliver Resources Inc. (EOR) for the Lower St. Croix Watershed Partnership (LSCWP).

First, centerline data was compiled for all paved roadways within or immediately adjacent to the targeted subwatershed boundaries. Next, each roadway was assigned a right-of-way width corresponding with its MNDOT functional classification. Right-of-way values were then referenced to generate a buffer around each roadway, and deciduous tree canopy abundance within these buffers (total % coverage) was quantified by intersecting them with the *Twin Cities Metro Area (TCMA) Urban Tree Canopy Classification* dataset; see Figure 9 for an example. Altogether, these processes allowed for canopy cover comparisons within the study areas, and correspondingly the prioritization of roadways most likely to contribute nutrient-rich stormwater derived from tree materials.

The streets are currently swept twice per year in Anoka, and five times per year in Coon Rapids. Enhanced sweeping schedules were modeled for each catchment in Anoka, and page 33 summarizes the modeling results. Maps are provided of road tree canopy cover percentage in the Catchment Profiles.

Hydrodynamic Devices

In heavily urbanized settings, stormwater is immediately intercepted with roadway catch basins and conveyed rapidly via storm sewer pipes to its destination. Once stormwater is intercepted by catch basins, it can be very difficult to supply treatment without large end-of-pipe projects such as regional ponds. One option is a hydrodynamic device (Figure 10). Hydrodynamic devices are installed in line with the existing storm sewer network and can provide treatment for up to 10-15 acres of upland drainage area. This practice applies some form of filtration, settling, or hydrodynamic separation to remove coarse sediment, litter, oil, and grease. These devices are particularly useful in small but highly urbanized drainage areas and can be used as pretreatment for other downstream stormwater BMPs.

Each device's pollutant removal potential was estimated using WinSLAMM. Devices were sized based on upstream drainage area to ensure peak flow does not exceed each device's design guidelines. For this analysis, Downstream Defender devices were modeled based on available information and to maintain continuity across other SRAs. Devices were proposed along particular storm sewer lines and often just upstream of intersections with another, larger line. Model results assume the device is receiving input from all nearby catch basins noted.

In order to calculate cost-effectiveness, the cost of each project had to be estimated. Cost estimation included labor costs for project outreach, promotion, design, administration, and maintenance over the anticipated life of the practice in addition to actual material and construction costs. Load reduction estimates for these projects are noted in the Catchment Profiles section.

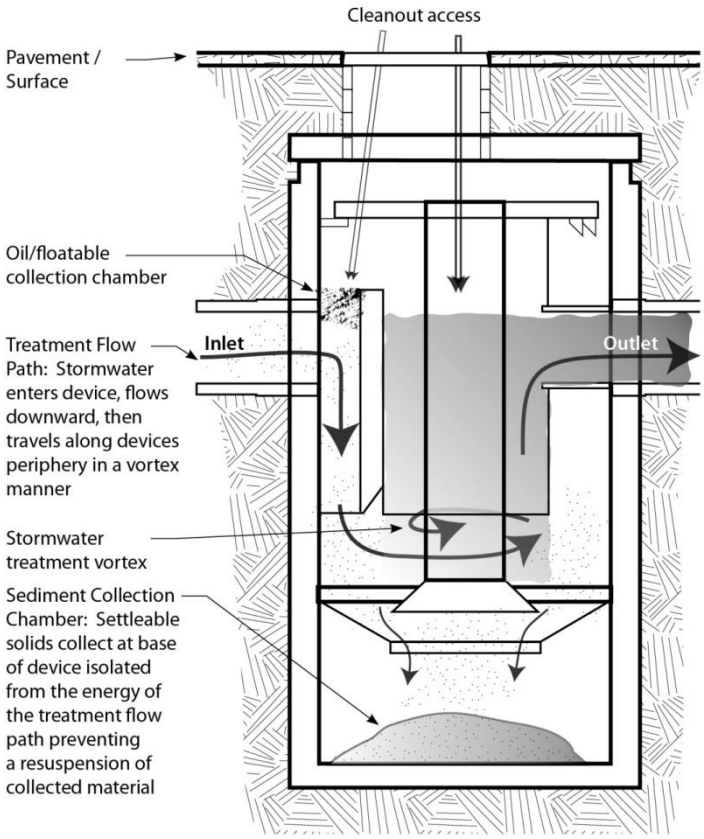


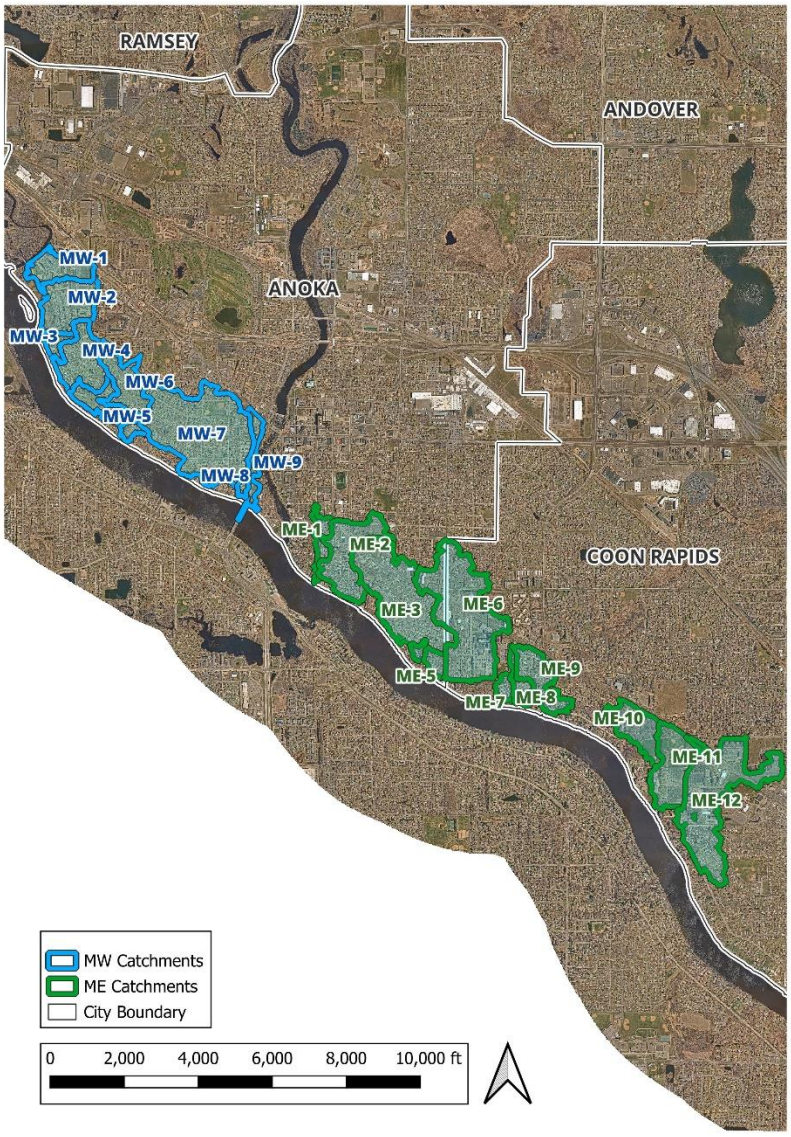
Figure 10: Schematic of a typical hydrodynamic device

Mississippi River Subwatershed

Catchment Profiles

Catchment ID	Page
Mississippi West (MW)	
MW-1	35
MW-2	38
MW-3	42
MW-4	46
MW-5	59
MW-6	70
MW-7	78
MW-8	100
MW-9	105
Mississippi East (ME)	
ME-1	108
ME-2	115
ME-3	124
ME-4	145
ME-5	148
ME-6	152
ME-7	167
ME-8	172
ME-9	179
ME-10	189
ME-11	195
ME-12	199

Existing Conditions Summary	
Acres	803.2
Dominant Land Cover	Residential
Volume (ac-ft/yr)	397
TP (lb/yr)	404
TSS (lb/yr)	128,672



SUBWATERSHED SUMMARY

The 803-acre Mississippi River study area was divided into twenty-one catchments over two distinct areas west and east of the confluence with the Rum River. Nine catchments were identified upstream (west) of the Rum River (MW catchments), and 12 catchments were identified downstream (east) of the Rum River (ME catchments). Catchment profiles on the following pages provide additional information, including details on existing and proposed stormwater treatment.

EXISTING STORMWATER TREATMENT

There is a considerable amount of existing stormwater treatment throughout the study area. There are multiple stormwater ponds, hydrodynamic devices, and natural bioinfiltration areas. The City of Anoka conducts street cleaning twice per year, and the City of Coon Rapids also conducts street cleaning five times per year. Table 7 provides a summary of catchment volume, TSS, and TP loading under base and existing conditions. Reductions associated with exiting BMPs are also included. Additional detail is provided in the Catchment Profiles.

Table 7: Catchment volume, TSS, and TP loading under base and existing conditions. Reductions associated with existing BMPs are also shown.

			BASE CONDITION			EXISTING CONDITION			REDUCTIONS DUE TO EXISTING BMPs		
Catchment	Acres	Dominant Land Cover	Volume (ac-ft/yr)	TSS (lb/yr)	TP (lb/yr)	Volume (ac-ft/yr)	TSS (lb/yr)	TP (lb/yr)	Volume (ac-ft/yr)	TSS (lb/yr)	TP (lb/yr)
MW-1	27.24	Residential	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-2	42.05	Residential	33.0	11635	32.7	33.0	5444	19.1	0.0	6191	13.6
MW-3	8.51	Residential	4.1	1675	5.6	1.6	554	2.1	2.5	1121	3.4
MW-4	38.57	Residential	17.0	7264	21.8	17.0	6515	20.1	0.0	749	1.7
MW-5	22.31	Residential	8.4	3656	11.7	8.4	3264	10.8	0.0	392	0.9
MW-6	38.48	Residential	14.7	6405	20.5	14.7	4932	17.0	0.0	1473	3.5
MW-7	130.96	Residential	60.0	24633	75.3	54.5	18499	60.0	5.5	6134	15.3
MW-8	3.1	Residential	1.5	600	1.9	1.5	538	1.7	0.0	63	0.1
MW-9	13.66	Freeway	15.0	5469	13.9	15.0	2167	7.3	0.0	3302	6.6
ME-1	12.37	Residential	5.2	2209	7.0	5.2	1665	5.7	0.0	544	1.3
ME-2	49.34	Residential	26.7	10709	29.8	25.8	9447	26.9	0.9	1262	2.9
ME-3	95.26	Residential	56.6	21982	60.8	44.8	14591	43.8	11.8	7391	17.0
ME-4	3.57	Residential	1.4	623	2.0	1.4	466	1.6	0.0	158	0.4
ME-5	7.55	Residential	3.0	1317	4.2	3.0	1001	3.4	0.0	316	0.8
ME-6	111.62	Residential	92.8	32038	83.1	81.5	25497	67.9	11.3	6541	15.2
ME-7	6.63	Residential	2.5	1107	3.5	2.5	970	3.2	0.0	137	0.3
ME-8	10.95	Residential	4.6	1962	6.1	4.6	1722	5.6	0.0	240	0.5
ME-9	30.56	Residential	16.2	6493	18.6	16.2	5807	17.1	0.0	686	1.5
ME-10	29.97	Park	8.0	3929	16.7	8.0	3664	16.1	0.0	265	0.6
ME-11	44.06	Institutional	36.6	14961	44.9	36.6	13934	43.2	0.0	1027	1.7
ME-12	35.44	Residential	21.6	8842	33.0	21.6	7996	31.1	0.0	846	2.0

RETROFITS CONSIDERED

STORMWATER PONDS

New ponds and retrofits to existing stormwater ponds were considered. In particular, there are stormwater ponds that are currently undersized to its contributing drainage area. An extensive field inventory of current pond condition was not completed, nor was any water quality monitoring conducted.

Because most of the pollutant reductions from existing BMPs throughout the subwatershed are due to stormwater ponds, continued pond condition inventories will be valuable. Maintenance needs could be identified in the future to ensure all ponds are functioning as originally designed, which is how the ponds were modeled in this analysis. Furthermore, water quality monitoring could identify any hot spots

that may warrant the consideration of pond retrofits (e.g. increasing storage volume through either increasing ponding depth or pond footprint or installation of either passive or pump-controlled iron-enhanced sand filters).

ENHANCED STREET SWEEPING

Enhanced street sweeping was also considered throughout the subwatershed. Methodology for the analysis is detailed in the 'Enhanced Street Sweeping' profile in the 'BMP Descriptions' section of this report. Road tree canopy cover maps are also included in each of the Catchment Profiles. However, increasing street sweeping frequency in the WinSLAMM models resulted in marginal additional reductions of TP and TSS.

The largest catchment modeled in WinSLAMM, MW-7 (131 acres with many roads and primarily residential land use), can be used as an example. Street cleaning frequency was increased to once every eight weeks (i.e. five times per year) in the WinSLAMM model, which resulted in the additional removal of 285 lbs-TSS/yr and 0.62 lbs-TP/yr. Considering the increased frequency results in four additional sweepings per year, the additional pollutant reductions are not very cost-effective (i.e. 71 lbs-TSS/yr and 0.15 lbs-TP/yr per additional sweeping event) compared to other alternatives.

Table 8 provides a summary of the additional annual reductions captured by increasing the street cleaning frequency from twice a year to five times a year, as well as the cost effectiveness. These values are conservative estimates based entirely on the WinSLAMM models, which do not account for tree canopy cover.

Table 8: Additional annual reductions with enhanced street cleaning (5x per year) via WinSLAMM. Note ME-5 – ME-12 are in Coon Rapids where street cleaning already occurs 5x per year.

Catchment ID	TSS (lb/yr)	TP (lb/yr)	Cost/1000lb-TSS*	Cost/lb-TP*
MW-1	N/A	N/A	N/A	N/A
MW-2	7	0.02	$90,390	$31,636
MW-3	9.7	0.022	$7,990	$3,523
MW-4	172	0.38	$4,034	$1,826
MW-5	93	0.21	$4,945	$2,190
MW-6	52	0.11	$14,318	$6,769
MW-7	285	0.62	$8,482	$3,899
MW-8	15.1	0.035	$3,575	$1,542
MW-9	1	0.001	$362,955	$362,955
ME-1	15	0.031	$18,894	$9,142
ME-2	193	0.41	$4,888	$2,301
ME-3	193	0.43	$9,055	$4,064
ME-4	4.2	0.008	$9,064	$4,759
ME-5	9.7	0.019	$18,065	$9,222
ME-6	N/A	N/A	N/A	N/A
ME-7	N/A	N/A	N/A	N/A
ME-8	N/A	N/A	N/A	N/A
ME-9	N/A	N/A	N/A	N/A
ME-10	N/A	N/A	N/A	N/A
ME-11	N/A	N/A	N/A	N/A
ME-12	N/A	N/A	N/A	N/A

*Based on $100/curb mile at an additional three sweepings per year.

The weighted average of tree canopy cover for each catchment is summarized in Table 9. Based on the distribution of values, it is recommended that catchments with an average tree canopy cover percentage greater than 40% are prioritized for enhanced street cleaning, preferably if the catchment does not have any existing stormwater treatment beyond street cleaning.

Table 9: Catchment curb-miles and average tree canopy cover percentage

Catchment ID	Curb-miles	Weighted Average % Canopy Cover
MW-1	0.5	27.4
MW-2	2.1	29.3
MW-3	0.3	32.7
MW-4	2.3	40.2
MW-5	1.5	41.6
MW-6	2.5	45.0
MW-7	8.1	43.4
MW-8	0.2	35.6
MW-9	1.2	23.8
ME-1	0.9	43.9
ME-2	3.1	38.7
ME-3	5.8	41.0
ME-4	0.1	51.2
ME-5	0.6	64.6
ME-6	5.5	45.4
ME-7	0.3	28.1
ME-8	0.8	54.8
ME-9	1.7	46.9
ME-10	0.5	45.4
ME-11	0.5	19.7
ME-12	3.9	45.2

Because the values calculated in WinSLAMM are conservative, an additional estimate for enhanced street cleaning has been included in Appendix E – Enhanced Street Cleaning Calculator. Pollutant load recovery, cost, and cost effectiveness estimates have been included using the "Street Sweeping Planning Calculator: Estimating Nutrient and Solids Load Recovery through Street Sweeping" Excel spreadsheet program (Kalinosky et al., 2014).

Catchment MW-1

Existing Catchment Summary	
Acres	27.24
Parcels	16
Land Cover	55.2% Residential 21.5% Shop 12.7% Institutional 6.3% Park 4.3% Open

CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River, near King's Island. Stormwater runoff is collected into multiple catch basins that route into an existing stormwater pond prior to discharging into the Mississippi River. Land use is a mix of commercial property, park land, institutional, and multi-family housing complexes.

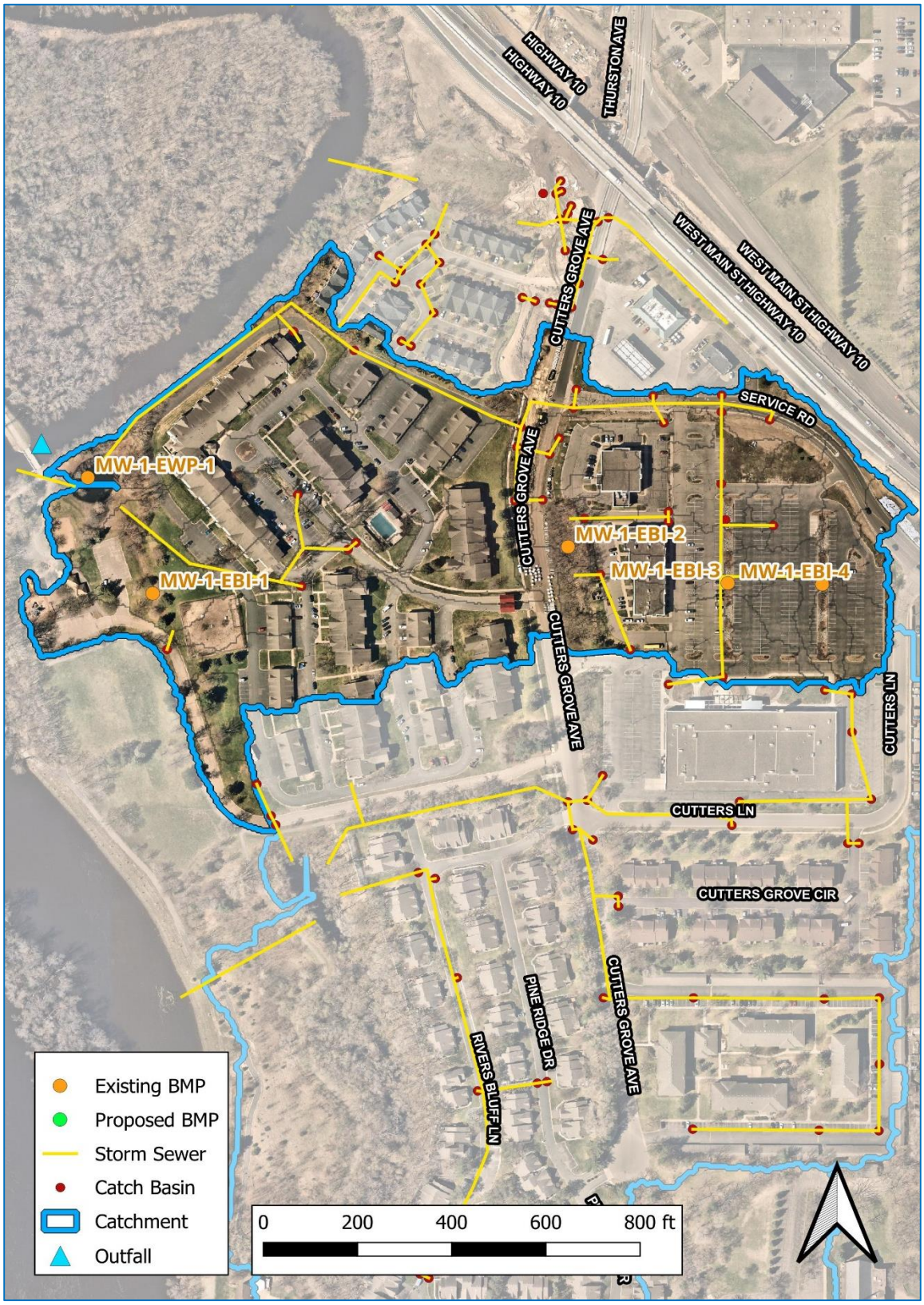
EXISTING STORMWATER TREATMENT

This catchment contains a stormwater pond at the outfall and several bioinfiltration / infiltration features amongst the commercial properties. Street cleaning is also conducted once in early spring and once in mid-summer by the City of Anoka.

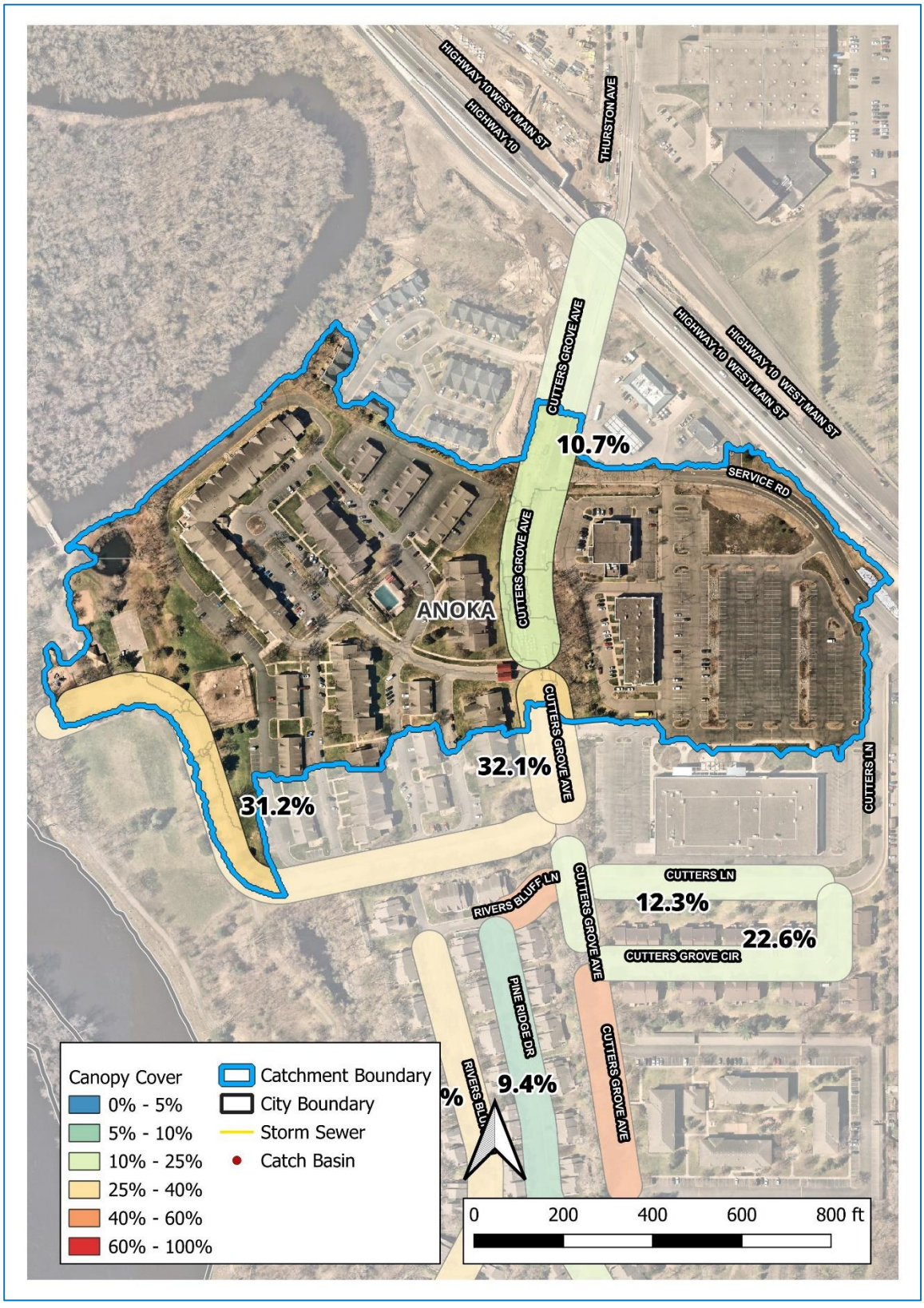
RETROFIT OPPORTUNITIES OVERVIEW

Due to existing treatment and limited space for new projects, no candidate BMPs were identified in this catchment. As such, this catchment and the existing treatment practices were not modeled in WinSLAMM. Enhanced street cleaning was considered for this catchment, however, it was not modeled in WinSLAMM due to the prevalence of existing stormwater treatment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

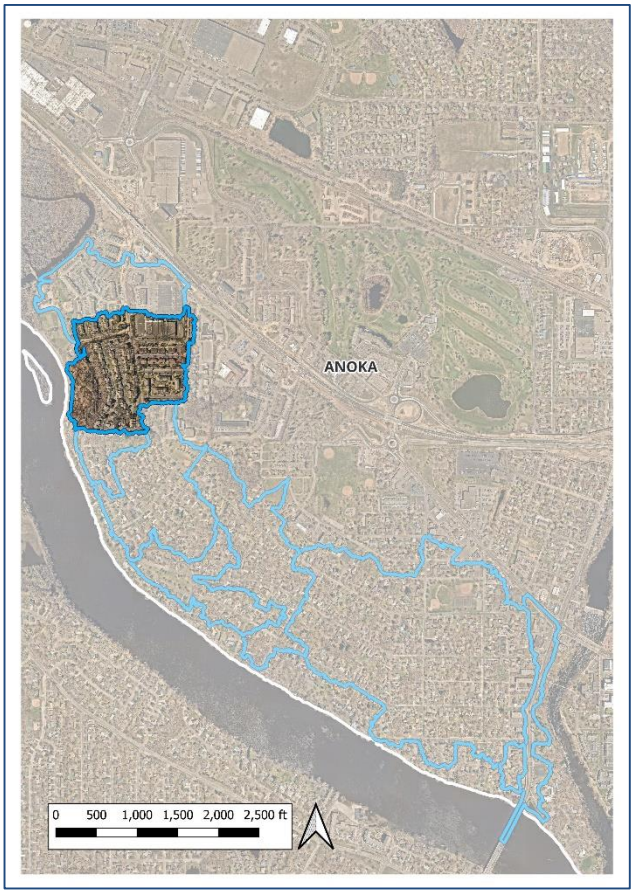


ROAD TREE CANOPY COVER



Catchment MW-2

Existing Catchment Summary	
Acres	42.05
Parcels	143
Land Cover	76.0% Residential 12.9% Institutional 10.7% Park 0.3% Shop



CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River. Stormwater runoff is collected into multiple catch basins that route into an existing stormwater pond prior to discharging into the Mississippi River. Land use is primarily residential with commercial and institutional properties along the northern side.

EXISTING STORMWATER TREATMENT

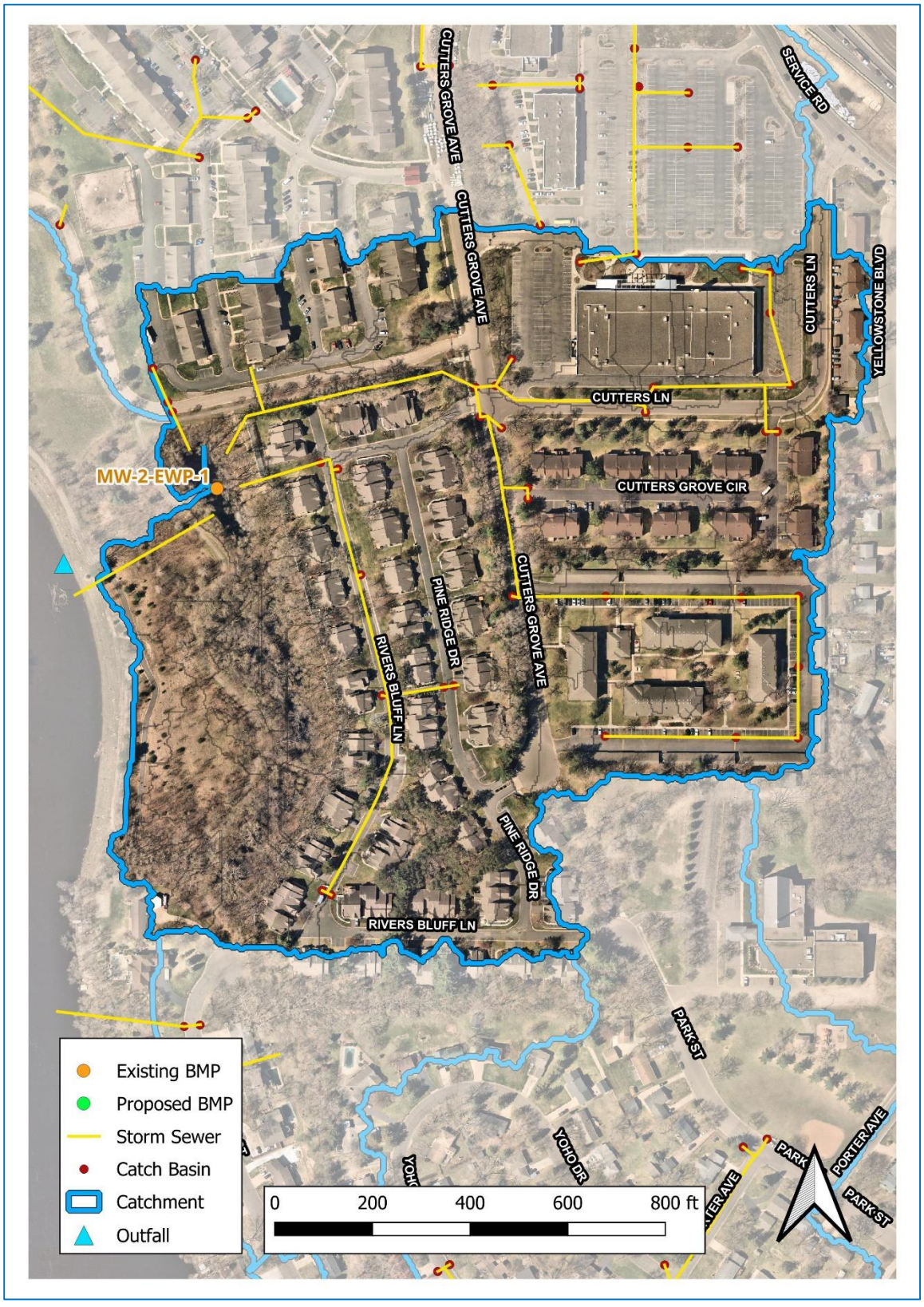
This catchment contains a stormwater pond at the outfall. Street cleaning is also conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	2			
	BMP Types	Street Cleaning, Wet Pond (EWP-1)			
	TP (lb/yr)	32.68	13.59	42%	**19.09**
	TSS (lb/yr)	11,635	6,191	53%	**5,444**
	Volume (acre-feet/yr)	33.0	0.0	0%	**33.0**

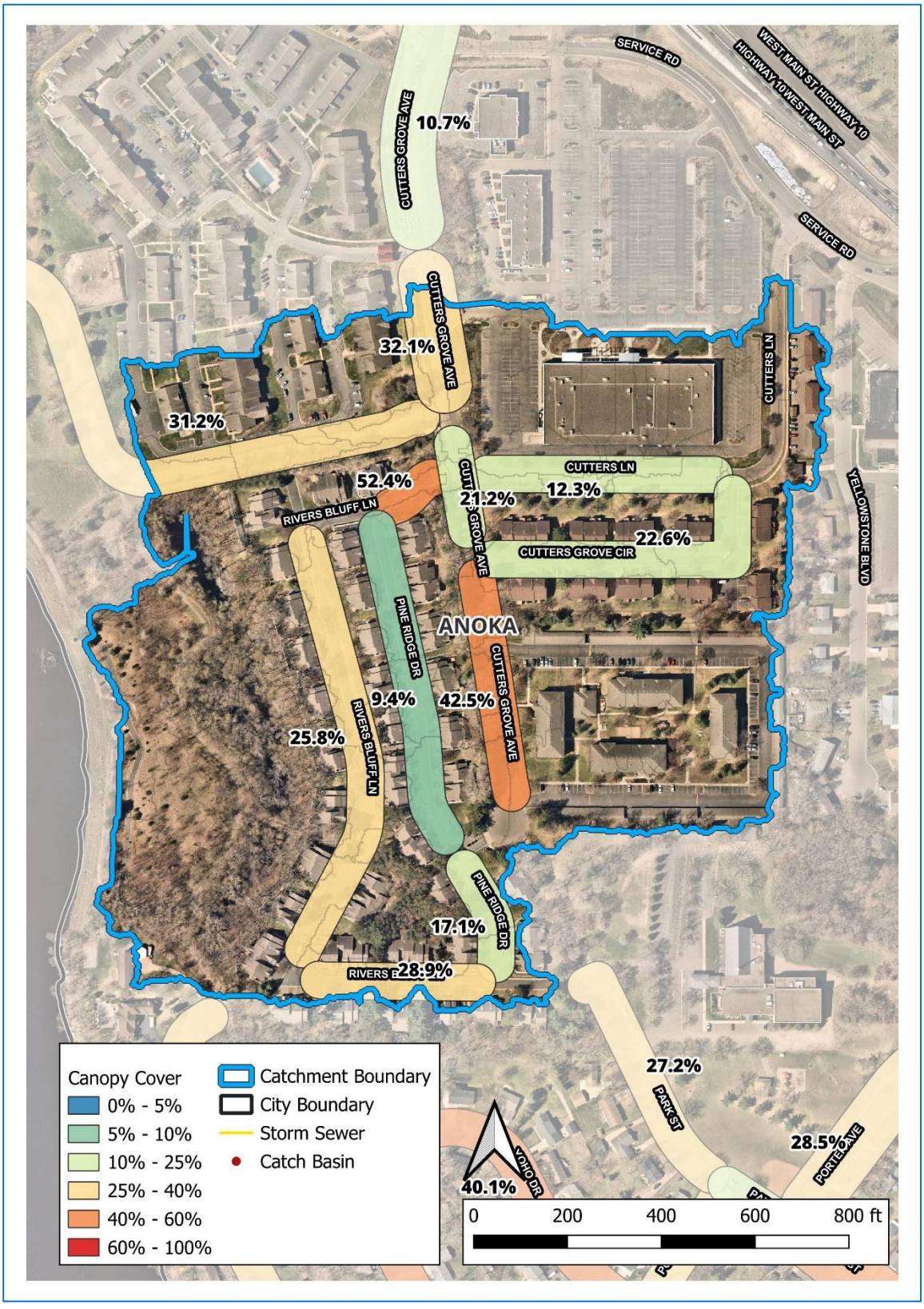
RETROFIT OPPORTUNITIES OVERVIEW

A stormwater pond modification project is proposed within this catchment. Due to existing and limited space for new projects, no other candidate BMPs were identified in this catchment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

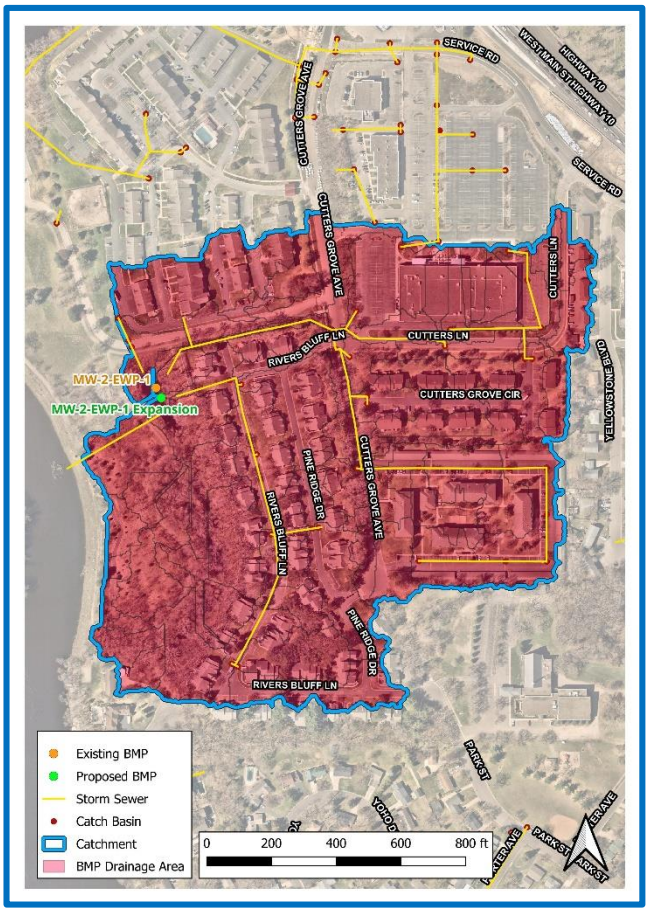


ROAD TREE CANOPY COVER



Project ID: MW-2-EWP-1 Expansion

Weston Woods
Wet Pond



Drainage Area – 42.05 acres

Location – PIN: 023125130032

Property Ownership – Private / City of Anoka

Site Specific Information – An opportunity to expand the existing wet pond exists at this location. Currently, the existing pond is undersized for its contributing drainage area of approximately 42 acres. Expanding the pond to nearly twice its current size will provide sufficient permanent pool volume below the outlet pipe. The existing pond is primarily located on private property, but an expansion to the west will also include land owned by the City of Anoka. The table below provides pollutant removals and estimated costs.

	Existing Pond Expansion		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	1.10	acres
	TP (lb/yr)	2.30	12.0%
	TSS (lb/yr)	1,037	19.0%
	Volume (acre-feet/yr)	0.00	0.0%
Cost	**Administration & Promotion Costs***		$8,300
	Design & Construction Costs**		$293,952
	Total Estimated Project Cost (2023)		**$302,252**
	Annual O&M***		$1,100
Efficiency	**30-yr Average Cost/lb-TP**	**$4,859**	
	30-yr Average Cost/1,000lb-TSS	**$10,776**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

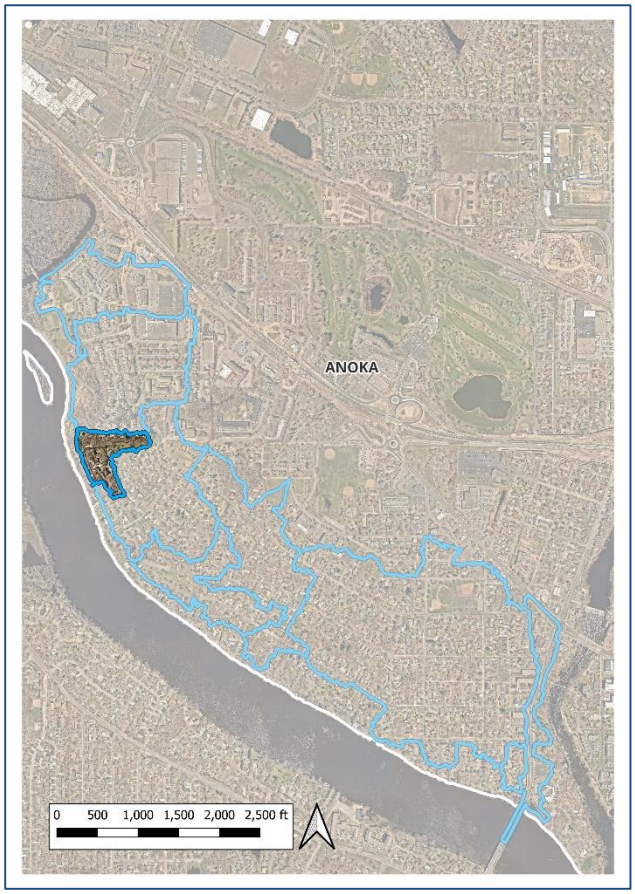
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: See Appendix B for detailed cost information

***$1,000/acre - Annual inspection and sediment/debris removal from pretreatment area

Catchment MW-3

Existing Catchment Summary	
Acres	8.51
Parcels	46
Land Cover	99.4% Residential 0.6% Park



CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River. Stormwater runoff on the western and northern portions of Benton St. are collected into one of two catch basins that directly discharge into the Mississippi River. There is also an existing bioinfiltration area near the cul-de-sac of Benton St. that treats water from the majority of this catchment. Land use is primarily single family residential houses.

EXISTING STORMWATER TREATMENT

This catchment contains a seemingly natural and very low-lying wooded bioinfiltration area that treats stormwater for a significant portion of the catchment. Field inspection notes indicate that there is no outlet structure, and no standing water was observed during wet spring conditions. In addition, street cleaning is conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

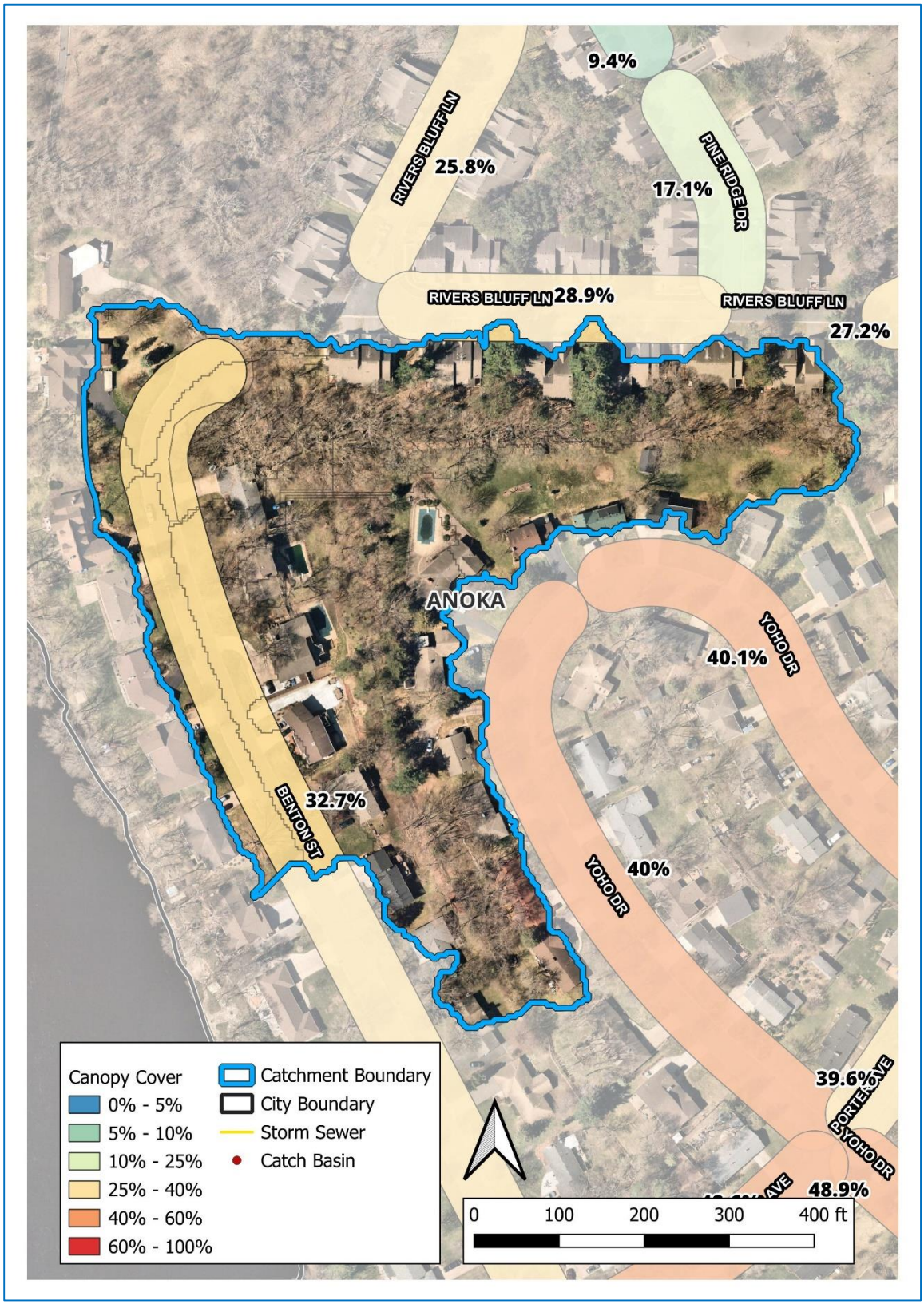
	Existing Conditions	**Base Loading**	**Treatment**	**Net Treatment %**	**Existing Loading**
Treatment	**Number of BMPs**	2			
	BMP Types	Street Cleaning, Infiltration Basin (EBI-1)			
	TP (lb/yr)	5.58	3.44	62%	**2.14**
	TSS (lb/yr)	1,675	1,121	67%	**554**
	Volume (acre-feet/yr)	4.1	2.51	61%	**1.6**

RETROFIT OPPORTUNITIES OVERVIEW

One bioinfiltration basin is proposed within this catchment.

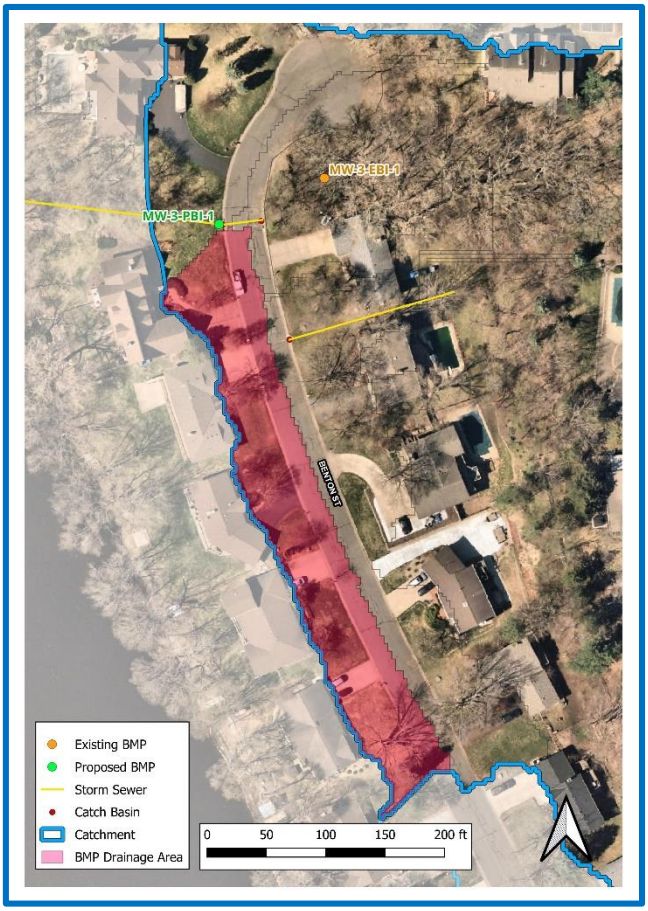
EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

ROAD TREE CANOPY COVER



Project ID: MW-3-PBI-1

Benton St.
Bioinfiltration Basin



Drainage Area – 0.65 acres

Location – City of Anoka Outlot

Property Ownership – City of Anoka

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is on the City of Anoka outlot near the catch basin that discharges stormwater directly into the Mississippi River. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected on Benton St. from the south. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.26	12.0%
	TSS (lb/yr)	72	13.0%
	Volume (acre-feet/yr)	0.17	10.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,235**	
	30-yr Average Cost/1,000lb-TSS	**$7,968**	
	30-yr Average Cost/ac-ft Vol.	**$3,448**	

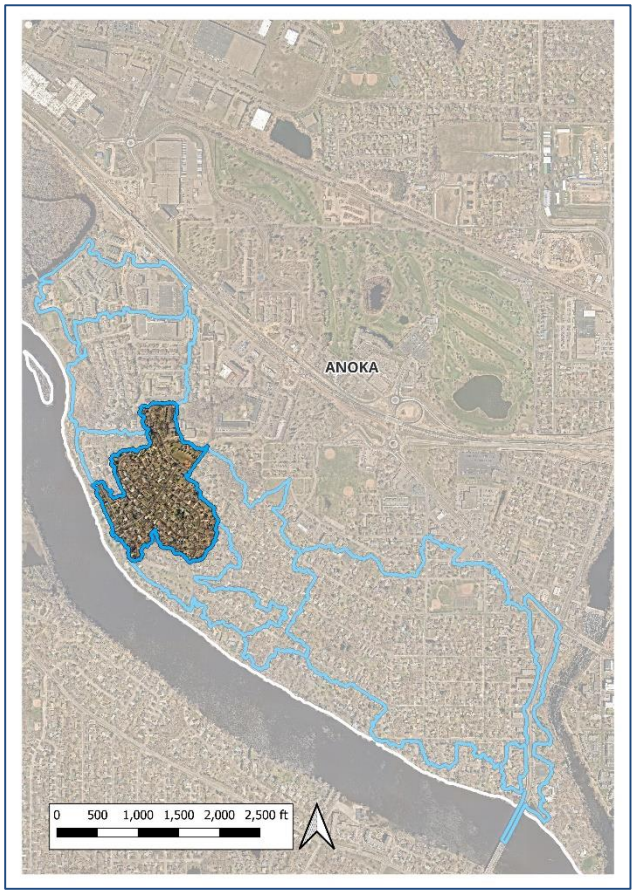
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Catchment MW-4

Existing Catchment Summary	
Acres	38.57
Parcels	123
Land Cover	85.0% Residential 8.3% Open 6.7% Park



CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River. Stormwater runoff is collected through multiple catch basins that discharge directly into the Mississippi River. Land use is primarily single family residential houses with open spaces on the northern side.

EXISTING STORMWATER TREATMENT

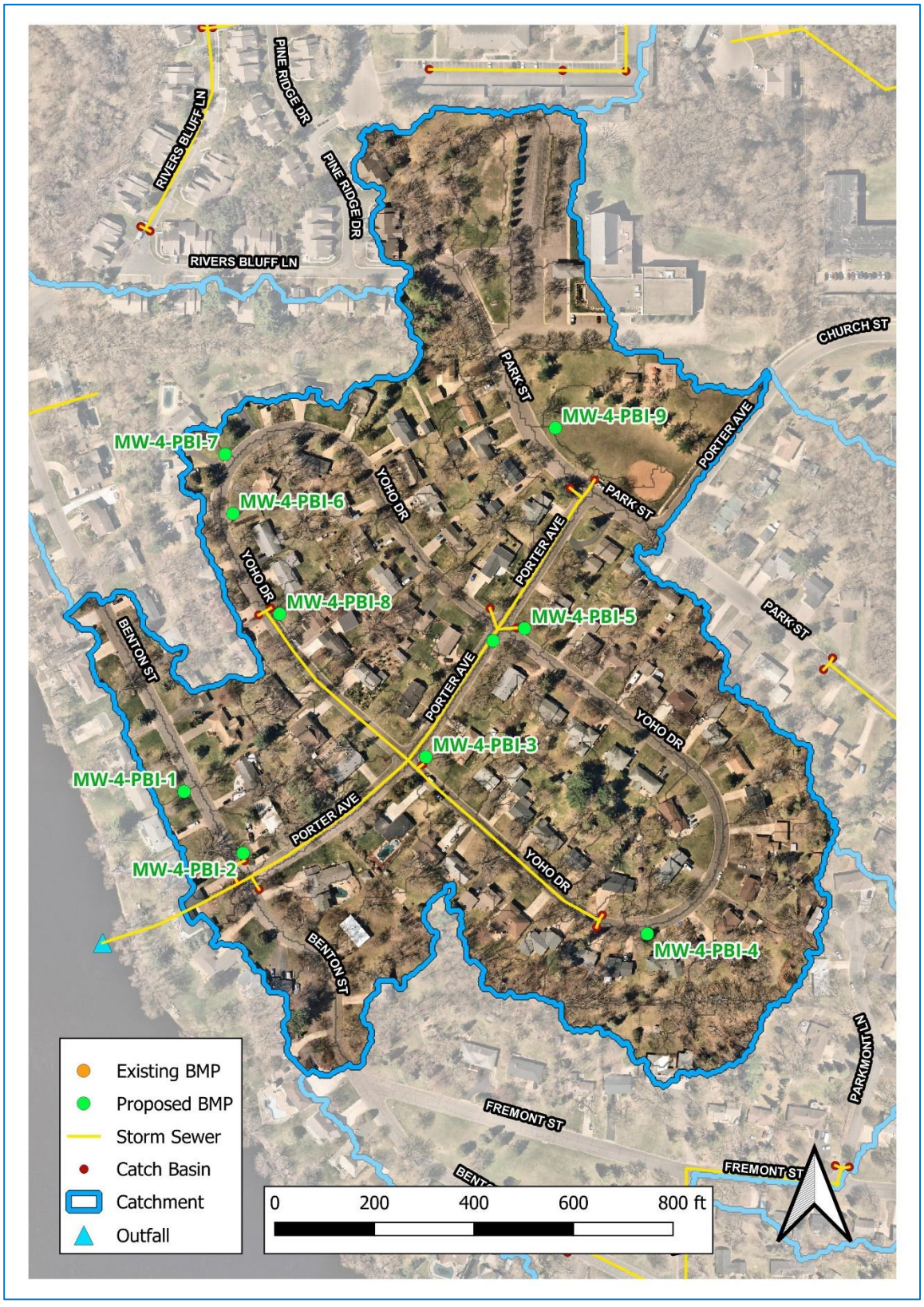
Street cleaning is conducted once in early spring and once in mid-summer by the City of Anoka. No other existing treatment was identified in this catchment. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	21.78	1.65	8%	**20.13**
	TSS (lb/yr)	7,264	749	10%	**6,515**
	Volume (acre-feet/yr)	17.0	0.00	0%	**17.0**

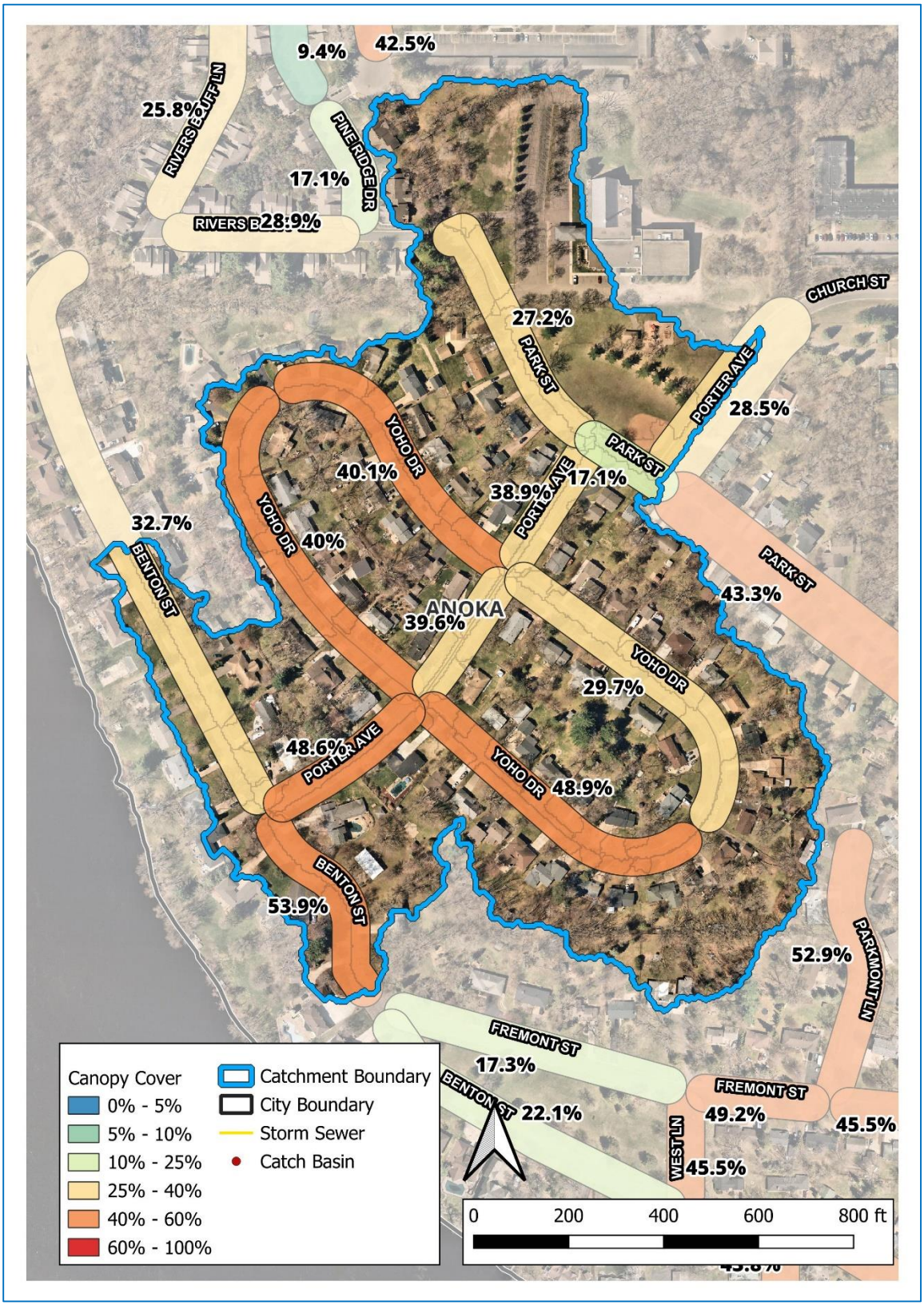
RETROFITS CONSIDERED

Several BMPs are proposed within this catchment. They include multiple bioinfiltration basins and one hydrodynamic separator.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER



Project ID: MW-4-PBI-1

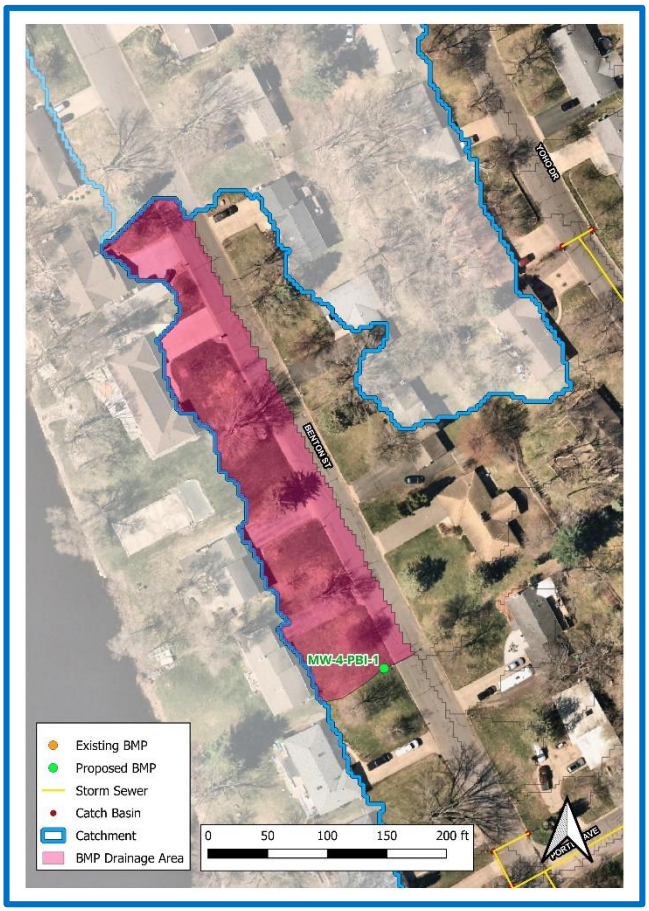
Benton St.
Bioinfiltration Basin

Drainage Area – 0.73 acres

Location – 1220 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected on Benton St. from the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.32	1.6%
	TSS (lb/yr)	96	1.5%
	Volume (acre-feet/yr)	0.23	1.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,795**	
	30-yr Average Cost/1,000lb-TSS	**$5,984**	
	30-yr Average Cost/ac-ft Vol.	**$2,503**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PBI-2

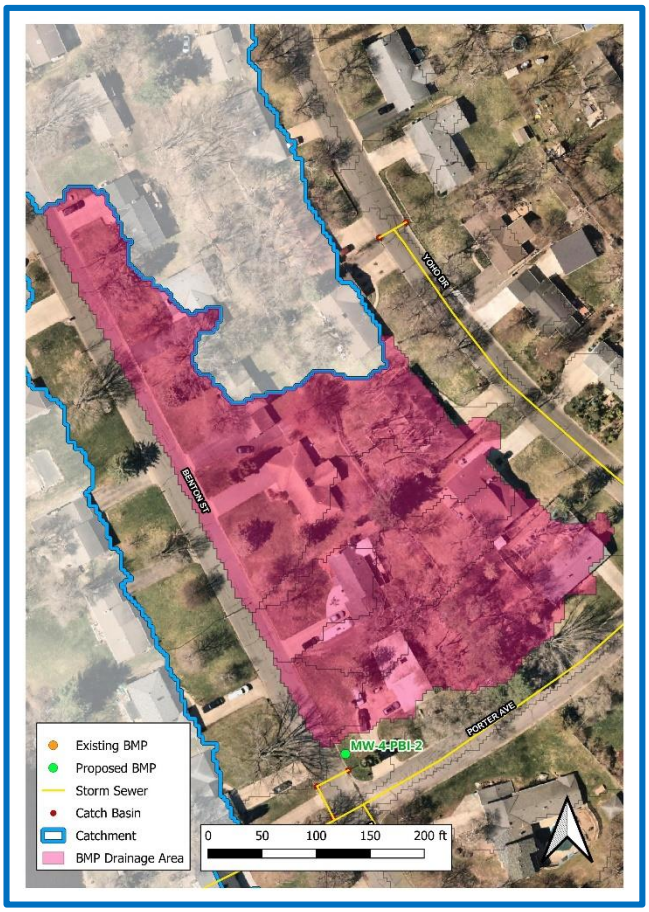
Benton St.
Bioinfiltration Basin

Drainage Area – 2.37 acres

Location – 1205 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected on Benton St. from the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250 sq-ft	
	TP (lb/yr)	0.52	2.6%
	TSS (lb/yr)	165	2.5%
	Volume (acre-feet/yr)	0.39	2.3%
Cost	Administration & Promotion Costs*	$664	
	Design & Construction Costs**	$9,820	
	Total Estimated Project Cost (2023)	**$10,484**	
	Annual O&M***	$225	
Efficiency	30-yr Average Cost/lb-TP	**$1,105**	
	30-yr Average Cost/1,000lb-TSS	**$3,482**	
	30-yr Average Cost/ac-ft Vol.	**$1,473**	

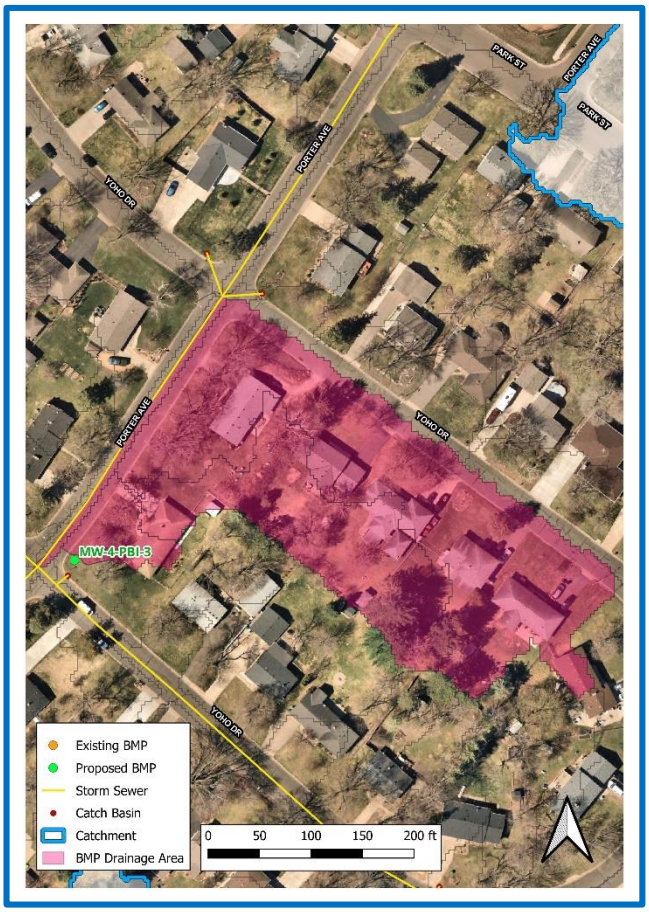
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PBI-3

Porter Ave.
Bioinfiltration Basin



Drainage Area – 2.11 acres

Location – 1904 Porter Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected on the northern portion of Yoho Dr. and the small section of Porter Ave. While the proposed BMP was modeled as a single inlet, there is potential to upgrade to a large, double inlet that would also treat the southern portion of Yoho Dr. The table below provides pollutant removals and estimated costs.

	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.50	2.5%
	TSS (lb/yr)	159	2.4%
	Volume (acre-feet/yr)	0.38	2.2%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,149**	
	30-yr Average Cost/1,000lb-TSS	**$3,613**	
	30-yr Average Cost/ac-ft Vol.	**$1,531**	

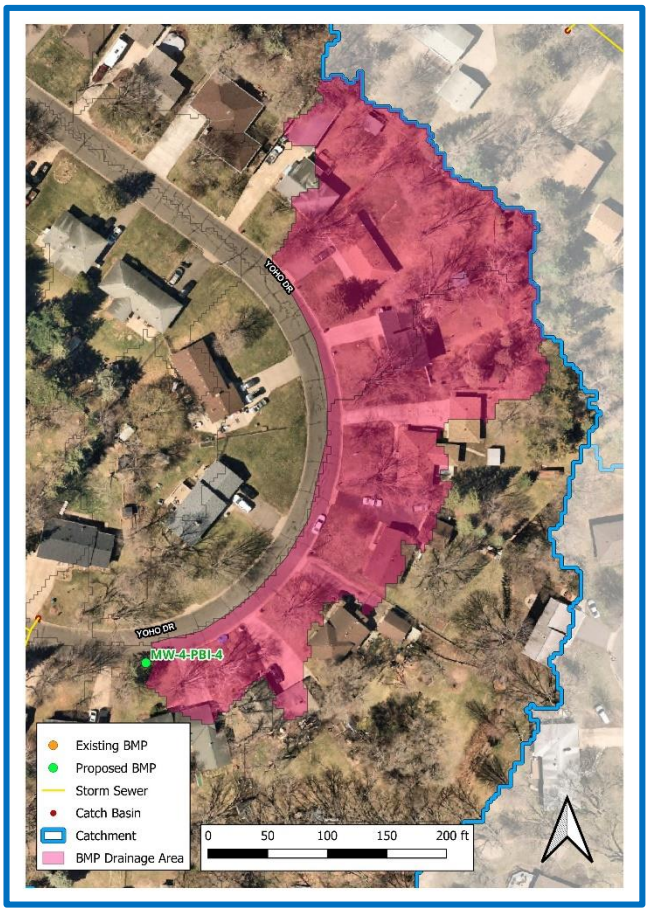
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PBI-4

Yoho Dr.
Bioinfiltration Basin



Drainage Area – 1.65 acres

Location – 149 Yoho Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected from multiple properties along Yoho Dr. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.49	2.4%
	TSS (lb/yr)	155	2.4%
	Volume (acre-feet/yr)	0.37	2.2%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,172**	
	30-yr Average Cost/1,000lb-TSS	**$3,706**	
	30-yr Average Cost/ac-ft Vol.	**$1,564**	

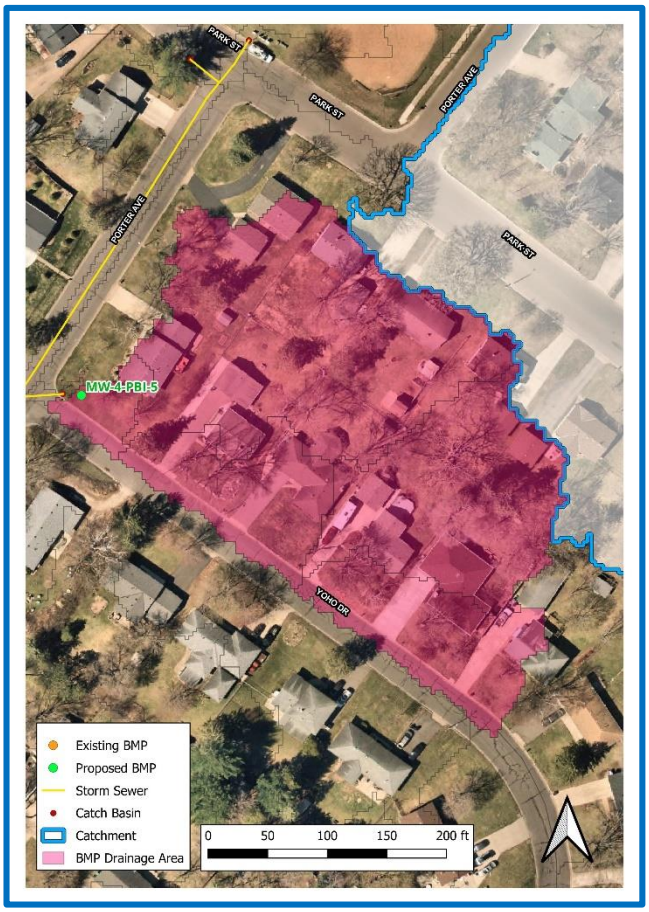
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PBI-5

Yoho Dr.
Bioinfiltration Basin



Drainage Area – 2.34 acres

Location – 1952 Porter Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected from multiple properties along Yoho Dr. While the proposed BMP was modeled as a single inlet, there is potential to upgrade to a large, double inlet that would also treat a portion of Park St. and Porter Ave. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.52	2.6%
	TSS (lb/yr)	165	2.5%
	Volume (acre-feet/yr)	0.39	2.3%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,105**	
	30-yr Average Cost/1,000lb-TSS	**$3,482**	
	30-yr Average Cost/ac-ft Vol.	**$1,473**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PBI-6

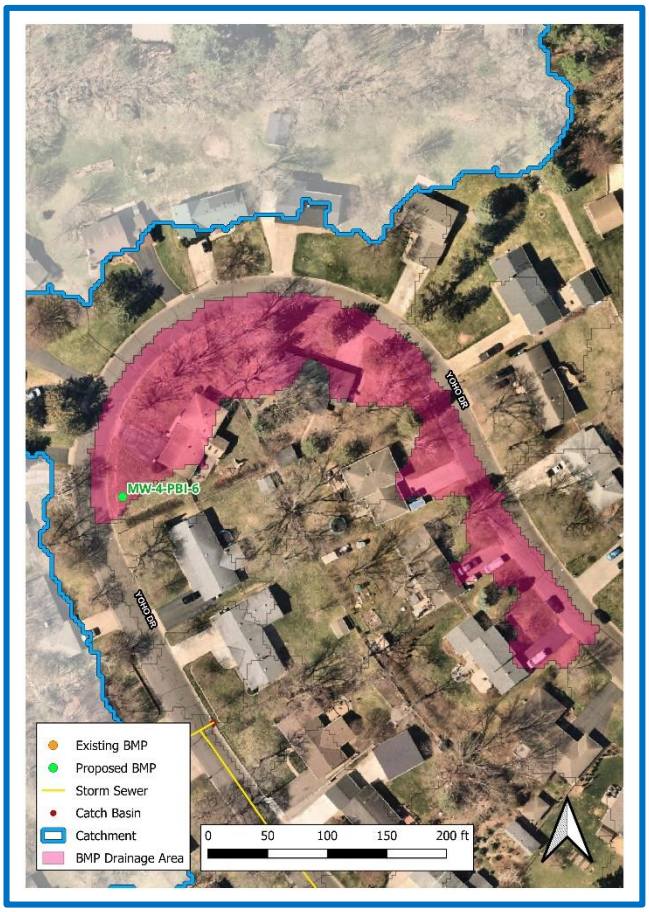
Yoho Dr.
Bioinfiltration Basin

Drainage Area – 0.86 acres

Location – 252 Yoho Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected from multiple properties along Yoho Dr. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.32	1.6%
	TSS (lb/yr)	103	1.6%
	Volume (acre-feet/yr)	0.25	1.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,795**	
	30-yr Average Cost/1,000lb-TSS	**$5,577**	
	30-yr Average Cost/ac-ft Vol.	**$2,309**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PBI-7

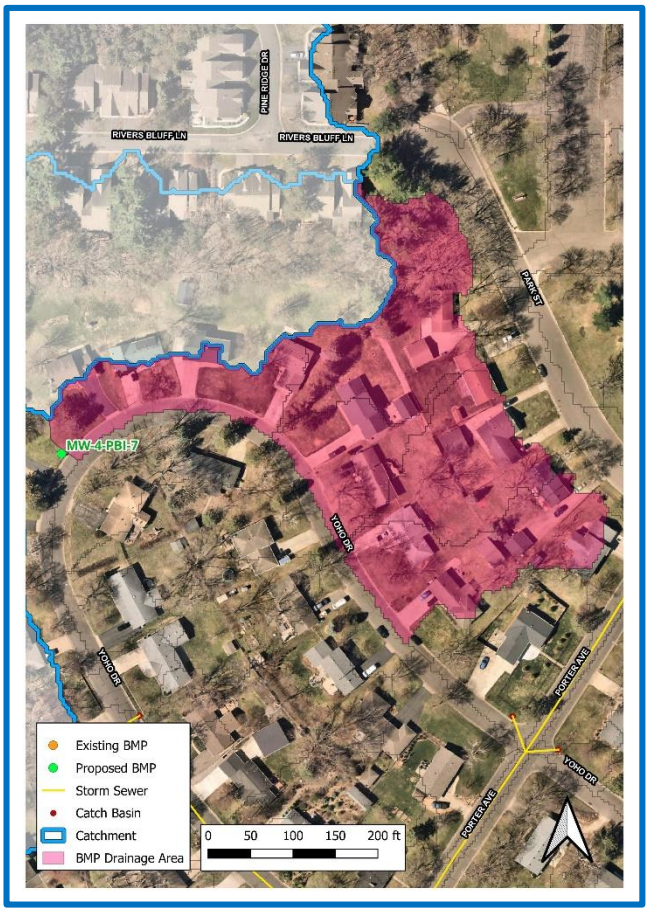
Yoho Dr.
Bioinfiltration Basin

Drainage Area – 2.86 acres

Location – 249 Yoho Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected from multiple properties along Yoho Dr. and Park St. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.53	2.6%
	TSS (lb/yr)	172	2.6%
	Volume (acre-feet/yr)	0.42	2.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,084**	
	30-yr Average Cost/1,000lb-TSS	**$3,340**	
	30-yr Average Cost/ac-ft Vol.	**$1,367**	

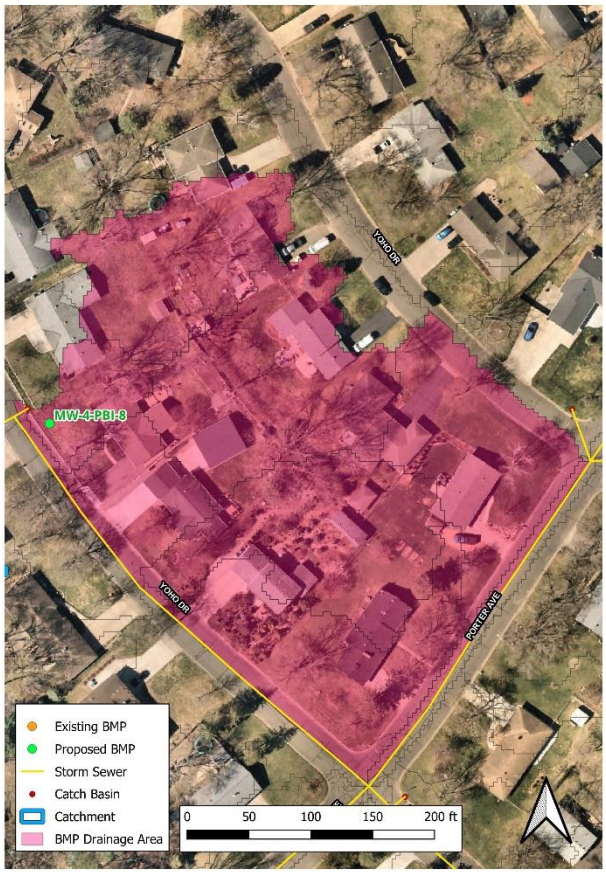
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PBI-8

Yoho Dr.
Bioinfiltration Basin



Drainage Area – 2.81 acres

Location – 274 Yoho Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected from multiple properties along Yoho Dr. and Porter Ave. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.54	2.7%
	TSS (lb/yr)	174	2.7%
	Volume (acre-feet/yr)	0.41	2.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,064**	
	30-yr Average Cost/1,000lb-TSS	**$3,302**	
	30-yr Average Cost/ac-ft Vol.	**$1,394**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PBI-9

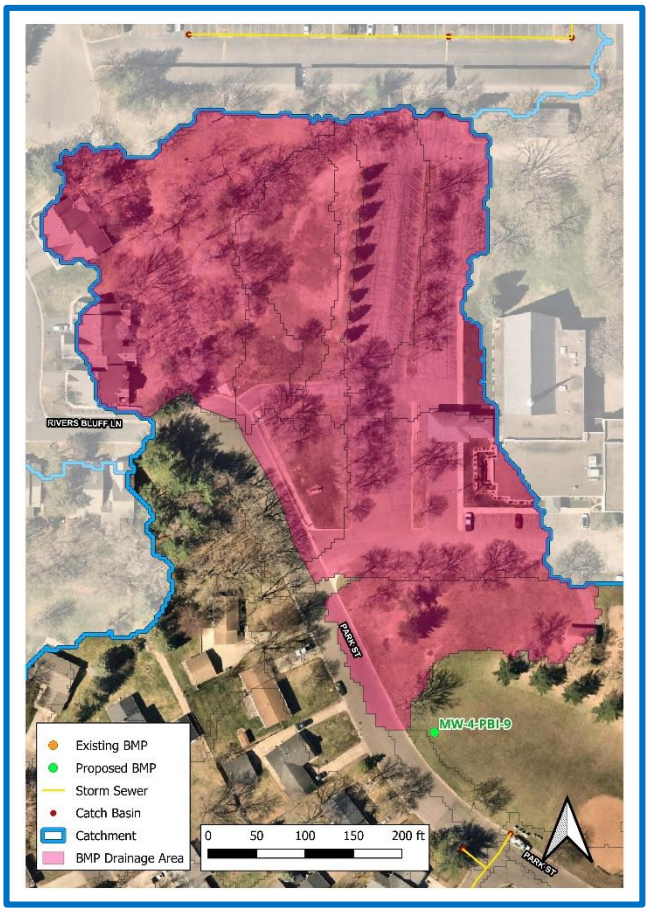
Rum River Dr.
Bioinfiltration Basin

Drainage Area – 4.47 acres

Location – 1201 Park St.

Property Ownership – City of Anoka

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within King Park on Park St. The proposed basin is a large, single inlet rain garden that would treat stormwater collected on Park St. and the large parking lot to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	500	sq-ft
	TP (lb/yr)	0.87	4.3%
	TSS (lb/yr)	407	6.2%
	Volume (acre-feet/yr)	0.92	5.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$16,320
	Total Estimated Project Cost (2023)		**$16,984**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$909**	
	30-yr Average Cost/1,000lb-TSS	**$1,944**	
	30-yr Average Cost/ac-ft Vol.	**$862**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-4-PHD-1

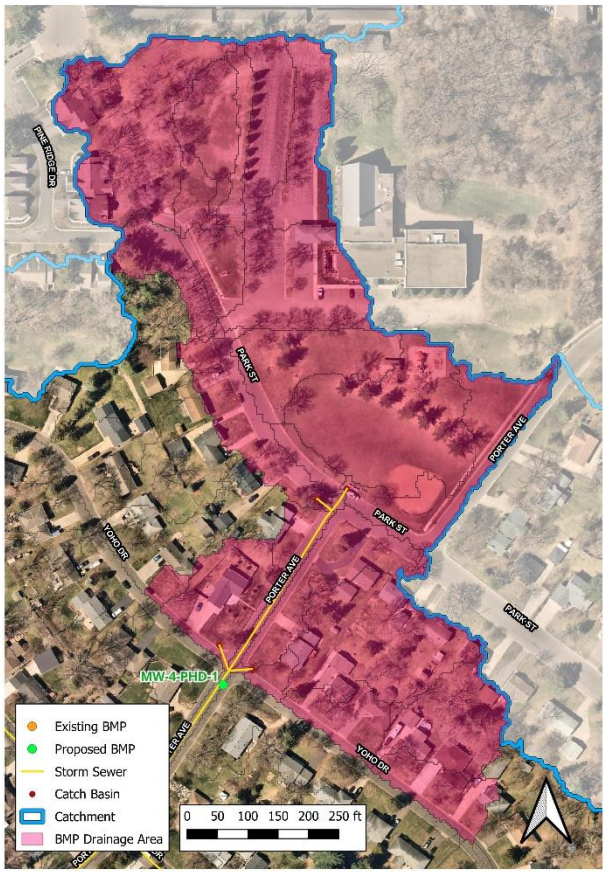
Porter Ave.
Hydrodynamic Device

Drainage Area – 11.16 acres

Location – Intersection of Porter Ave. and Yoho Dr.

Property Ownership – City of Anoka

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line on Porter Ave. at the intersection of Yoho Dr. A device at this location would provide treatment to stormwater runoff from the northern side of this catchment. The table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	10	ft diameter
	TP (lb/yr)	0.71	3.5%
	TSS (lb/yr)	335	5.1%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$7,514**	
	30-yr Average Cost/1,000lb-TSS	**$15,925**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

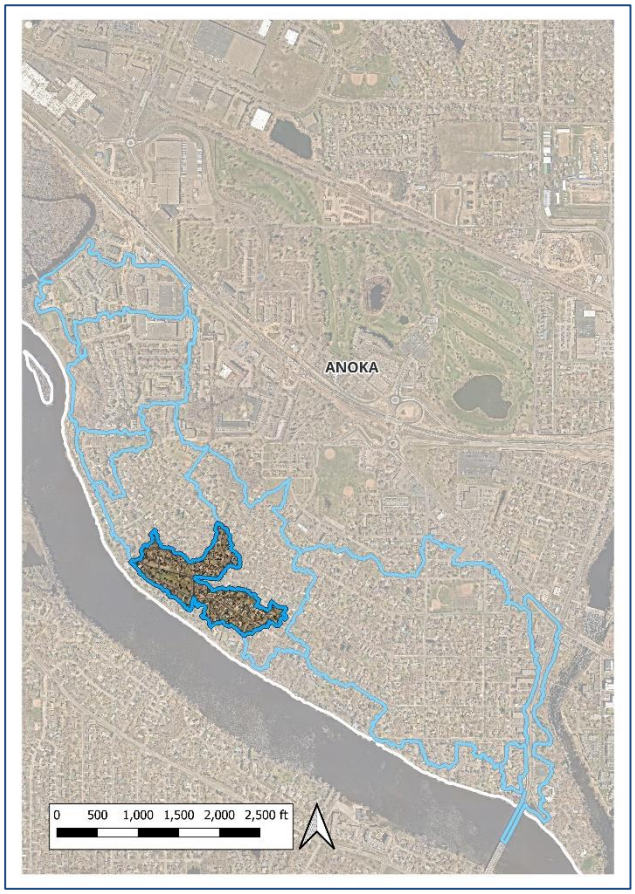
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Catchment MW-5

Existing Catchment Summary	
Acres	22.31
Parcels	89
Land Cover	88.4% Residential 11.6% Park



CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River. Stormwater runoff is collected through catch basins on Benton St. and Parkmont Ln. that discharge directly into the Mississippi River. Land use is primarily single family residential houses with park property on the western side.

EXISTING STORMWATER TREATMENT

Street cleaning is conducted once in early spring and once in mid-summer by the City of Anoka. No other existing treatment was identified in this catchment. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	11.66	0.91	8%	**10.75**
	TSS (lb/yr)	3,656	392	11%	**3,264**
	Volume (acre-feet/yr)	8.4	0.00	0%	**8.4**

RETROFITS CONSIDERED

Several BMPs are proposed within this catchment. They include multiple bioinfiltration basins and three hydrodynamic separators. The proposed hydrodynamic separators are shown to be located within the same intersection, but have been split up due to the large size of their respective contributing drainage areas.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

ROAD TREE CANOPY COVER

Project ID: MW-5-PBI-1

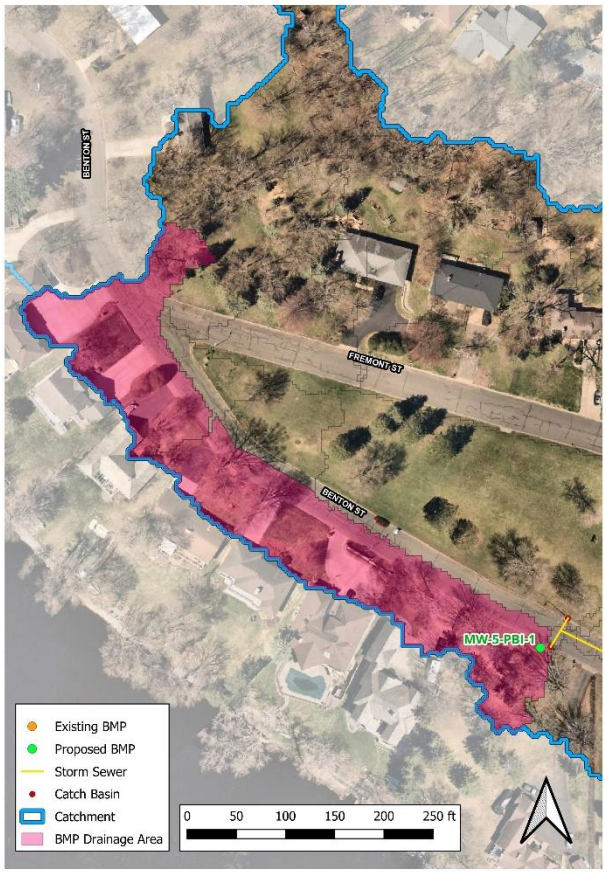
Benton St.
Bioinfiltration Basin

Drainage Area – 1.27 acres

Location – 1106 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Benton St. from the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.41	3.8%
	TSS (lb/yr)	129	4.0%
	Volume (acre-feet/yr)	0.31	3.6%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$1,401**
	30-yr Average Cost/1,000lb-TSS		**$4,453**
	30-yr Average Cost/ac-ft Vol.		**$1,883**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-5-PBI-2

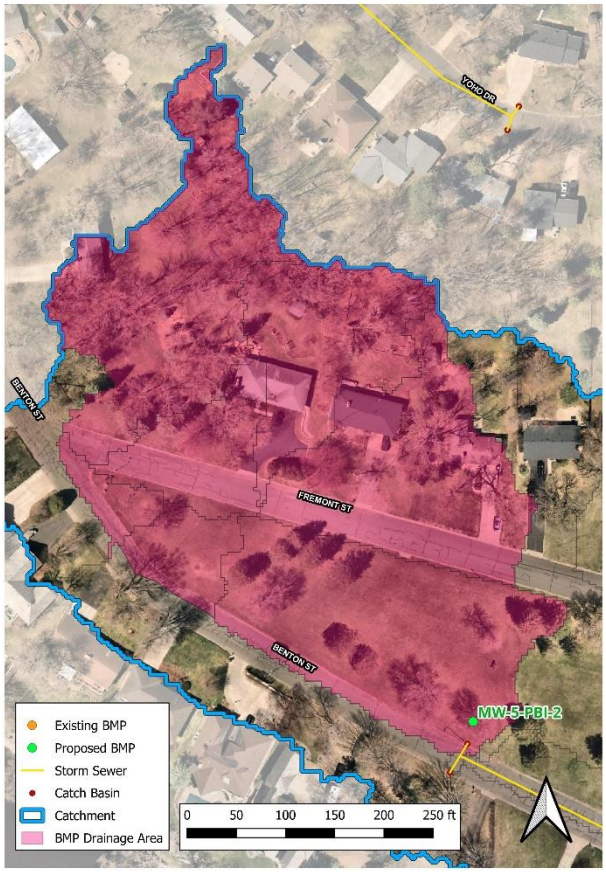
Benton St.
Bioinfiltration Basin

Drainage Area – 4.41 acres

Location – 1131 Benton St.

Property Ownership – City of Anoka

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within Ehlen Park on Benton St. The proposed basin is a large, single inlet rain garden that would treat a significant portion of stormwater collected on the western side of the catchment. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	500	sq-ft
	TP (lb/yr)	0.92	8.6%
	TSS (lb/yr)	297	9.1%
	Volume (acre-feet/yr)	0.69	8.2%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$16,320
	Total Estimated Project Cost (2023)		**$16,984**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$857**	
	30-yr Average Cost/1,000lb-TSS	**$2,664**	
	30-yr Average Cost/ac-ft Vol.	**$1,152**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-5-PBI-3

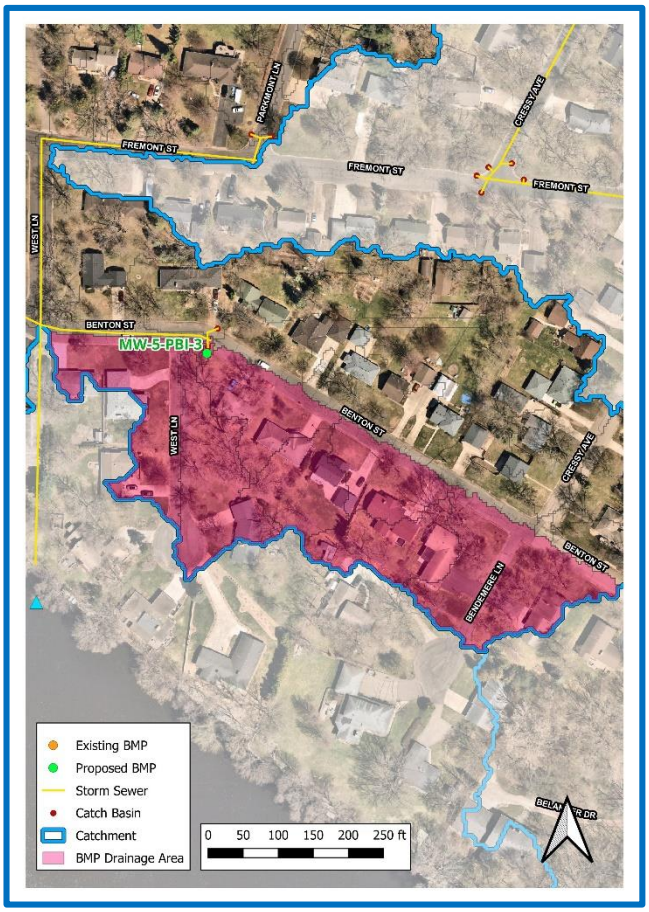
Benton St.
Bioinfiltration Basin

Drainage Area – 3.40 acres

Location – 1020 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a large, double inlet rain garden that would treat stormwater collected along Benton St. and West Ln. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	500	sq-ft
	TP (lb/yr)	0.92	8.5%
	TSS (lb/yr)	290	8.9%
	Volume (acre-feet/yr)	0.69	8.2%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$16,320
	Total Estimated Project Cost (2023)		**$16,984**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$863**	
	30-yr Average Cost/1,000lb-TSS	**$2,728**	
	30-yr Average Cost/ac-ft Vol.	**$1,153**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-5-PBI-4

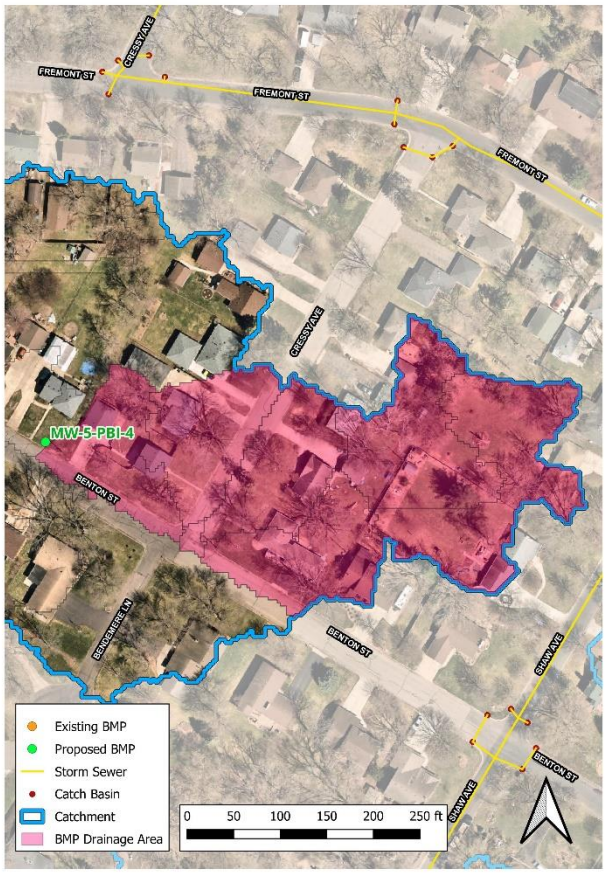
Benton St.
Bioinfiltration Basin

Drainage Area – 2.41 acres

Location – 1803 Cressy Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Benton St. and Cressy Ave. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.52	4.8%
	TSS (lb/yr)	166	5.1%
	Volume (acre-feet/yr)	0.39	4.7%
Cost	**Administration & Promotion Costs***	$664	
	Design & Construction Costs**	$9,820	
	Total Estimated Project Cost (2023)	**$10,484**	
	Annual O&M***	$225	
Efficiency	**30-yr Average Cost/lb-TP**	**$1,105**	
	30-yr Average Cost/1,000lb-TSS	**$3,461**	
	30-yr Average Cost/ac-ft Vol.	**$1,464**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-5-PBI-5

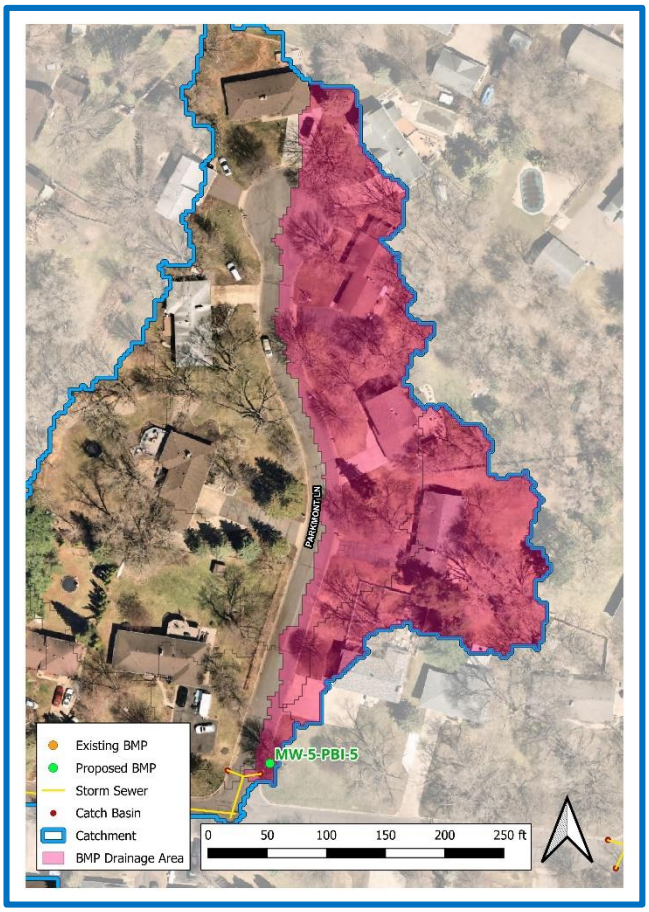
Parkmont Ln.
Bioinfiltration Basin

Drainage Area – 1.47 acres

Location – 1021 Fremont St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Parkmont Ln. up to the cul-de-sac. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.43	4.0%
	TSS (lb/yr)	137	4.2%
	Volume (acre-feet/yr)	0.32	3.9%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,336**	
	30-yr Average Cost/1,000lb-TSS	**$4,193**	
	30-yr Average Cost/ac-ft Vol.	**$1,768**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-5-PHD-1

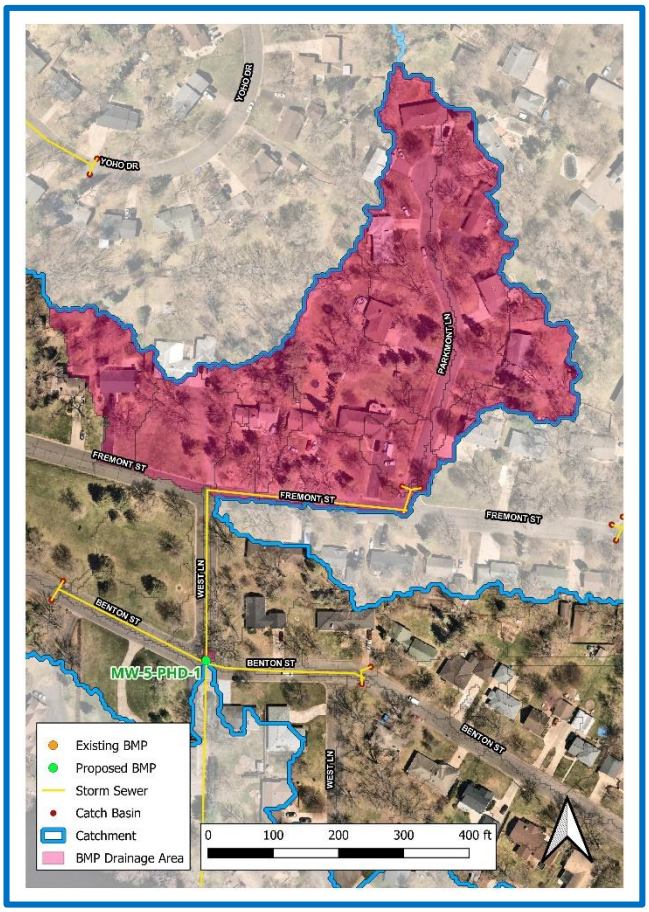
Benton St.
Hydrodynamic Device

Drainage Area – 5.47 acres

Location – Intersection of Benton St. and West Ln.

Property Ownership – City of Anoka

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line on Benton St. at the intersection of West Ln. A device at this location would provide treatment to stormwater runoff from the northern side of this catchment. The table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	8	ft diameter
	TP (lb/yr)	0.36	3.3%
	TSS (lb/yr)	146	4.5%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$54,000
	Total Estimated Project Cost (2023)		**$57,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$5,931**	
	30-yr Average Cost/1,000lb-TSS	**$14,623**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($36,000 for materials) + ($18,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Project ID: MW-5-PHD-2

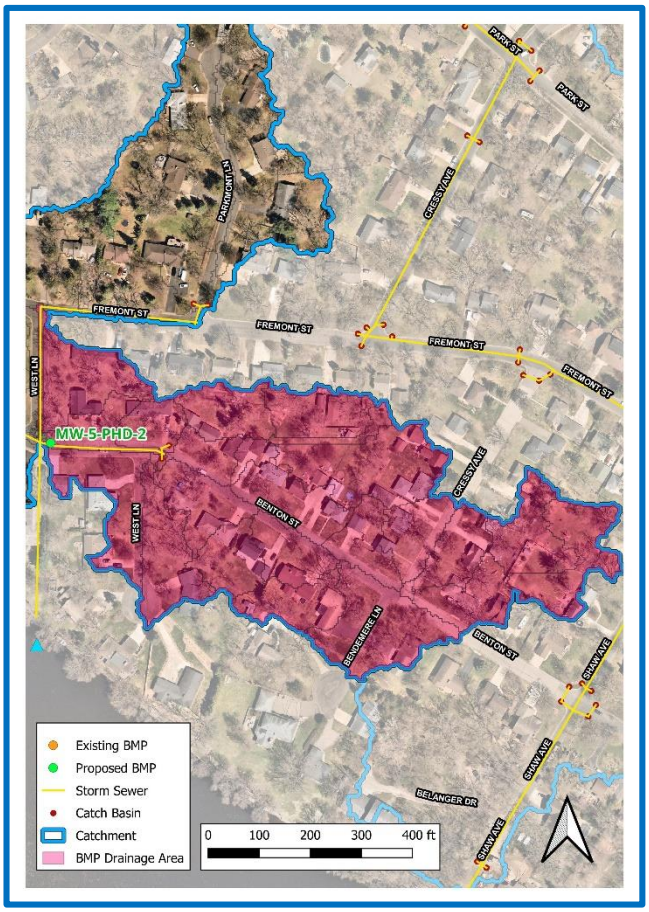
Benton St.
Hydrodynamic Device

Drainage Area – 9.47 acres

Location – Intersection of Benton St. and West Ln.

Property Ownership – City of Anoka

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line on Benton St. at the intersection of West Ln. A device at this location would provide treatment to stormwater runoff from the eastern side of this catchment. The table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	10	ft diameter
	TP (lb/yr)	0.60	5.6%
	TSS (lb/yr)	241	7.4%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$8,892**	
	30-yr Average Cost/1,000lb-TSS	**$22,137**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

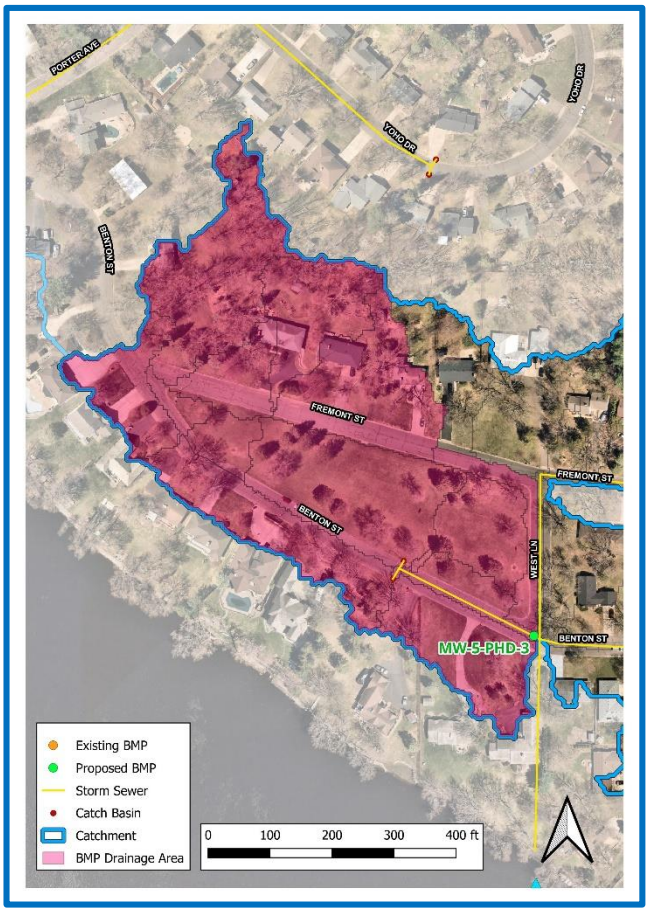
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Project ID: MW-5-PHD-3

Benton St.
Hydrodynamic Device



Drainage Area – 7.36 acres

Location – Intersection of Benton St. and West Ln.

Property Ownership – City of Anoka

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line on Benton St. at the intersection of West Ln. A device at this location would provide treatment to stormwater runoff from the western side of this catchment. The table below provides pollutant removals and estimated costs.

Hydrodynamic Device			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	10	ft diameter
	TP (lb/yr)	0.47	4.4%
	TSS (lb/yr)	191	5.9%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$11,351**	
	30-yr Average Cost/1,000lb-TSS	**$27,932**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

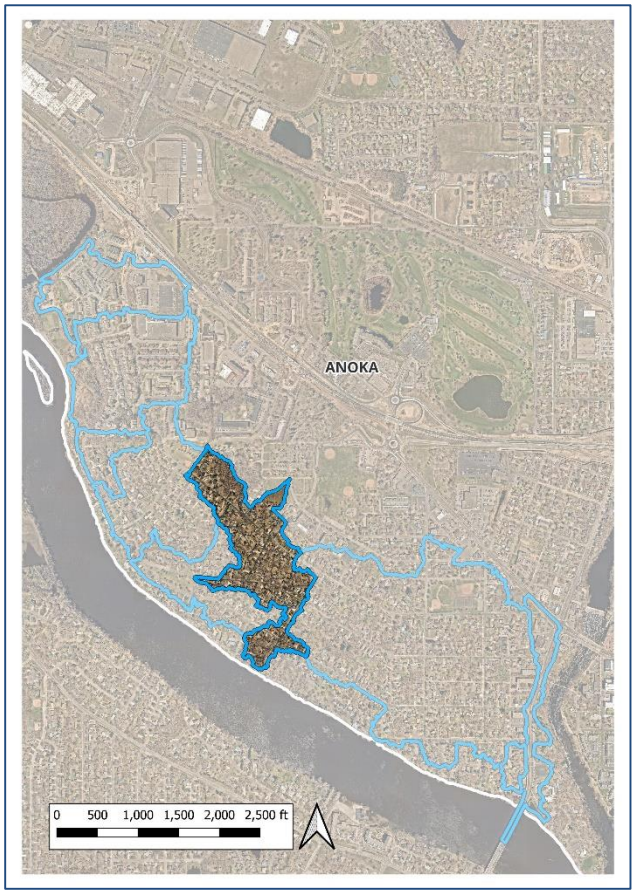
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Catchment MW-6

Existing Catchment Summary	
Acres	38.48
Parcels	126
Land Cover	91.1% Residential 3.3% Open 2.6% Institutional 2.5% Park 0.4% Industrial



CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River. Stormwater runoff is collected through multiple catch basins throughout the catchment that route water into an existing hydrodynamic device before discharging into the Mississippi River. Land use is primarily single family residential houses with open space on the northern side.

EXISTING STORMWATER TREATMENT

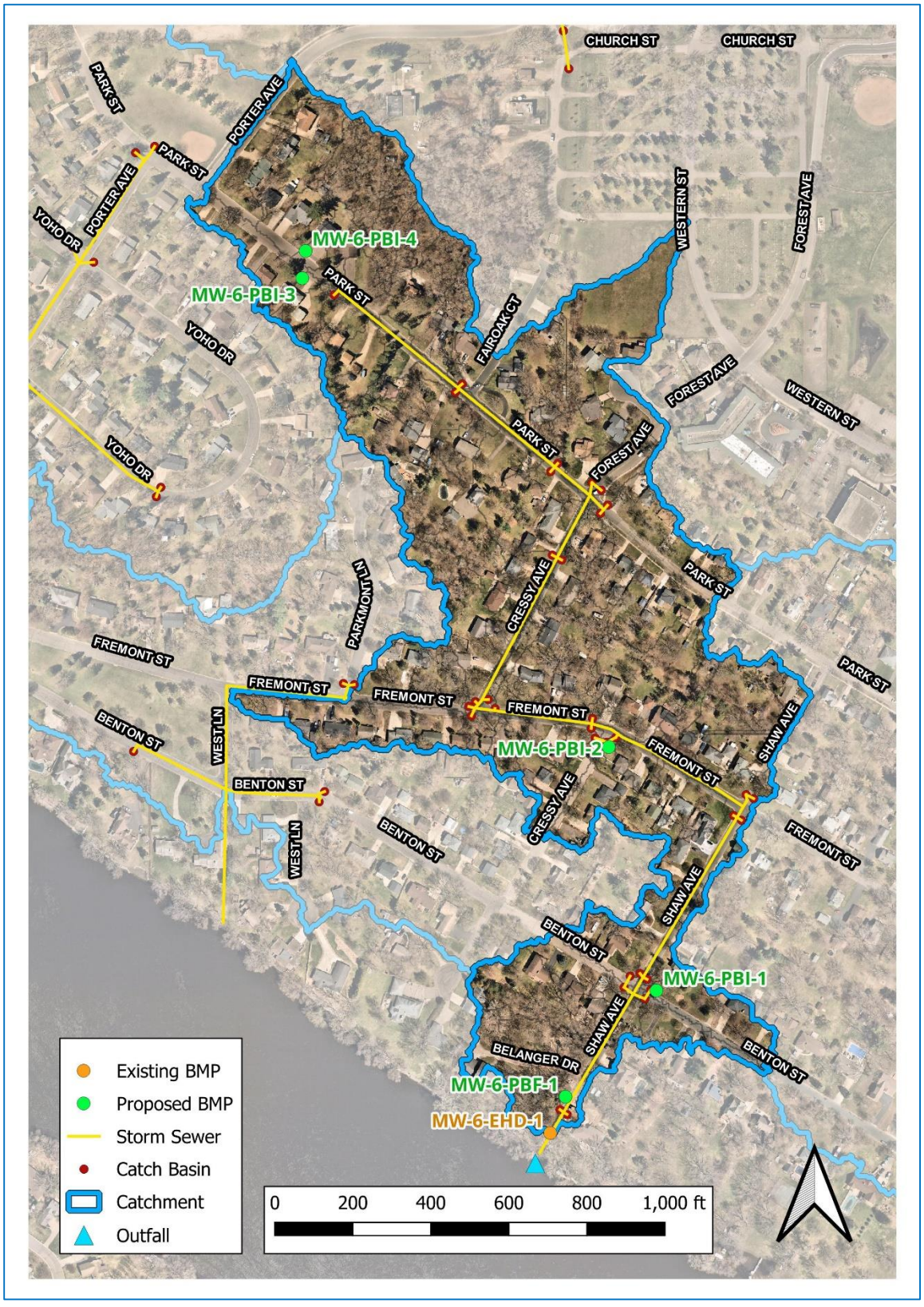
This catchment contains a hydrodynamic device near the outfall that treats the majority of the catchment. In addition, street cleaning is conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	2			
	BMP Types	Street Cleaning, Hydrodynamic Device (EHD-1)			
	TP (lb/yr)	20.51	3.52	17%	**16.99**
	TSS (lb/yr)	6,405	1,473	23%	**4,932**
	Volume (acre-feet/yr)	14.7	0.00	0%	**14.7**

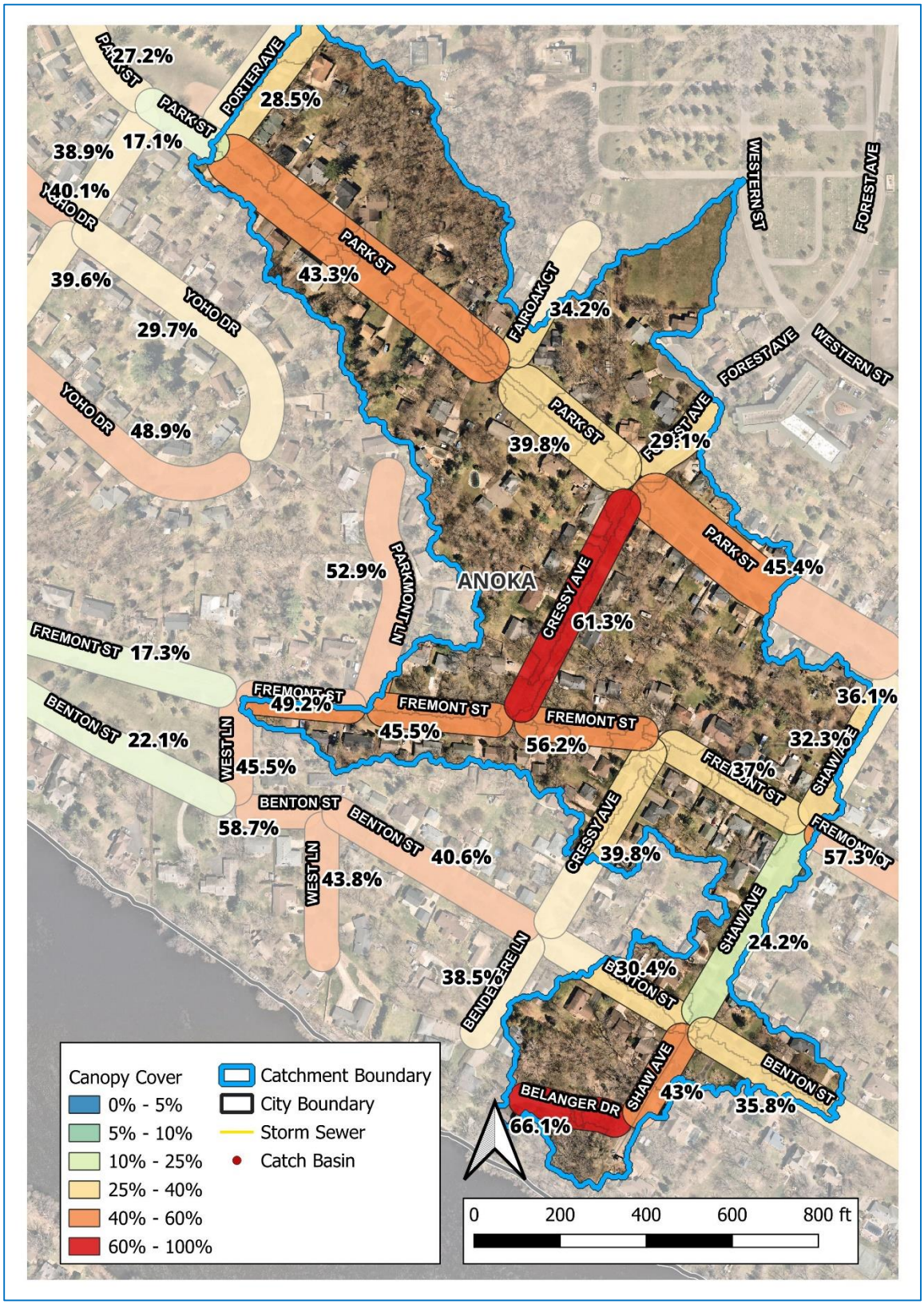
RETROFITS CONSIDERED

Four bioinfiltration basins and one biofiltration basin are proposed within this catchment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER



Project ID: MW-6-PBI-1

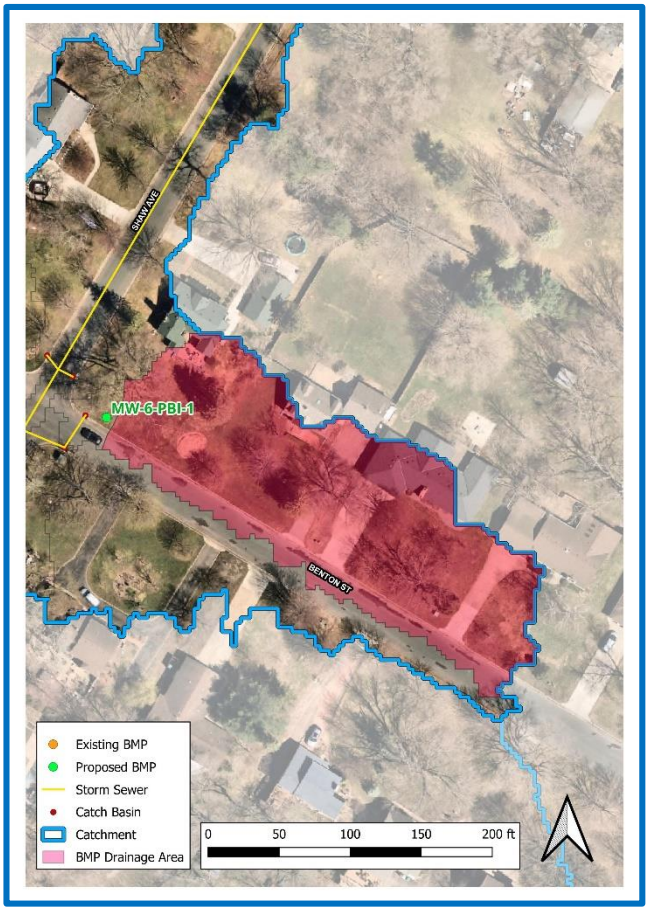
Benton St.
Bioinfiltration Basin

Drainage Area – 0.77 acres

Location – 755 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Benton St. east of the catch basin. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.29	1.7%
	TSS (lb/yr)	88	1.8%
	Volume (acre-feet/yr)	0.23	1.6%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$1,981**
	30-yr Average Cost/1,000lb-TSS		**$6,528**
	30-yr Average Cost/ac-ft Vol.		**$2,460**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-6-PBI-2

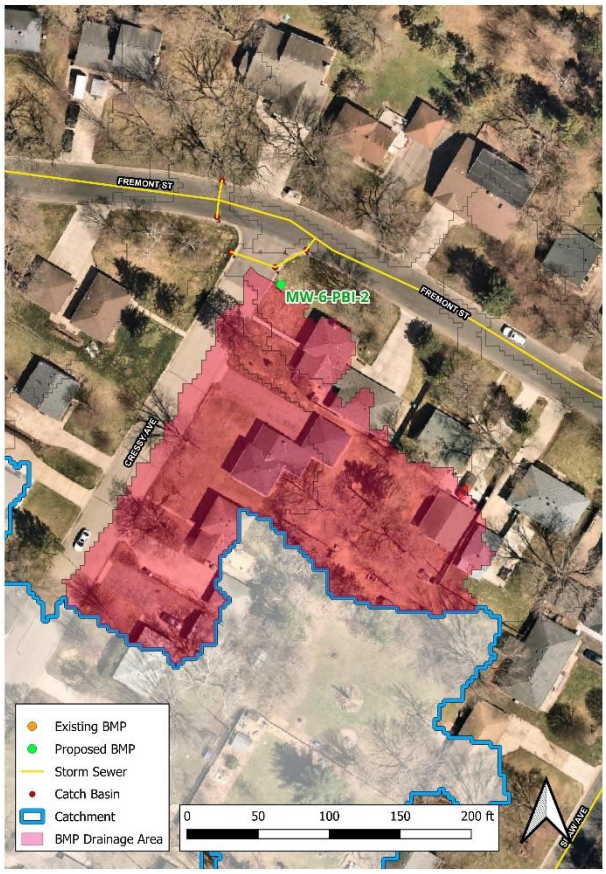
Cressy Ave.
Bioinfiltration Basin

Drainage Area – 0.91 acres

Location – 1832 Cressy Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Cressy Ave. south of the catch basin. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250 sq-ft	
	TP (lb/yr)	0.32	1.9%
	TSS (lb/yr)	96	1.9%
	Volume (acre-feet/yr)	0.26	1.7%
Cost	Administration & Promotion Costs*	$664	
	Design & Construction Costs**	$9,820	
	Total Estimated Project Cost (2023)	**$10,484**	
	Annual O&M***	$225	
Efficiency	30-yr Average Cost/lb-TP	**$1,795**	
	30-yr Average Cost/1,000lb-TSS	**$5,984**	
	30-yr Average Cost/ac-ft Vol.	**$2,244**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-6-PBI-3

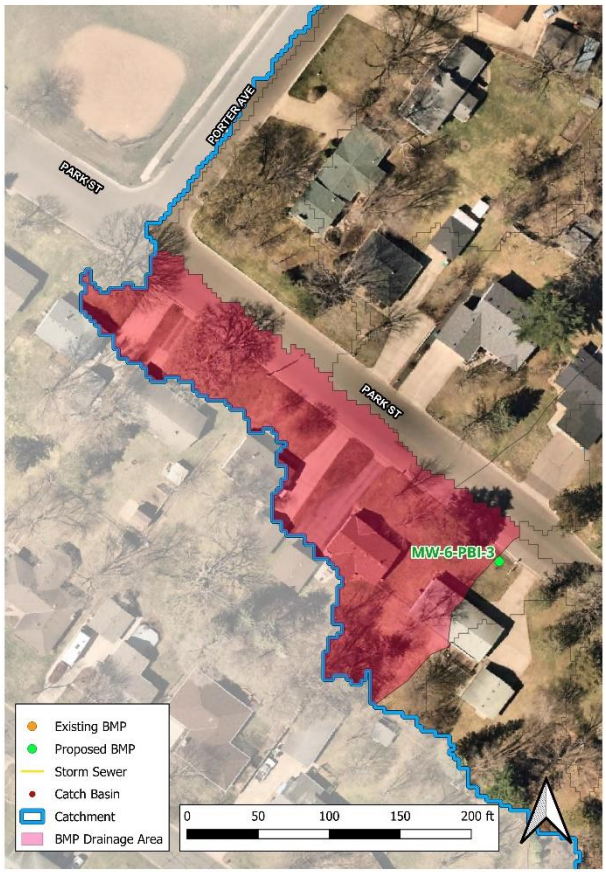
Park St.
Bioinfiltration Basin

Drainage Area – 0.70 acres

Location – 1112 Park St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Park St. from the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.28	1.6%
	TSS (lb/yr)	83	1.7%
	Volume (acre-feet/yr)	0.22	1.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$2,052**
	30-yr Average Cost/1,000lb-TSS		**$6,921**
	30-yr Average Cost/ac-ft Vol.		**$2,591**

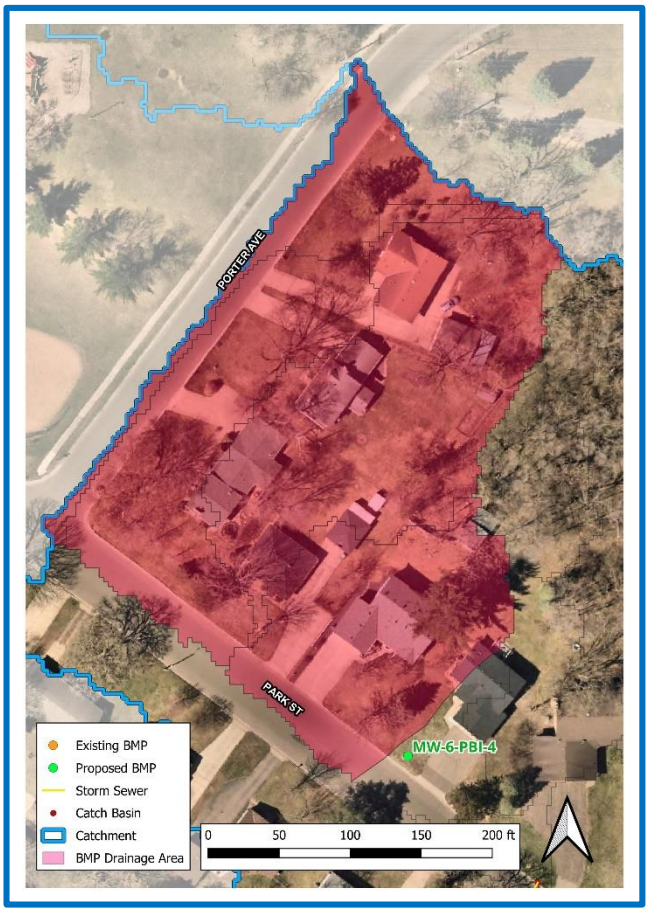
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-6-PBI-4

Park St.
Bioinfiltration Basin



Drainage Area – 2.19 acres

Location – 1119 Park St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Park St. and Porter Ave. from the west. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.47	2.8%
	TSS (lb/yr)	143	2.9%
	Volume (acre-feet/yr)	0.37	2.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$1,222**
	30-yr Average Cost/1,000lb-TSS		**$4,017**
	30-yr Average Cost/ac-ft Vol.		**$1,533**

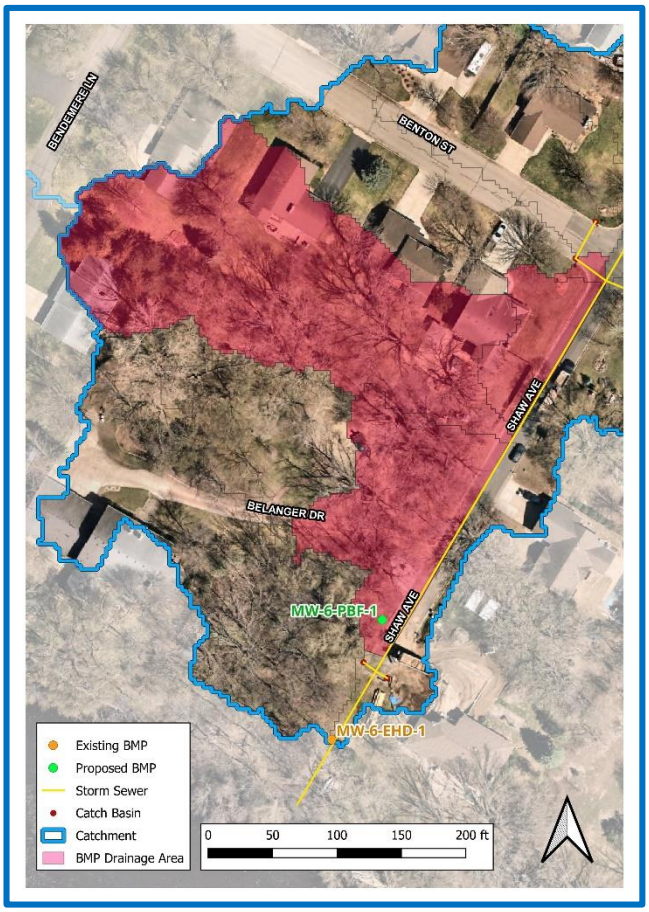
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-6-PBF-1

Shaw Ave.
Biofiltration Basin



Drainage Area – 1.52 acres

Location – PIN: 123125220013

Property Ownership – Private

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is on undeveloped private property near the catch basin at the end of Shaw Ave. It should be noted that the parcel data in this location shows a proposed cul-de-sac for Belanger Dr. that may limit construction of a BMP in this area. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Shaw Ave. to the north. Soils in this area are classified as Hydrologic Soil Group B, which have moderately low runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

	Curb-Cut Biofiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.26	1.5%
	TSS (lb/yr)	91	1.8%
	Volume (acre-feet/yr)	0.10	0.7%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$23,320
	Total Estimated Project Cost (2023)		**$23,984**
	Annual O&M***		$295
Efficiency	**30-yr Average Cost/lb-TP**	**$4,209**	
	30-yr Average Cost/1,000lb-TSS	**$12,027**	
	30-yr Average Cost/ac-ft Vol.	**$11,183**	

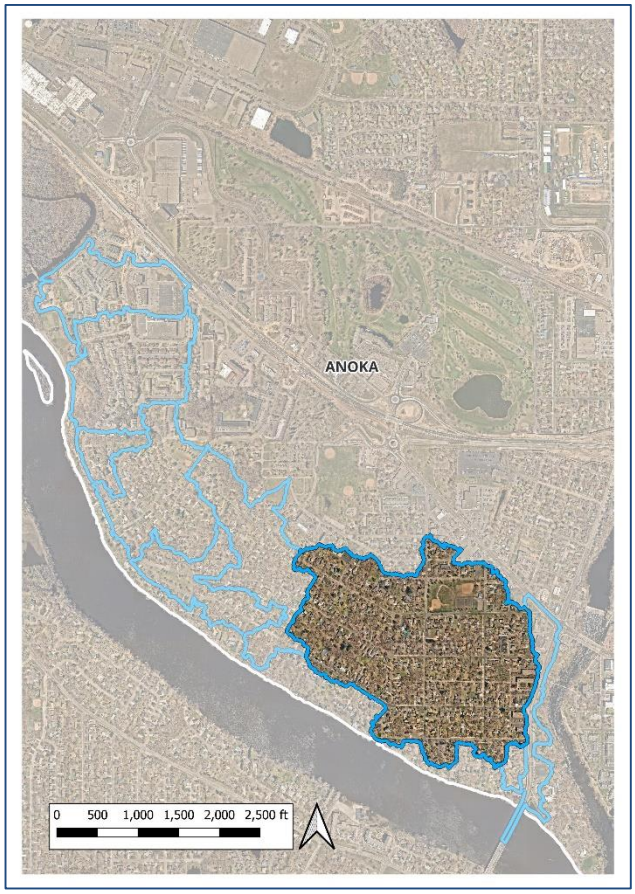
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Catchment MW-7

Existing Catchment Summary	
Acres	130.96
Parcels	318
Land Cover	91.6% Residential 5.5% Park 1.6% Institutional 1.3% Shop



CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River. This catchment is the largest one included in this report for Mississippi River catchments that are west of the Rum River. Stormwater runoff is collected through multiple catch basins throughout the catchment that route water into an existing hydrodynamic device before discharging into the Mississippi River. Land use is primarily single family residential houses, with multi-family housing on the east side and park property to the north.

EXISTING STORMWATER TREATMENT

This catchment contains a complex hydrodynamic device near the outfall that treats the majority of the catchment. In addition, street cleaning is conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	**Base Loading**	**Treatment**	**Net Treatment %**	**Existing Loading**
Treatment	**Number of BMPs**	3			
	BMP Types	Street Cleaning, Hydrodynamic Device (EHD-1), Bioinfiltration Basin (EBI-1)			
	TP (lb/yr)	75.26	15.29	20%	**59.97**
	TSS (lb/yr)	24,633	6,134	25%	**18,499**
	Volume (acre-feet/yr)	60.0	5.51	9%	**54.5**

RETROFITS CONSIDERED

Multiple bioinfiltration basins and one biofiltration basin are proposed within this catchment. Due to the abundant number of catch basins throughout the catchment, the contributing drainage size for the majority of proposed practices is relatively small compared to other catchments.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

ROAD TREE CANOPY COVER

Project ID: MW-7-PBI-1

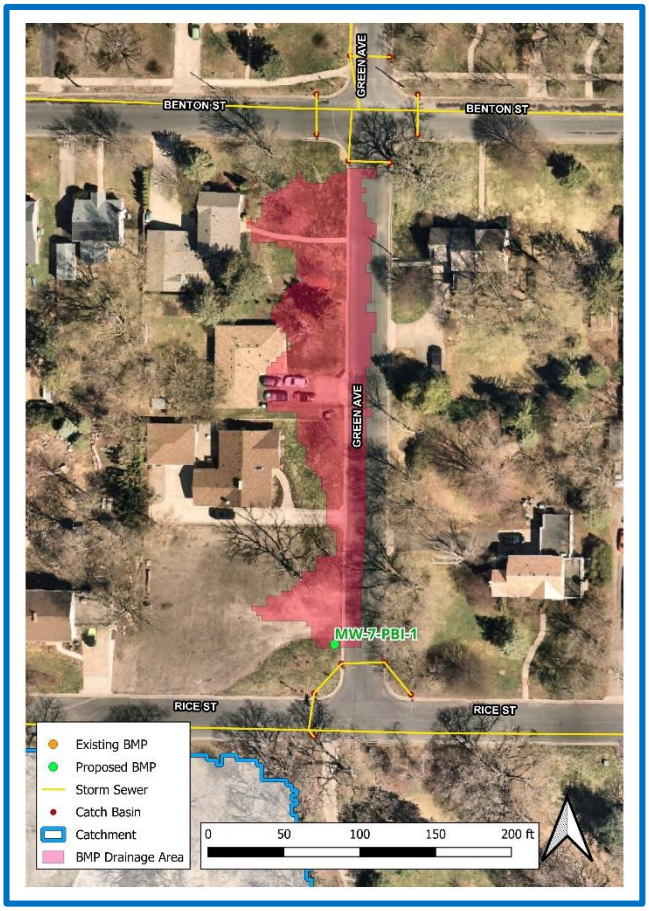
Green Ave.
Bioinfiltration Basin

Drainage Area – 0.35 acres

Location – 500 Rice St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within a privately owned vacant lot near the stormwater catch basin. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Green Ave. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.16	0.3%
	TSS (lb/yr)	51	0.3%
	Volume (acre-feet/yr)	0.14	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$3,590**
	30-yr Average Cost/1,000lb-TSS		**$11,264**
	30-yr Average Cost/ac-ft Vol.		**$4,171**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-2

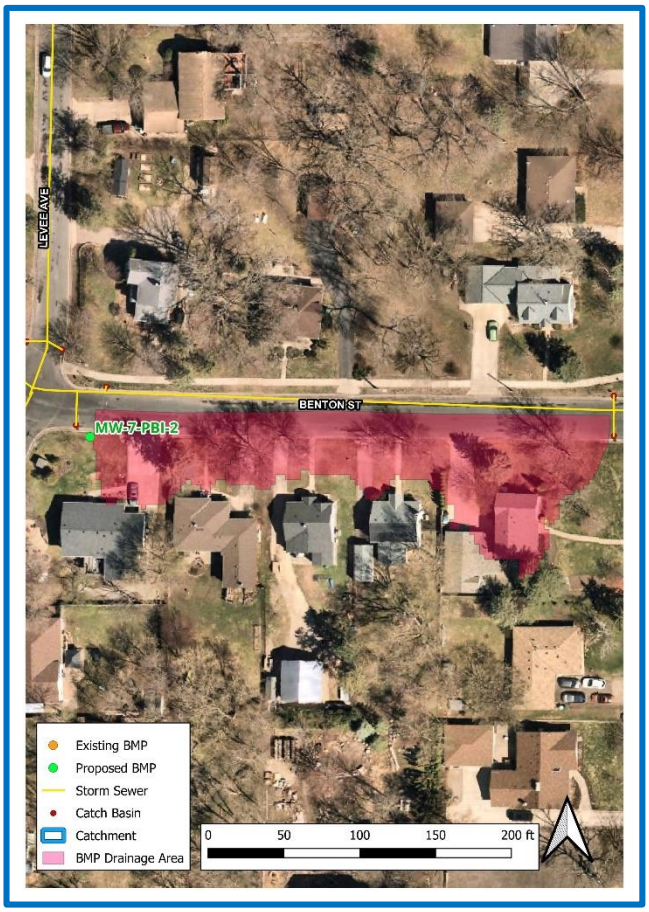
Benton St.
Bioinfiltration Basin

Drainage Area – 0.45 acres

Location – 530 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Benton St. to the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.20	0.3%
	TSS (lb/yr)	63	0.3%
	Volume (acre-feet/yr)	0.16	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$2,872**
	30-yr Average Cost/1,000lb-TSS		**$9,119**
	30-yr Average Cost/ac-ft Vol.		**$3,575**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-3

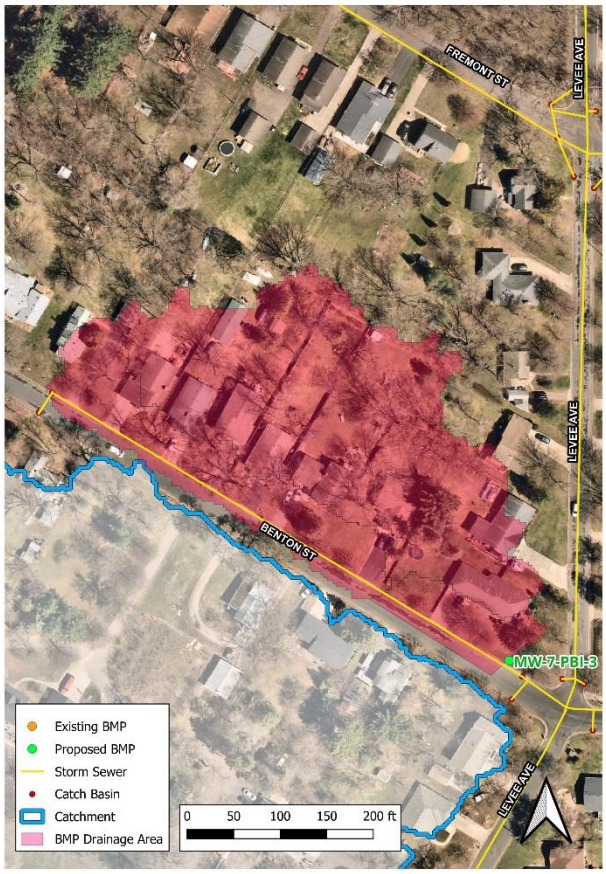
Benton St.
Bioinfiltration Basin

Drainage Area – 2.70 acres

Location – 605 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Benton St. to the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.52	0.9%
	TSS (lb/yr)	163	0.9%
	Volume (acre-feet/yr)	0.41	0.8%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$1,105**
	30-yr Average Cost/1,000lb-TSS		**$3,524**
	30-yr Average Cost/ac-ft Vol.		**$1,390**

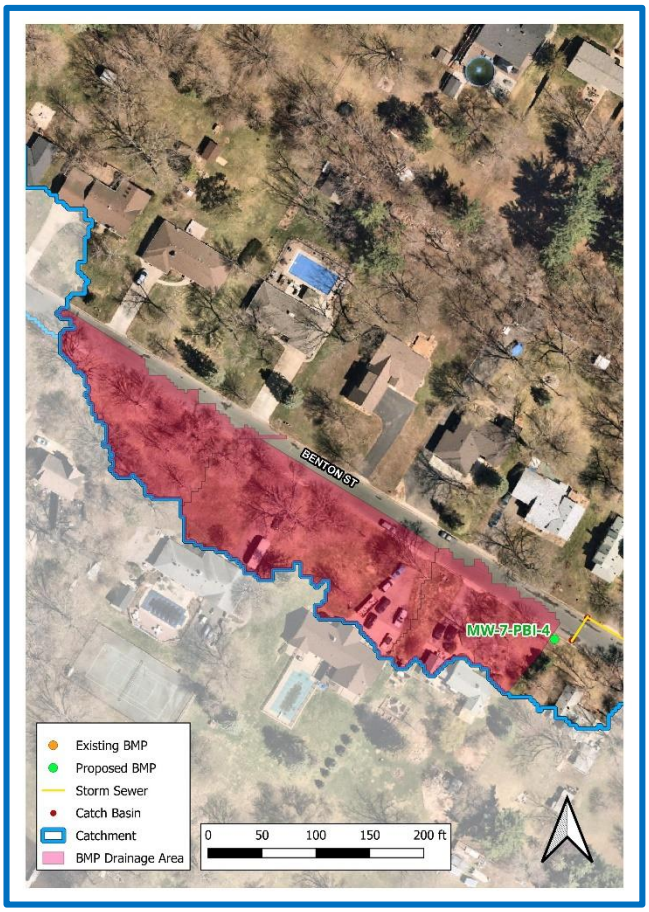
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-4

Benton St.
Bioinfiltration Basin



Drainage Area – 1.12 acres

Location – 656 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Benton St. to the west. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.37	0.6%
	TSS (lb/yr)	114	0.6%
	Volume (acre-feet/yr)	0.30	0.5%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,553**	
	30-yr Average Cost/1,000lb-TSS	**$5,039**	
	30-yr Average Cost/ac-ft Vol.	**$1,925**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-5

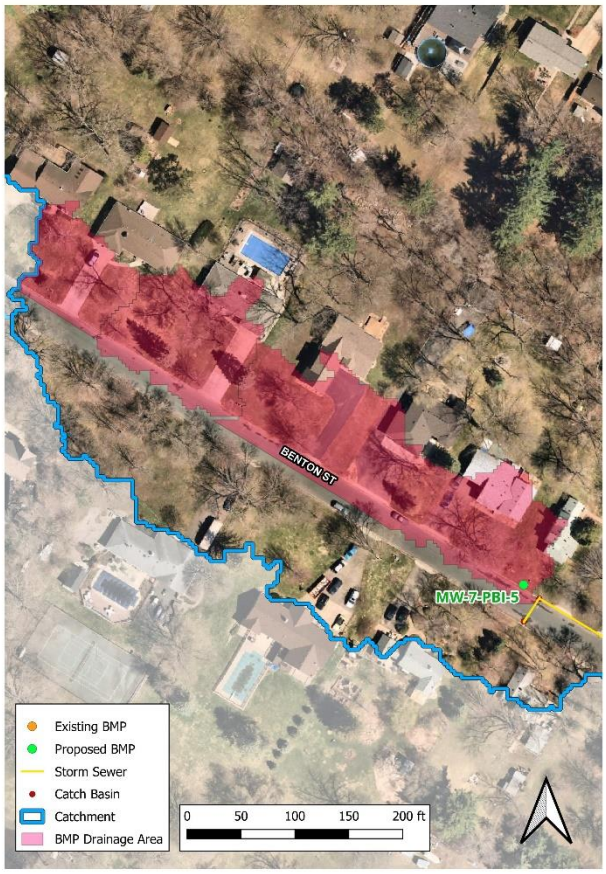
Benton St.
Bioinfiltration Basin

Drainage Area – 1.17 acres

Location – 649 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Benton St. to the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.37	0.6%
	TSS (lb/yr)	117	0.6%
	Volume (acre-feet/yr)	0.30	0.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$1,553**
	30-yr Average Cost/1,000lb-TSS		**$4,910**
	30-yr Average Cost/ac-ft Vol.		**$1,925**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-6

Benton St.
Bioinfiltration Basin

Drainage Area – 0.53 acres

Location – 458 Benton St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Benton St. to the east. The table below provides pollutant removals and estimated costs.

	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.24	0.4%
	TSS (lb/yr)	72	0.4%
	Volume (acre-feet/yr)	0.18	0.3%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$2,394**	
	30-yr Average Cost/1,000lb-TSS	**$7,979**	
	30-yr Average Cost/ac-ft Vol.	**$3,128**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-7

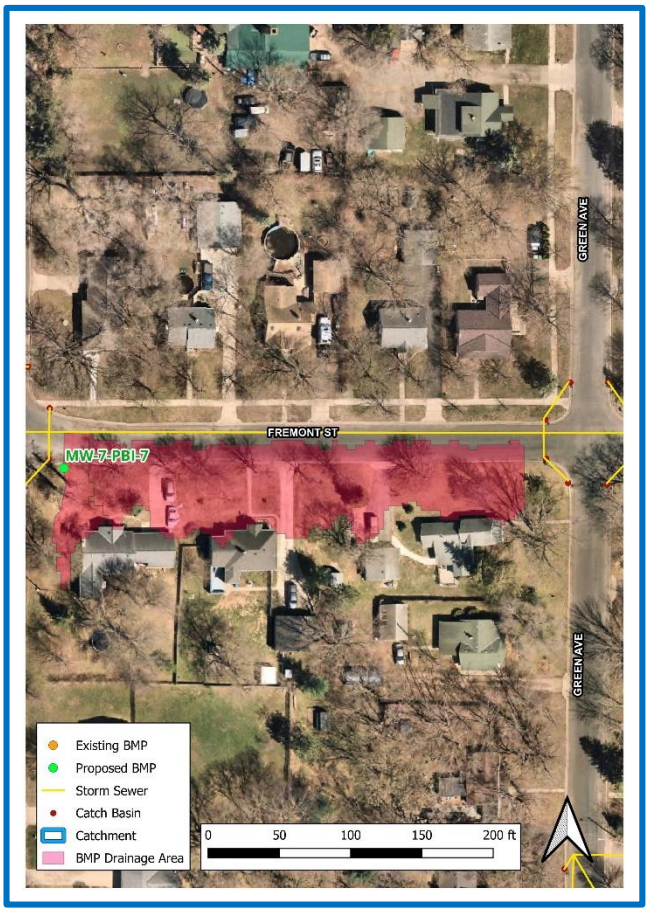
Fremont St.
Bioinfiltration Basin

Drainage Area – 0.44 acres

Location – 526 Fremont St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Fremont St. to the east. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.20	0.3%
	TSS (lb/yr)	62	0.3%
	Volume (acre-feet/yr)	0.16	0.3%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$2,872**	
	30-yr Average Cost/1,000lb-TSS	**$9,266**	
	30-yr Average Cost/ac-ft Vol.	**$3,575**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-8

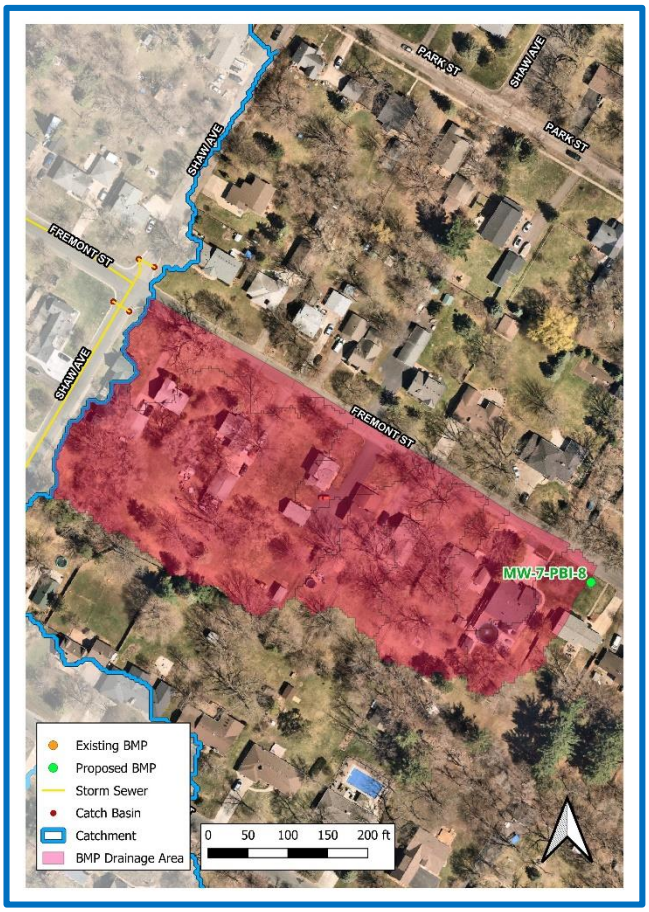
Fremont St.
Bioinfiltration Basin

Drainage Area – 3.72 acres

Location – 702 Fremont St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Fremont St. to the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.56	0.9%
	TSS (lb/yr)	176	1.0%
	Volume (acre-feet/yr)	0.46	0.8%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,026**	
	30-yr Average Cost/1,000lb-TSS	**$3,264**	
	30-yr Average Cost/ac-ft Vol.	**$1,251**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-9

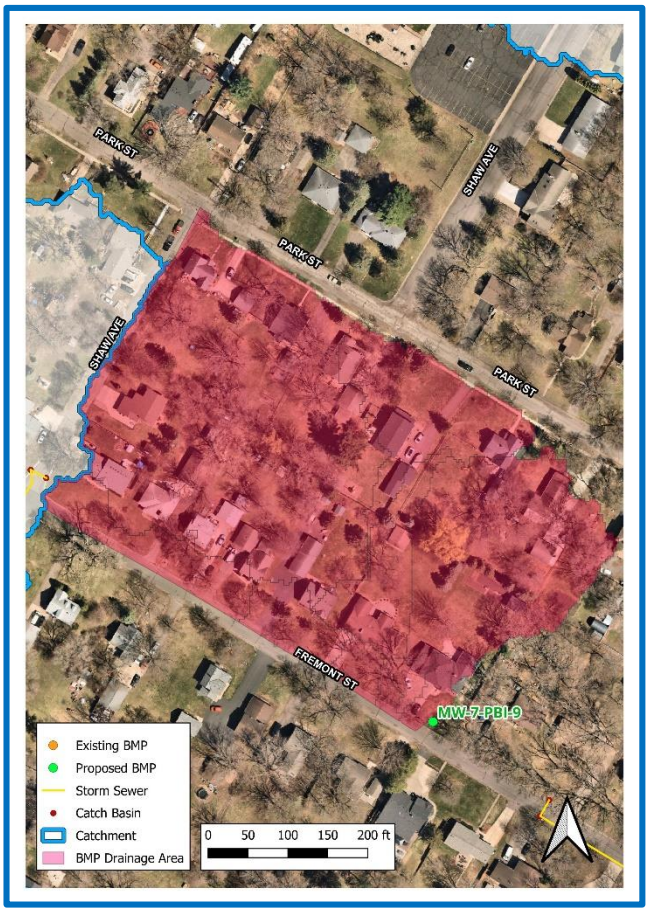
Fremont St.
Bioinfiltration Basin

Drainage Area – 5.65 acres

Location – 711 Fremont St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Fremont St. to the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.61	1.0%
	TSS (lb/yr)	190	1.0%
	Volume (acre-feet/yr)	0.48	0.9%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$942**	
	30-yr Average Cost/1,000lb-TSS	**$3,024**	
	30-yr Average Cost/ac-ft Vol.	**$1,192**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-10

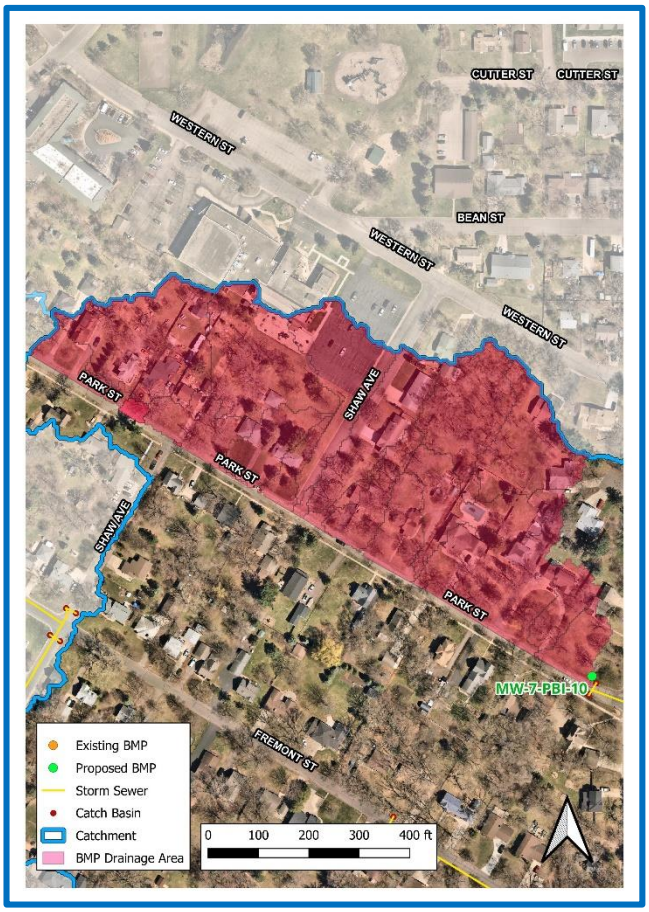
Rum River Dr.
Bioinfiltration Basin

Drainage Area – 9.66 acres

Location – 611 Park St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat a significant amount of stormwater collected along Park St. and Shaw Ave. to the west. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.62	1.0%
	TSS (lb/yr)	209	1.1%
	Volume (acre-feet/yr)	0.53	1.0%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$927**	
	30-yr Average Cost/1,000lb-TSS	**$2,749**	
	30-yr Average Cost/ac-ft Vol.	**$1,088**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-11

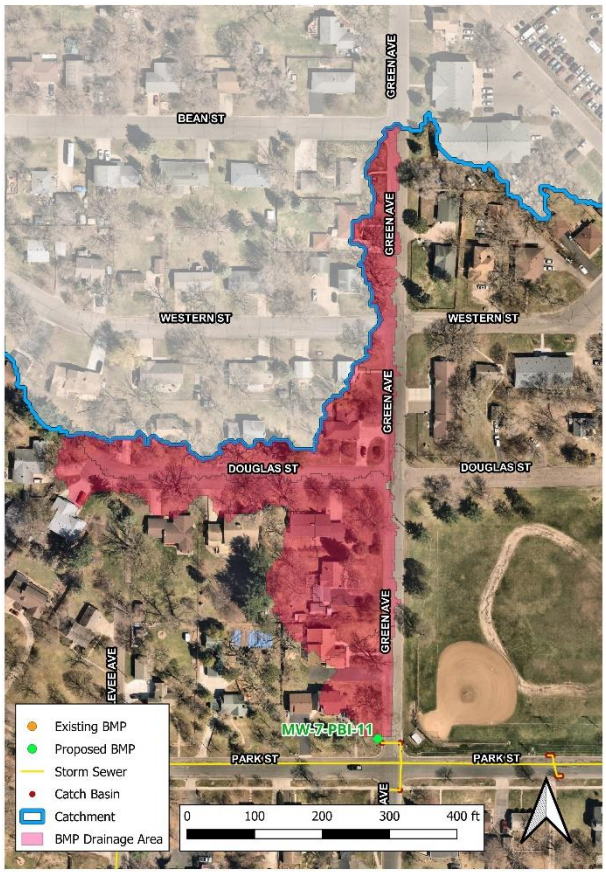
Green Ave.
Bioinfiltration Basin

Drainage Area – 2.71 acres

Location – 501 Park St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Green Ave. and Douglas St. to the north. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.51	0.9%
	TSS (lb/yr)	162	0.9%
	Volume (acre-feet/yr)	0.41	0.8%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,126**	
	30-yr Average Cost/1,000lb-TSS	**$3,546**	
	30-yr Average Cost/ac-ft Vol.	**$1,390**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-12

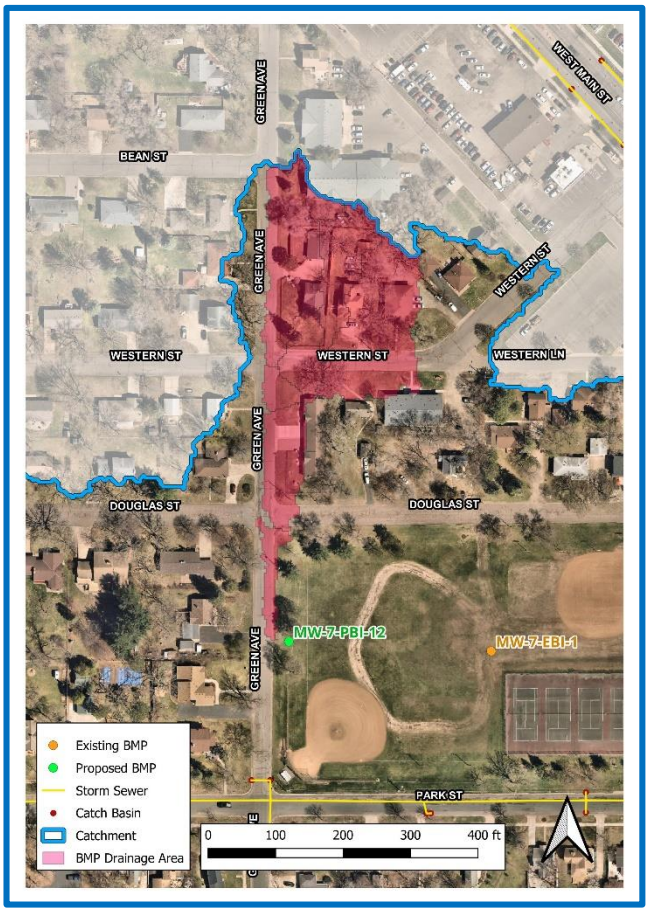
Rick Sorenson Park
Bioinfiltration Basin

Drainage Area – 1.81 acres

Location – 2015 State Ave.

Property Ownership – City of Anoka

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within Rick Sorenson Park on Green Ave. A bioinfiltration basin at this location would supplement the existing treatment provided by the park itself. The proposed basin is a large, single inlet rain garden that would treat stormwater collected on Green Ave. and Western St. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	500	sq-ft
	TP (lb/yr)	0.63	1.1%
	TSS (lb/yr)	217	1.2%
	Volume (acre-feet/yr)	0.67	1.2%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$16,320
	Total Estimated Project Cost (2023)		**$16,984**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,256**	
	30-yr Average Cost/1,000lb-TSS	**$3,646**	
	30-yr Average Cost/ac-ft Vol.	**$1,188**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-13

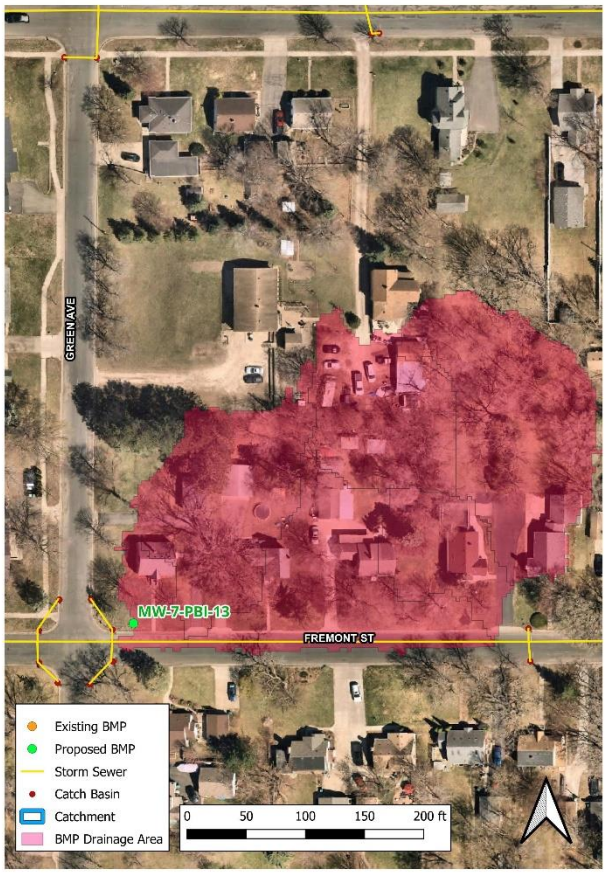
Fremont St.
Bioinfiltration Basin

Drainage Area – 2.06 acres

Location – 455 Fremont St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Fremont St. to the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.47	0.8%
	TSS (lb/yr)	149	0.8%
	Volume (acre-feet/yr)	0.39	0.7%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,222**	
	30-yr Average Cost/1,000lb-TSS	**$3,855**	
	30-yr Average Cost/ac-ft Vol.	**$1,472**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-14

Fremont St.
Bioinfiltration Basin

Drainage Area – 0.52 acres

Location – 456 Fremont St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Fremont St. to the east. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.23	0.4%
	TSS (lb/yr)	72	0.4%
	Volume (acre-feet/yr)	0.18	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,498**	
	30-yr Average Cost/1,000lb-TSS	**$7,979**	
	30-yr Average Cost/ac-ft Vol.	**$3,128**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-15

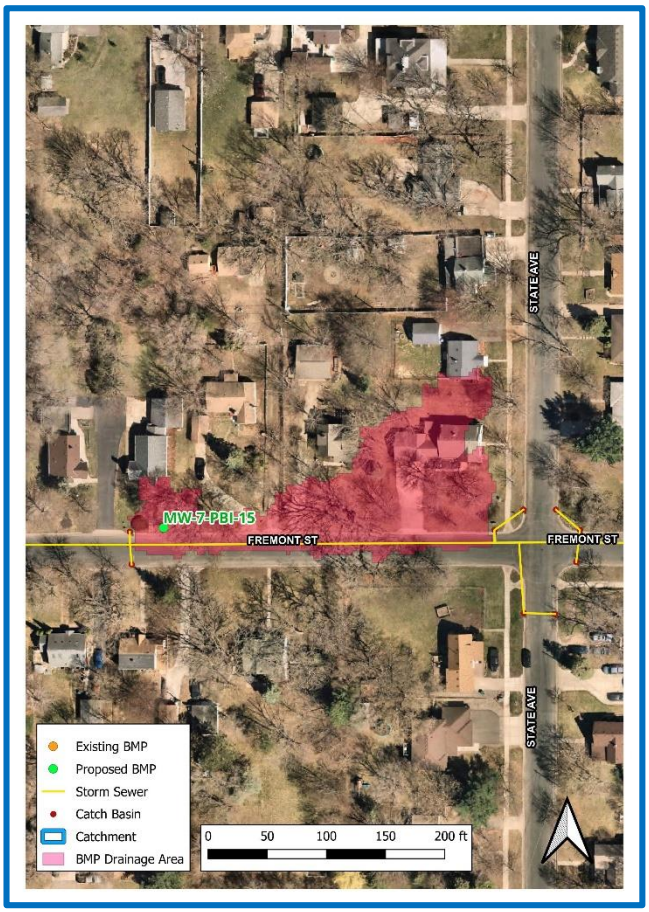
Fremont St.
Bioinfiltration Basin

Drainage Area – 0.55 acres

Location – 429 Fremont St

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Fremont St. to the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.24	0.4%
	TSS (lb/yr)	74	0.4%
	Volume (acre-feet/yr)	0.18	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,394**	
	30-yr Average Cost/1,000lb-TSS	**$7,763**	
	30-yr Average Cost/ac-ft Vol.	**$3,128**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-16

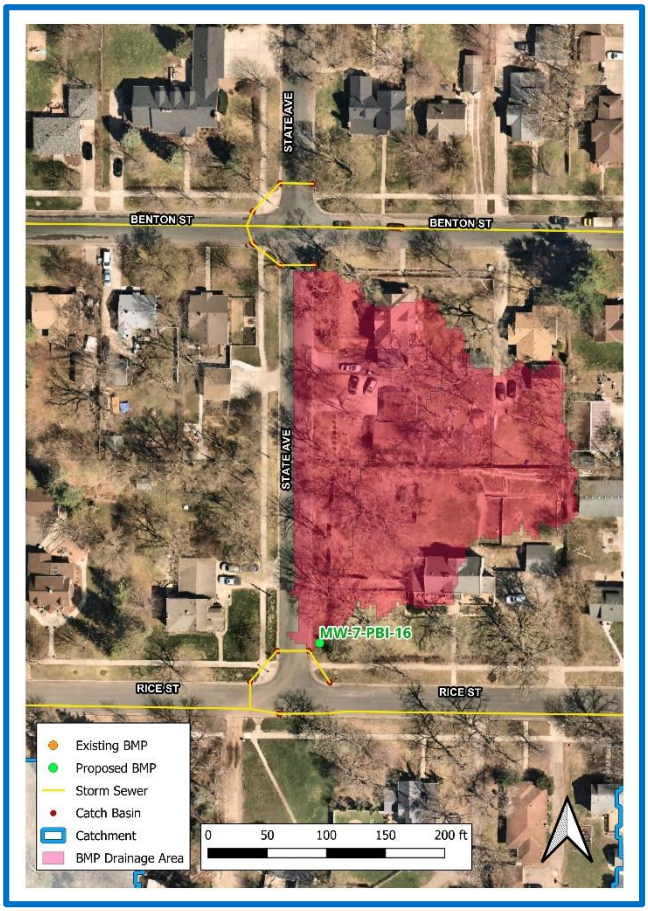
State Ave.
Bioinfiltration Basin

Drainage Area – 1.19 acres

Location – 317 Rice St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along State Ave. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.38	0.6%
	TSS (lb/yr)	118	0.6%
	Volume (acre-feet/yr)	0.30	0.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,512**	
	30-yr Average Cost/1,000lb-TSS	**$4,868**	
	30-yr Average Cost/ac-ft Vol.	**$1,925**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-17

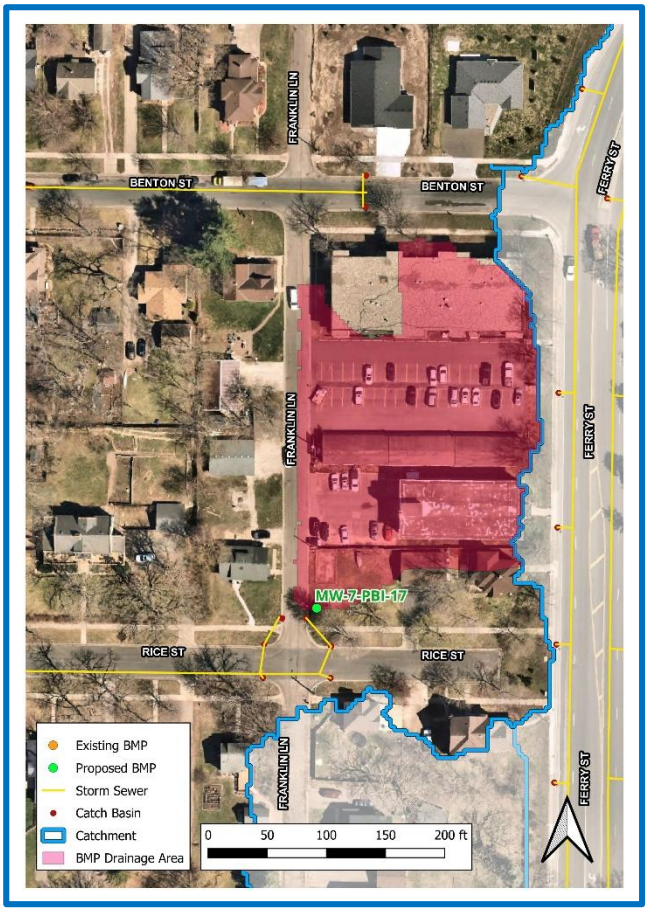
Franklin Ln.
Bioinfiltration Basin

Drainage Area – 1.15 acres

Location – 1703 Ferry St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Franklin Ln. from the commercial parking lots to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.36	0.6%
	TSS (lb/yr)	133	0.7%
	Volume (acre-feet/yr)	0.41	0.8%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,596**	
	30-yr Average Cost/1,000lb-TSS	**$4,319**	
	30-yr Average Cost/ac-ft Vol.	**$1,390**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBI-18

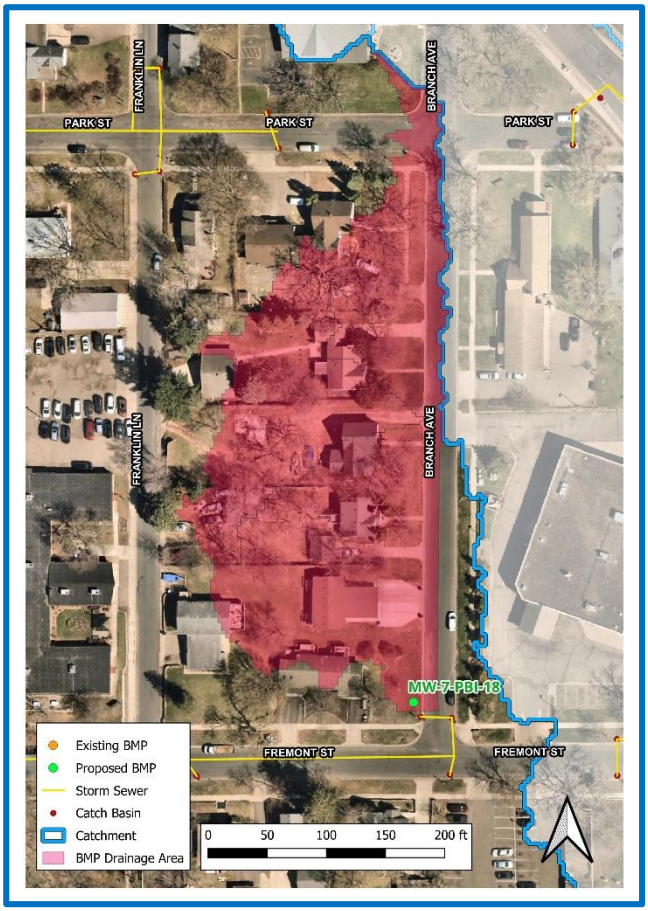
Branch Ave.
Bioinfiltration Basin

Drainage Area – 1.68 acres

Location – 205 Fremont St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Branch Ave. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.38	0.6%
	TSS (lb/yr)	132	0.7%
	Volume (acre-feet/yr)	0.44	0.8%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,512**	
	30-yr Average Cost/1,000lb-TSS	**$4,352**	
	30-yr Average Cost/ac-ft Vol.	**$1,317**	

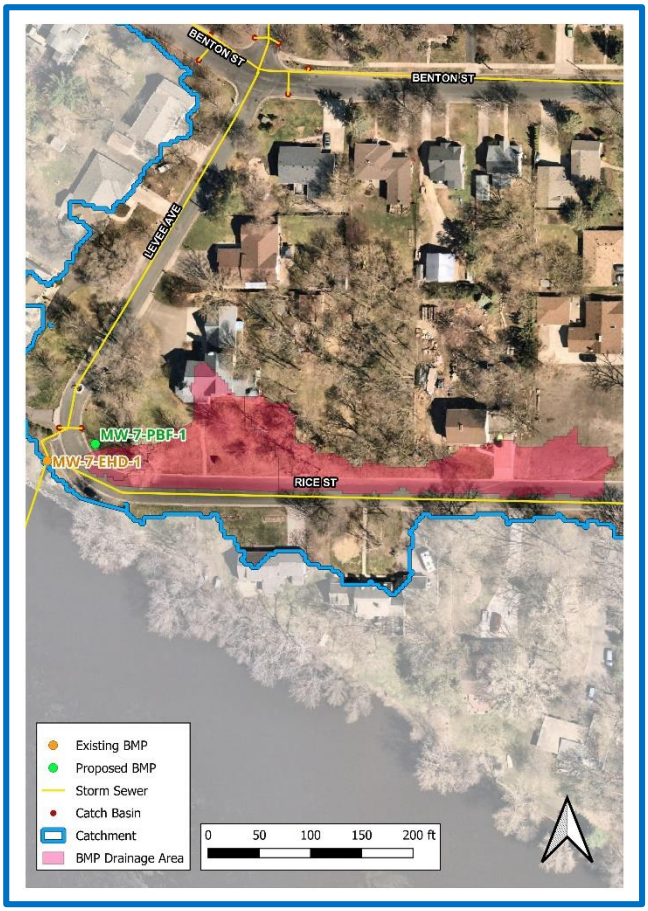
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-7-PBF-1

Rice St.
Biofiltration Basin



Drainage Area – 0.61 acres

Location – 532 Rice St. / 519 Rice St.

Property Ownership – City of Anoka / Private

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is on the corner of Rice St. opposite of the Rice St. Beach. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Rice St. to the east. Soils in this area are classified as Hydrologic Soil Group B, which have moderately low runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

	Curb-Cut Biofiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.22	0.4%
	TSS (lb/yr)	78	0.4%
	Volume (acre-feet/yr)	0.09	0.2%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$23,320
	Total Estimated Project Cost (2023)		**$23,984**
	Annual O&M***		$295
Efficiency	**30-yr Average Cost/lb-TP**	**$4,975**	
	30-yr Average Cost/1,000lb-TSS	**$14,032**	
	30-yr Average Cost/ac-ft Vol.	**$11,919**	

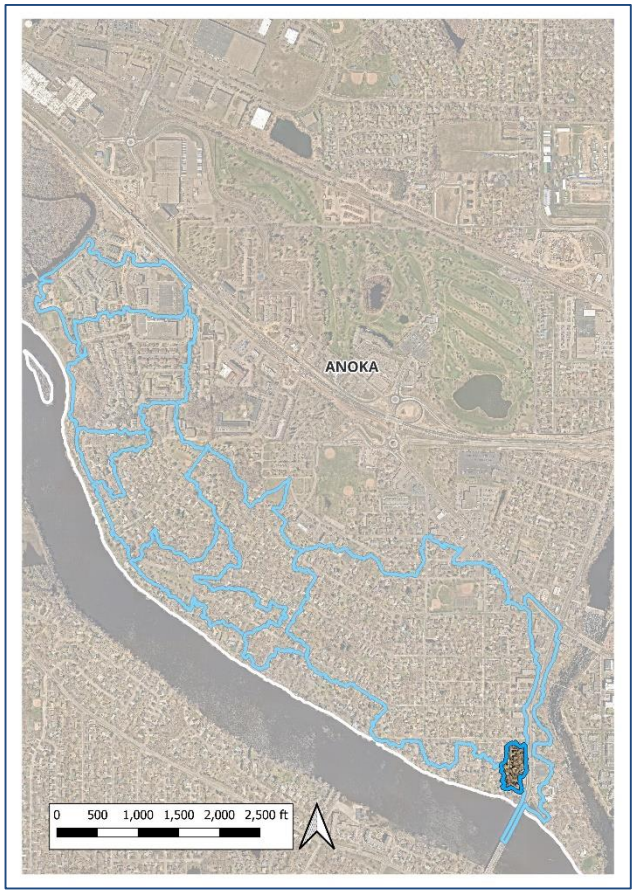
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Catchment MW-8

Existing Catchment Summary	
Acres	3.10
Parcels	25
Land Cover	100% Residential



CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River. It is a relatively small catchment that only contains a few properties within its drainage area. Stormwater runoff is routed along Franklin Ln. until it enters a single catch basin at the cul-de-sac, where it discharges directly into the Mississippi River.

EXISTING STORMWATER TREATMENT

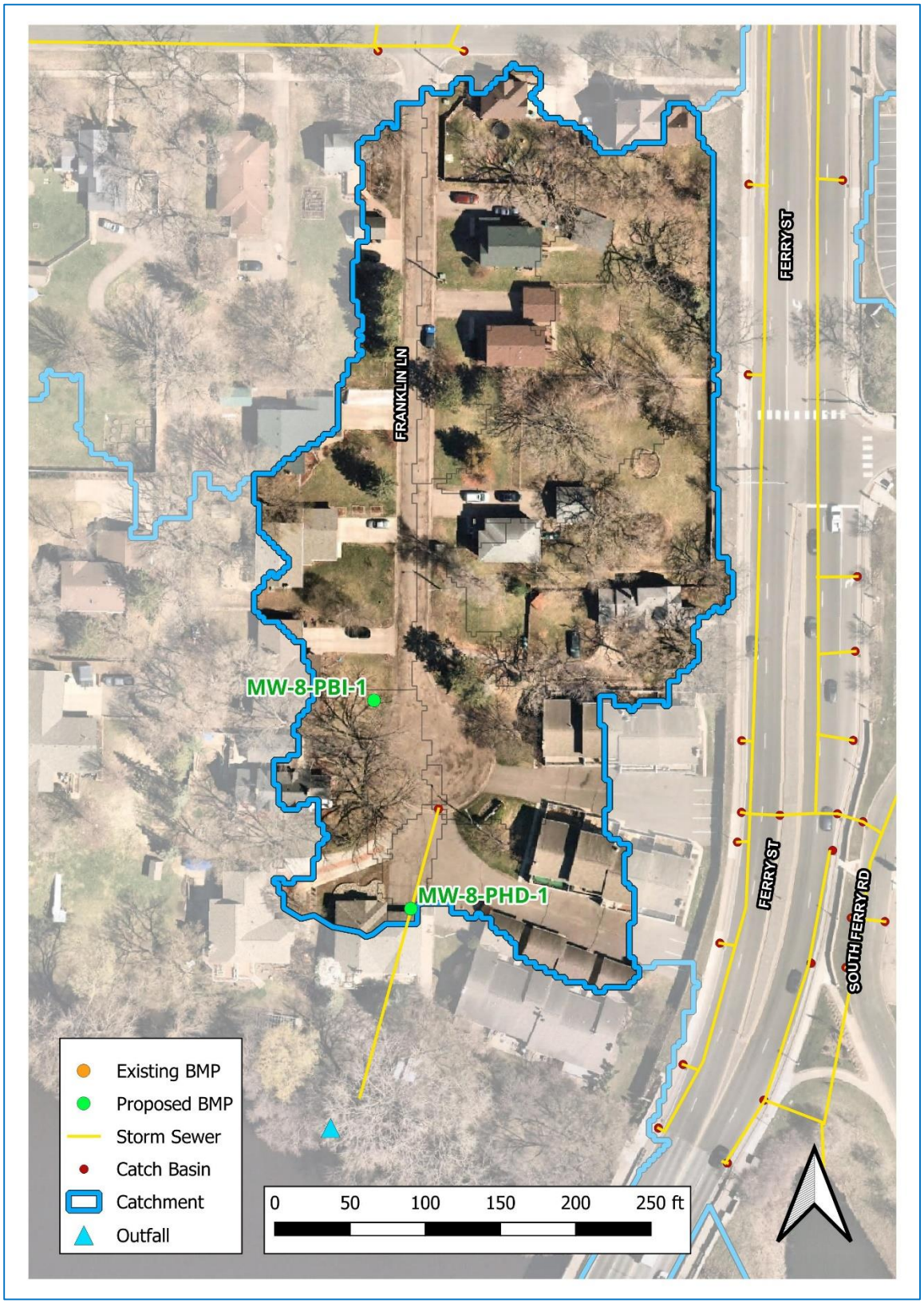
Street cleaning is conducted once in early spring and once in mid-summer by the City of Anoka. No other existing treatment was identified in this catchment. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	1.87	0.15	8%	**1.72**
	TSS (lb/yr)	600	63	10%	**538**
	Volume (acre-feet/yr)	1.5	0.00	0%	**1.5**

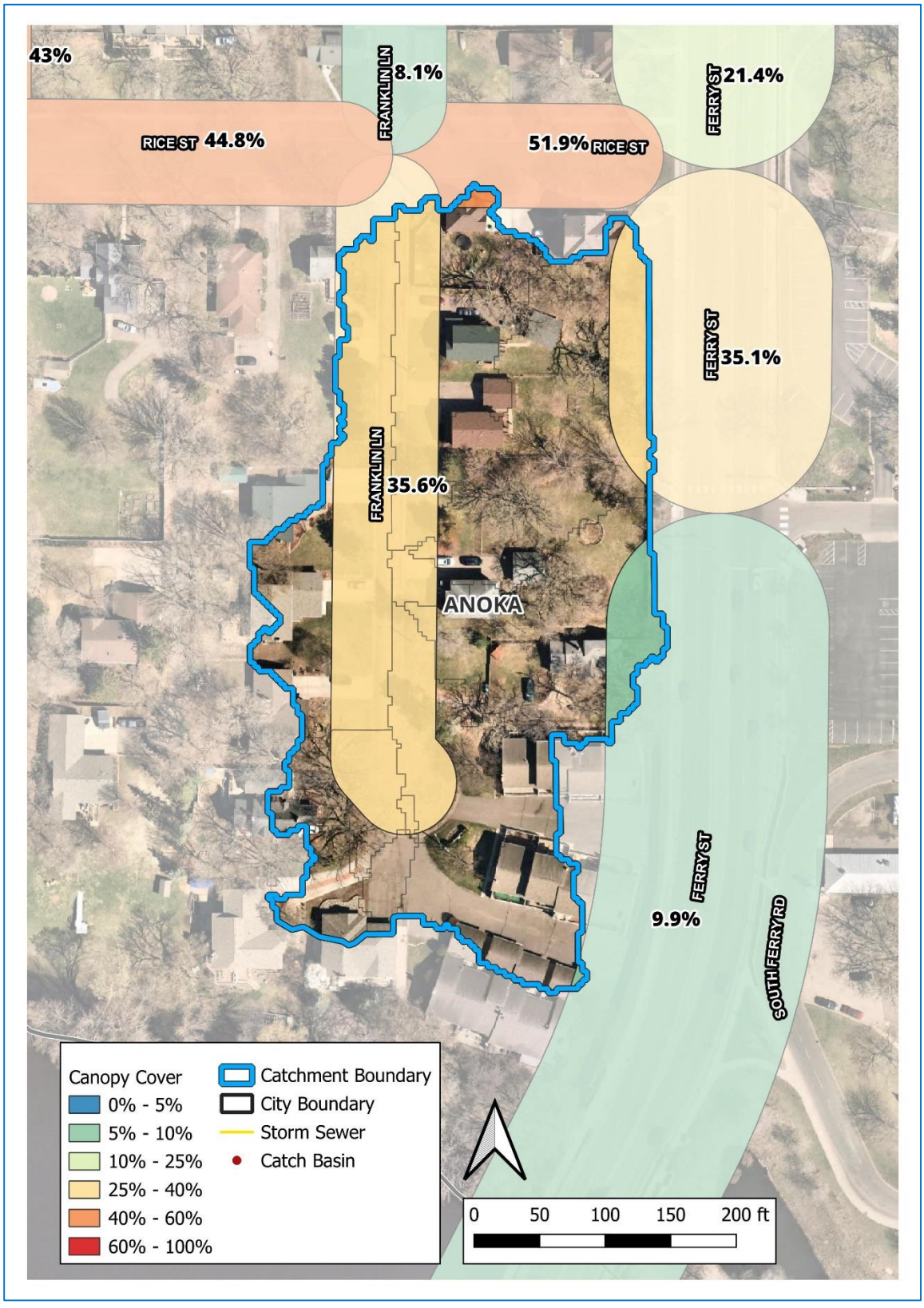
RETROFITS CONSIDERED

One bioinfiltration basin and one hydrodynamic device are proposed practices within this catchment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER



Project ID: MW-8-PBI-1

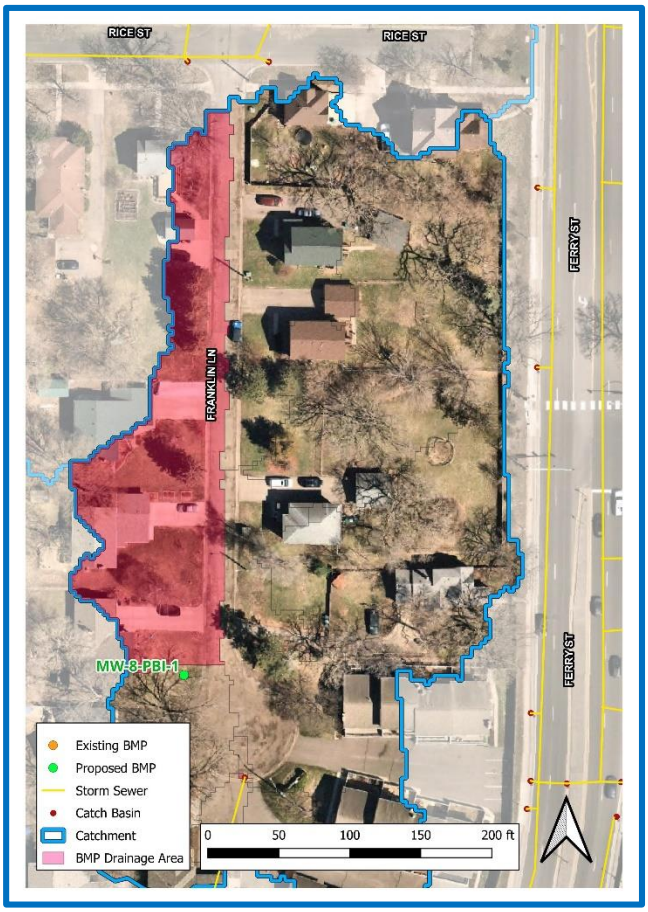
Franklin Ln.
Bioinfiltration Basin

Drainage Area – 0.57 acres

Location – 1525 Franklin Ln.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Franklin Ln. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.25	14.8%
	TSS (lb/yr)	79	14.7%
	Volume (acre-feet/yr)	0.19	12.7%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$2,262**
	30-yr Average Cost/1,000lb-TSS		**$7,281**
	30-yr Average Cost/ac-ft Vol.		**$2,960**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: MW-8-PHD-1

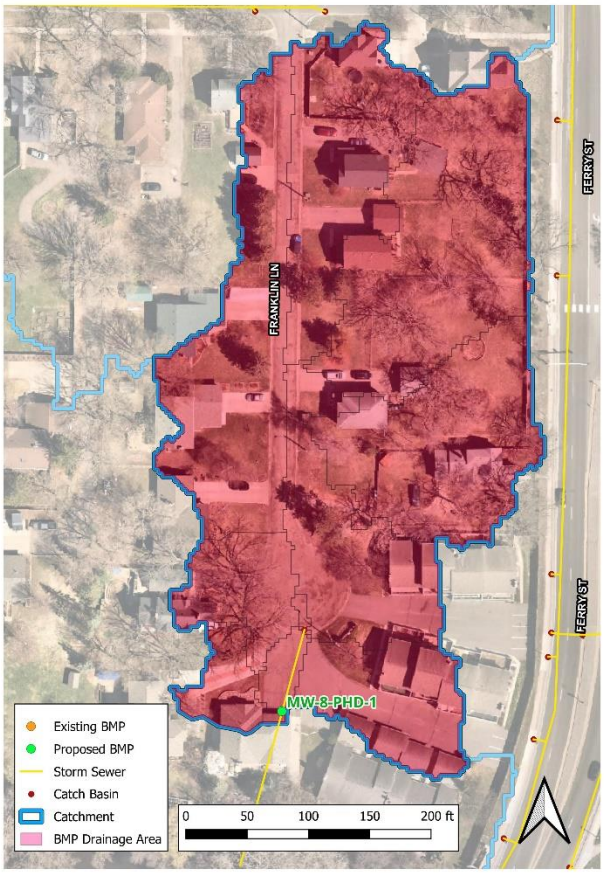
Franklin Ln.
Hydrodynamic Device

Drainage Area – 3.10 acres

Location – Franklin Ln. cul-de-sac

Property Ownership – City of Anoka / Private

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line at the end of the cul-de-sac of Franklin Ln. A device at this location would provide treatment to stormwater runoff for the entire catchment. The table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	6	ft diameter
	TP (lb/yr)	0.21	12.1%
	TSS (lb/yr)	86	16.0%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$37,500
	Total Estimated Project Cost (2023)		**$41,250**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$7,620**	
	30-yr Average Cost/1,000lb-TSS	**$18,452**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

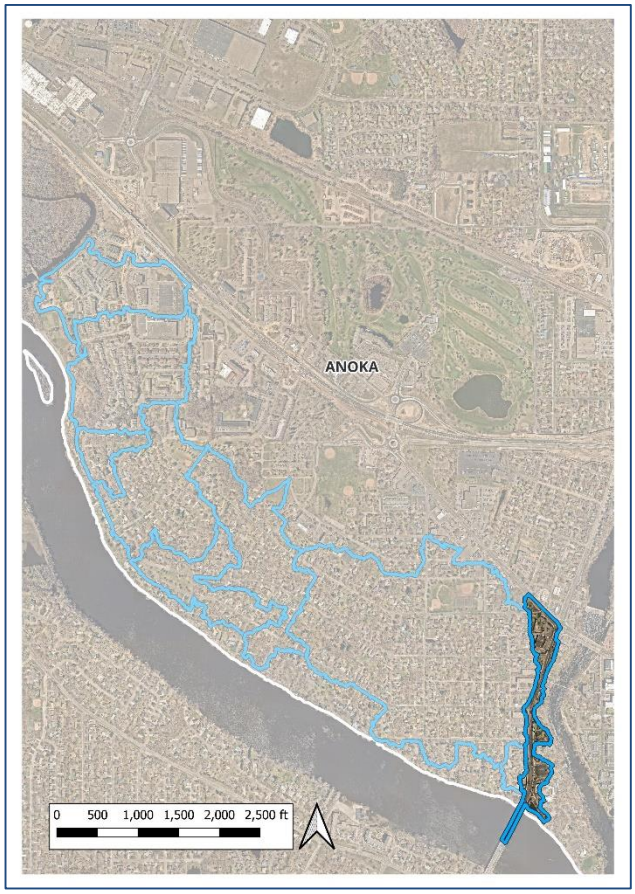
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($25,000 for materials) + ($12,500 for labor and installation costs)

***Per BMP: (1 cleanings/year)*(3 hours/cleaning)*($70/hour)

Catchment MW-9

Existing Catchment Summary	
Acres	13.66
Parcels	44
Land Cover	36.6% Freeway 34.3% Shop 14.6% Residential 4.9% Institutional 6.2% Open 3.4% Park



CATCHMENT DESCRIPTION

This catchment is located in Anoka, upstream of the Mississippi River's confluence with the Rum River. Stormwater runoff is collected into multiple catch basins on Ferry St. that route into an existing stormwater pond prior to discharging into the Mississippi River. Land use is primarily a mix of freeway and commercial properties, with small areas of residential, institutional, and open property throughout.

EXISTING STORMWATER TREATMENT

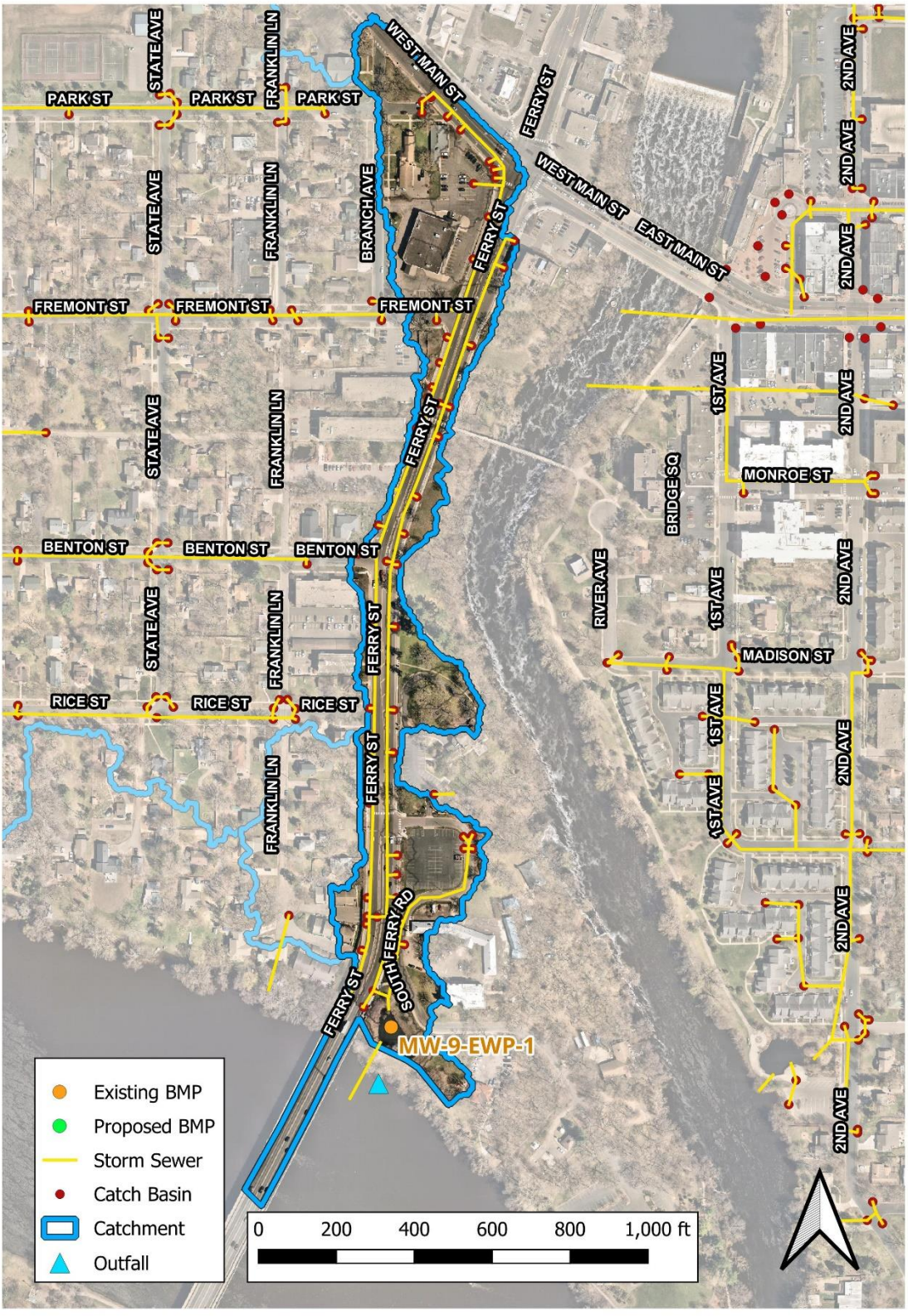
This catchment contains a stormwater pond at the outfall that provides treatment to the majority of the catchment. Street cleaning is also conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	**Base Loading**	**Treatment**	**Net Treatment %**	**Existing Loading**
Treatment	**Number of BMPs**	2			
	BMP Types	Street Cleaning, Wet Pond (EWP-1)			
	TP (lb/yr)	13.85	6.59	48%	**7.26**
	TSS (lb/yr)	5,469	3,302	60%	**2,167**
	Volume (acre-feet/yr)	15.0	0.01	0%	**15.0**

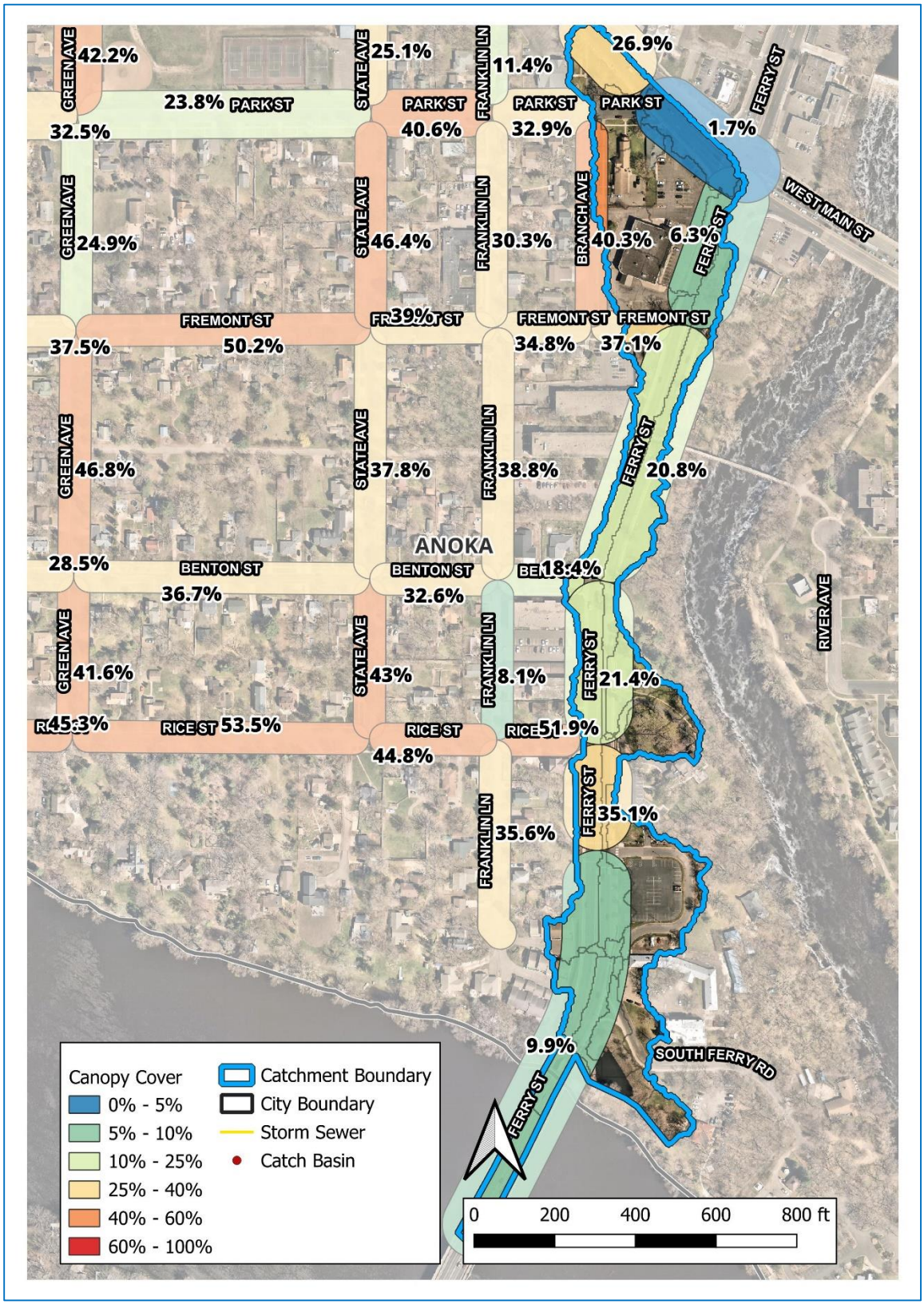
RETROFITS CONSIDERED

Due to existing treatment and limited space for new projects, no candidate BMPs were identified in this catchment. A stormwater pond modification project was considered for further analysis; the pond was reconstructed in 2001 and a field investigation noted a sediment plume near the storm line inlet. However, given the limited space and location adjacent to Ferry St., it was deemed that an expansion is not feasible. Instead, consideration should be given to increase maintenance of the stormwater pond.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

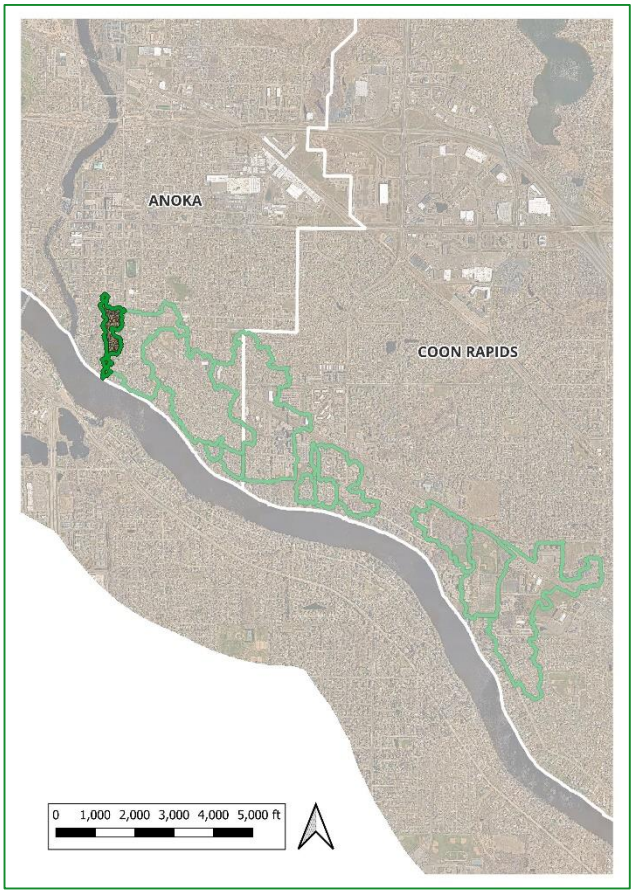


ROAD TREE CANOPY COVER



Catchment ME-1

Existing Catchment Summary	
Acres	12.37
Parcels	58
Land Cover	100% Residential



CATCHMENT DESCRIPTION

This catchment is located in Anoka, downstream of the Mississippi River's confluence with the Rum River. Stormwater runoff is collected into multiple catch basins on 3rd Ave. that route into an existing hydrodynamic device prior to discharging into the Mississippi River.

EXISTING STORMWATER TREATMENT

This catchment contains a hydrodynamic device at the end of 3rd Ave. near the outfall that provides treatment to the majority of the catchment. Street cleaning is also conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	2			
	BMP Types	Street Cleaning, Hydrodynamic Device (EHD-1)			
	TP (lb/yr)	7.01	1.31	19%	**5.70**
	TSS (lb/yr)	2,209	544	25%	**1,665**
	Volume (acre-feet/yr)	5.2	0.00	0%	**5.2**

RETROFITS CONSIDERED

Four bioinfiltration basins are proposed within this catchment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

ROAD TREE CANOPY COVER

Project ID: ME-1-PBI-1

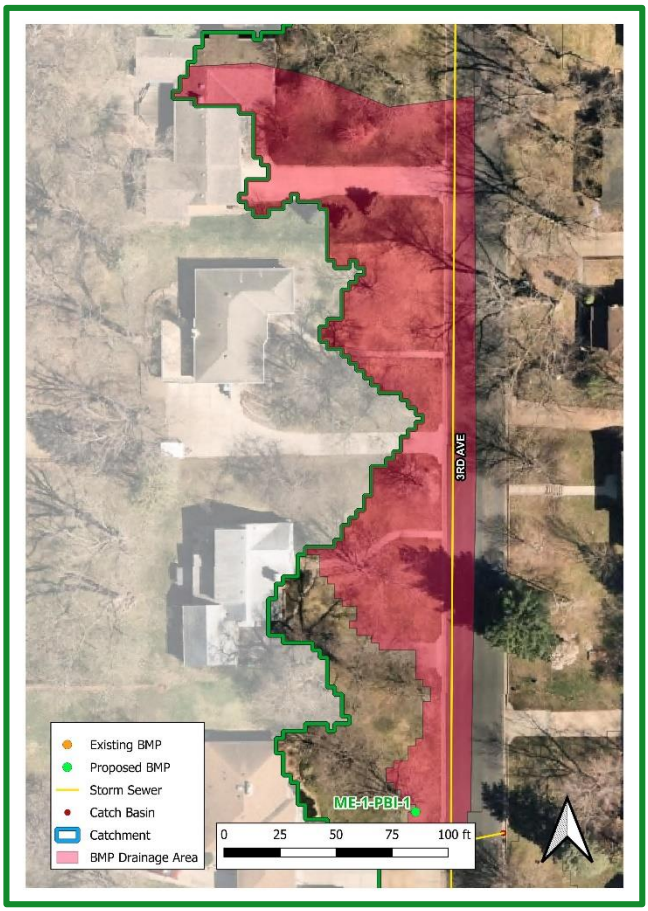
3rd Ave.
Bioinfiltration Basin

Drainage Area – 0.43 acres

Location – 1329 3rd Ave

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 3rd Ave. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.19	3.3%
	TSS (lb/yr)	56	3.4%
	Volume (acre-feet/yr)	0.15	3.0%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$3,089**	
	30-yr Average Cost/1,000lb-TSS	**$10,258**	
	30-yr Average Cost/ac-ft Vol.	**$3,727**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-1-PBI-2

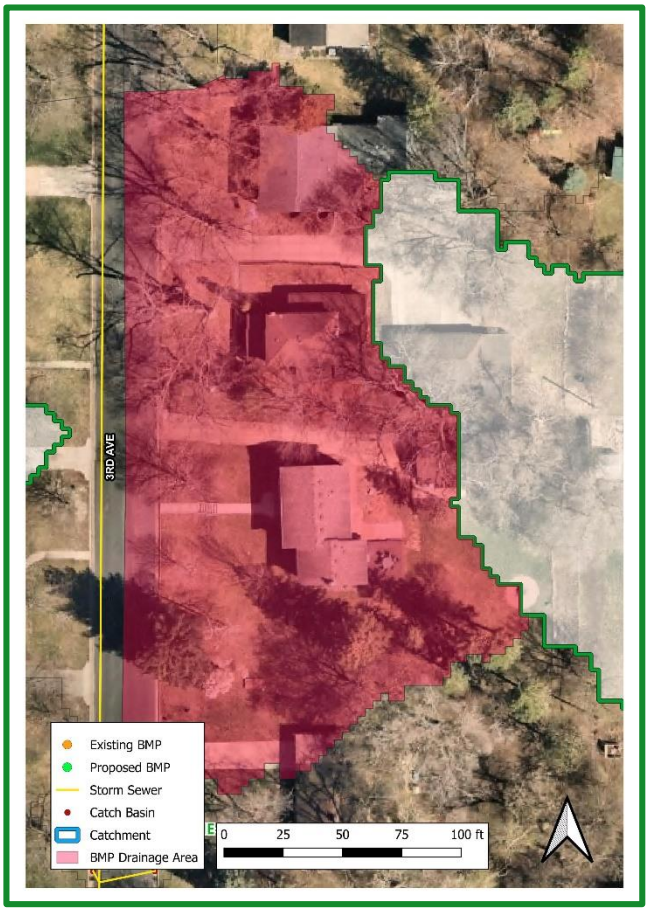
3rd Ave.
Bioinfiltration Basin

Drainage Area – 0.82 acres

Location – 1322 3rd Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 3rd Ave. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.29	5.1%
	TSS (lb/yr)	90	5.4%
	Volume (acre-feet/yr)	0.26	5.0%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,961**	
	30-yr Average Cost/1,000lb-TSS	**$6,383**	
	30-yr Average Cost/ac-ft Vol.	**$2,199**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-1-PBI-3

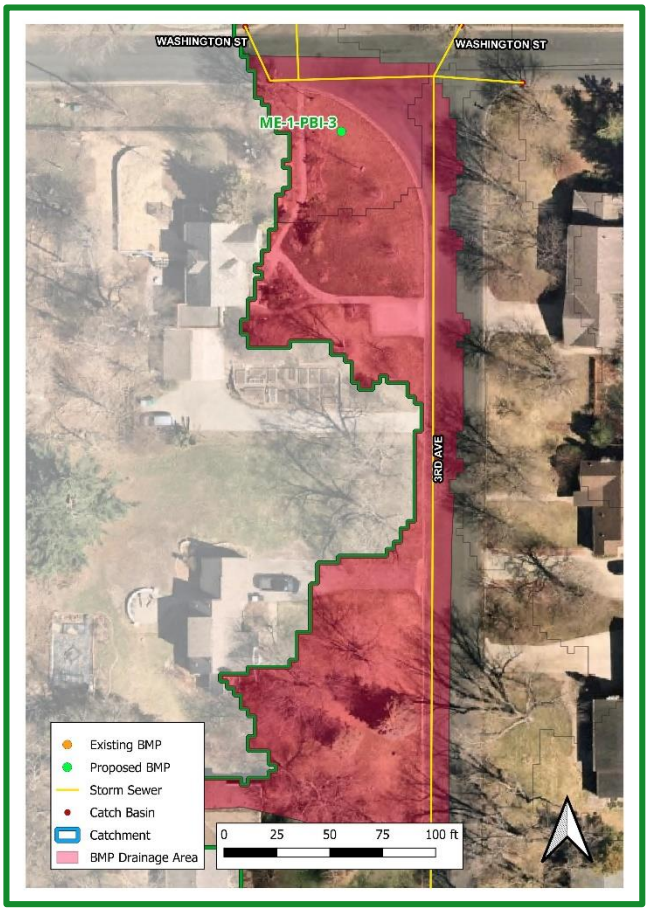
3rd Ave.
Bioinfiltration Basin

Drainage Area – 0.60 acres

Location – 1435 3rd Ave

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 3rd Ave. to the south. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.24	4.3%
	TSS (lb/yr)	74	4.4%
	Volume (acre-feet/yr)	0.20	3.9%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,345**	
	30-yr Average Cost/1,000lb-TSS	**$7,763**	
	30-yr Average Cost/ac-ft Vol.	**$2,861**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-1-PBI-4

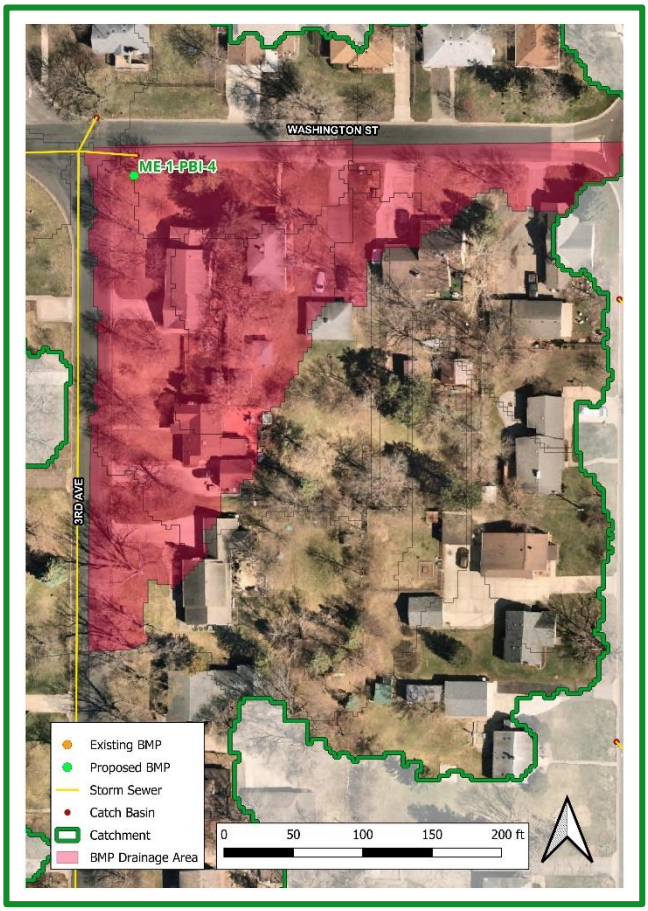
Washington St.
Bioinfiltration Basin

Drainage Area – 1.34 acres

Location – 1434 3rd Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a large, double inlet rain garden that would treat stormwater collected along both 3rd Ave. to the south and Washington St. from the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	500	sq-ft
	TP (lb/yr)	0.52	9.1%
	TSS (lb/yr)	162	9.7%
	Volume (acre-feet/yr)	0.49	9.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$16,320
	Total Estimated Project Cost (2023)		**$16,984**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,524**	
	30-yr Average Cost/1,000lb-TSS	**$4,884**	
	30-yr Average Cost/ac-ft Vol.	**$1,625**	

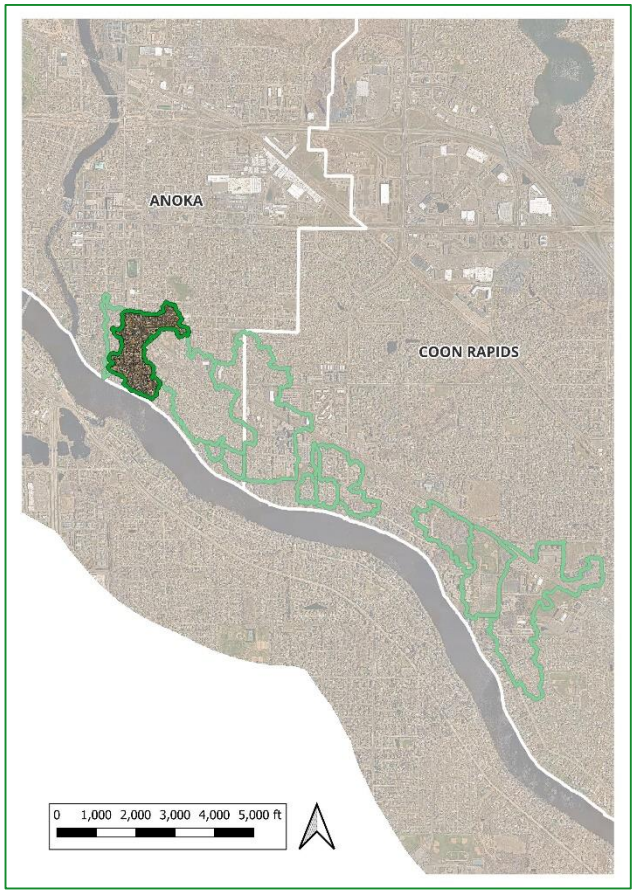
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Catchment ME-2

Existing Catchment Summary	
Acres	49.34
Parcels	132
Land Cover	66.7% Residential 12.4% Institutional 10.1% Park 8.3% Commercial 2.5% Industrial



CATCHMENT DESCRIPTION

This catchment is located in Anoka, downstream of the Mississippi River's confluence with the Rum River. Stormwater runoff is collected through multiple catch basins throughout the catchment that discharge water directly into the Mississippi River. The catchment is relatively large, and land use is primarily single family residential houses with commercial properties on the northern side.

EXISTING STORMWATER TREATMENT

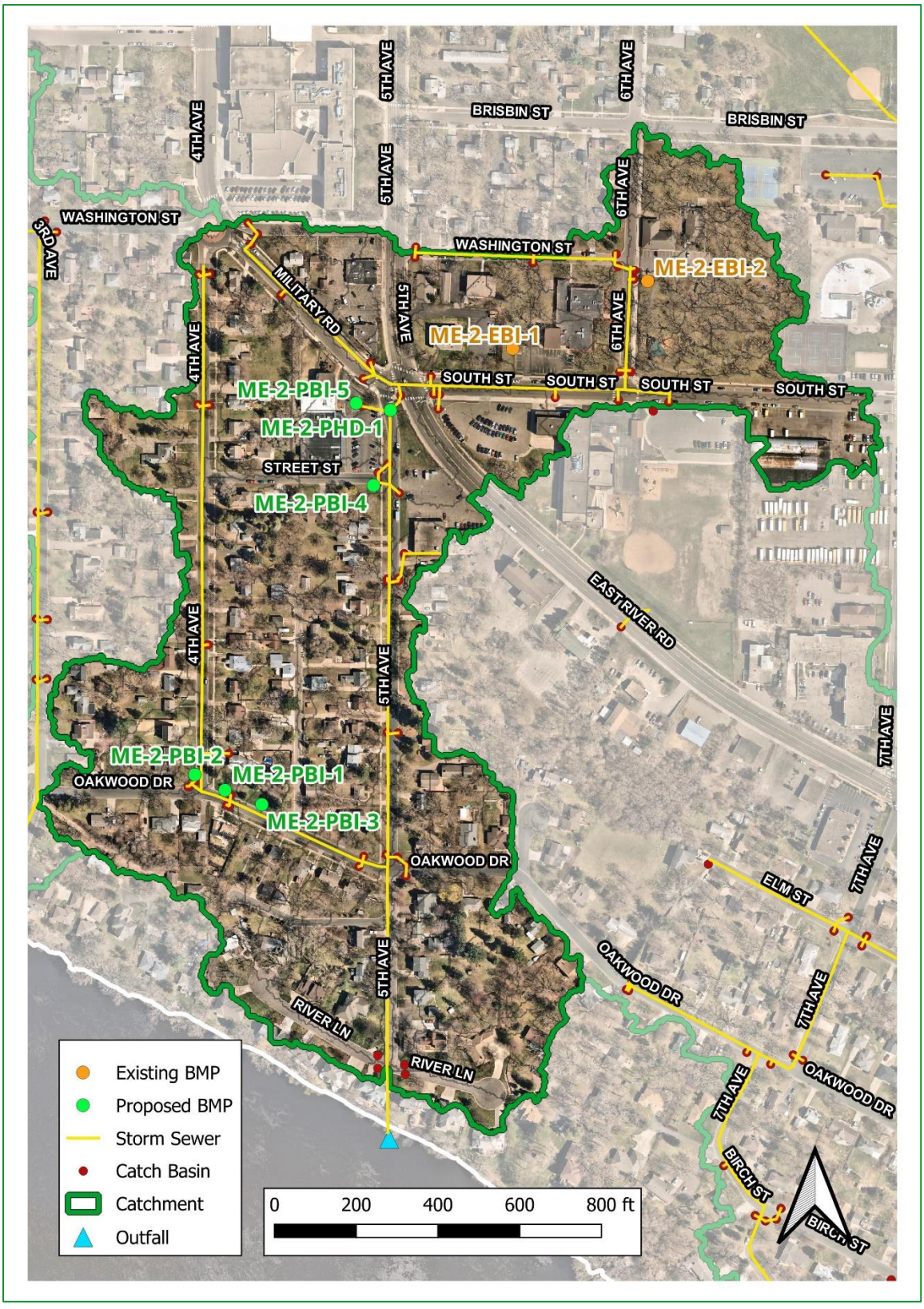
This catchment contains two bioinfiltration basins that provide treatment to a portion of the commercial properties on the northern side. These basins are naturally low-lying areas with curb-cuts installed to route stormwater runoff from the parking lots. Street cleaning is also conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	3			
	BMP Types	Street Cleaning, Bioinfiltration Basin (EBI-1, EBI-2)			
	TP (lb/yr)	29.79	2.90	10%	**26.89**
	TSS (lb/yr)	10,709	1,262	12%	**9,447**
	Volume (acre-feet/yr)	26.7	0.87	3%	**25.8**

RETROFITS CONSIDERED

Five bioinfiltration basins and one hydrodynamic device are proposed within this catchment.

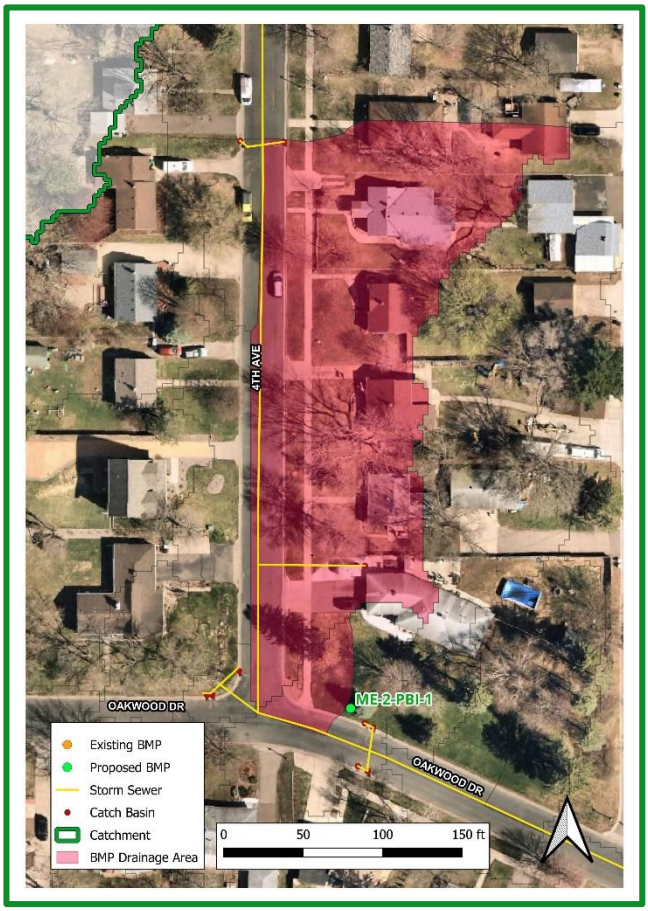
EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER

Project ID: ME-2-PBI-1

Oakwood Dr.
Bioinfiltration Basin



Drainage Area – 0.96 acres

Location – 401 Oakwood Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 4th Ave. to the north. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.35	1.3%
	TSS (lb/yr)	109	1.2%
	Volume (acre-feet/yr)	0.25	1.0%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,641**	
	30-yr Average Cost/1,000lb-TSS	**$5,270**	
	30-yr Average Cost/ac-ft Vol.	**$2,275**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-2-PBI-2

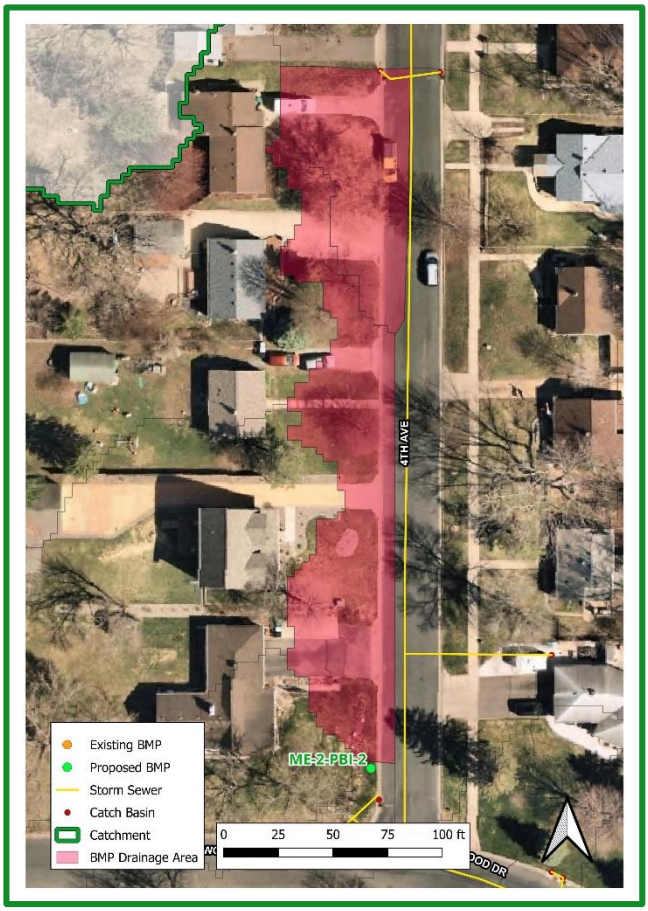
4th Ave.
Bioinfiltration Basin

Drainage Area – 0.32 acres

Location – 1201 4th Ave

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 4th Ave. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.15	0.6%
	TSS (lb/yr)	47	0.5%
	Volume (acre-feet/yr)	0.11	0.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$3,830**	
	30-yr Average Cost/1,000lb-TSS	**$12,223**	
	30-yr Average Cost/ac-ft Vol.	**$5,005**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-2-PBI-3

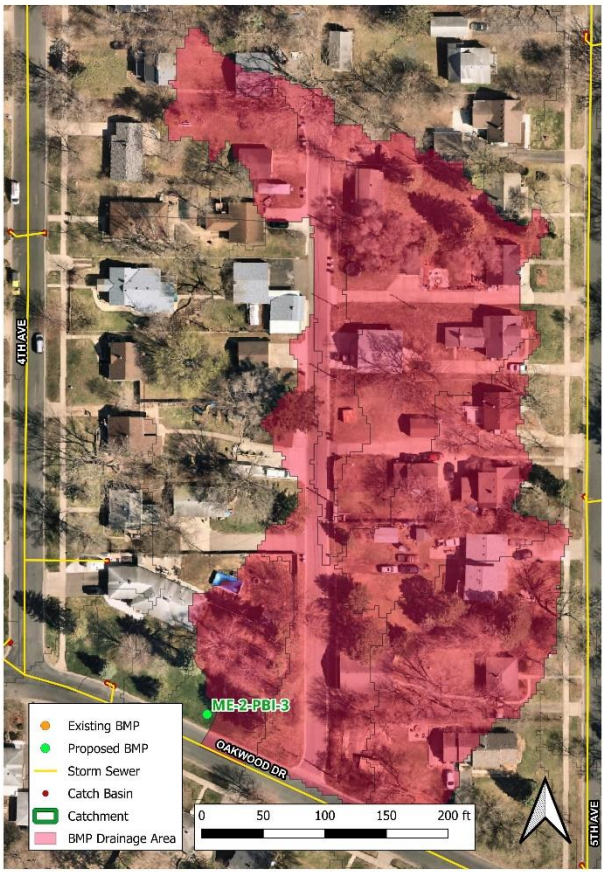
Oakwood Dr.
Bioinfiltration Basin

Drainage Area – 2.82 acres

Location – 401 Oakwood Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along the private residential road between 4th Ave. and 5th Ave. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.55	2.0%
	TSS (lb/yr)	174	1.8%
	Volume (acre-feet/yr)	0.41	1.6%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,044**	
	30-yr Average Cost/1,000lb-TSS	**$3,302**	
	30-yr Average Cost/ac-ft Vol.	**$1,390**	

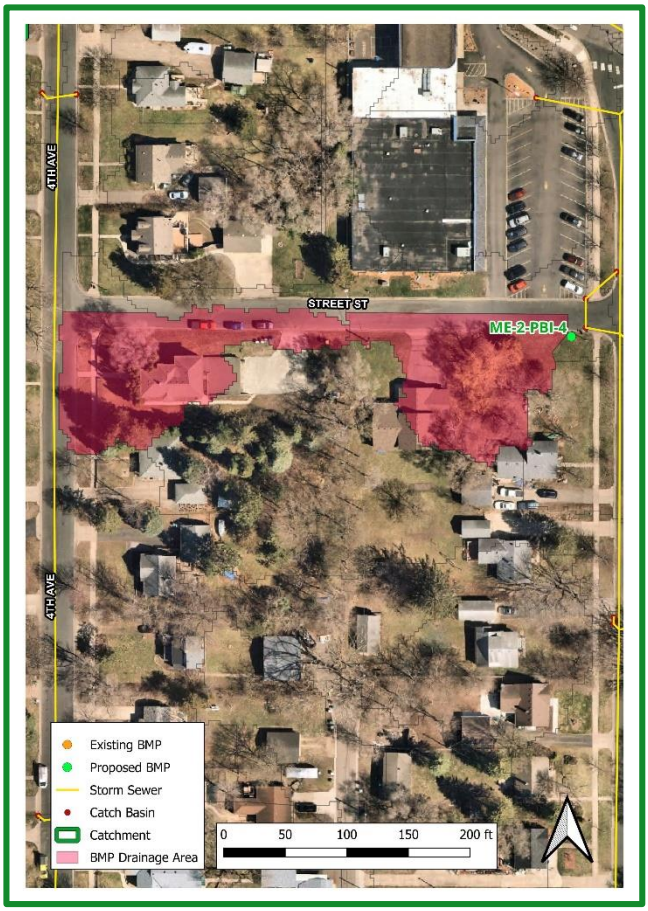
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-2-PBI-4

Street St.
Bioinfiltration Basin



Drainage Area – 0.68 acres

Location – 1305 5th Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Street St. to the west. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.28	1.0%
	TSS (lb/yr)	93	1.0%
	Volume (acre-feet/yr)	0.28	1.1%
Cost	**Administration & Promotion Costs***	$664	
	Design & Construction Costs**	$9,820	
	Total Estimated Project Cost (2023)	**$10,484**	
	Annual O&M***	$225	
Efficiency	**30-yr Average Cost/lb-TP**	**$2,052**	
	30-yr Average Cost/1,000lb-TSS	**$6,177**	
	30-yr Average Cost/ac-ft Vol.	**$2,085**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-2-PBI-5

Montessori Renaissance Academy
Bioinfiltration Basin

Drainage Area – 0.79 acres

Location – 1333 5th Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within a parking lot island near the catch basin. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected from the majority of the parking lot and runoff from the roof. The table below provides pollutant removals and estimated costs.

	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.36	1.3%
	TSS (lb/yr)	142	1.5%
	Volume (acre-feet/yr)	0.34	1.3%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,596**	
	30-yr Average Cost/1,000lb-TSS	**$4,046**	
	30-yr Average Cost/ac-ft Vol.	**$1,668**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-2-PHD-1

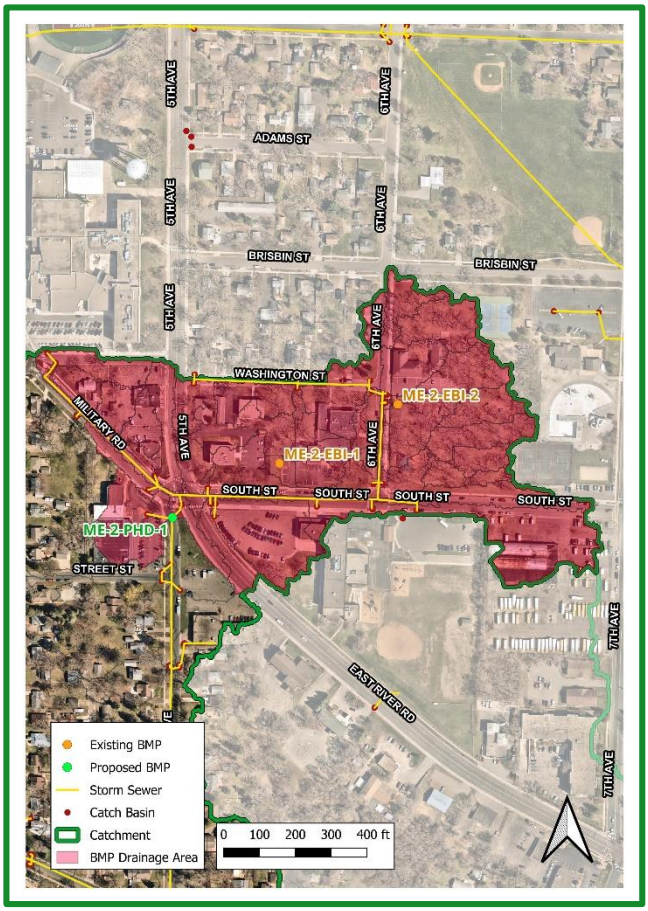
5th Ave.
Hydrodynamic Device

Drainage Area – 16.4 acres

Location – Intersection of Military Rd. and 5th Ave.

Property Ownership – City of Anoka

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line near the intersection of Military Rd. and 5th Ave. A device at this location would provide treatment to stormwater runoff for the northeastern portion of this catchment. The table below provides pollutant removals and estimated costs.



Hydrodynamic Device			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	10	ft diameter
	TP (lb/yr)	0.98	3.6%
	TSS (lb/yr)	512	5.4%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$5,444**	
	30-yr Average Cost/1,000lb-TSS	**$10,420**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

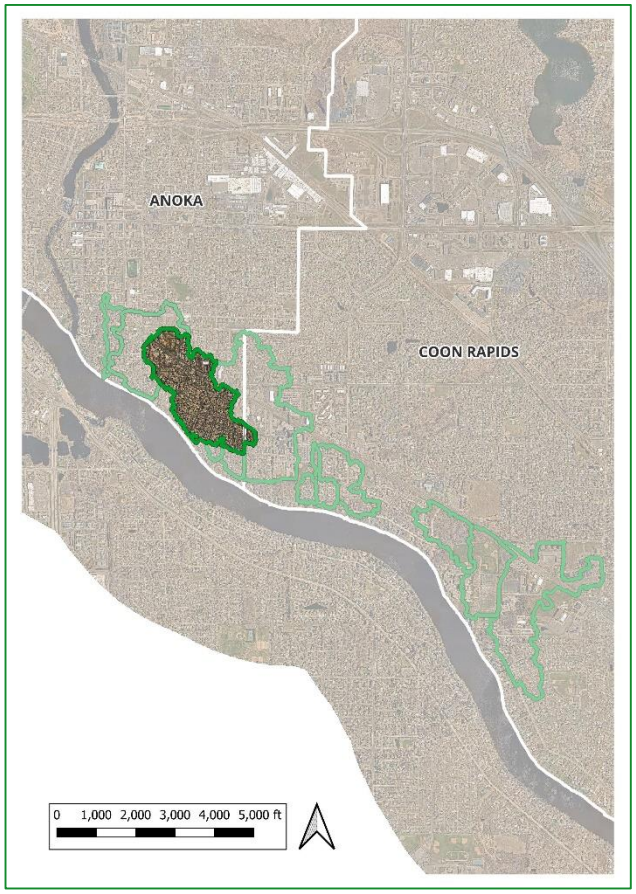
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Catchment ME-3

Existing Catchment Summary	
Acres	95.26
Parcels	262
Land Cover	75.7% Residential 13.0% Commercial 8.2% Institutional 1.7% Industrial 1.5% Open



CATCHMENT DESCRIPTION

This catchment is located in Anoka, downstream of the Mississippi River's confluence with the Rum River, as well as a small portion of Coon Rapids on the southeastern side of the catchment. Stormwater runoff is routed through multiple, closely-spaced catch basins that route water into an existing hydrodynamic device prior to discharging into the Mississippi River. The catchment is relatively large, and land use is primarily single family residential houses with commercial properties on the northern side near East River Rd.

EXISTING STORMWATER TREATMENT

This catchment contains one bioinfiltration basin and one hydrodynamic device. The biofiltration device is located on the side of East River Rd. near Lincoln Elementary. The existing hydrodynamic device is located near the catchment outfall. Street cleaning is also conducted once in early spring and once in mid-summer by the City of Anoka, and five times per year by the City of Coon Rapids. Present day stormwater pollutant loading and treatment is summarized in the table below.

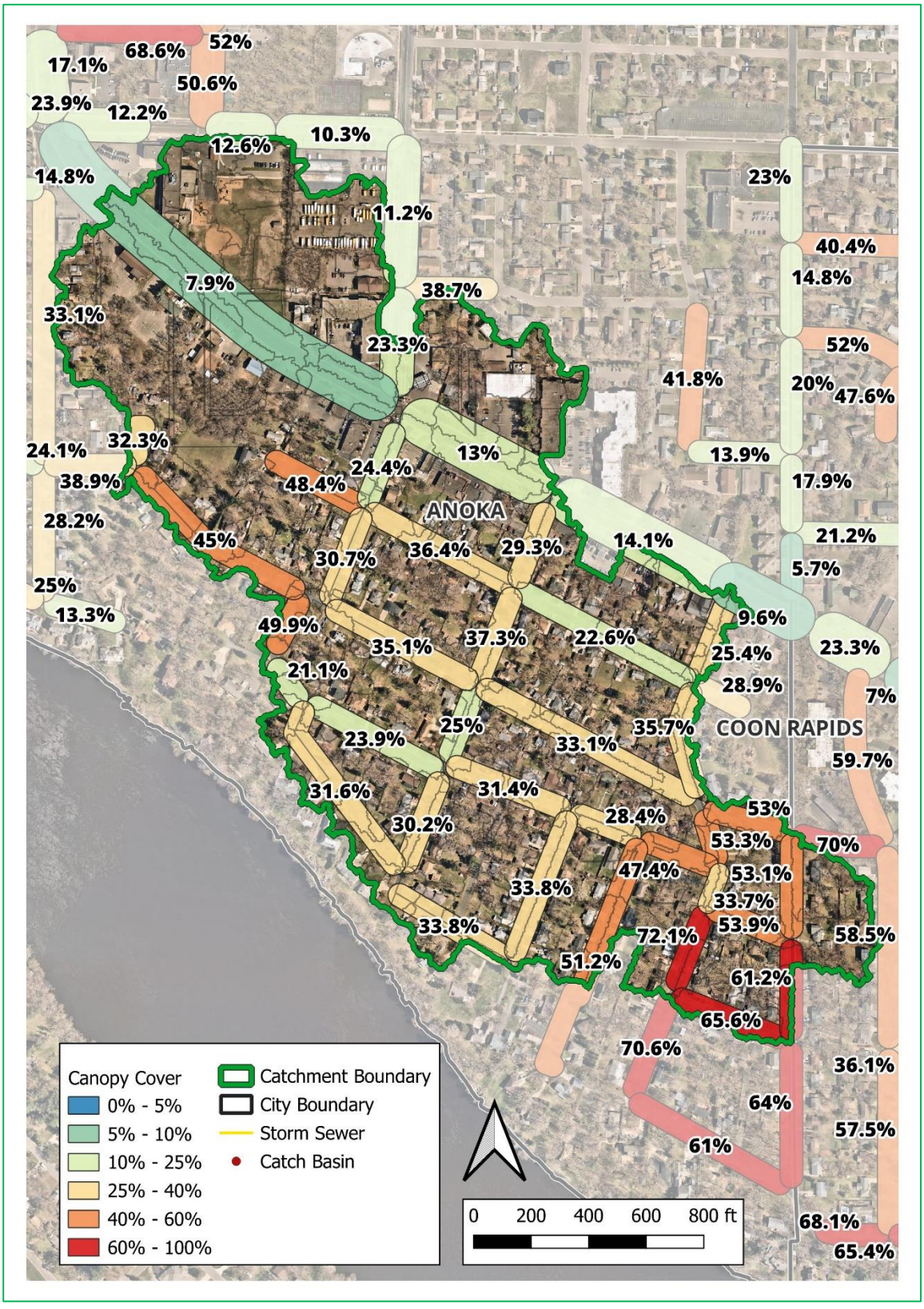
	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	3			
	BMP Types	Street Cleaning, Hydrodynamic Device (EHD-1),			
	TP (lb/yr)	60.80	17.01	28%	**43.79**
	TSS (lb/yr)	21,982	7,391	34%	**14,591**
	Volume (acre-feet/yr)	56.6	11.75	21%	**44.8**

RETROFITS CONSIDERED

Multiple bioinfiltration basins are proposed within this catchment. Due to the abundant number of catch basins throughout the catchment, the contributing drainage size for the majority of proposed practices is relatively small compared to other catchments.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

ROAD TREE CANOPY COVER



Project ID: ME-3-PBI-1

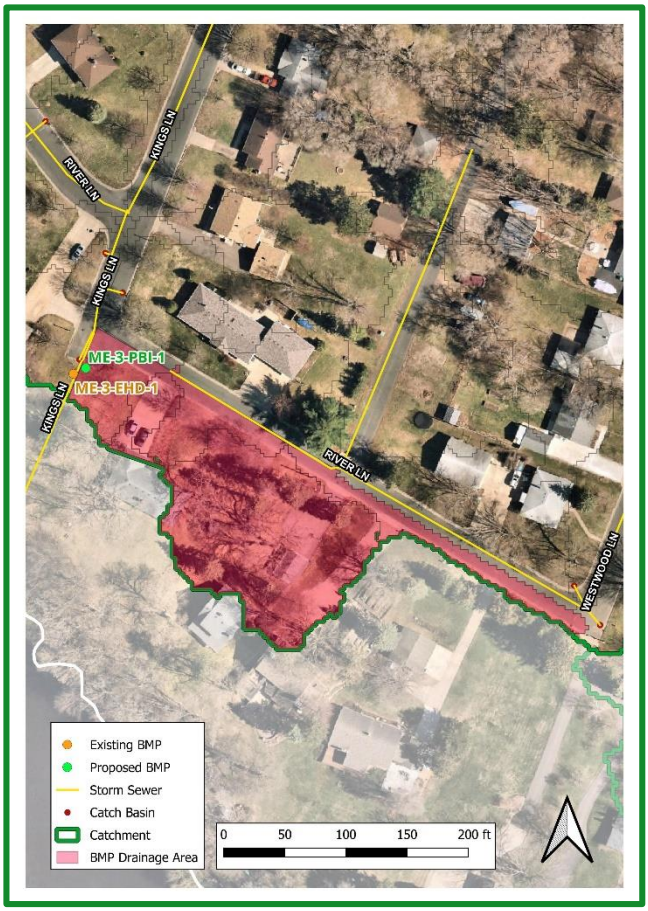
Kings Ln.
Bioinfiltration Basin

Drainage Area – 0.76 acres

Location – Kings Ln. City Outlot

Property Ownership – City of Anoka

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is at the end of Kings Ln. in a city-owned outlot. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected from River Ln. to the east. A double inlet is not recommended at this location due to an existing catch basin just north of the proposed project. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	500	sq-ft
	TP (lb/yr)	0.35	0.8%
	TSS (lb/yr)	107	0.7%
	Volume (acre-feet/yr)	0.28	0.6%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$16,320
	Total Estimated Project Cost (2023)		**$16,984**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,260**	
	30-yr Average Cost/1,000lb-TSS	**$7,394**	
	30-yr Average Cost/ac-ft Vol.	**$2,872**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-2

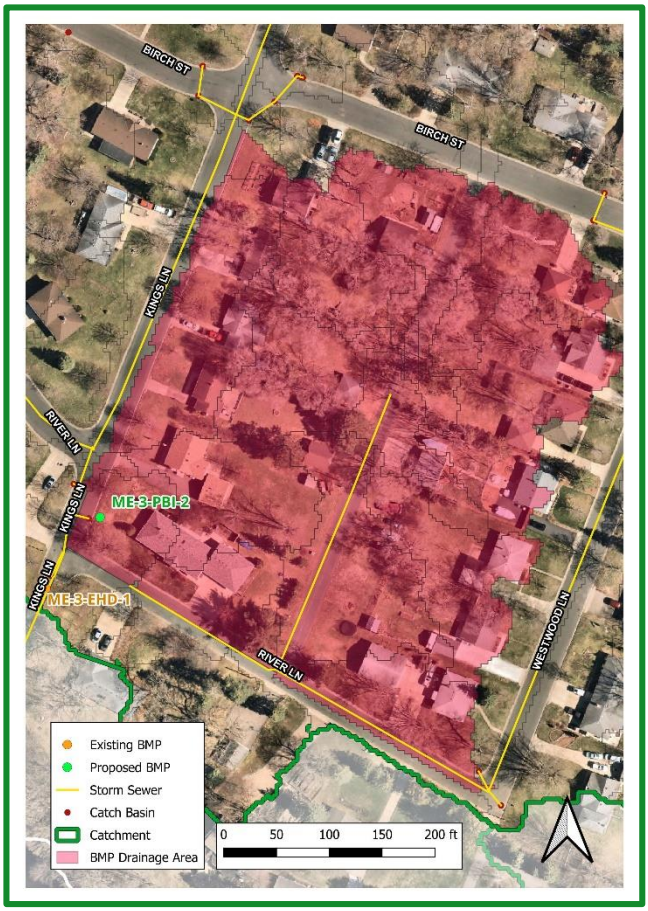
Kings Ln.
Bioinfiltration Basin

Drainage Area – 4.43 acres

Location – 803 River Ln.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a large, double inlet rain garden that would treat stormwater collected along both River Ln. to the east and Kings Ln. to the north. Additionally, it would also capture stormwater collected on the private residential road between Kings Ln. and Westwood Ln. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	500	sq-ft
	TP (lb/yr)	0.97	2.2%
	TSS (lb/yr)	303	2.1%
	Volume (acre-feet/yr)	0.76	1.7%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$16,320
	Total Estimated Project Cost (2023)		**$16,984**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$816**	
	30-yr Average Cost/1,000lb-TSS	**$2,611**	
	30-yr Average Cost/ac-ft Vol.	**$1,044**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

Project ID: ME-3-PBI-3

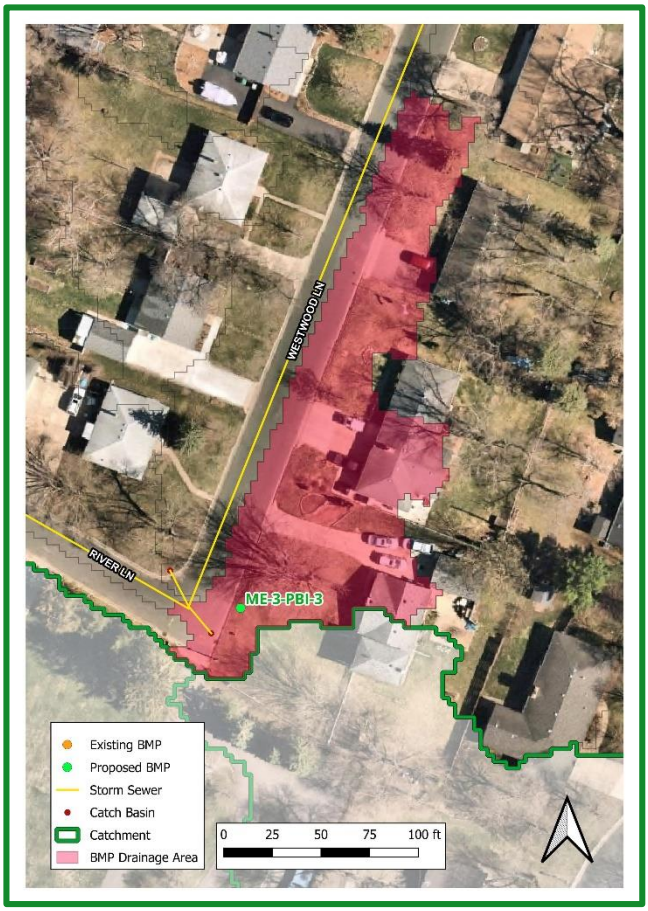
Westwood Ln.
Bioinfiltration Basin

Drainage Area – 0.43 acres

Location – 904 Westwood Ln.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Westwood Ln. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.19	0.4%
	TSS (lb/yr)	58	0.4%
	Volume (acre-feet/yr)	0.14	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$3,024**	
	30-yr Average Cost/1,000lb-TSS	**$9,905**	
	30-yr Average Cost/ac-ft Vol.	**$4,171**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-4

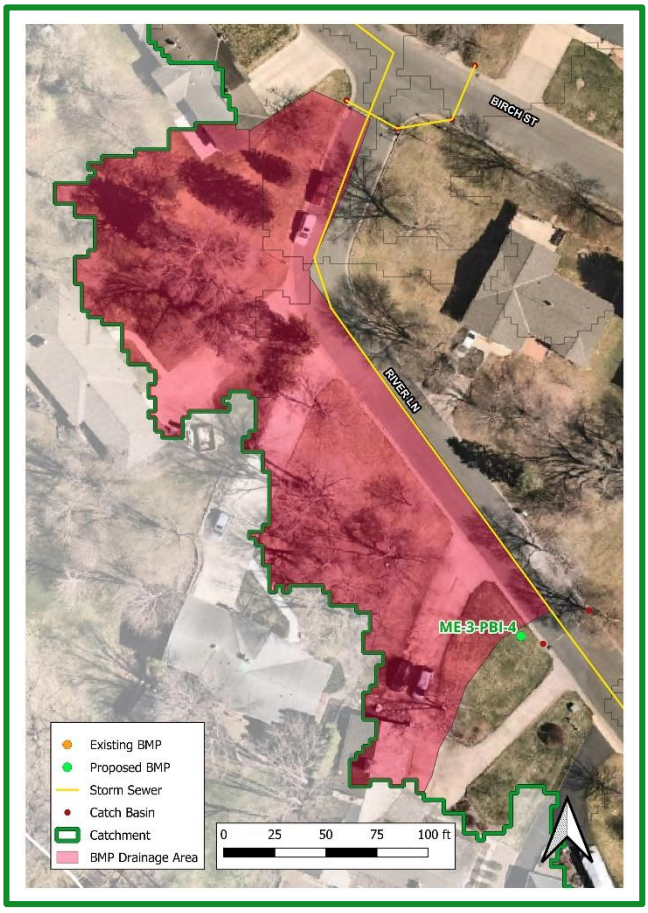
River Ln.
Bioinfiltration Basin

Drainage Area – 0.72 acres

Location – 720 River Ln.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along River Ln. to the northwest. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.29	0.7%
	TSS (lb/yr)	87	0.6%
	Volume (acre-feet/yr)	0.23	0.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$1,981**
	30-yr Average Cost/1,000lb-TSS		**$6,603**
	30-yr Average Cost/ac-ft Vol.		**$2,502**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-5

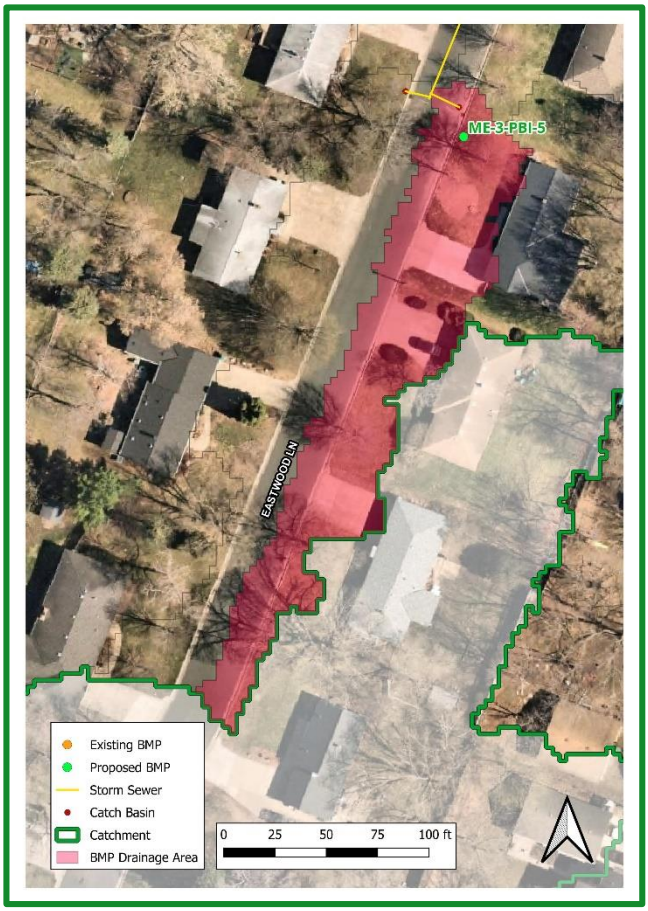
Eastwood Ln.
Bioinfiltration Basin

Drainage Area – 0.29 acres

Location – 918 Eastwood Ln.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Eastwood Ln. to the south. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.14	0.3%
	TSS (lb/yr)	41	0.3%
	Volume (acre-feet/yr)	0.11	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$4,103**	
	30-yr Average Cost/1,000lb-TSS	**$14,011**	
	30-yr Average Cost/ac-ft Vol.	**$5,005**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-6

Oakwood Dr.
Bioinfiltration Basin

Drainage Area – 0.45 acres

Location – 818 Oakwood Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Oakwood Dr. to the east. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.20	0.5%
	TSS (lb/yr)	62	0.4%
	Volume (acre-feet/yr)	0.16	0.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,872**	
	30-yr Average Cost/1,000lb-TSS	**$9,266**	
	30-yr Average Cost/ac-ft Vol.	**$3,575**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-7

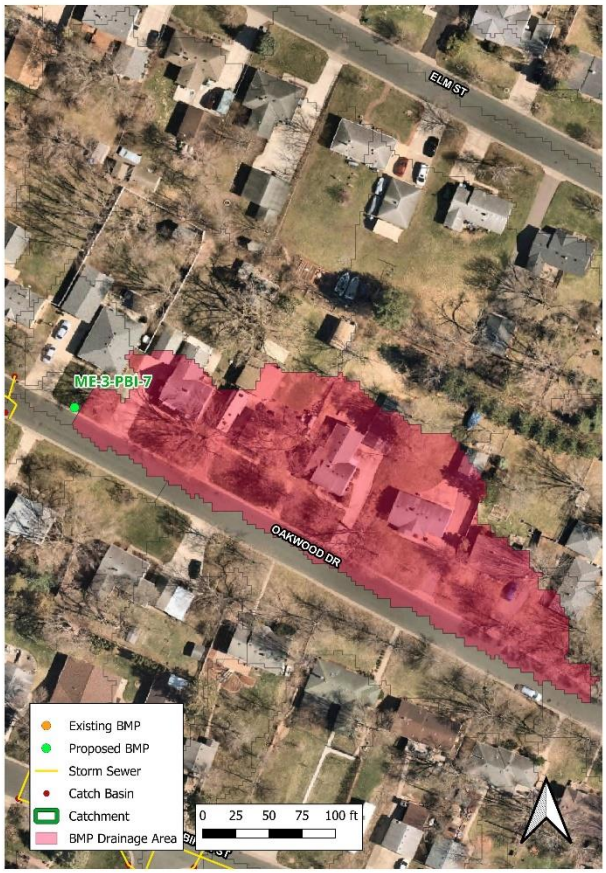
Oakwood Dr.
Bioinfiltration Basin

Drainage Area – 0.93 acres

Location – 823 Oakwood Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Oakwood Dr. to the east. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.33	0.8%
	TSS (lb/yr)	101	0.7%
	Volume (acre-feet/yr)	0.25	0.6%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,741**	
	30-yr Average Cost/1,000lb-TSS	**$5,688**	
	30-yr Average Cost/ac-ft Vol.	**$2,275**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-8

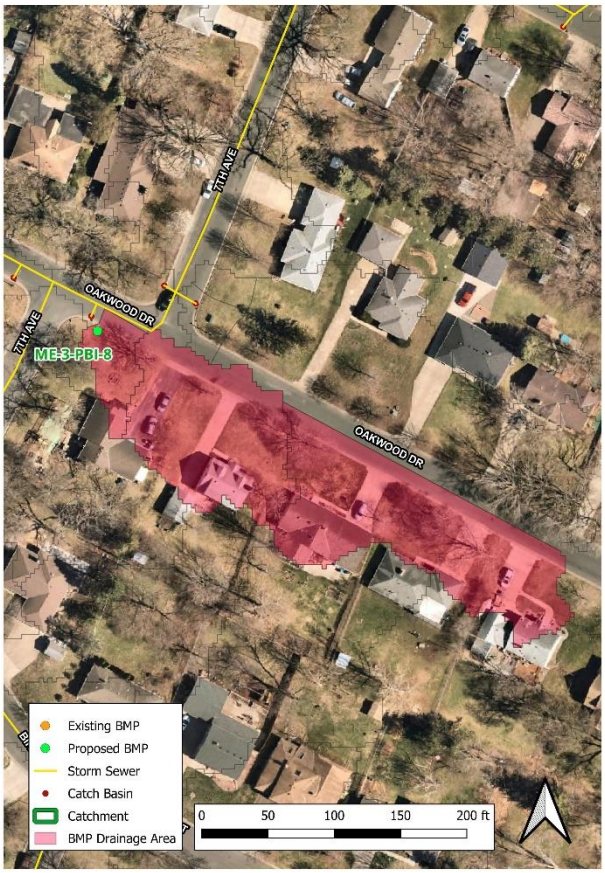
Oakwood Dr.
Bioinfiltration Basin

Drainage Area – 0.74 acres

Location – 638 Oakwood Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Oakwood Dr. to the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.29	0.7%
	TSS (lb/yr)	88	0.6%
	Volume (acre-feet/yr)	0.23	0.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,981**	
	30-yr Average Cost/1,000lb-TSS	**$6,528**	
	30-yr Average Cost/ac-ft Vol.	**$2,502**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-9

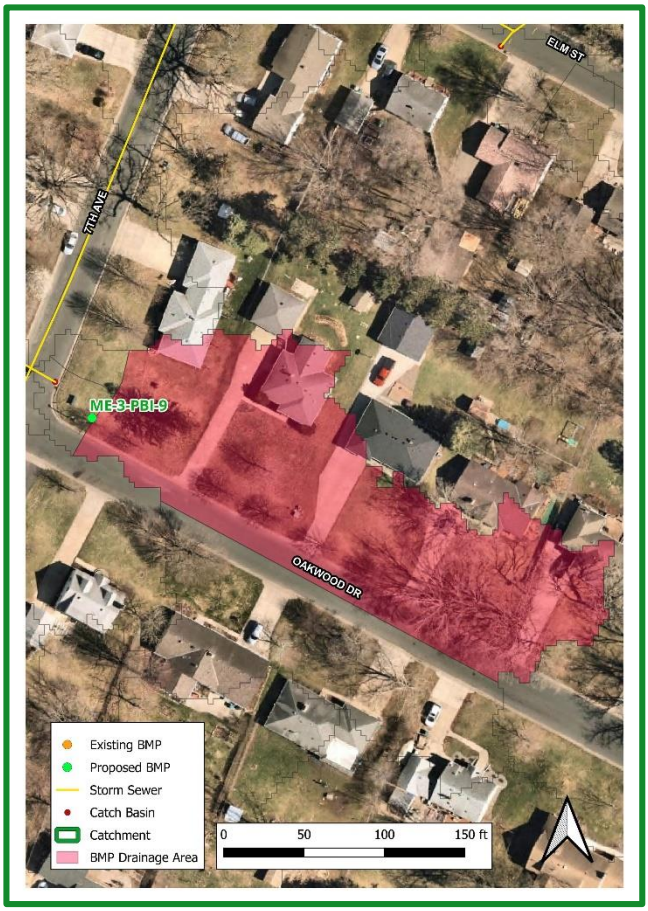
Oakwood Dr.
Bioinfiltration Basin

Drainage Area – 0.73 acres

Location – 1104 7th Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Oakwood Dr. to the east. A double inlet rain garden is not feasible in this location due to the existing electrical box. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.29	0.7%
	TSS (lb/yr)	88	0.6%
	Volume (acre-feet/yr)	0.23	0.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,981**	
	30-yr Average Cost/1,000lb-TSS	**$6,528**	
	30-yr Average Cost/ac-ft Vol.	**$2,502**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-10

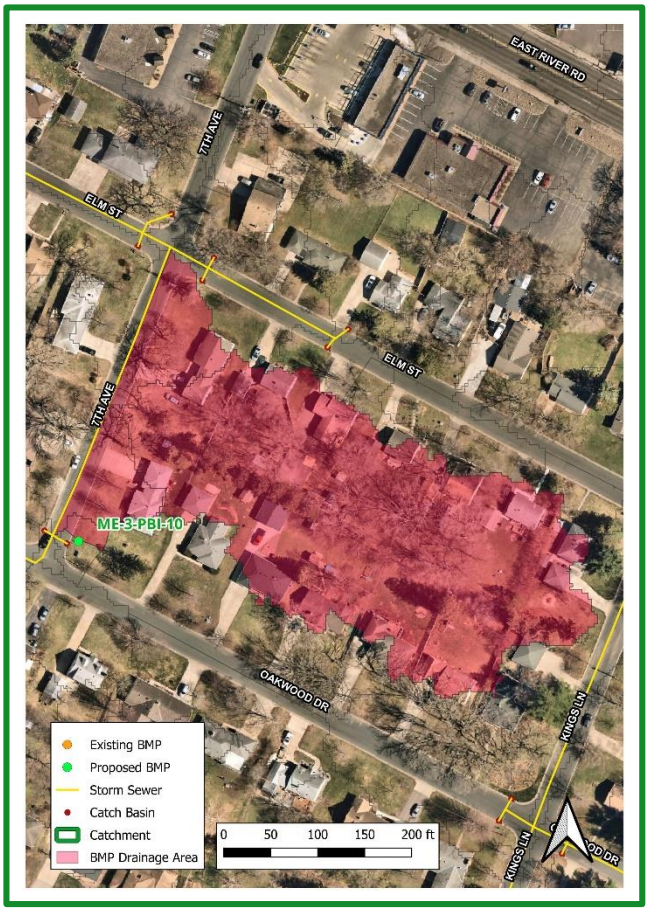
Oakwood Dr.
Bioinfiltration Basin

Drainage Area – 2.66 acres

Location – 1104 7th Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 7th Ave. to the north. A double inlet rain garden is not feasible in this location due to the existing electrical box. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.52	1.2%
	TSS (lb/yr)	160	1.1%
	Volume (acre-feet/yr)	0.39	0.9%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,105**	
	30-yr Average Cost/1,000lb-TSS	**$3,590**	
	30-yr Average Cost/ac-ft Vol.	**$1,472**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-11

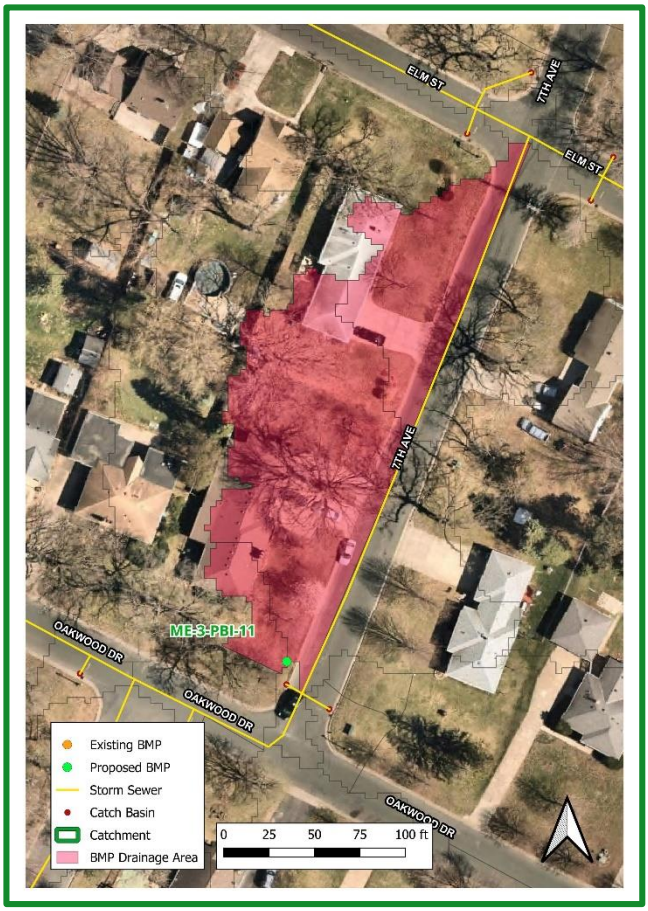
7th Ave.
Bioinfiltration Basin

Drainage Area – 0.52 acres

Location – 1103 7th Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 7th Ave. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.23	0.5%
	TSS (lb/yr)	69	0.5%
	Volume (acre-feet/yr)	0.18	0.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,498**	
	30-yr Average Cost/1,000lb-TSS	**$8,326**	
	30-yr Average Cost/ac-ft Vol.	**$3,128**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-12

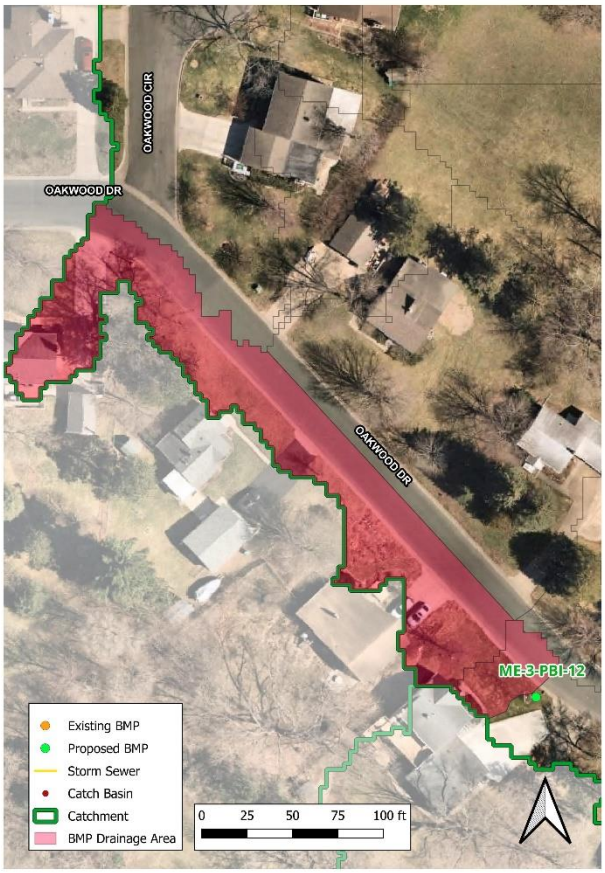
Oakwood Dr.
Bioinfiltration Basin

Drainage Area – 0.39 acres

Location – 544 Oakwood Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Oakwood Dr. to the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.18	0.4%
	TSS (lb/yr)	53	0.4%
	Volume (acre-feet/yr)	0.14	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$3,191**	
	30-yr Average Cost/1,000lb-TSS	**$10,839**	
	30-yr Average Cost/ac-ft Vol.	**$4,171**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-13

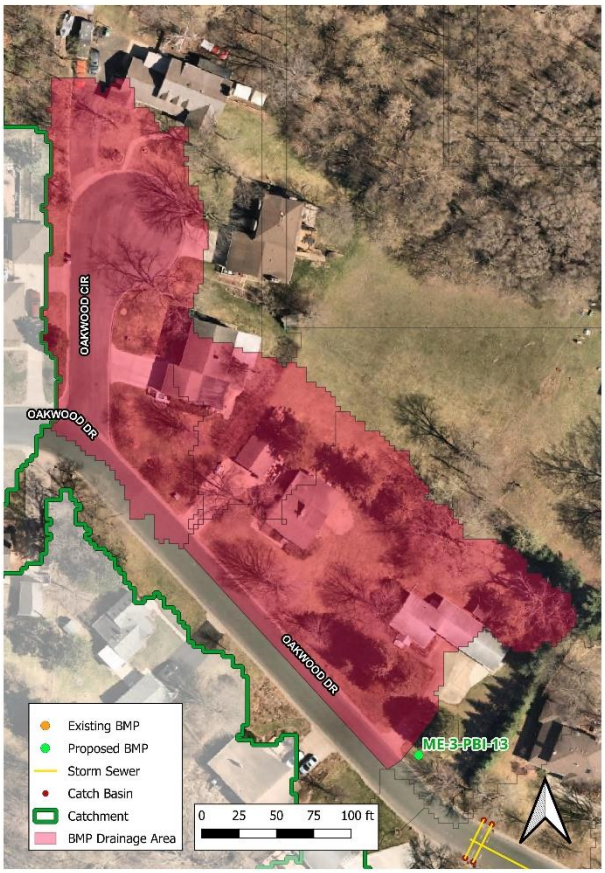
Oakwood Dr.
Bioinfiltration Basin

Drainage Area – 1.44 acres

Location – 531 Oakwood Dr.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Oakwood Dr. to the west, including the Oakwood Cir. cul-de-sac. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.41	0.9%
	TSS (lb/yr)	127	0.9%
	Volume (acre-feet/yr)	0.32	0.7%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,401**	
	30-yr Average Cost/1,000lb-TSS	**$4,523**	
	30-yr Average Cost/ac-ft Vol.	**$1,787**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-14

7th Ave.
Bioinfiltration Basin

Drainage Area – 0.70 acres

Location – 625 Elm St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 7th Ave. to the north, which primarily includes the parking lot of the adjacent commercial property. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.24	0.5%
	TSS (lb/yr)	108	0.7%
	Volume (acre-feet/yr)	0.37	0.8%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$2,394**
	30-yr Average Cost/1,000lb-TSS		**$5,319**
	30-yr Average Cost/ac-ft Vol.		**$1,564**

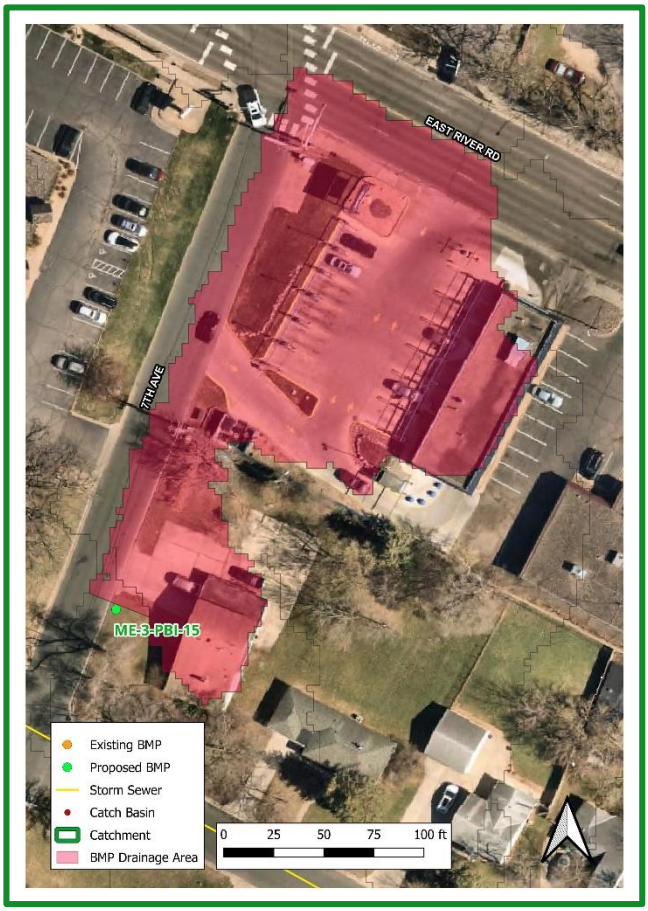
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-15

7th Ave.
Bioinfiltration Basin



Drainage Area – 0.75 acres

Location – 1152 7th Ave.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 7th Ave. to the north, which primarily includes the parking lot of the adjacent commercial property. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.24	0.5%
	TSS (lb/yr)	109	0.7%
	Volume (acre-feet/yr)	0.37	0.8%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$2,394**
	30-yr Average Cost/1,000lb-TSS		**$5,270**
	30-yr Average Cost/ac-ft Vol.		**$1,564**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-16

Elm St.
Bioinfiltration Basin

Drainage Area – 0.41 acres

Location – 714 Elm St.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Elm St. to the east. The table below provides pollutant removals and estimated costs.

Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.19	0.4%
	TSS (lb/yr)	57	0.4%
	Volume (acre-feet/yr)	0.14	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$3,024**	
	30-yr Average Cost/1,000lb-TSS	**$10,078**	
	30-yr Average Cost/ac-ft Vol.	**$4,171**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-17

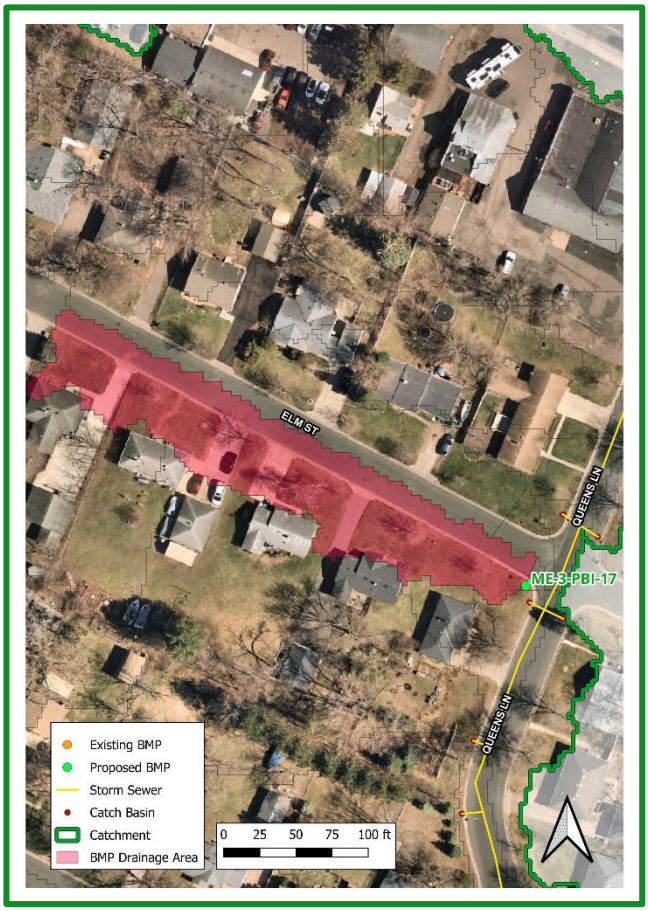
Elm St.
Bioinfiltration Basin

Drainage Area – 0.45 acres

Location – 1117 Queens Ln.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Elm St. the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.20	0.5%
	TSS (lb/yr)	61	0.4%
	Volume (acre-feet/yr)	0.16	0.4%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,872**	
	30-yr Average Cost/1,000lb-TSS	**$9,417**	
	30-yr Average Cost/ac-ft Vol.	**$3,575**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-3-PBI-18

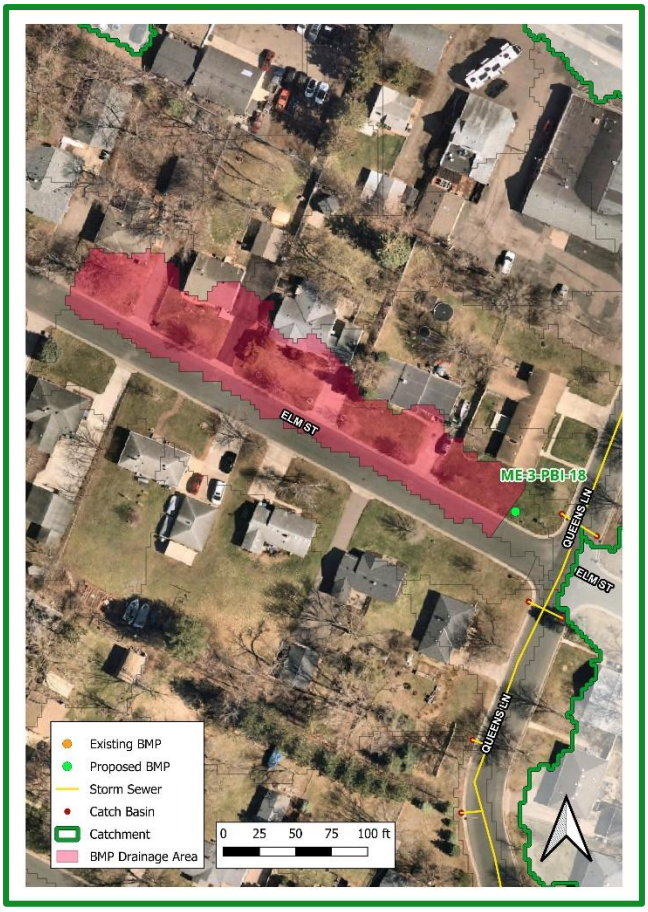
Elm St.
Bioinfiltration Basin

Drainage Area – 0.2 acres

Location – 1153 Queens Ln.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Elm St. the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.19	0.4%
	TSS (lb/yr)	58	0.4%
	Volume (acre-feet/yr)	0.14	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$3,024**	
	30-yr Average Cost/1,000lb-TSS	**$9,905**	
	30-yr Average Cost/ac-ft Vol.	**$4,171**	

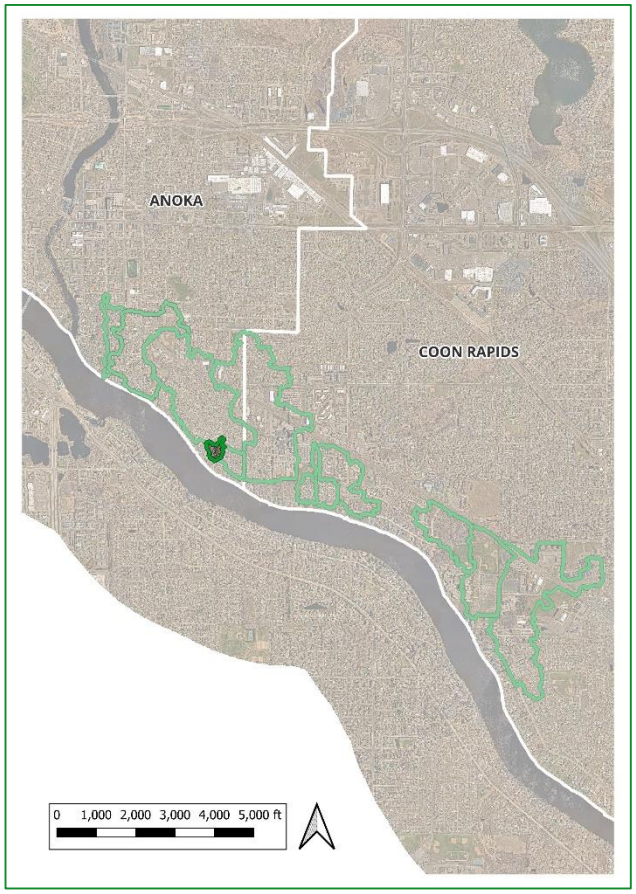
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Catchment ME-4

Existing Catchment Summary	
Acres	3.57
Parcels	22
Land Cover	100% Residential



CATCHMENT DESCRIPTION

This catchment is located in Anoka, downstream of the Mississippi River's confluence with the Rum River. It is a relatively small catchment that only contains a few properties within its drainage area. Stormwater runoff is routed along Eastwood Ln. where it enters an existing hydrodynamic device prior to discharging into the Mississippi River.

EXISTING STORMWATER TREATMENT

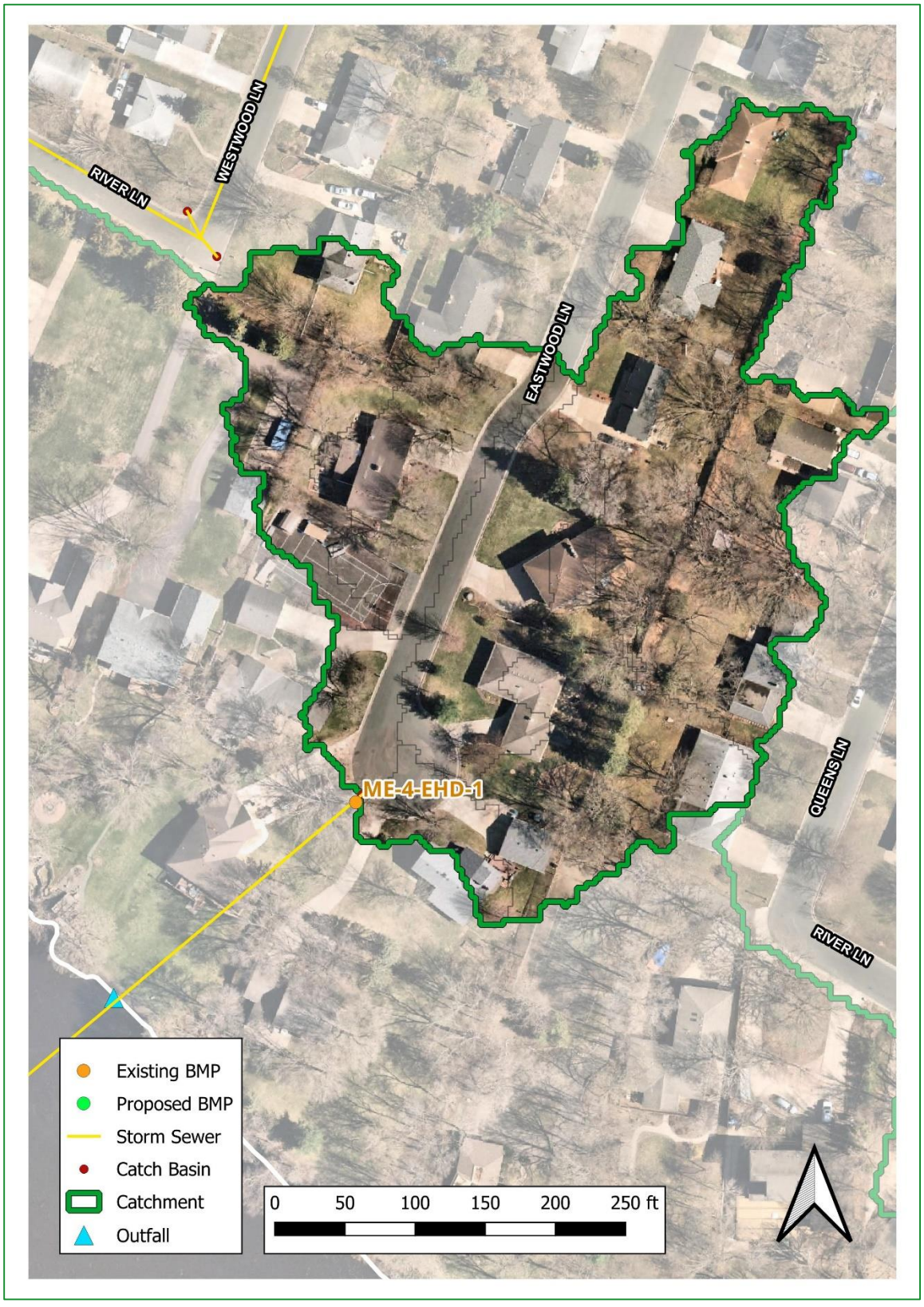
This catchment contains an existing hydrodynamic device at the outfall that provides treatment to the entire catchment. Street cleaning is also conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	2			
	BMP Types	Street Cleaning, Hydrodynamic Device (EHD-1)			
	TP (lb/yr)	1.99	0.38	19%	**1.61**
	TSS (lb/yr)	623	158	25%	**466**
	Volume (acre-feet/yr)	1.4	0.00	0%	**1.4**

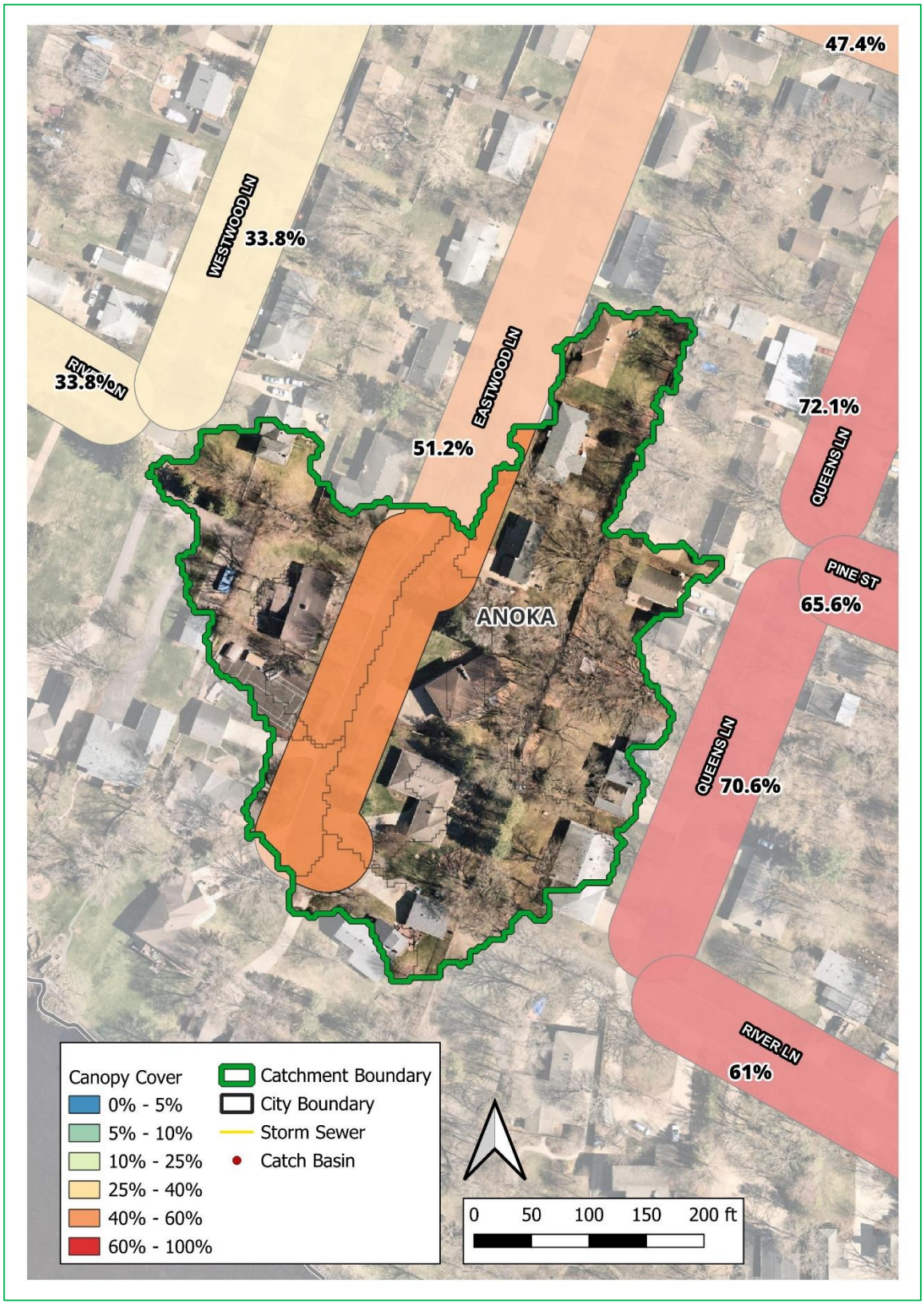
RETROFITS CONSIDERED

No treatment practices are currently proposed within this catchment due to its relatively small size and the existing hydrodynamic device providing treatment to the entire drainage area.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

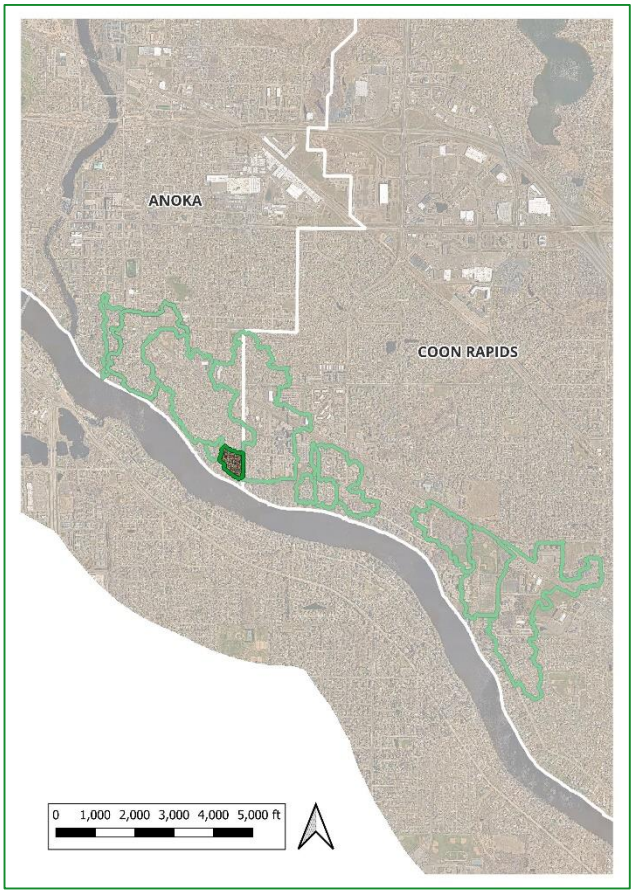


ROAD TREE CANOPY COVER



Catchment ME-5

Existing Catchment Summary	
Acres	7.55
Parcels	22
Land Cover	100% Residential



CATCHMENT DESCRIPTION

This catchment is located in Anoka, downstream of the Mississippi River's confluence with the Rum River. It is a relatively small catchment that only contains a few properties within its drainage area. Stormwater runoff is routed to River Ln. where it enters an existing hydrodynamic device prior to discharging into the Mississippi River.

EXISTING STORMWATER TREATMENT

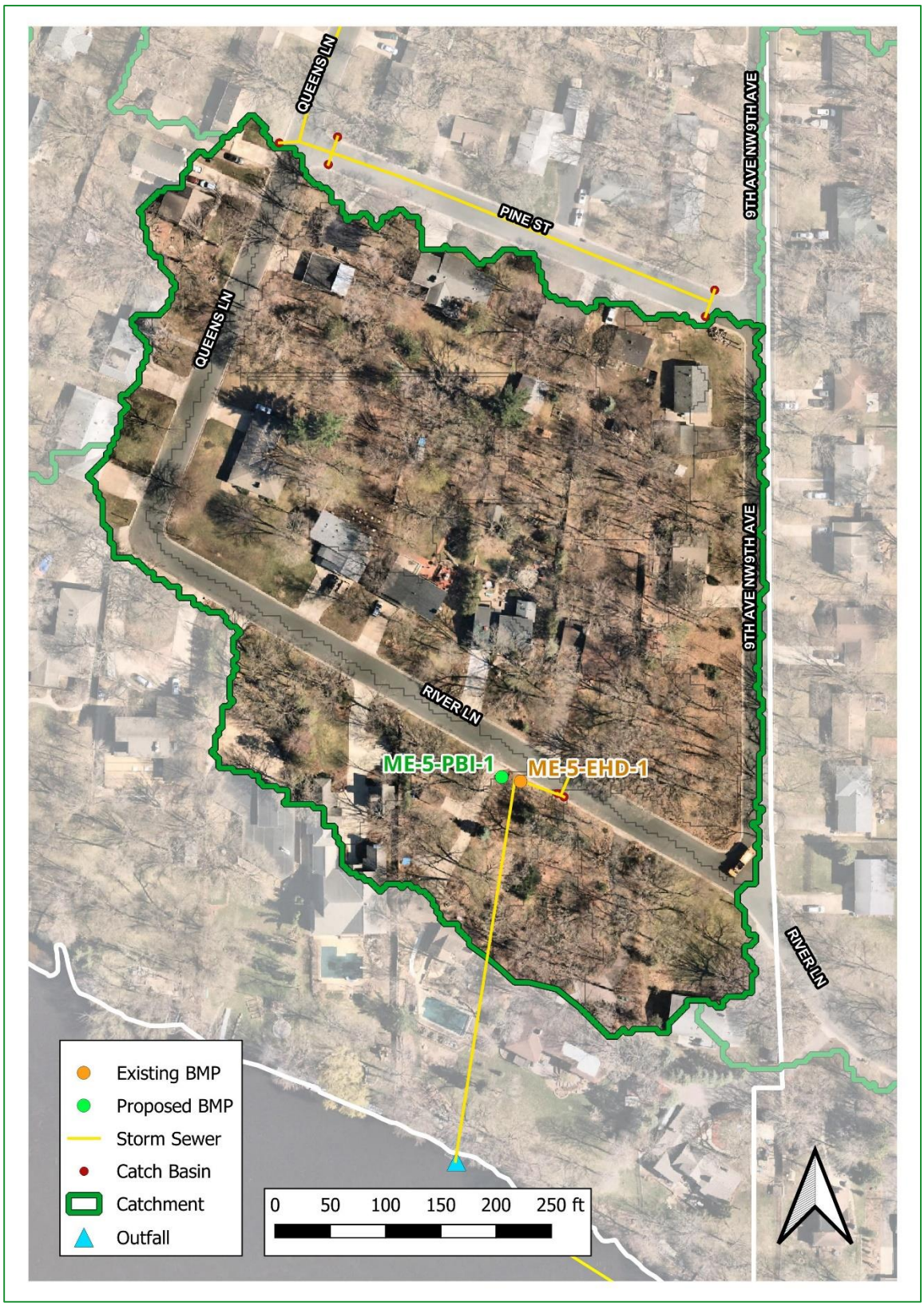
This catchment contains an existing hydrodynamic device at the outfall that provides treatment to the entire catchment. Street cleaning is also conducted once in early spring and once in mid-summer by the City of Anoka. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	2			
	BMP Types	Street Cleaning, Hydrodynamic Device (EHD-1)			
	TP (lb/yr)	4.20	0.76	18%	**3.44**
	TSS (lb/yr)	1,317	316	24%	**1,001**
	Volume (acre-feet/yr)	3.0	0.00	0%	**3.0**

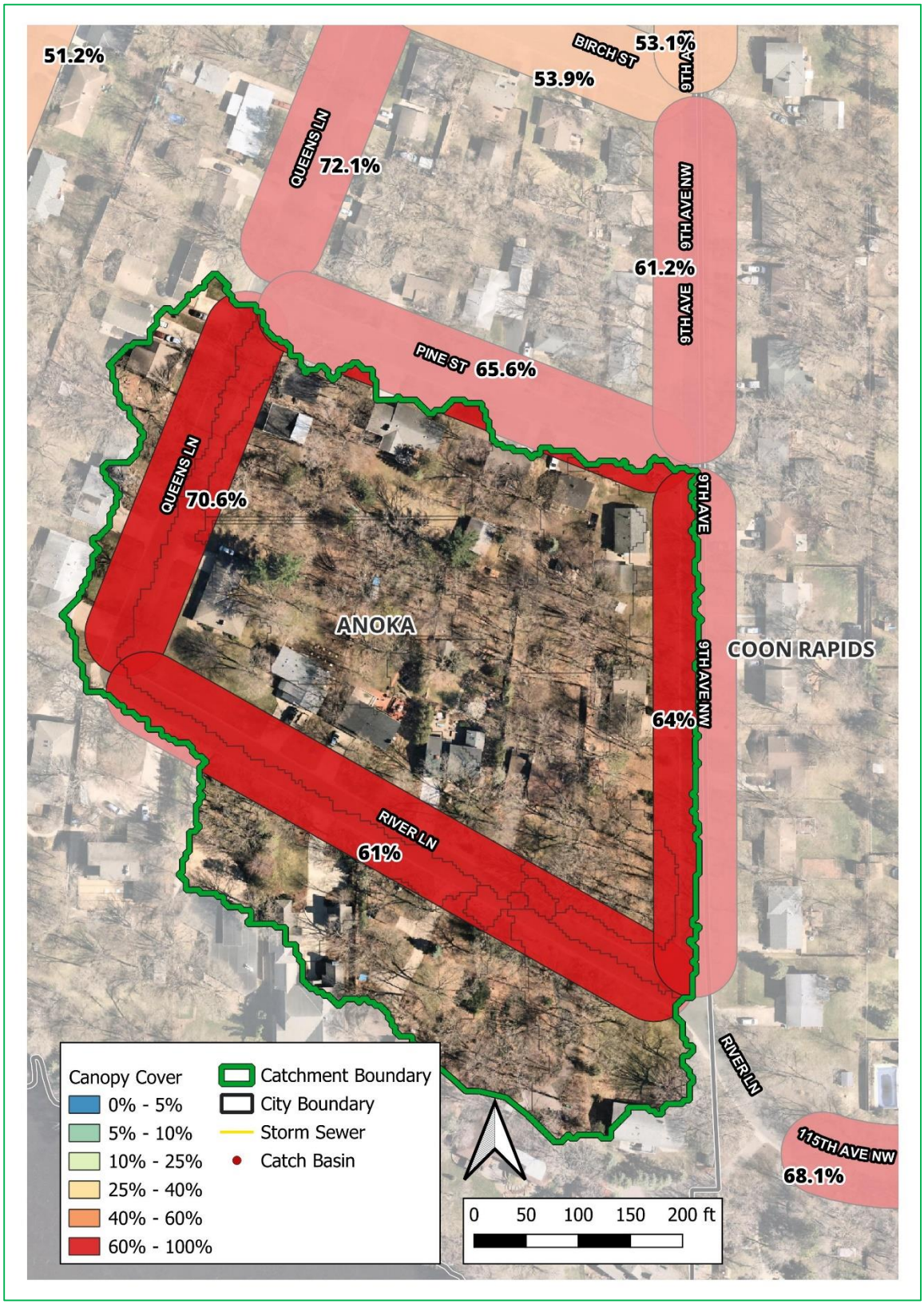
RETROFITS CONSIDERED

One bioinfiltration basin is proposed within this catchment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER



Project ID: ME-5-PBI-1

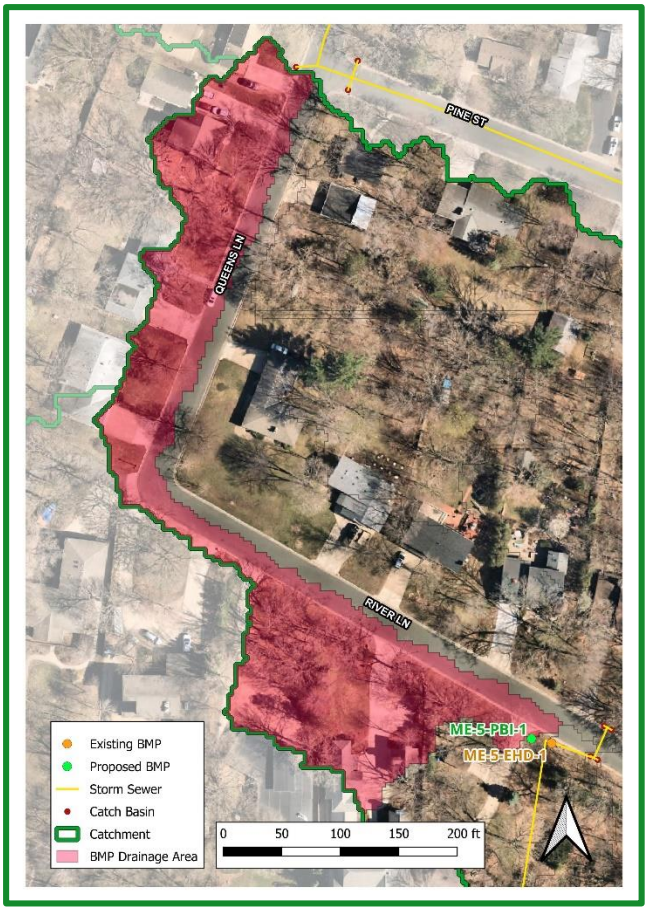
River Ln.
Bioinfiltration Basin

Drainage Area – 1.33 acres

Location – 882 River Ln.

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along River Ln. and Queens Ln. to the west. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.38	11.1%
	TSS (lb/yr)	117	11.7%
	Volume (acre-feet/yr)	0.31	10.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$1,504**
	30-yr Average Cost/1,000lb-TSS		**$4,906**
	30-yr Average Cost/ac-ft Vol.		**$1,845**

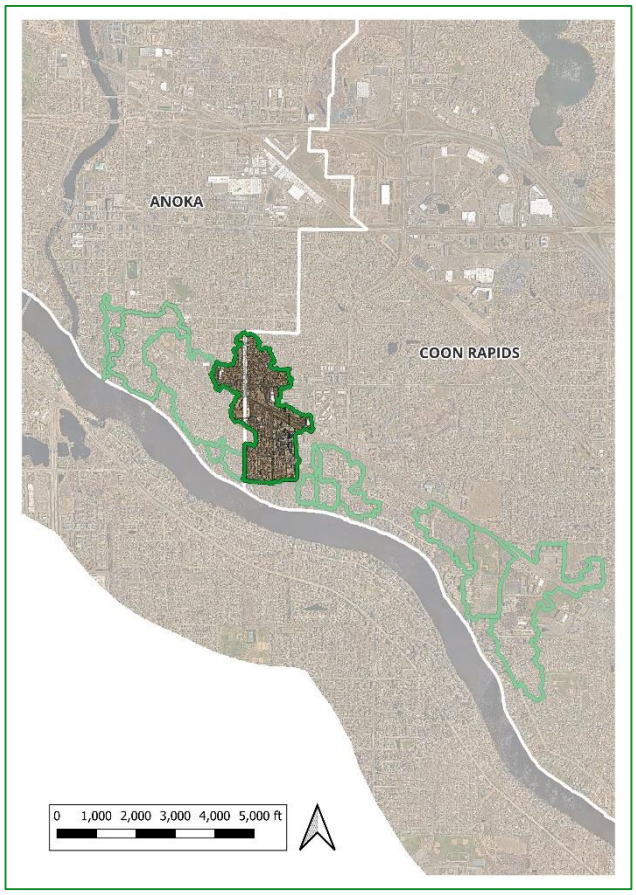
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Catchment ME-6

Existing Catchment Summary	
Acres	111.62
Parcels	229
Land Cover	53.2% Residential 25.1% Institutional 17.8% Commercial 3.1% Open 1.0% Park



CATCHMENT DESCRIPTION

This catchment is located in both Anoka and Coon Rapids. This catchment is the largest one included in this report for Mississippi River catchments that are east of the Rum River. A variety of existing treatment practices exist throughout the catchment. Land use is a combination of residential, institutional, and commercial. A significant portion of this catchment contains the Mercy Hospital Campus and its associated parking lots.

EXISTING STORMWATER TREATMENT

This catchment contains multiple existing stormwater treatment practices. Three bioinfiltration basins treat stormwater runoff from the northern side of the catchment, and one natural bioinfiltration basin at Elm St. Park treats stormwater runoff from a nearby parking lot. There are also two grass swales on both sides of Coon Rapids Blvd. adjacent to Mercy Hospital. In addition, the hospital itself contains two subsurface stormwater treatment systems that provide treatment to parking lot runoff. One of these subsurface systems recently replaced the stormwater pond previously present at the southwestern corner of Mercy Hospital due to the need for increased parking capacity. These subsurface systems were not modeled due to the lack of information.

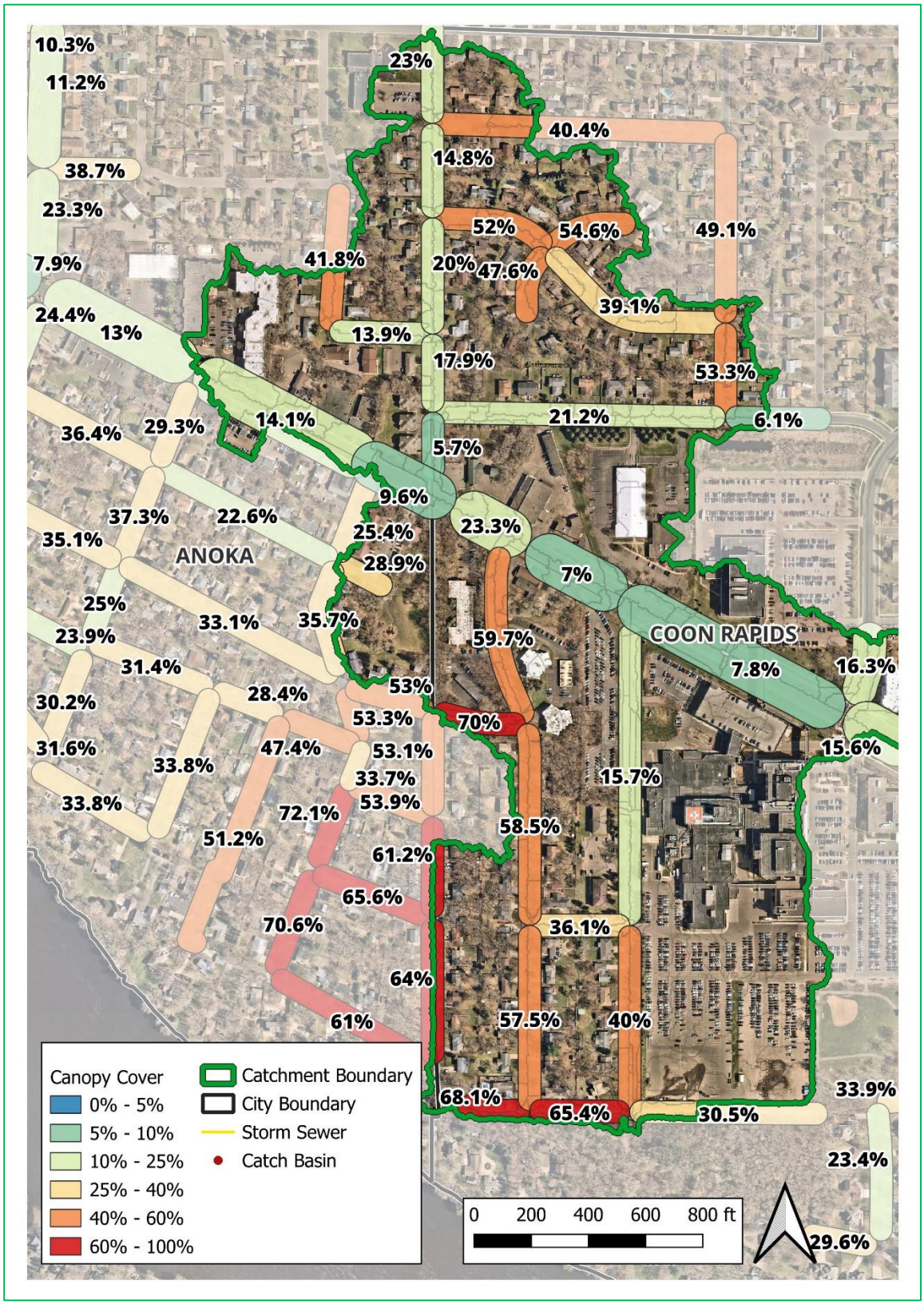
	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	7			
	BMP Types	Street Cleaning, Grass Swale (2), Bioinfiltration (4)			
	TP (lb/yr)	83.10	15.19	18%	**67.91**
	TSS (lb/yr)	32,038	6,541	20%	**25,497**
	Volume (acre-feet/yr)	92.8	11.29	12%	**81.5**

RETROFITS CONSIDERED

Multiple stormwater treatment practices are proposed within this catchment. They include nine bioinfiltration basins, two hydrodynamic devices, and a retrofit to an existing stormwater pond to increase ponding depth.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

ROAD TREE CANOPY COVER



Project ID: ME-6-PBI-1

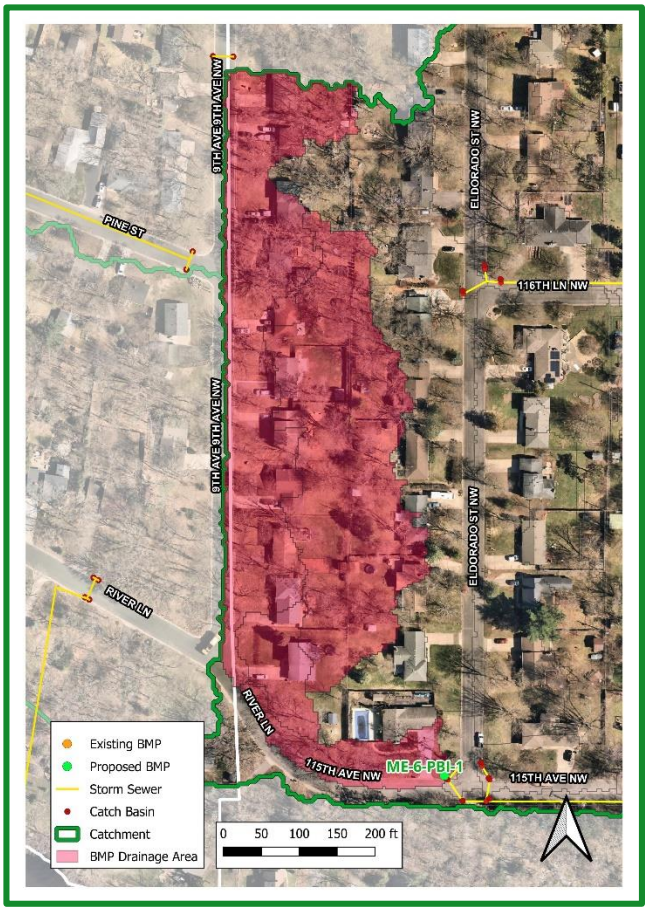
115th Ave. NW
Bioinfiltration Basin

Drainage Area – 4.07 acres

Location – 4131 115th Ave. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 115th Ave. and 9th Ave to the northwest. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250 sq-ft	
	TP (lb/yr)	0.59	0.9%
	TSS (lb/yr)	186	0.7%
	Volume (acre-feet/yr)	0.44	0.5%
Cost	Administration & Promotion Costs*	$664	
	Design & Construction Costs**	$9,820	
	Total Estimated Project Cost (2023)	**$10,484**	
	Annual O&M***	$225	
Efficiency	30-yr Average Cost/lb-TP	**$974**	
	30-yr Average Cost/1,000lb-TSS	**$3,089**	
	30-yr Average Cost/ac-ft Vol.	**$1,317**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-PBI-2

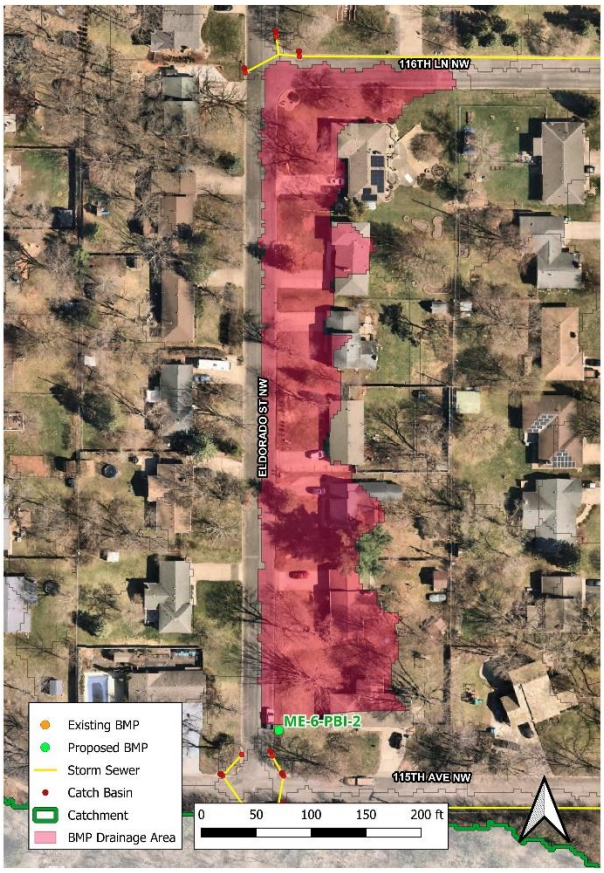
Eldorado St. NW
Bioinfiltration Basin

Drainage Area – 1.25 acres

Location – 11501 Eldorado St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Eldorado St. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.40	0.6%
	TSS (lb/yr)	123	0.5%
	Volume (acre-feet/yr)	0.30	0.4%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,436**	
	30-yr Average Cost/1,000lb-TSS	**$4,670**	
	30-yr Average Cost/ac-ft Vol.	**$1,925**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-PBI-3

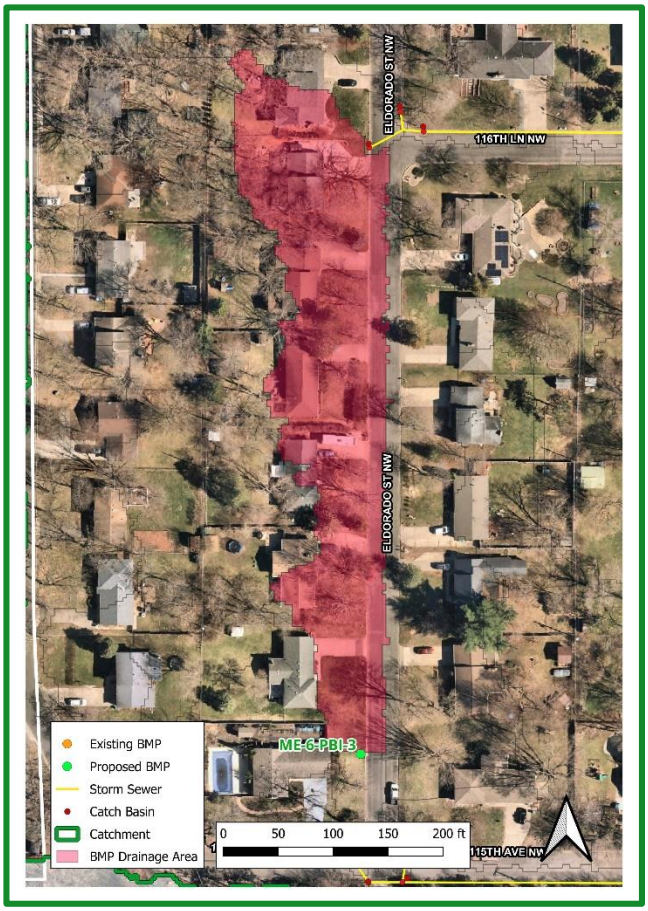
Eldorado St. NW
Bioinfiltration Basin

Drainage Area – 1.26 acres

Location – 4131 115th Ave. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Eldorado St. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.40	0.6%
	TSS (lb/yr)	123	0.5%
	Volume (acre-feet/yr)	0.30	0.4%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,436**	
	30-yr Average Cost/1,000lb-TSS	**$4,670**	
	30-yr Average Cost/ac-ft Vol.	**$1,925**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-PBI-4

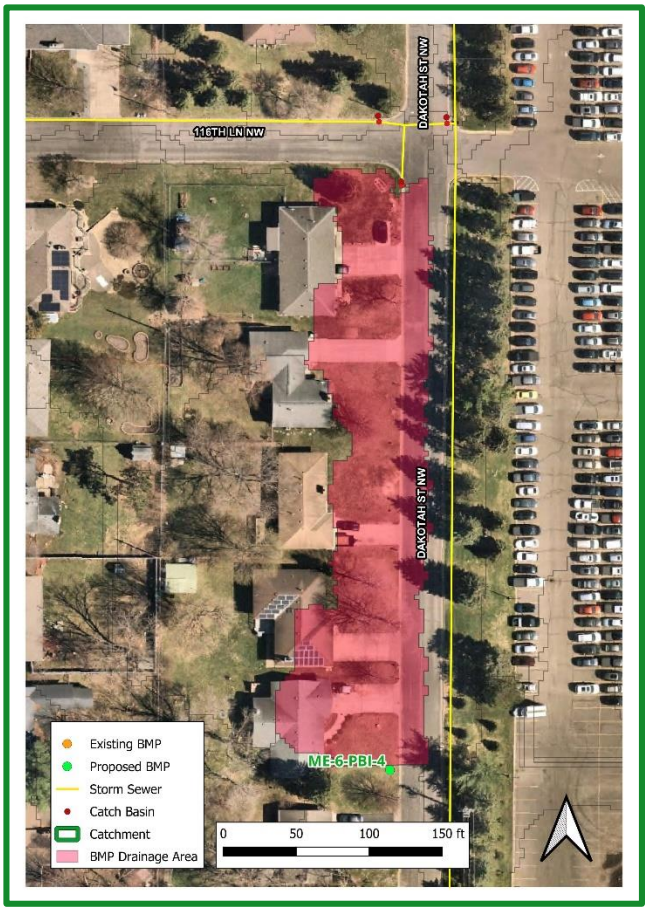
Dakotah St. NW
Bioinfiltration Basin

Drainage Area – 0.68 acres

Location – 11520 Dakotah St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Dakotah St. to the north. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.28	0.4%
	TSS (lb/yr)	89	0.3%
	Volume (acre-feet/yr)	0.23	0.3%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$2,052**	
	30-yr Average Cost/1,000lb-TSS	**$6,455**	
	30-yr Average Cost/ac-ft Vol.	**$2,502**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-PBI-5

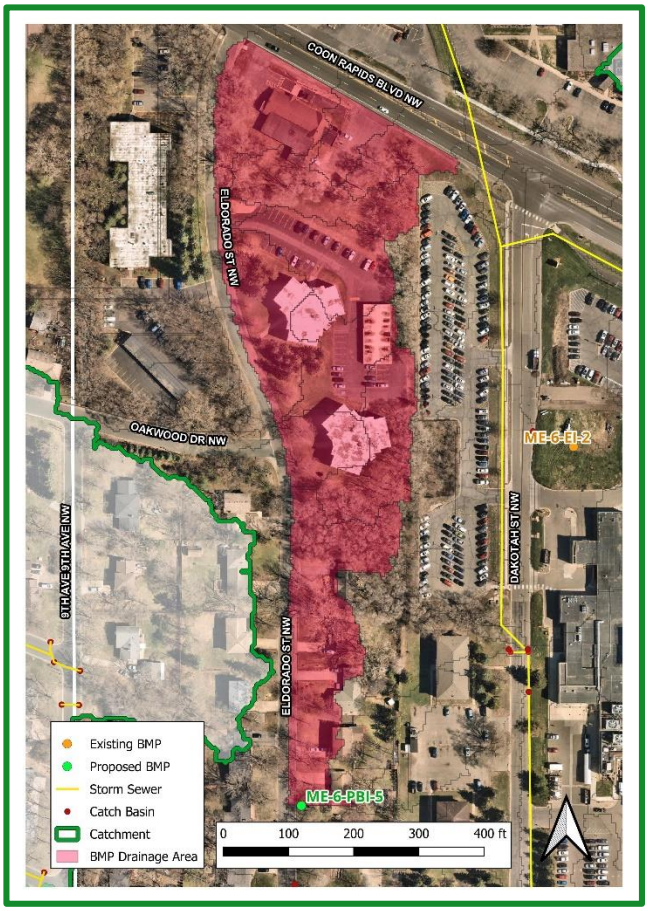
Eldorado St. NW
Bioinfiltration Basin

Drainage Area – 4.98 acres

Location – 11635 Eldorado St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Eldorado St. to the north up to Coon Rapids Blvd. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.44	0.6%
	TSS (lb/yr)	178	0.7%
	Volume (acre-feet/yr)	0.51	0.6%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,306**	
	30-yr Average Cost/1,000lb-TSS	**$3,227**	
	30-yr Average Cost/ac-ft Vol.	**$1,137**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-PBI-6

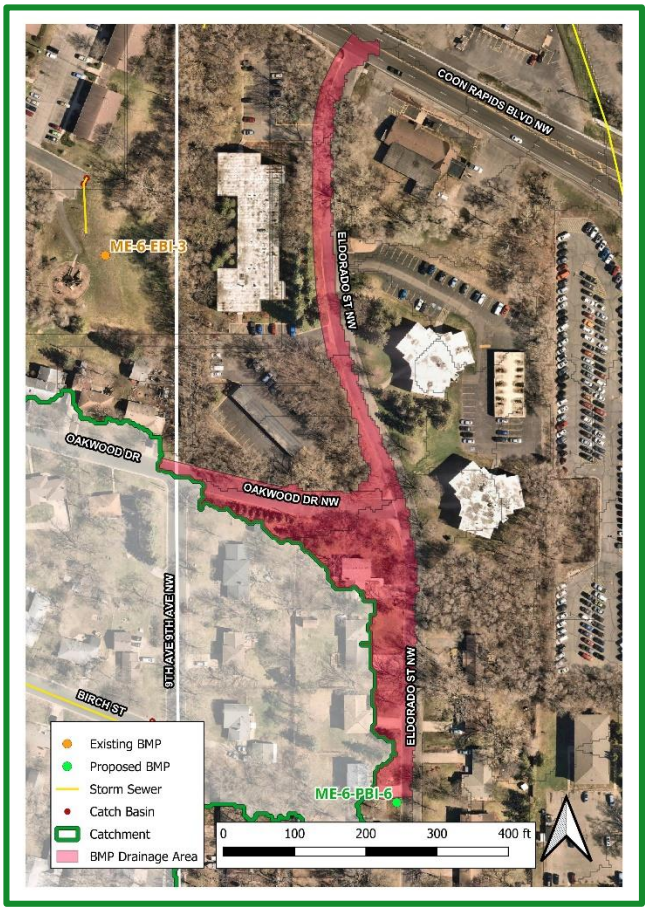
Eldorado St. NW
Bioinfiltration Basin

Drainage Area – 1.49 acres

Location – 11654 Eldorado St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Eldorado St. to the north up to Coon Rapids Blvd. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.40	0.6%
	TSS (lb/yr)	141	0.6%
	Volume (acre-feet/yr)	0.37	0.5%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,436**	
	30-yr Average Cost/1,000lb-TSS	**$4,074**	
	30-yr Average Cost/ac-ft Vol.	**$1,564**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-PBI-7

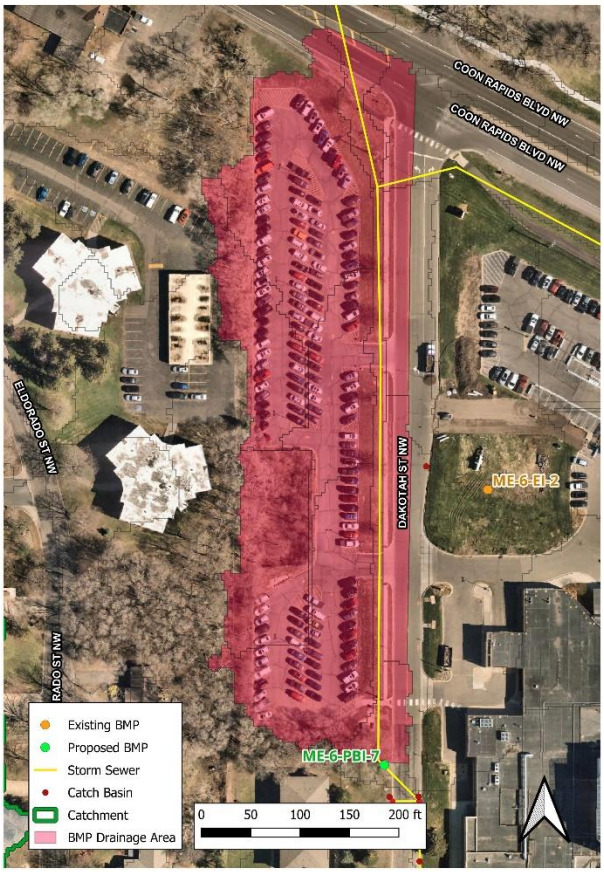
Dakotah St. NW
Bioinfiltration Basin

Drainage Area – 2.87 acres

Location – 11670 Dakota St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of an apartment complex. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Dakotah St. to the north, which primarily includes the parking lots up to Coon Rapids Blvd. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.43	0.6%
	TSS (lb/yr)	182	0.7%
	Volume (acre-feet/yr)	0.48	0.6%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,336**	
	30-yr Average Cost/1,000lb-TSS	**$3,156**	
	30-yr Average Cost/ac-ft Vol.	**$1,192**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-PBI-8

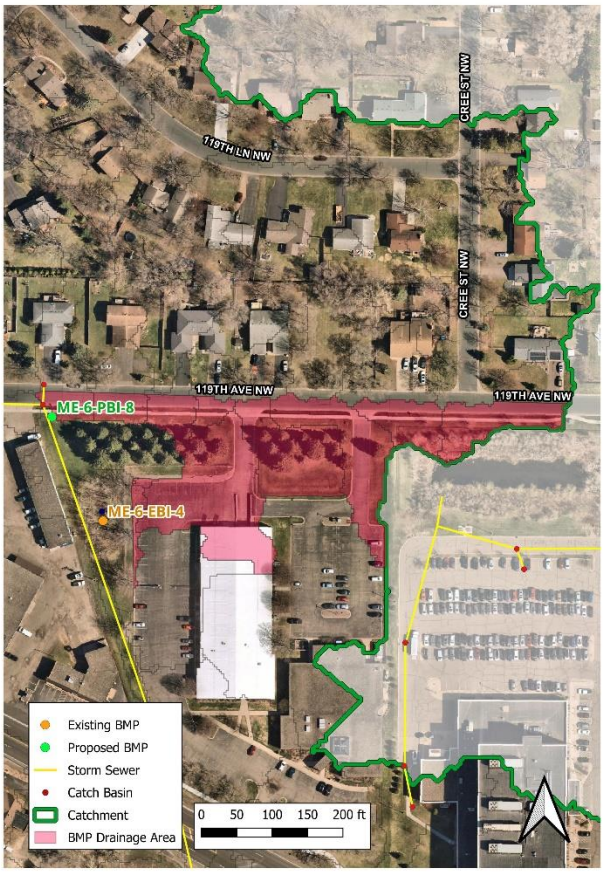
119th Ave. NW
Bioinfiltration Basin

Drainage Area – 1.85 acres

Location – 4101 Coon Rapids Blvd. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the lawn of a commercial property. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 119th Ave. to the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.32	0.5%
	TSS (lb/yr)	158	0.6%
	Volume (acre-feet/yr)	0.48	0.6%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,795**	
	30-yr Average Cost/1,000lb-TSS	**$3,636**	
	30-yr Average Cost/ac-ft Vol.	**$1,192**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-PBI-9

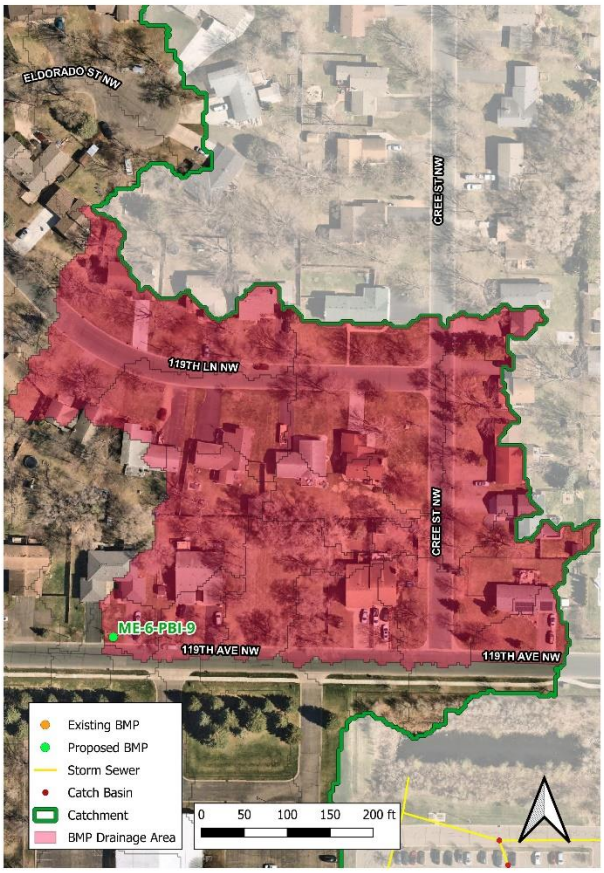
119th Ave. NW
Bioinfiltration Basin

Drainage Area – 4.92 acres

Location – 4107 119th Ave. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential duplex. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected on 119th Ave., Cree St., and 119th Ln. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.55	0.8%
	TSS (lb/yr)	180	0.7%
	Volume (acre-feet/yr)	0.48	0.6%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,044**	
	30-yr Average Cost/1,000lb-TSS	**$3,191**	
	30-yr Average Cost/ac-ft Vol.	**$1,192**	

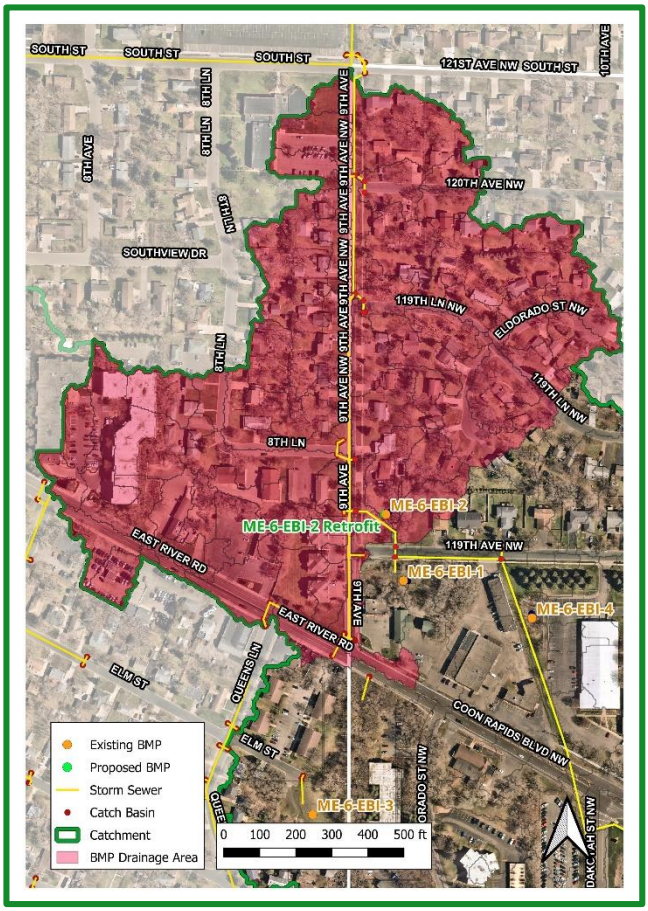
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-6-EBI-2 Retrofit

9th Ave. NW
Stormwater Pond Retrofit



Drainage Area – 30.19 acres

Location – PIN 073124410065

Property Ownership – City of Coon Rapids

Site Specific Information – An opportunity to retrofit the existing stormwater pond by increasing its depth exists at this location. The pipe outlet is installed near the bottom elevation of the stormwater pond. While the WinSLAMM model was initially based on existing plan sets, a field visit during a storm event showed a newer and larger inlet pipe, channelization along the bottom from the inlet pipe to the outlet pipe, and less freeboard than detailed on the existing plan set. A stand pipe at the outlet was initially considered, but was rejected due to these newer conditions. This proposed project would excavate the bottom by approximately 3.5-feet, increasing stormwater ponding depth and significantly reducing pollutant loading. The table below provides pollutant removals and estimated costs.

Bioinfiltration Basin Retrofit			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	0.44	acres
	TP (lb/yr)	10.76	15.8%
	TSS (lb/yr)	3,796	14.9%
	Volume (acre-feet/yr)	11.32	0.0%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$55,116
	Total Estimated Project Cost (2023)		**$55,780**
	Annual O&M***		$444
Efficiency	**30-yr Average Cost/lb-TP**	**$214**	
	30-yr Average Cost/1,000lb-TSS	**$607**	
	30-yr Average Cost/ac-ft Vol.	**$203**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: See Appendix B for detailed cost information

***$1,000/acre - Annual inspection and sediment/debris removal

Project ID: ME-6-PHD-1

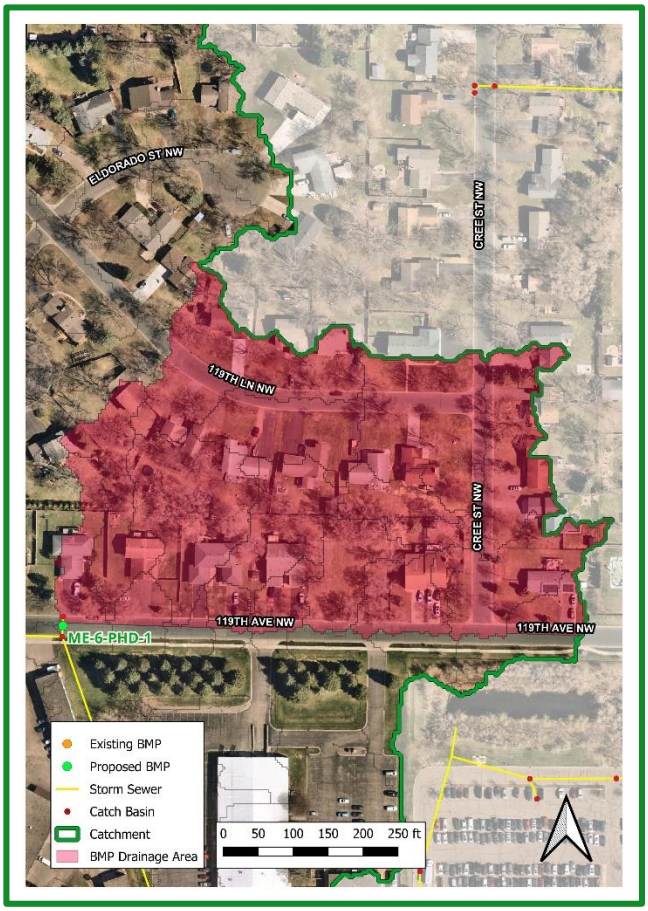
119th Ave. NW
Hydrodynamic Device

Drainage Area – 6.49 acres

Location – 119th Ave. NW

Property Ownership – City of Coon Rapids

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line on 119th Ave. A device at this location would provide treatment to stormwater runoff collected on 119h Ave., Cree St., and 119th Ln. The table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	8	ft diameter
	TP (lb/yr)	0.39	0.6%
	TSS (lb/yr)	162	0.6%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$54,000
	Total Estimated Project Cost (2023)		**$57,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$5,474**	
	30-yr Average Cost/1,000lb-TSS	**$13,179**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($36,000 for materials) + ($18,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Project ID: ME-6-PHD-2

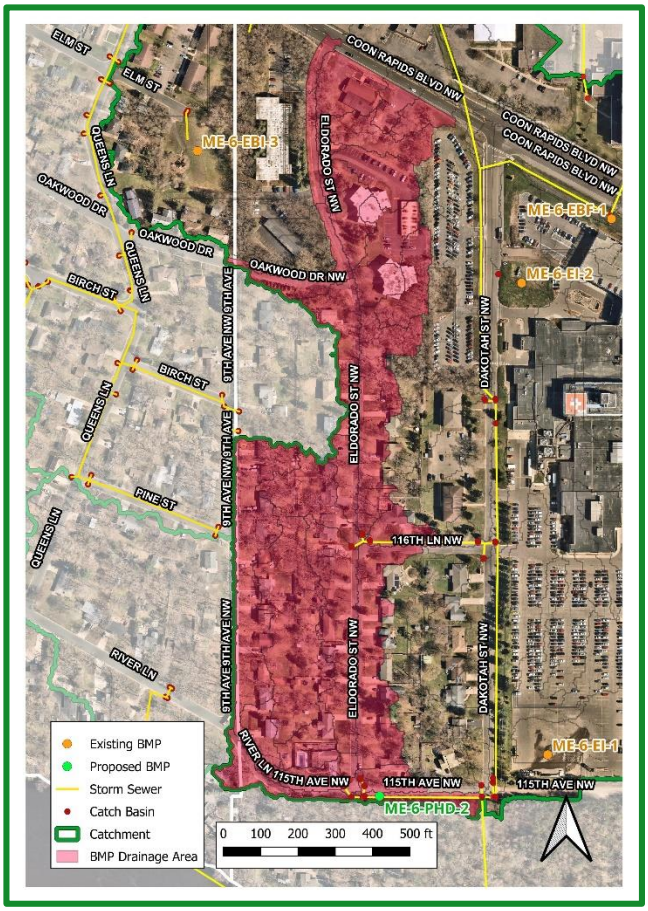
115th Ave. NW
Hydrodynamic Device

Drainage Area – 16.00 acres

Location – 115th Ave. NW

Property Ownership – City of Coon Rapids

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line near the intersection of 115th Ave. and Eldorado St. A device at this location would provide treatment to stormwater runoff from the north of this proposed location up to Coon Rapids Blvd. The table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	10	ft diameter
	TP (lb/yr)	0.86	1.3%
	TSS (lb/yr)	380	1.5%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$6,203**	
	30-yr Average Cost/1,000lb-TSS	**$14,039**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

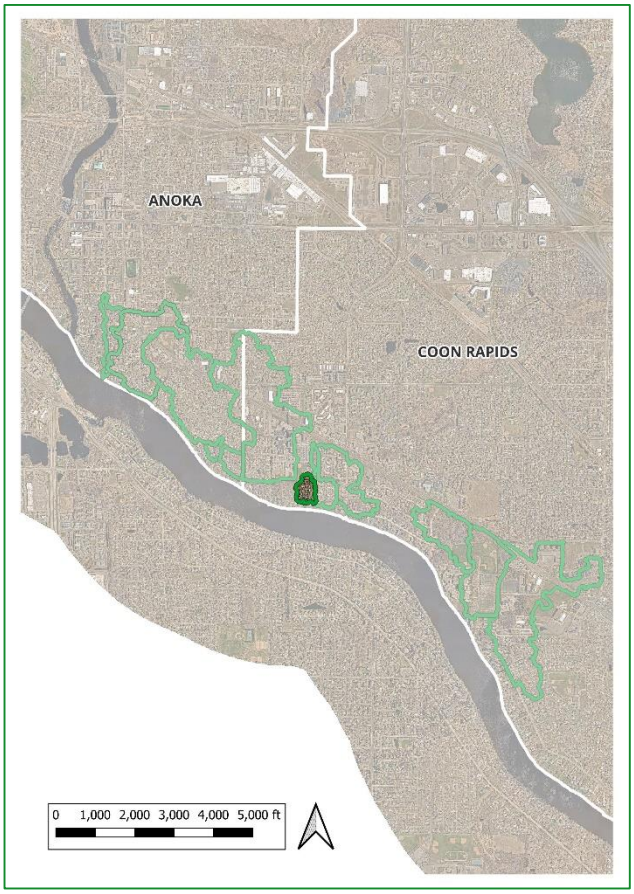
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Catchment ME-7

Existing Catchment Summary	
Acres	6.63
Parcels	22
Land Cover	92.0% Residential 8.0% Park



CATCHMENT DESCRIPTION

This catchment is located in Coon Rapids. It is a relatively small catchment that only contains a few properties within its drainage area. Stormwater runoff is routed along Blackfoot St. and 114th Ln where it enters catch basins that discharge directly into the Mississippi River. Land use is primarily single family residential houses with park space on the northern side.

EXISTING STORMWATER TREATMENT

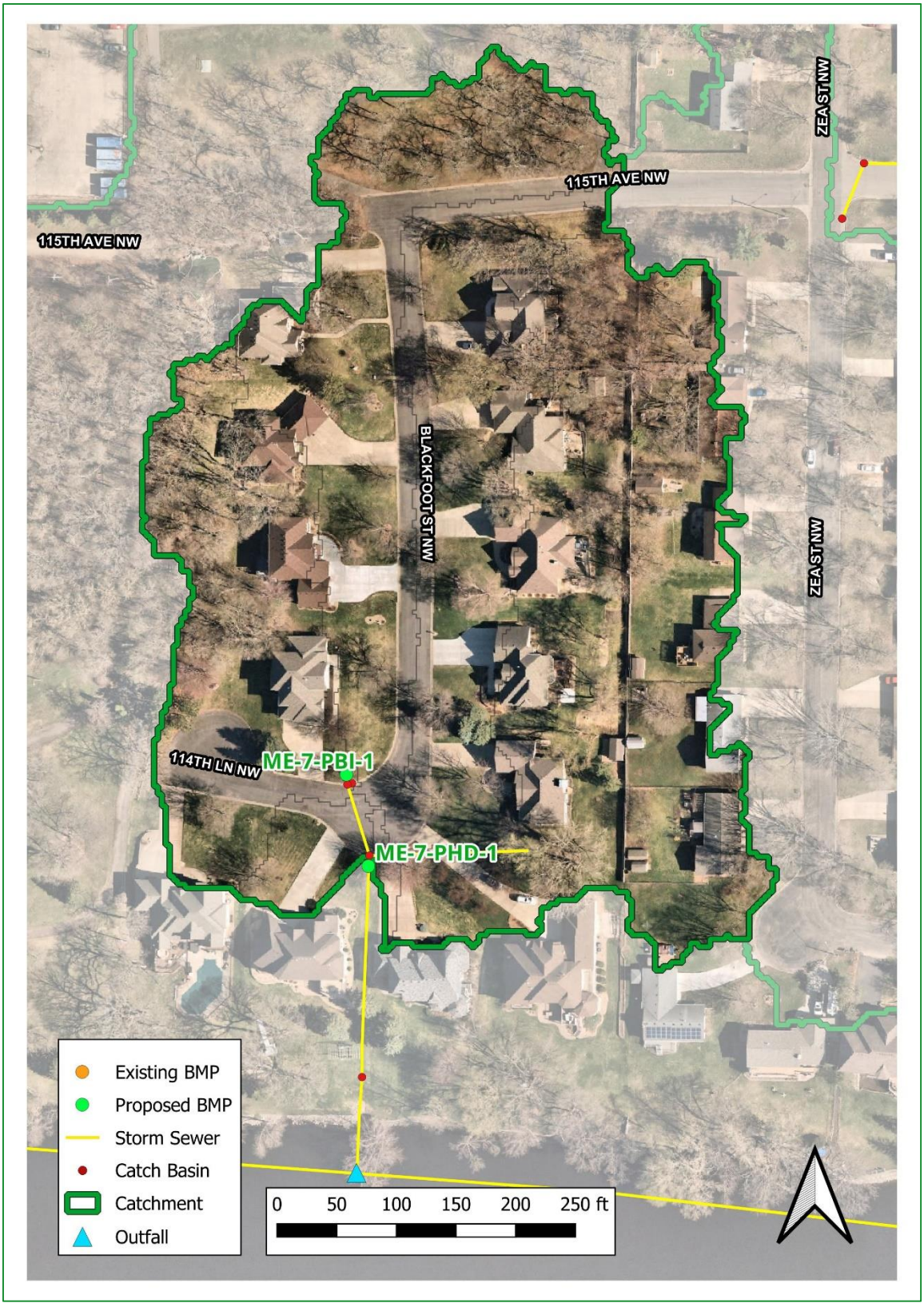
Street cleaning is conducted five times per year by the City of Coon Rapids. No other existing treatment was identified in this catchment. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	3.53	0.32	9%	**3.21**
	TSS (lb/yr)	1,107	137	12%	**970**
	Volume (acre-feet/yr)	2.5	0.00	0%	**2.5**

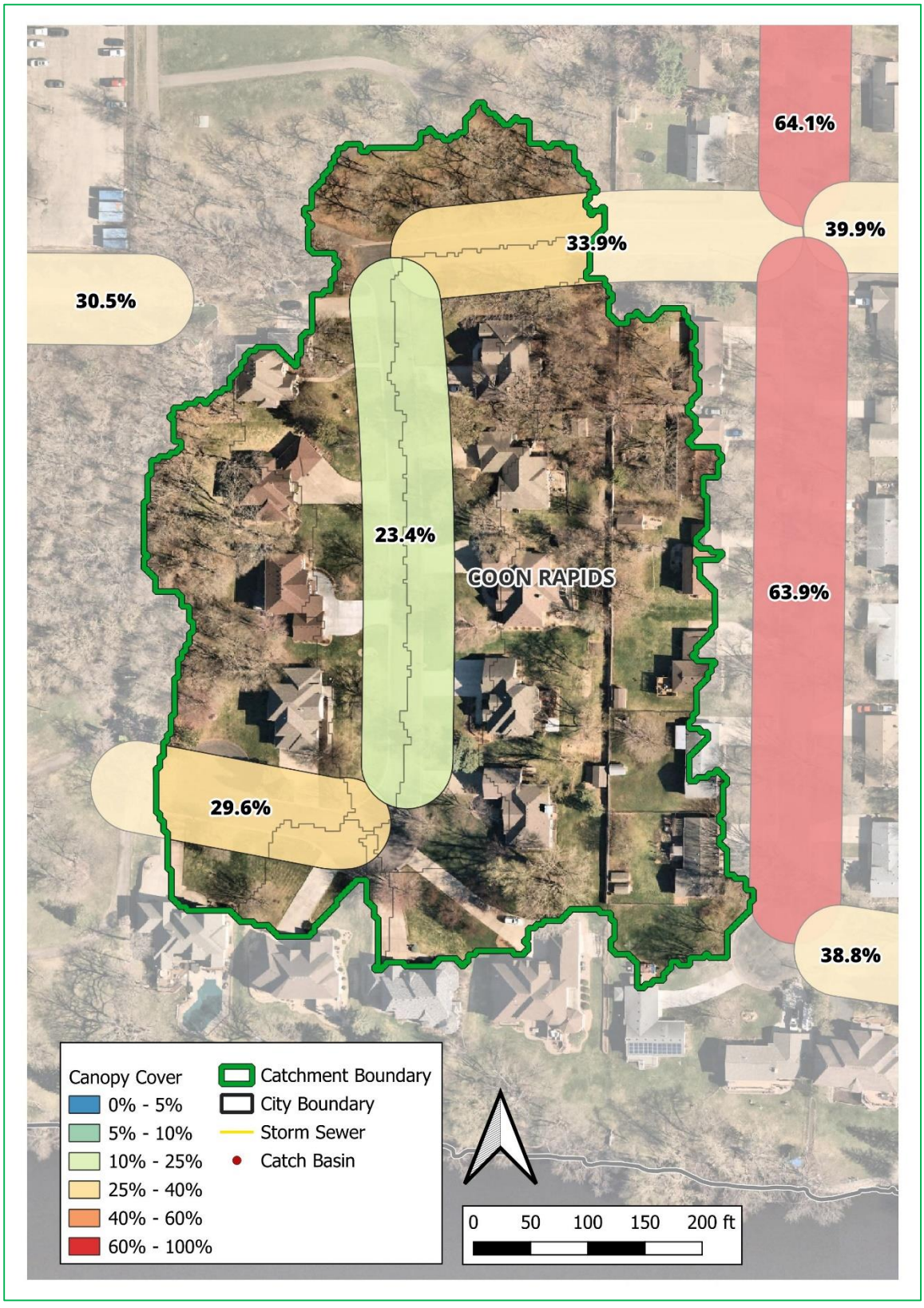
RETROFITS CONSIDERED

One bioinfiltration basin and one hydrodynamic device are proposed within this catchment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER



Project ID: ME-7-PBI-1

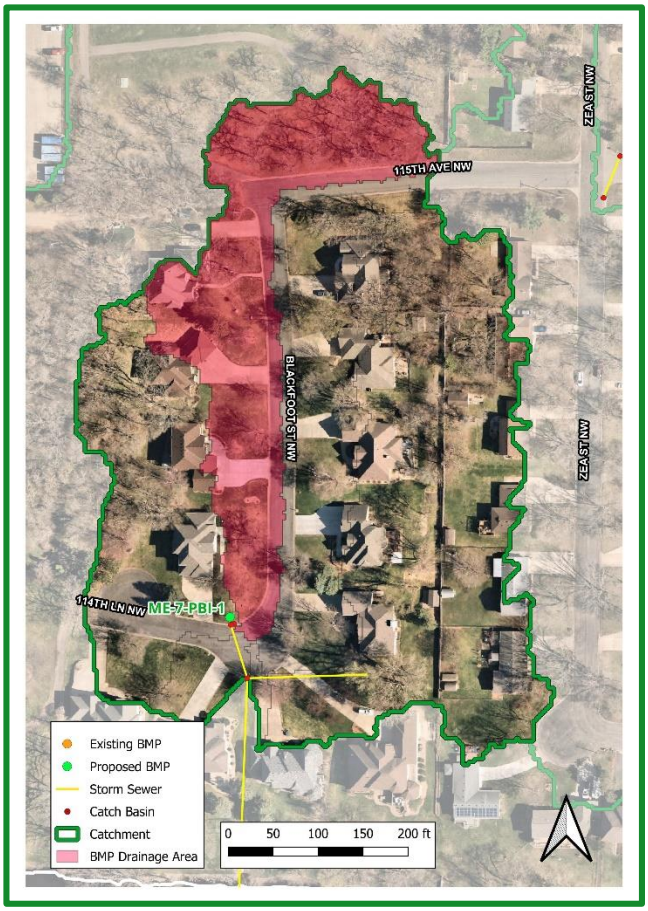
114th Ave. NW
Bioinfiltration Basin

Drainage Area – 1.51 acres

Location – 11460 Blackfoot St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Blackfoot St. NW to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250 sq-ft	
	TP (lb/yr)	0.39	12.2%
	TSS (lb/yr)	124	12.7%
	Volume (acre-feet/yr)	0.30	11.7%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,469**	
	30-yr Average Cost/1,000lb-TSS	**$4,648**	
	30-yr Average Cost/ac-ft Vol.	**$1,936**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-7-PHD-1

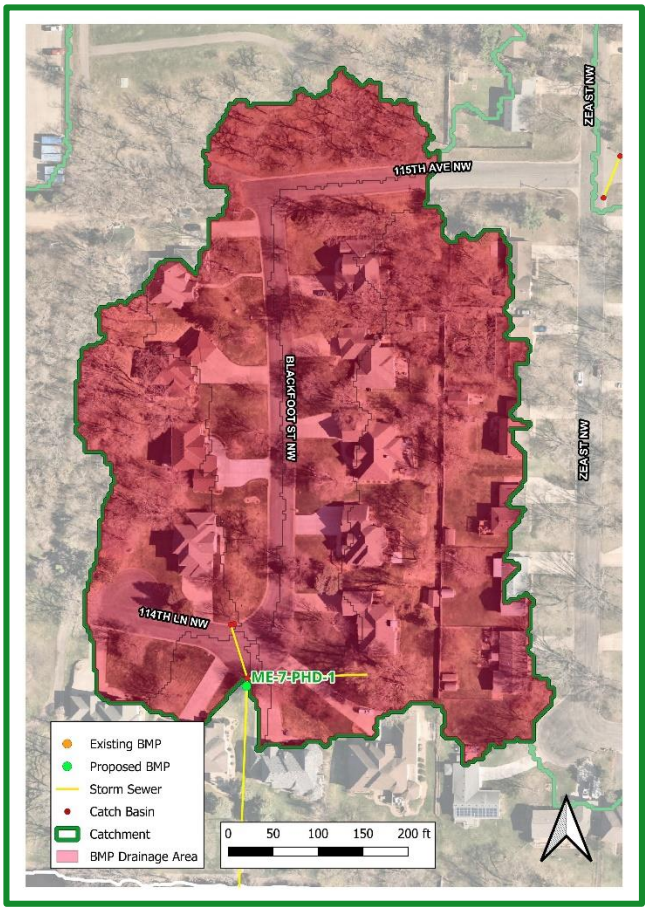
114th Ln. and Blackfoot St.
Hydrodynamic Device

Drainage Area – 6.63 acres

Location – 114th Ln. NW

Property Ownership – City of Coon Rapids / Private

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line near the intersection of 114th. Ln and Blackfoot St. A device at this location would provide treatment to stormwater runoff to the entire catchment. The table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	8	ft diameter
	TP (lb/yr)	0.39	12.0%
	TSS (lb/yr)	155	16.0%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$54,000
	Total Estimated Project Cost (2023)		**$57,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$5,531**	
	30-yr Average Cost/1,000lb-TSS	**$13,756**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

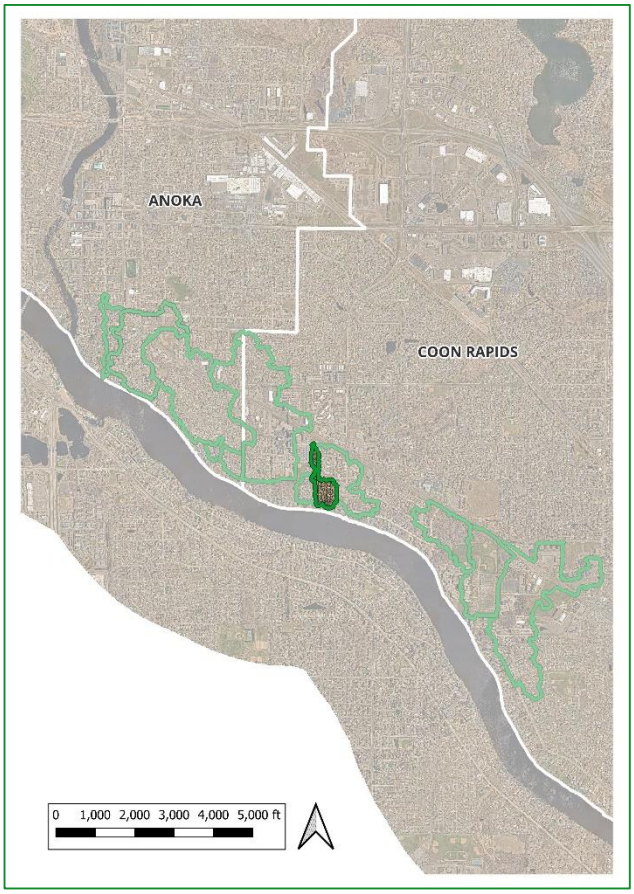
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($36,000 for materials) + ($18,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Catchment ME-8

Existing Catchment Summary	
Acres	10.95
Parcels	50
Land Cover	97.2% Residential 2.4% Commercial 0.4% Park



CATCHMENT DESCRIPTION

This catchment is located in Coon Rapids. Stormwater runoff is routed along Zea St. and Yucca St. prior to entering one of two catch basins on 114th Ln. that discharge directly into the Mississippi River. Land use is primarily single family residential housing.

EXISTING STORMWATER TREATMENT

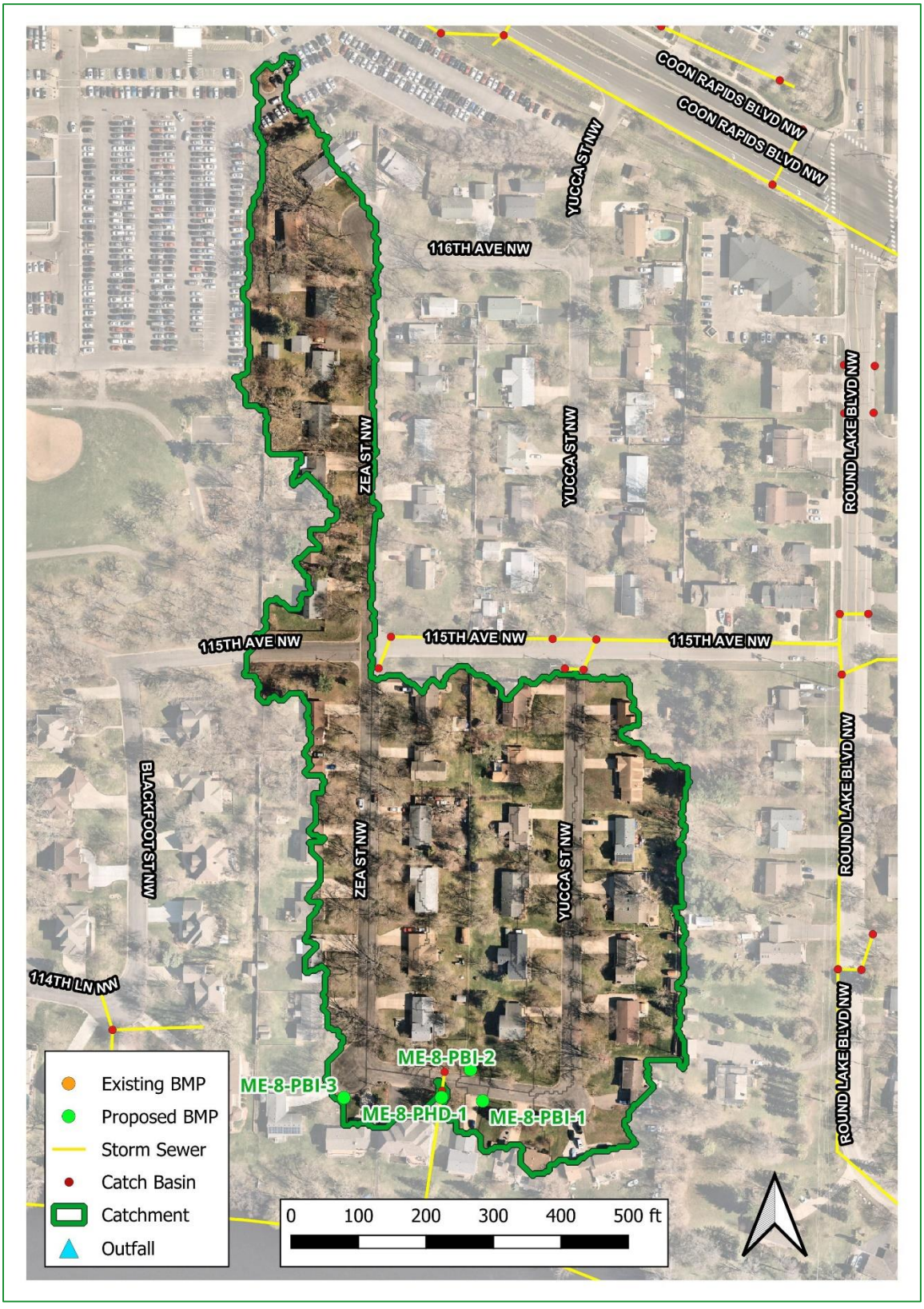
Street cleaning is conducted five times per year by the City of Coon Rapids. No other existing treatment was identified in this catchment. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	6.14	0.55	9%	**5.60**
	TSS (lb/yr)	1,962	240	12%	**1,722**
	Volume (acre-feet/yr)	4.6	0.00	0%	**4.6**

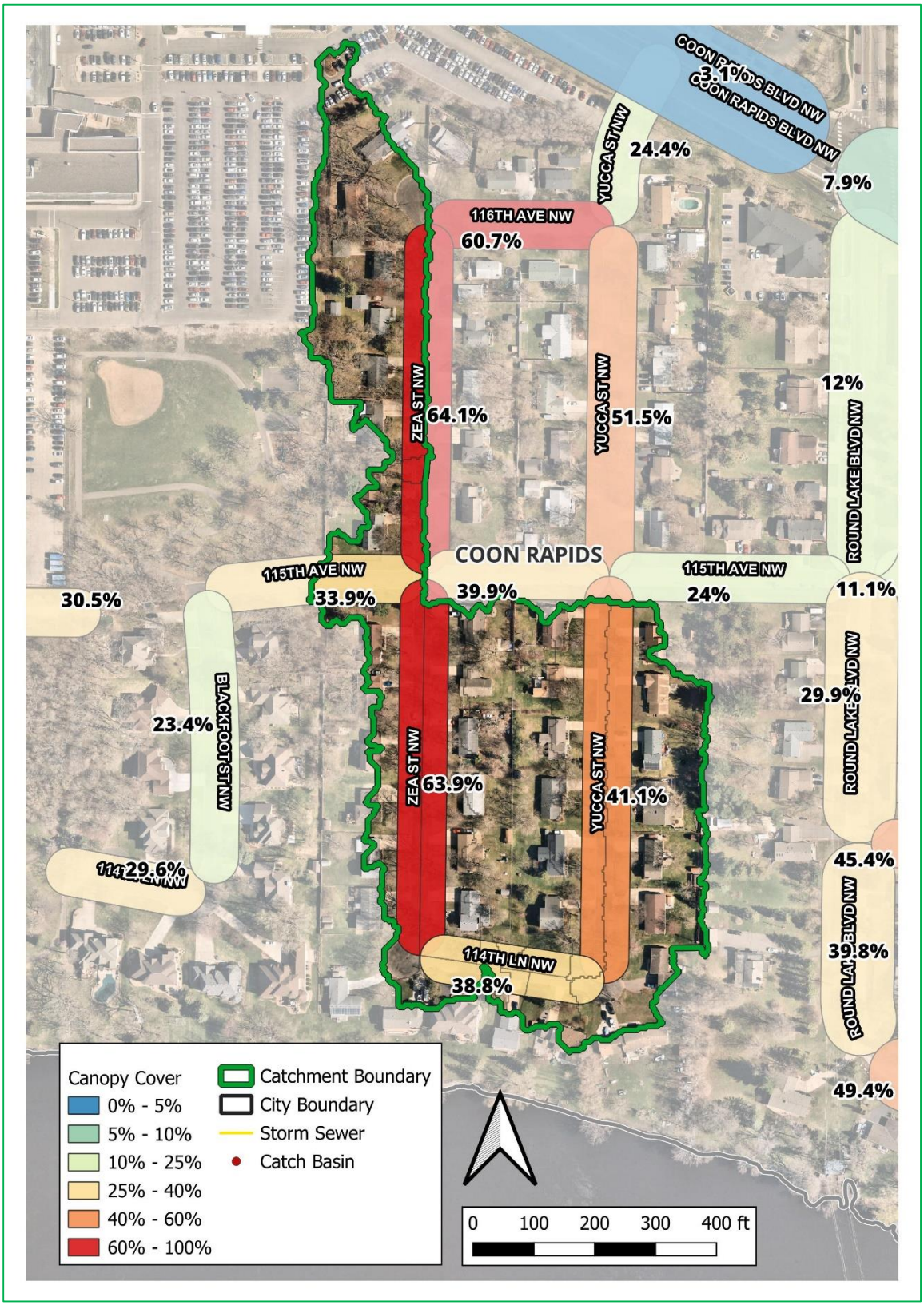
RETROFITS CONSIDERED

Three bioinfiltration basins and one hydrodynamic device are recommended within this catchment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER



Project ID: ME-8-PBI-1

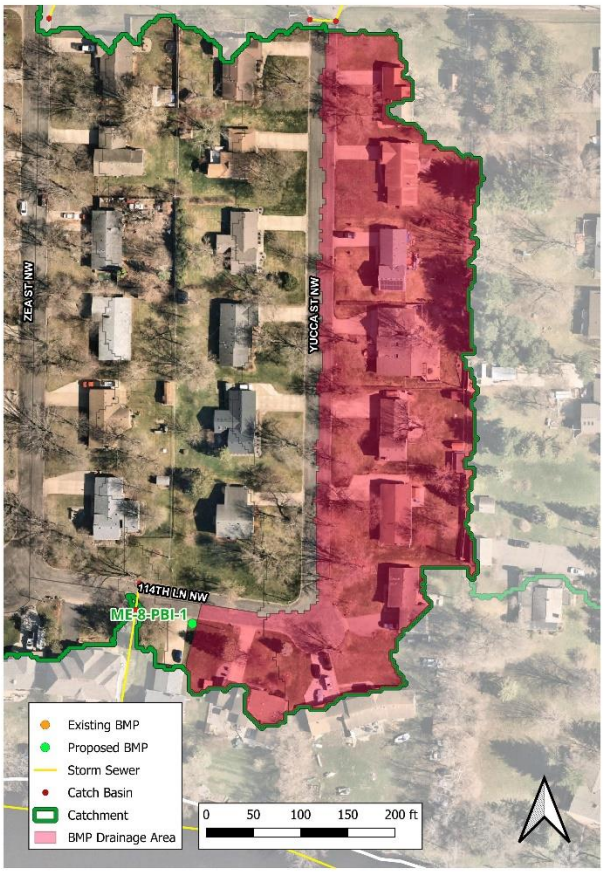
114th Ave. NW
Bioinfiltration Basin

Drainage Area – 2.51 acres

Location – 3856 114th Ln. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Yucca St. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.52	9.3%
	TSS (lb/yr)	164	9.5%
	Volume (acre-feet/yr)	0.40	8.7%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,101**	
	30-yr Average Cost/1,000lb-TSS	**$3,503**	
	30-yr Average Cost/ac-ft Vol.	**$1,445**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-8-PBI-2

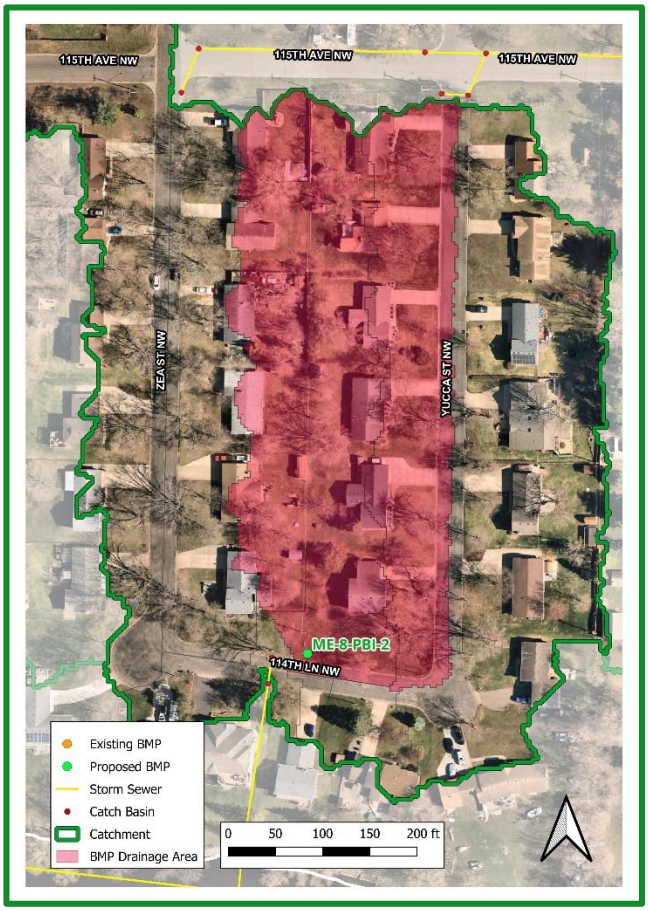
114th Ave. NW
Bioinfiltration Basin

Drainage Area – 3.05 acres

Location – 11420 Yucca St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Yucca St. to the north. The table below provides pollutant removals and estimated costs.



	Curb-Cut Bioinfiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.55	9.9%
	TSS (lb/yr)	174	10.1%
	Volume (acre-feet/yr)	0.42	9.2%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,041**	
	30-yr Average Cost/1,000lb-TSS	**$3,302**	
	30-yr Average Cost/ac-ft Vol.	**$1,365**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-8-PBI-3

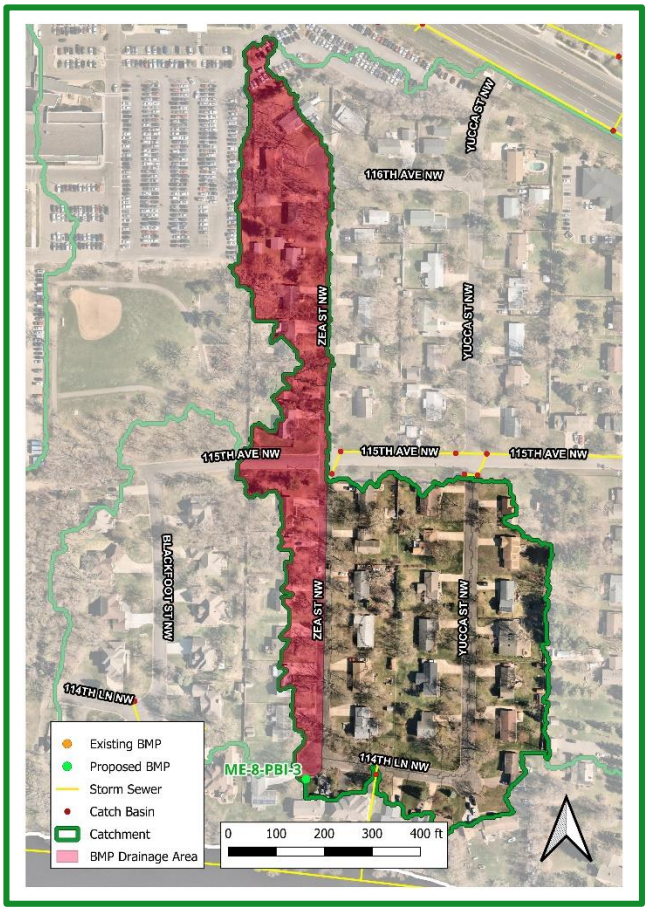
114th Ave. NW
Bioinfiltration Basin

Drainage Area – 3.99 acres

Location – 3906 114th Ln NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Zea St. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.56	10.0%
	TSS (lb/yr)	187	10.9%
	Volume (acre-feet/yr)	0.46	10.1%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,024**	
	30-yr Average Cost/1,000lb-TSS	**$3,072**	
	30-yr Average Cost/ac-ft Vol.	**$1,247**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-8-PHD-1

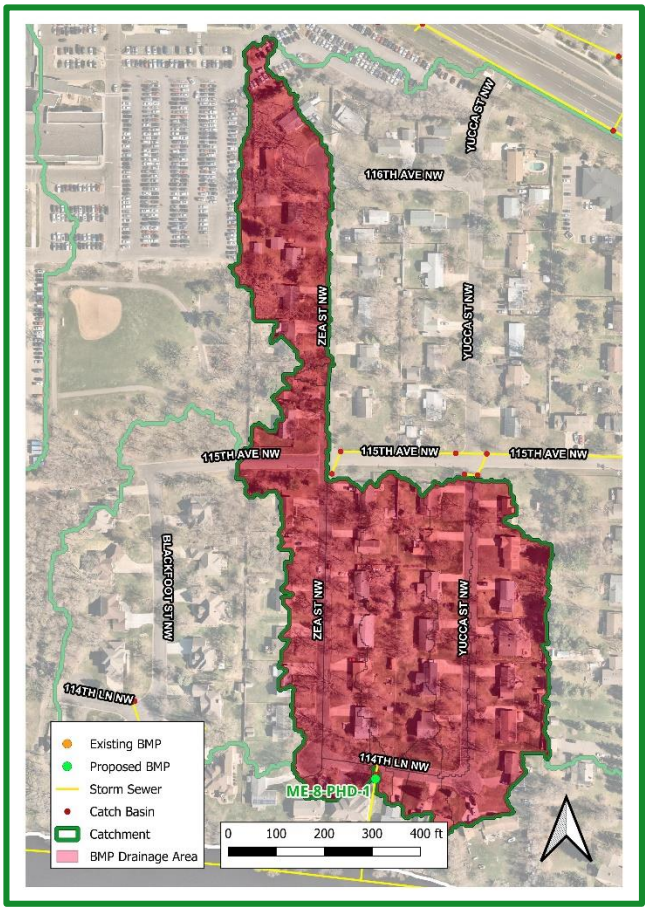
114th Ave. NW
Hydrodynamic Device

Drainage Area – 10.95 acres

Location – 114th Ln. NW

Property Ownership – City of Coon Rapids / Private

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line on 114th Ln. A device at this location would provide treatment to stormwater runoff from Zea St. and Yucca St. The table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	10	ft diameter
	TP (lb/yr)	0.64	11.5%
	TSS (lb/yr)	263	15.3%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$8,284**	
	30-yr Average Cost/1,000lb-TSS	**$20,285**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

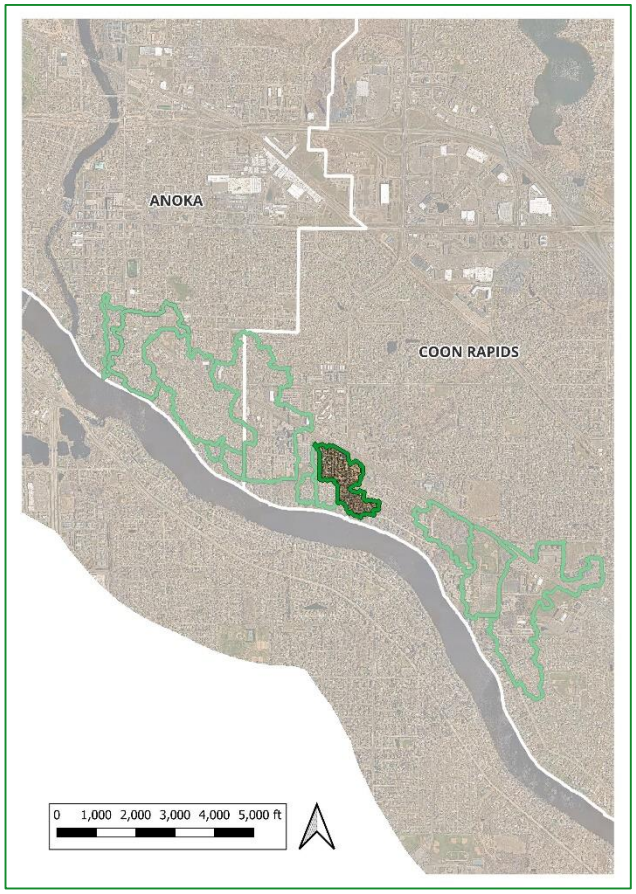
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Catchment ME-9

Existing Catchment Summary	
Acres	30.56
Parcels	88
Land Cover	85.9% Residential 12.8% Commercial 1.3% Industrial



CATCHMENT DESCRIPTION

This catchment is located in Coon Rapids. It is a moderate-sized catchment that is primarily single family residential houses with some commercial properties along the northern side near Coon Rapids Blvd. Stormwater runoff is collected in a series of catch basins throughout the catchment that discharge directly into the Mississippi River.

EXISTING STORMWATER TREATMENT

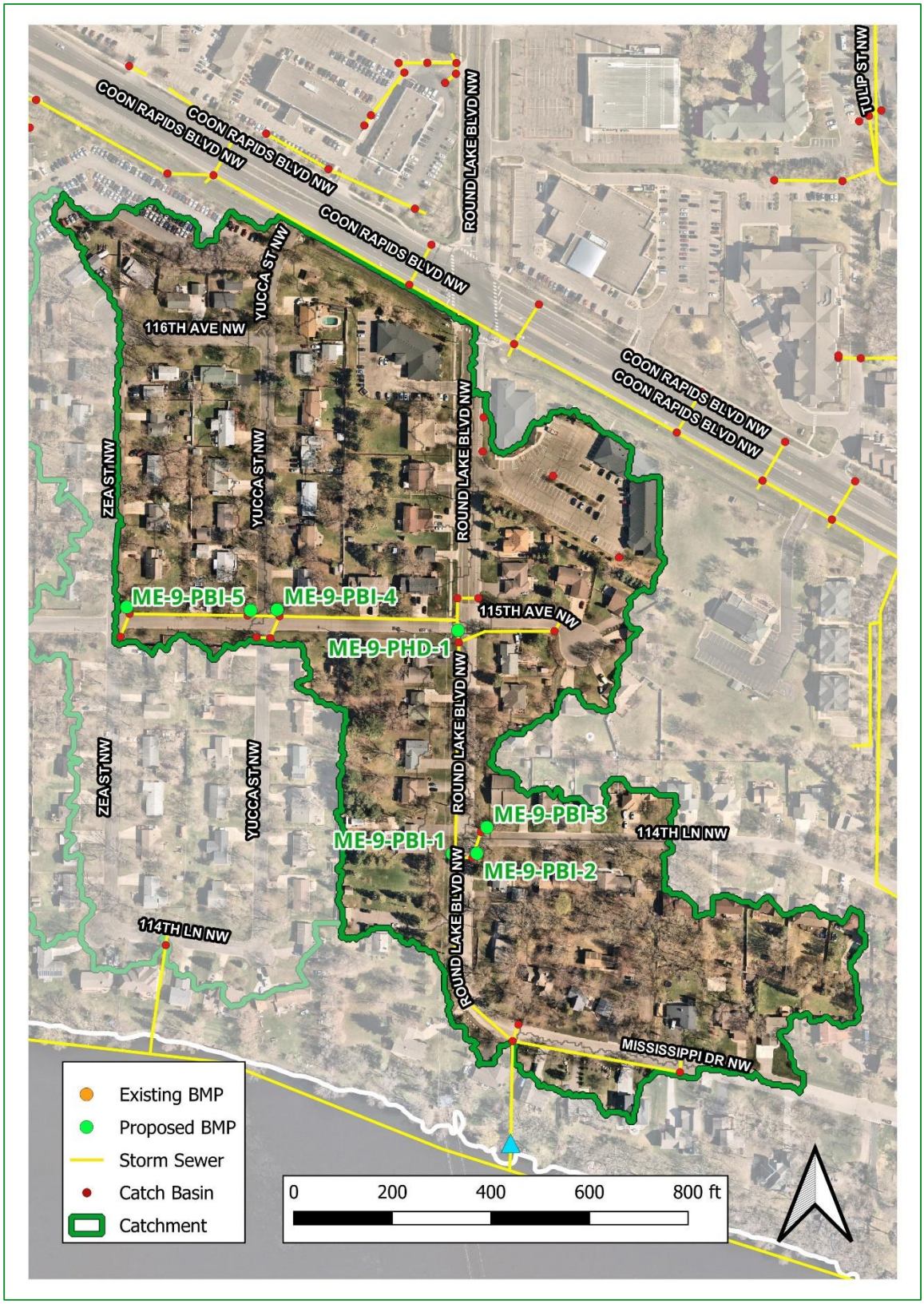
Street cleaning is conducted five times per year by the City of Coon Rapids. No other existing treatment was identified in this catchment. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	18.62	1.51	8%	**17.11**
	TSS (lb/yr)	6,493	686	11%	**5,807**
	Volume (acre-feet/yr)	16.2	0.00	0%	**16.2**

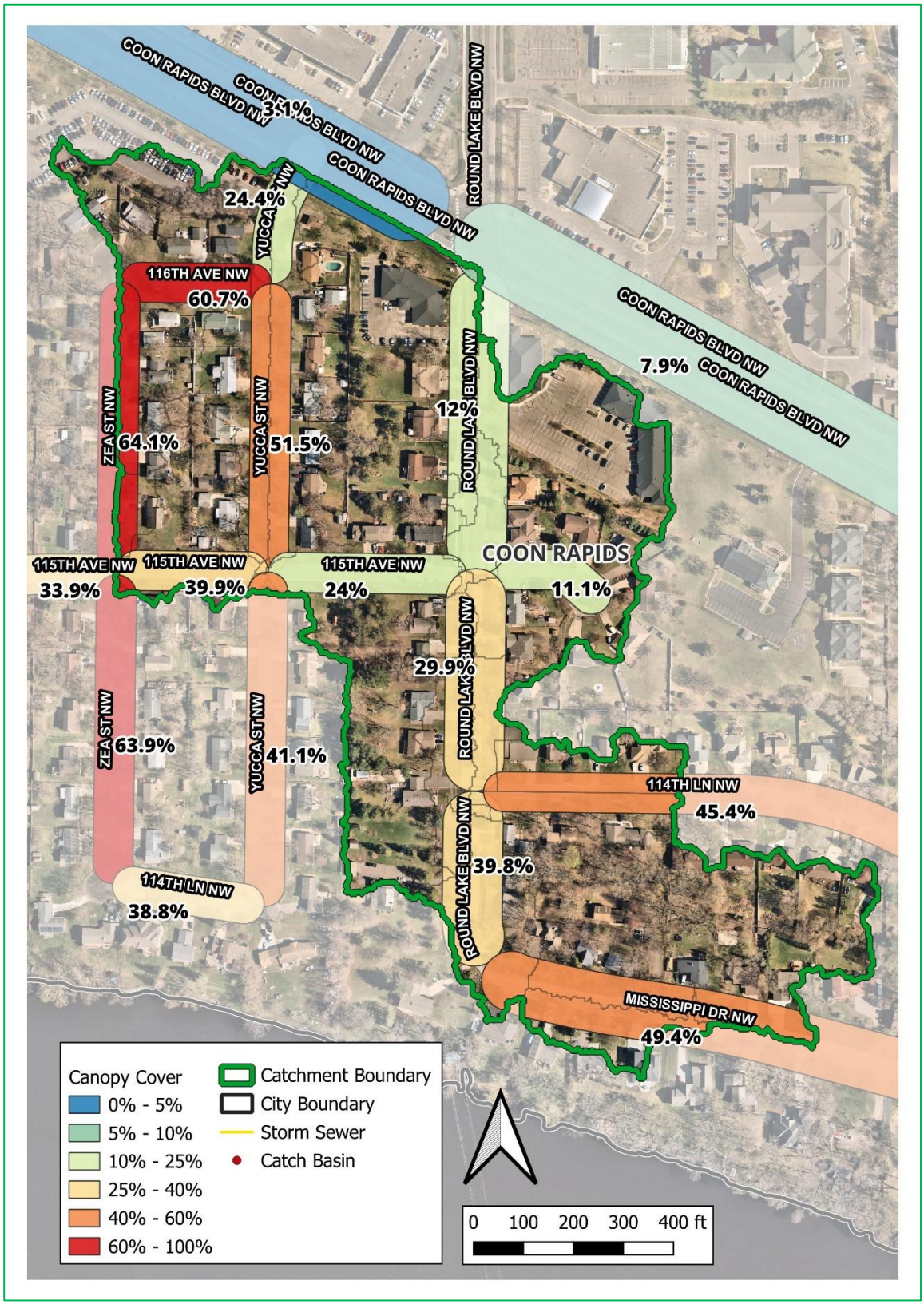
RETROFITS CONSIDERED

Five bioinfiltration basins and one hydrodynamic device are proposed within this catchment.

EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER



Project ID: ME-9-PBI-1

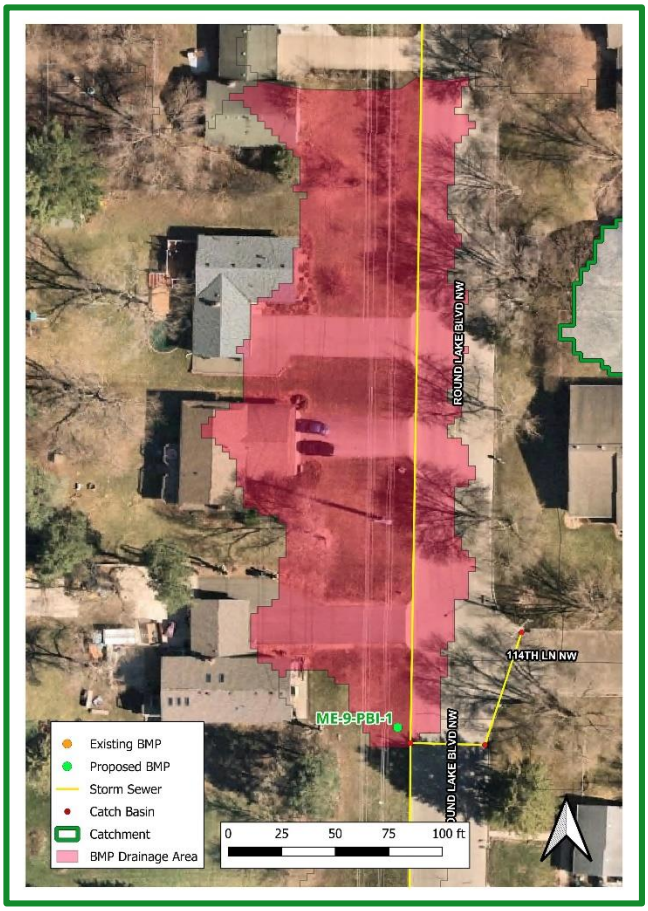
Round Lake Blvd. NW
Bioinfiltration Basin

Drainage Area – 0.60 acres

Location – 11428 Round Lake Blvd. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Round Lake Blvd. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.26	1.5%
	TSS (lb/yr)	81	1.4%
	Volume (acre-feet/yr)	0.20	1.2%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$2,209**	
	30-yr Average Cost/1,000lb-TSS	**$7,092**	
	30-yr Average Cost/ac-ft Vol.	**$2,848**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-9-PBI-2

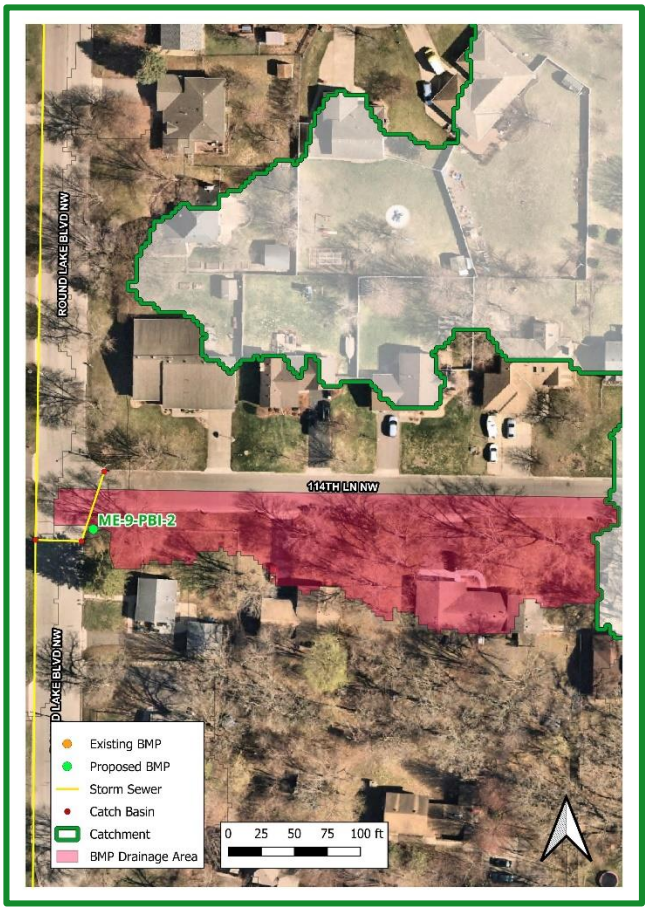
Round Lake Blvd. NW
Bioinfiltration Basin

Drainage Area – 0.67 acres

Location – 11425 Round Lake Blvd. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 114th Ln. to the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.28	1.6%
	TSS (lb/yr)	87	1.5%
	Volume (acre-feet/yr)	0.22	1.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP		**$2,052**
	30-yr Average Cost/1,000lb-TSS		**$6,603**
	30-yr Average Cost/ac-ft Vol.		**$2,665**

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-9-PBI-3

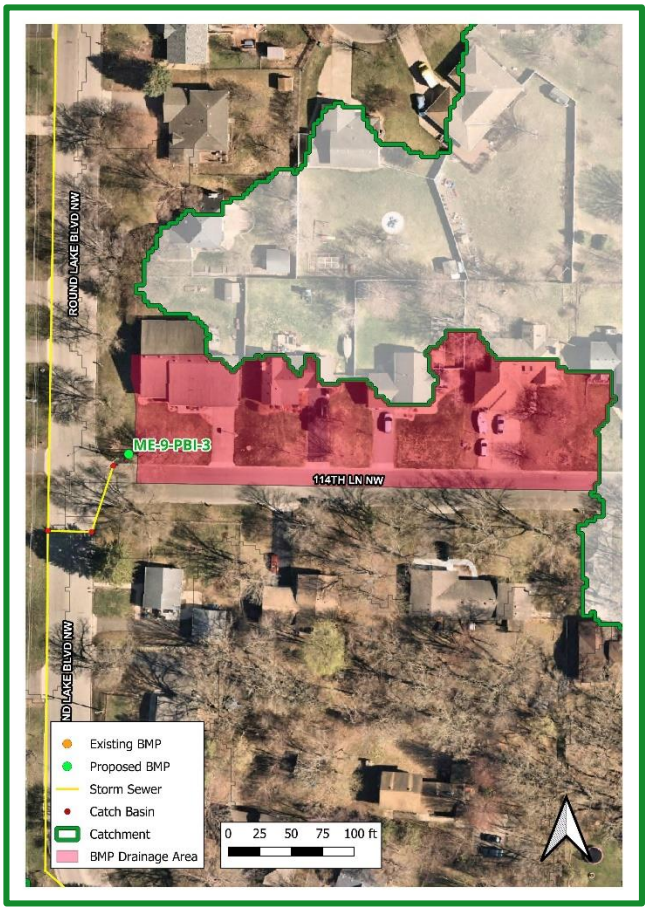
114th Ave. NW
Bioinfiltration Basin

Drainage Area – 0.82 acres

Location – 3777 114th Ln. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 114th Ln. to the east. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250 sq-ft	
	TP (lb/yr)	0.32	1.9%
	TSS (lb/yr)	98	1.7%
	Volume (acre-feet/yr)	0.24	1.5%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,795**	
	30-yr Average Cost/1,000lb-TSS	**$5,862**	
	30-yr Average Cost/ac-ft Vol.	**$2,366**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-9-PBI-4

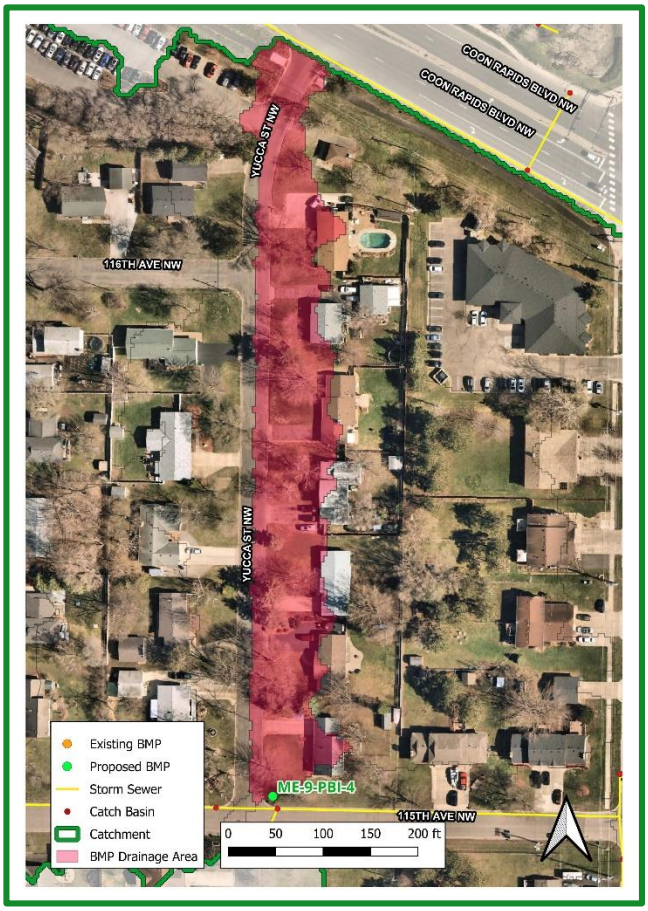
Yucca St. NW
Bioinfiltration Basin

Drainage Area – 1.34 acres

Location – 11511 Yucca St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Yucca St. NW up to Coon Rapids Blvd. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.39	2.3%
	TSS (lb/yr)	144	2.5%
	Volume (acre-feet/yr)	0.34	2.1%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,473**	
	30-yr Average Cost/1,000lb-TSS	**$3,989**	
	30-yr Average Cost/ac-ft Vol.	**$1,689**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-9-PBI-5

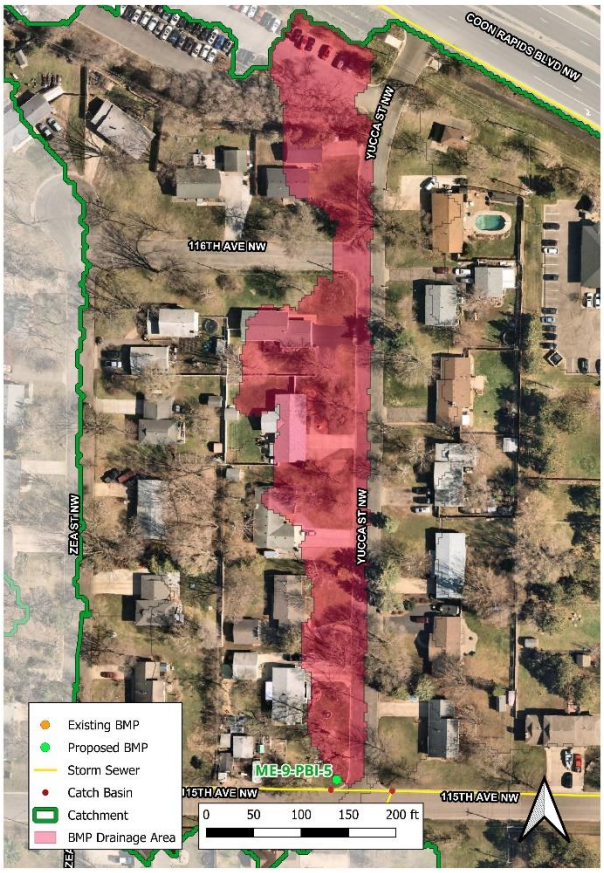
Yucca St. NW
Bioinfiltration Basin

Drainage Area – 1.49 acres

Location – 11514 Yucca St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Yucca St. NW up to Coon Rapids Blvd. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	**Total Size of BMP (sq-ft)**	250	sq-ft
	TP (lb/yr)	0.40	2.3%
	TSS (lb/yr)	143	2.5%
	Volume (acre-feet/yr)	0.36	2.2%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	**30-yr Average Cost/lb-TP**	**$1,436**	
	30-yr Average Cost/1,000lb-TSS	**$4,017**	
	30-yr Average Cost/ac-ft Vol.	**$1,605**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-9-PBI-6

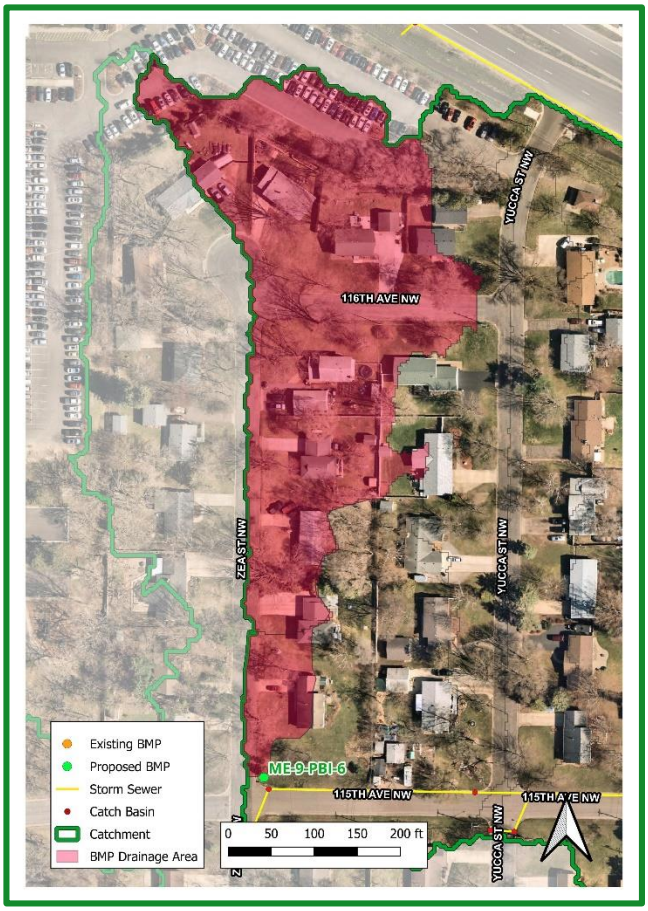
Zea St. NW
Bioinfiltration Basin

Drainage Area – 3.12 acres

Location – 11515 Zea St. NW

Property Ownership – Private

Site Specific Information – An opportunity for a bioinfiltration basin exists at this location. The proposed location is within the front yard of a private residential house. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Zea St. to the north. The table below provides pollutant removals and estimated costs.



Curb-Cut Bioinfiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.51	3.0%
	TSS (lb/yr)	178	3.1%
	Volume (acre-feet/yr)	0.44	2.7%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$9,820
	Total Estimated Project Cost (2023)		**$10,484**
	Annual O&M***		$225
Efficiency	30-yr Average Cost/lb-TP	**$1,126**	
	30-yr Average Cost/1,000lb-TSS	**$3,227**	
	30-yr Average Cost/ac-ft Vol.	**$1,294**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($26/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-9-PHD-1

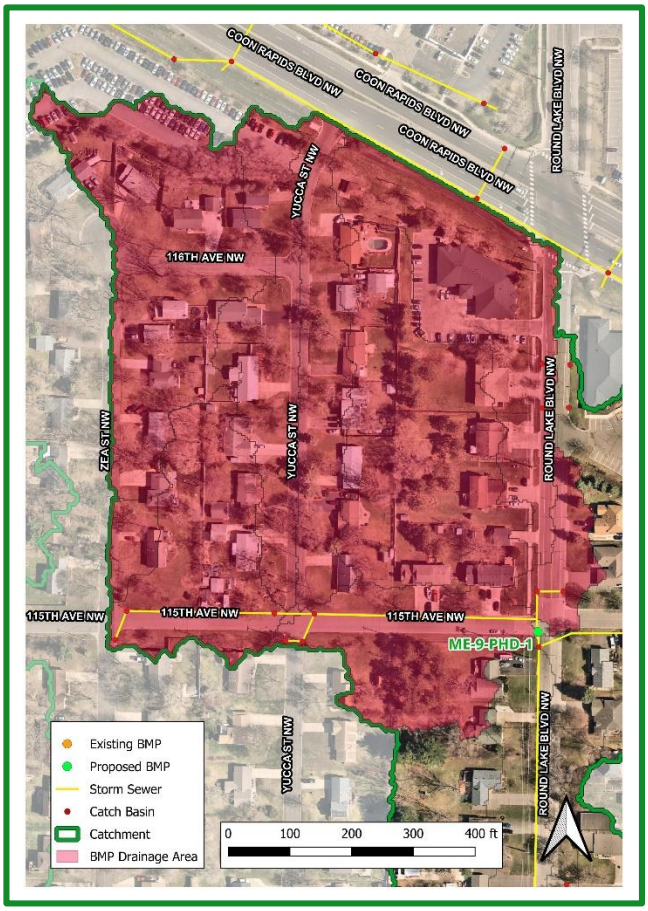
Round Lake Blvd. NW
Hydrodynamic Device

Drainage Area – 14.63 acres

Location – Intersection of 115th Ave. NW and Round Lake Blvd. NW

Property Ownership – City of Coon Rapids

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line at the intersection of 115th Ave. and Round Lake Blvd. A device at this location would provide treatment to stormwater runoff from the northwestern portion of the catchment. The table below provides pollutant removals and estimated costs.



Hydrodynamic Device			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	10	ft diameter
	TP (lb/yr)	0.83	4.9%
	TSS (lb/yr)	384	6.6%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$6,428**	
	30-yr Average Cost/1,000lb-TSS	**$13,893**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

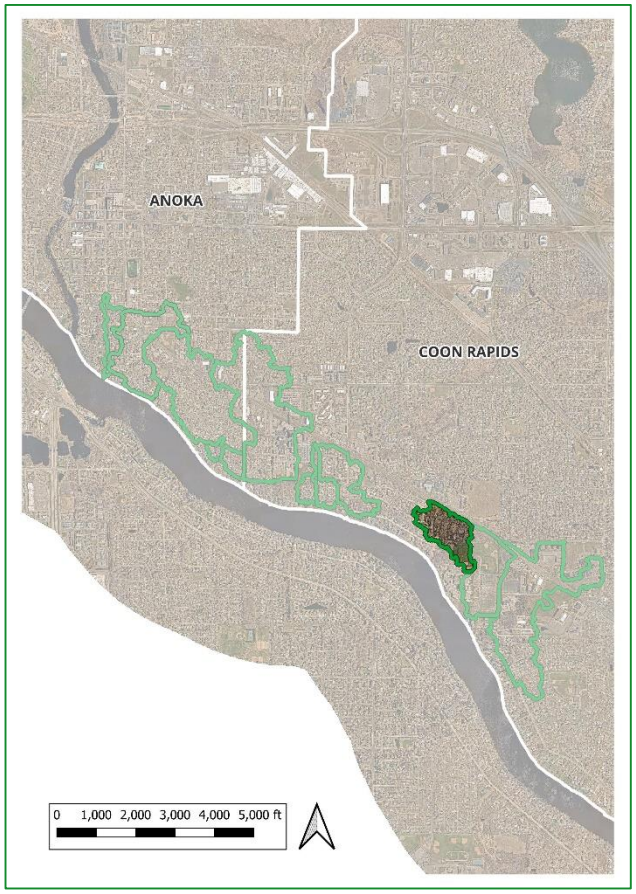
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Catchment ME-10

Existing Catchment Summary	
Acres	29.97
Parcels	23
Land Cover	60.8% Park 25.3% Inst. 13.8% Residential



CATCHMENT DESCRIPTION

This catchment is located in Coon Rapids. It is a moderate-sized catchment that is primarily made up of natural land that belongs to the Anoka-Ramsey Community College. In addition, the area to the west of Pheasant Ridge Dr. contains residential single-family houses. Stormwater runoff is routed along Pheasant Ridge Dr. prior to entering a series of catch basins that discharge water directly into the Mississippi River.

EXISTING STORMWATER TREATMENT

Street cleaning is conducted five times per year by the City of Coon Rapids. No other existing treatment was identified in this catchment. Present day stormwater pollutant loading and treatment is summarized in the table below.

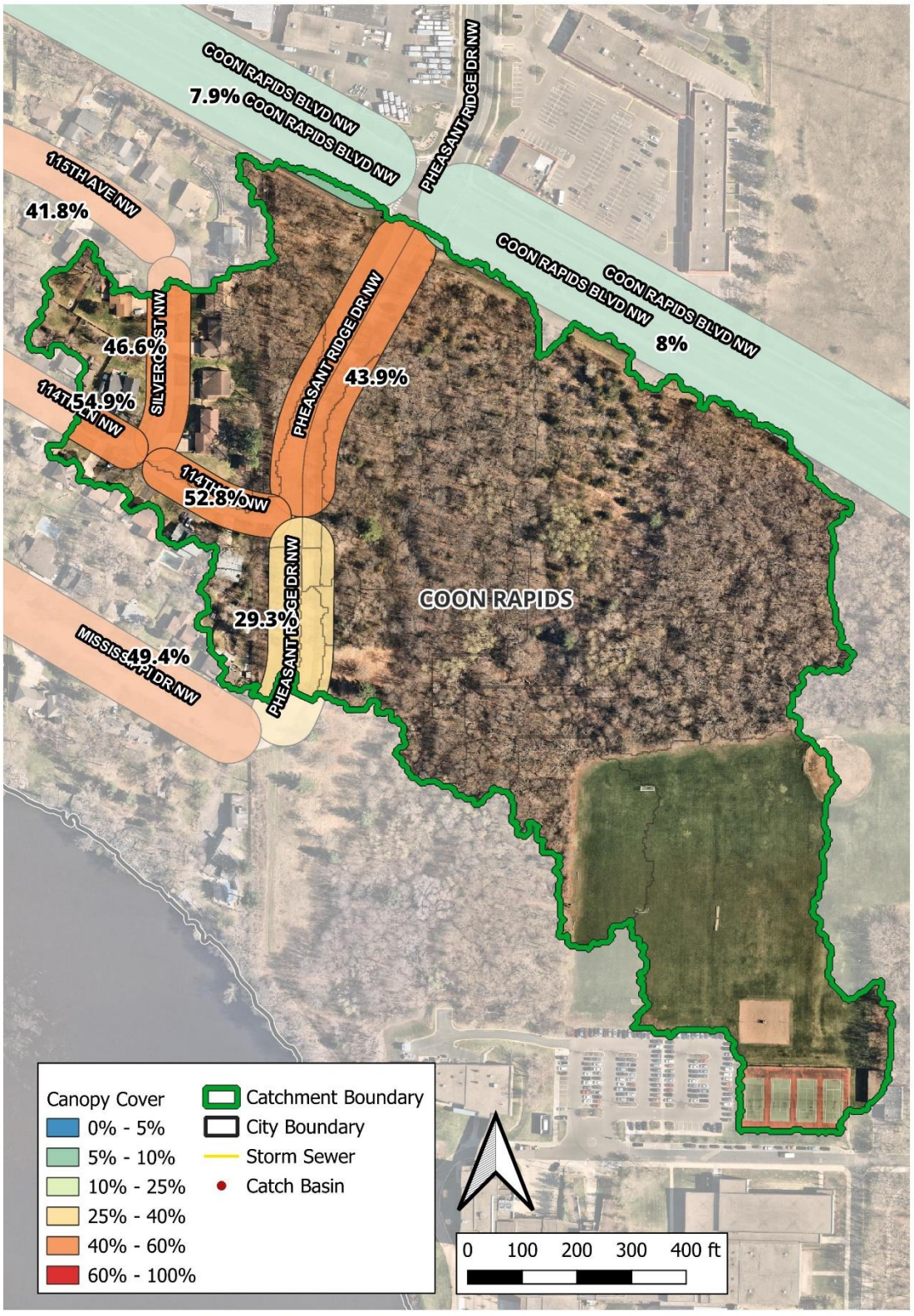
	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	16.66	0.61	4%	**16.05**
	TSS (lb/yr)	3,929	265	7%	**3,664**
	Volume (acre-feet/yr)	8.0	0.00	0%	**8.0**

RETROFITS CONSIDERED

Two biofiltration basins and one hydrodynamic device are proposed within this catchment.

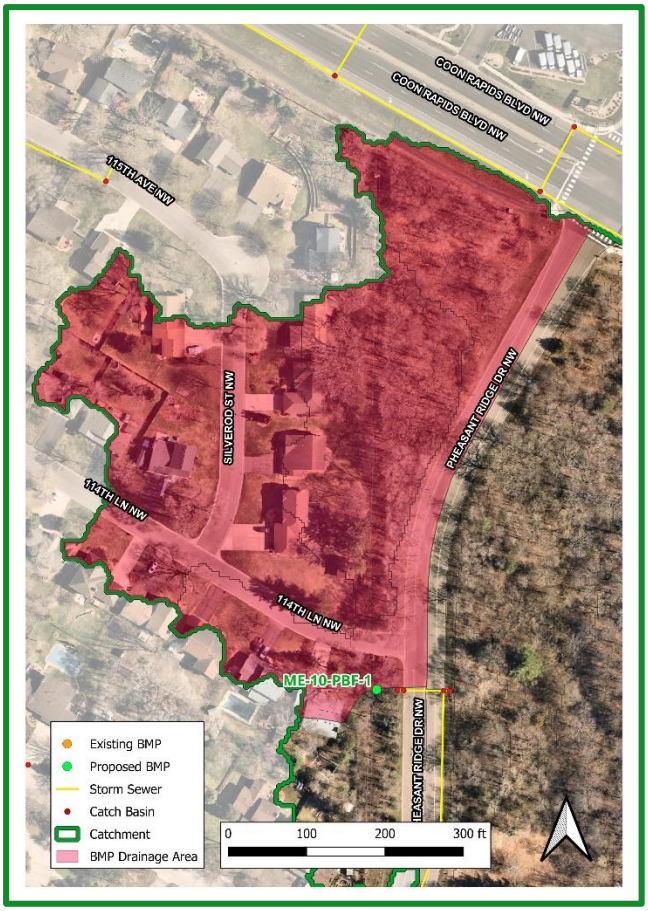
EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES

ROAD TREE CANOPY COVER



Project ID: ME-10-PBF-1

Pheasant Ridge Dr. NW
Biofiltration Basin



Drainage Area – 6.15 acres

Location – PIN: 173124130004

Property Ownership – Anoka Ramsey Community College

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is near the catch basin on a narrow stretch of land along the west side of Pheasant Ridge Dr. that is owned by the Anoka-Ramsey Community College. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Shaw Ave. to the north. Soils in this area are classified as Hydrologic Soil Group C, which have moderately high runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

	Curb-Cut Biofiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.35	2.2%
	TSS (lb/yr)	132	3.6%
	Volume (acre-feet/yr)	0.07	0.9%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$23,320
	Total Estimated Project Cost (2023)		**$23,984**
	Annual O&M***		$295
Efficiency	**30-yr Average Cost/lb-TP**	**$3,127**	
	30-yr Average Cost/1,000lb-TSS	**$8,291**	
	30-yr Average Cost/ac-ft Vol.	**$15,359**	

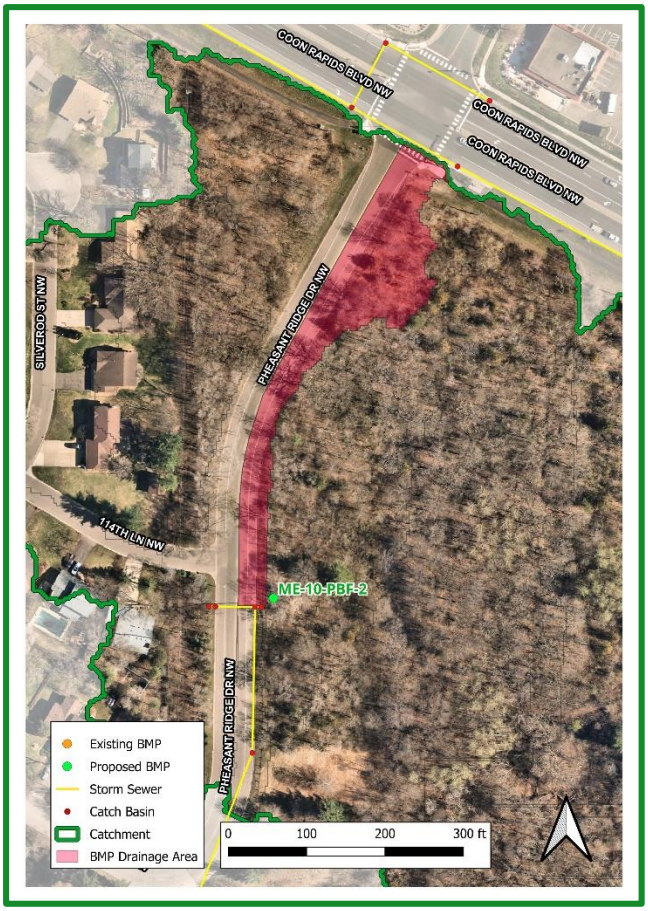
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-10-PBF-2

Pheasant Ridge Dr. NW
Biofiltration Basin



Drainage Area – 0.82 acres

Location – PIN 173124130004

Property Ownership – Anoka Ramsey Community College

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is near the catch basin on the east side of Pheasant Ridge Dr. on forested land that is owned by the Anoka-Ramsey Community College. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Shaw Ave. to the north. Soils in this area are classified as Hydrologic Soil Group C, which have moderately high runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

	Curb-Cut Biofiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.14	0.9%
	TSS (lb/yr)	49	1.3%
	Volume (acre-feet/yr)	0.03	0.4%
Cost	**Administration & Promotion Costs***	$664	
	Design & Construction Costs**	$23,320	
	Total Estimated Project Cost (2023)	**$23,984**	
	Annual O&M***	$295	
Efficiency	**30-yr Average Cost/lb-TP**	**$7,818**	
	30-yr Average Cost/1,000lb-TSS	**$22,336**	
	30-yr Average Cost/ac-ft Vol.	**$32,857**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-10-PHD-1

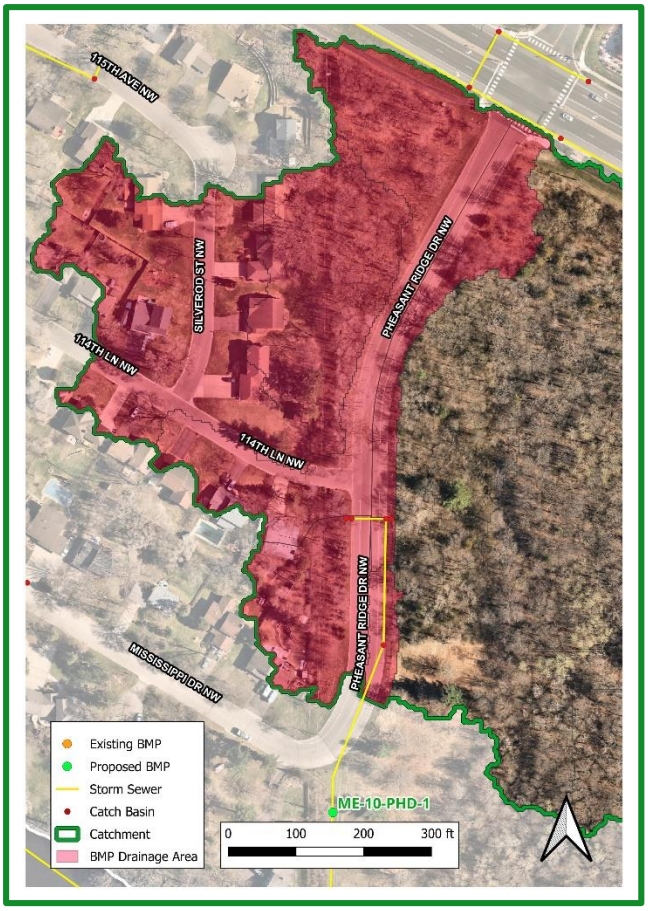
Pheasant Ridge Dr. NW
Hydrodynamic Device

Drainage Area – 8.12 acres

Location – PIN 173124130004

Property Ownership – City of Coon Rapids / Anoka Ramsey Community College

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line on Pheasant Ridge Dr. A device at this location would provide treatment to stormwater runoff from the residential area west of Pheasant Ridge Dr. The table below provides pollutant removals and estimated costs.



Hydrodynamic Device			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	10	ft diameter
	TP (lb/yr)	0.59	3.7%
	TSS (lb/yr)	216	5.9%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$9,042**	
	30-yr Average Cost/1,000lb-TSS	**$24,699**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

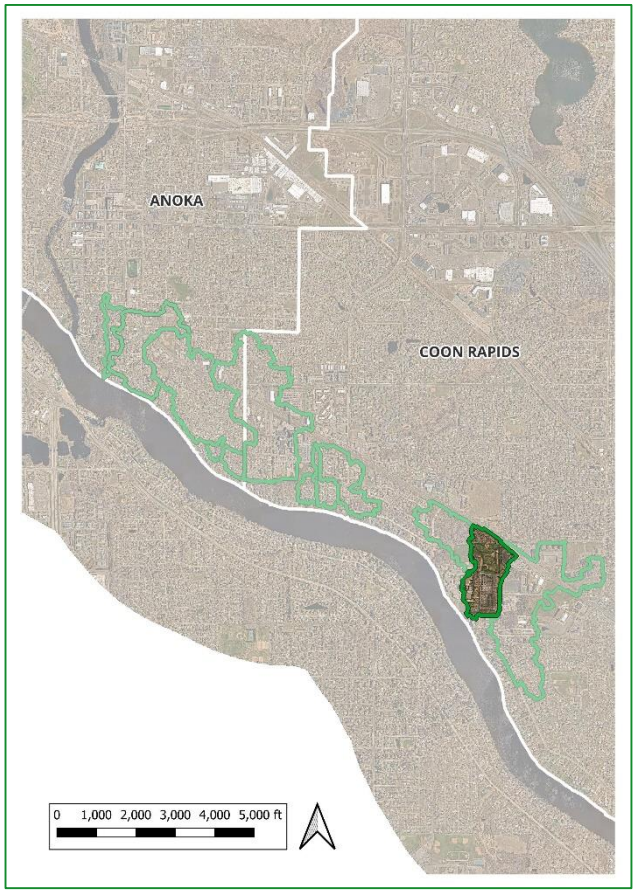
*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

Catchment ME-11

Existing Catchment Summary	
Acres	44.06
Parcels	23
Land Cover	87.4% Inst. 9.2% Park 3.4% Residential



CATCHMENT DESCRIPTION

This catchment is located in Coon Rapids. The drainage area to the catchment outfall is located entirely within the Anoka-Ramsey Community College campus, excluding the areas on the west side of the campus that drain to separate, smaller catchments.

EXISTING STORMWATER TREATMENT

This catchment contains one existing bioinfiltration basin, however, this basin appears to primarily collect stormwater runoff from a small portion of the campus roof and the adjacent field. Because the upstream drainage area for this existing bioinfiltration basin is small and does not include any of the parking lot runoff, this basin has not been modeled as an existing stormwater treatment practice. In addition, street cleaning is conducted five times per year by the City of Coon Rapids.

Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	44.88	1.66	4%	**43.22**
	TSS (lb/yr)	14,961	1,027	7%	**13,934**
	Volume (acre-feet/yr)	36.6	0.00	0%	**36.6**

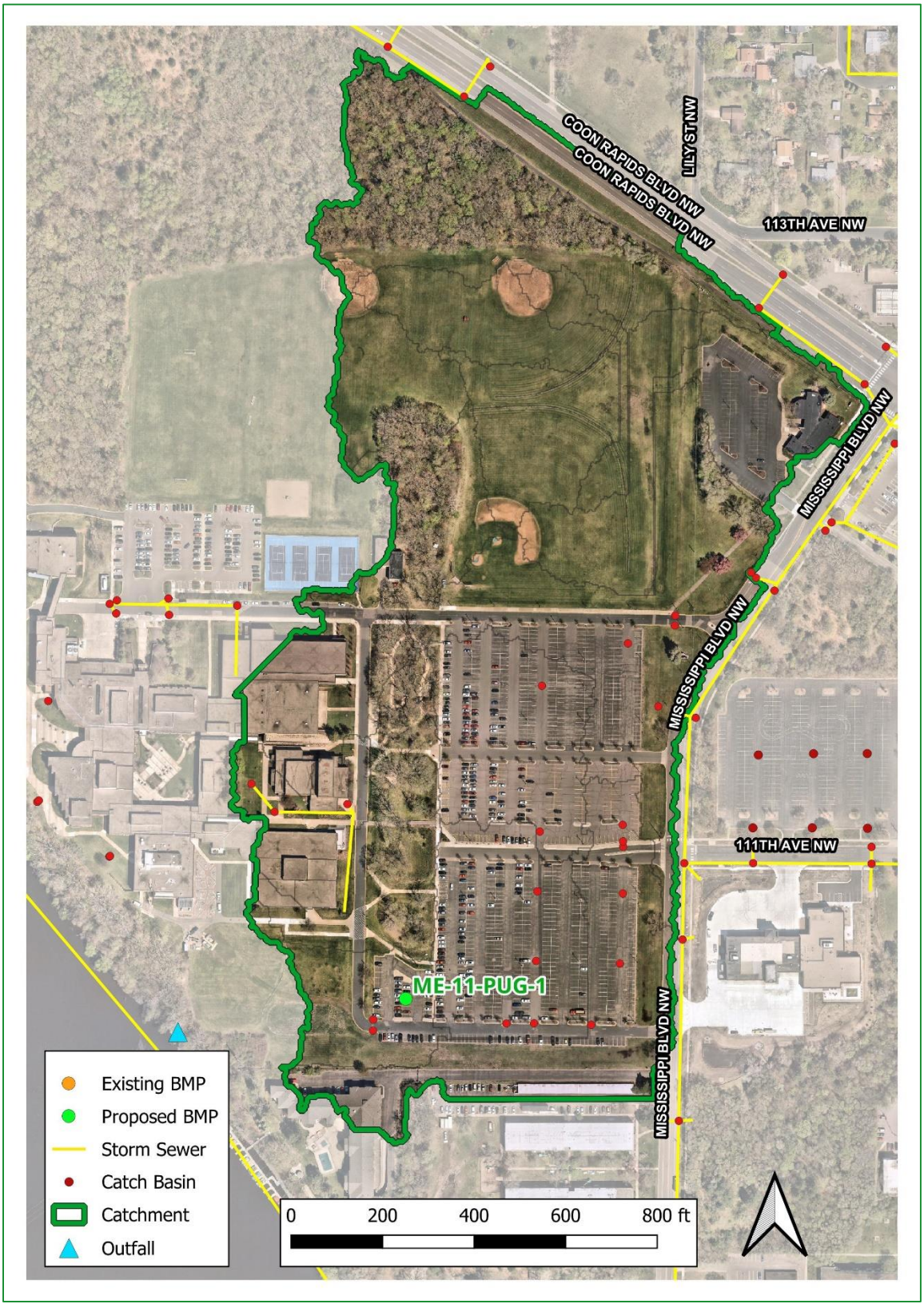
RETROFITS CONSIDERED

One underground structure is proposed within this catchment.

RETROFITS CONSIDERED BUT REJECTED

Modification to the existing bioinfiltration basin to a wet pond was considered as a potential project, however, based on field assessments, the existing stormwater infrastructure is too deep for an appropriately-sized wet pond in this location while also maintaining available green space for the Anoka-Ramsey Community College campus.

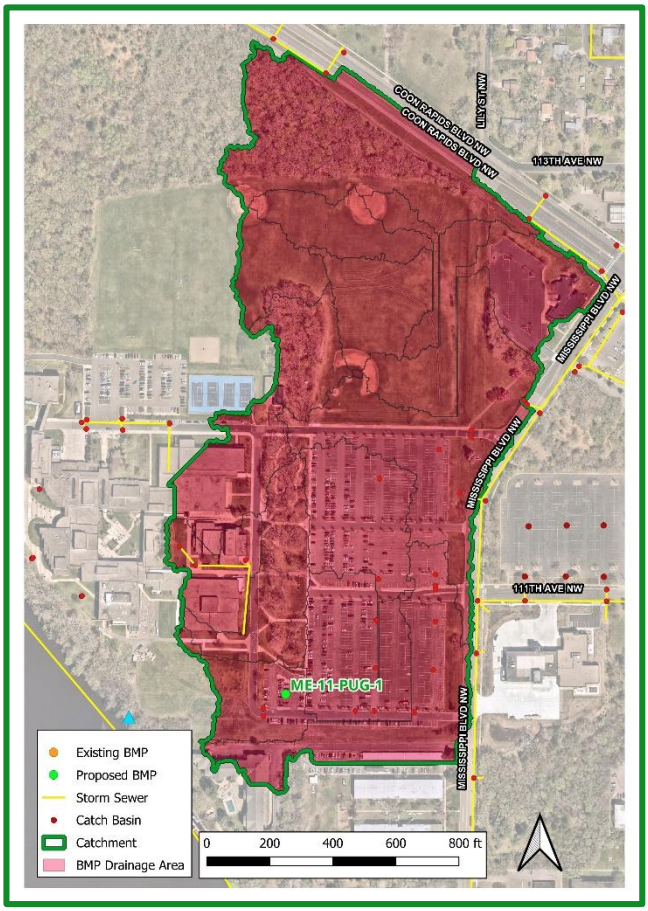
EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER

Project ID: ME-11-PUG-1

Anoka Ramsey Community College Underground Structure



Drainage Area – 44.06 acres

Location – SW Anoka Ramsey Community College

Property Ownership – Anoka Ramsey Community College

Site Specific Information – An underground structure is proposed near this location. The structure would provide treatment to stormwater runoff from the majority of the catchment, depending on the location of stormwater infrastructure. It is recommended that an underground structure is paired with any potential road or parking lot rehabilitation projects for cost effectiveness. Soils in this area are classified as Hydrologic Soil Group C, which have moderately high runoff potential and reduces the effectiveness of the underground structure. In addition, based on field assessments, the existing stormwater infrastructure appears to be fairly deep below surface, which significantly increases the cost of installing an underground structure. The table below provides pollutant removals and estimated costs.

Underground Structure			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	25,500 sq-ft	
	TP (lb/yr)	20.56	47.6%
	TSS (lb/yr)	8,757	62.8%
	Volume (acre-feet/yr)	36.50	99.7%
Cost	**Administration & Promotion Costs***		$8,300
	Design & Construction Costs**		$1,406,760
	Total Estimated Project Cost (2023)		**$1,415,060**
	Annual O&M***		$280
Efficiency	**30-yr Average Cost/lb-TP**	**$2,308**	
	30-yr Average Cost/1,000lb-TSS	**$5,418**	
	30-yr Average Cost/ac-ft Vol.	**$1,300**	

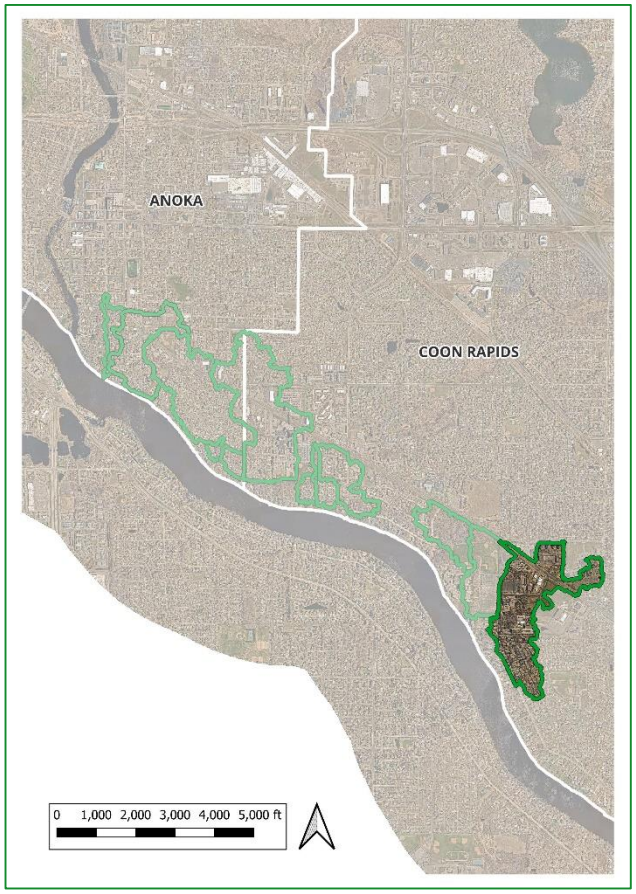
*Indirect Cost: (100 hours at $83/hour base cost)

**Direct Cost: See Appendix B for detailed cost information

***Per BMP: (1 cleaning/year)*(4 hours/cleaning)*($70/hour)

Catchment ME-12

Existing Catchment Summary	
Acres	35.44
Parcels	151
Land Cover	41.7% Residential 30.3% Commercial 10.5% Open 9.7% Institutional 7.8% Park



CATCHMENT DESCRIPTION

This catchment is located in Coon Rapids. It is a relatively large catchment that is divided into two sections for the purposes of modeling and analysis. The northern half of the catchment is primarily commercial property and contains several existing stormwater treatment practices, while the southern half of the catchment is primarily residential property with no known existing treatment. For this report, due to the abundance of existing treatment in the northern half of the catchment, only the southern portion of the catchment has been modeled with proposed stormwater treatment practices.

EXISTING STORMWATER TREATMENT

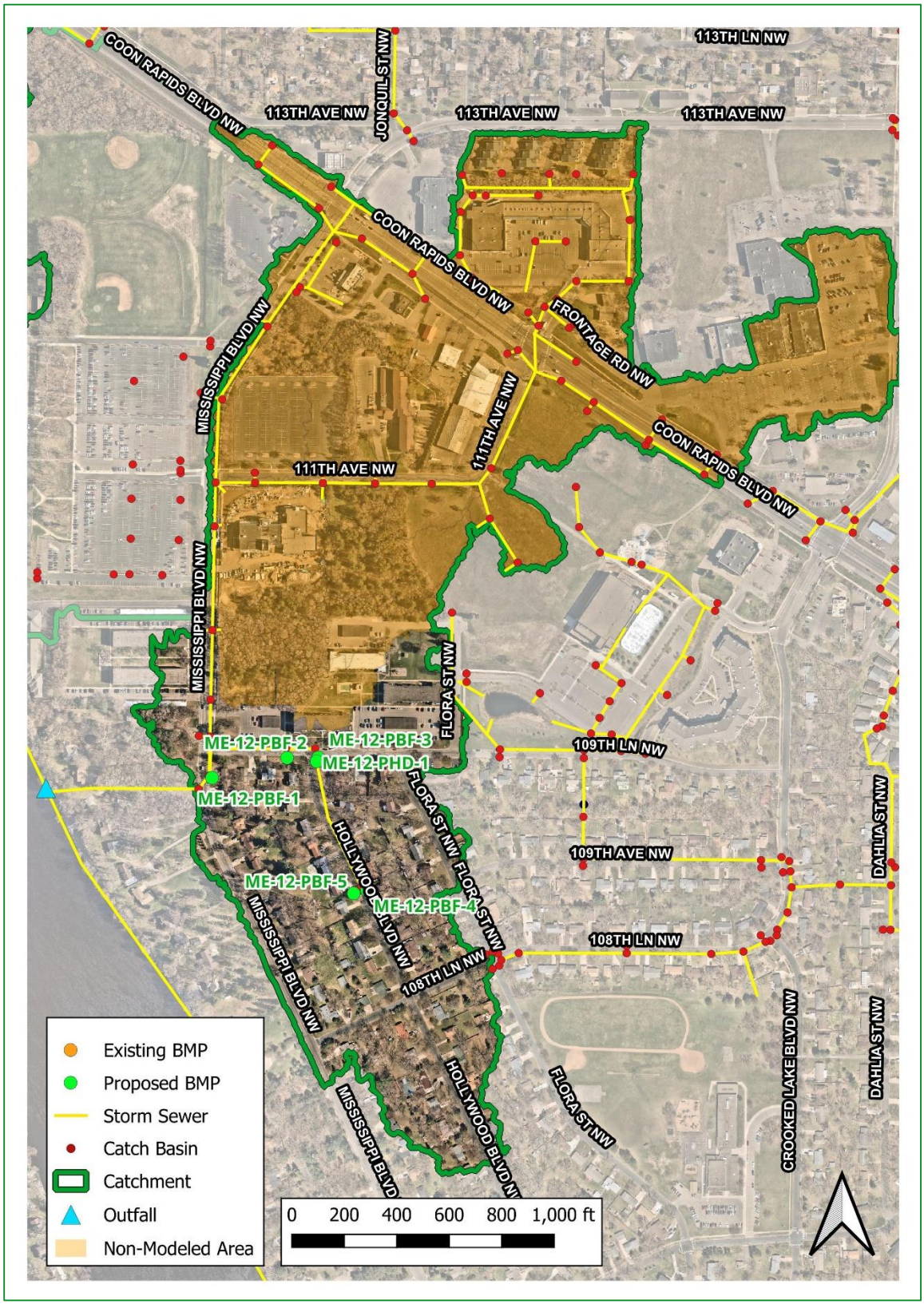
Street cleaning is conducted five times per year by the City of Coon Rapids. No other existing treatment was identified in this portion of the catchment. Present day stormwater pollutant loading and treatment is summarized in the table below.

	Existing Conditions	Base Loading	Treatment	Net Treatment %	Existing Loading
Treatment	Number of BMPs	1			
	BMP Types	Street Cleaning			
	TP (lb/yr)	33.01	1.95	6%	**31.06**
	TSS (lb/yr)	8,842	846	10%	**7,996**
	Volume (acre-feet/yr)	21.6	0.00	0%	**21.6**

RETROFITS CONSIDERED

Five biofiltration basins and one hydrodynamic device are proposed within this catchment.

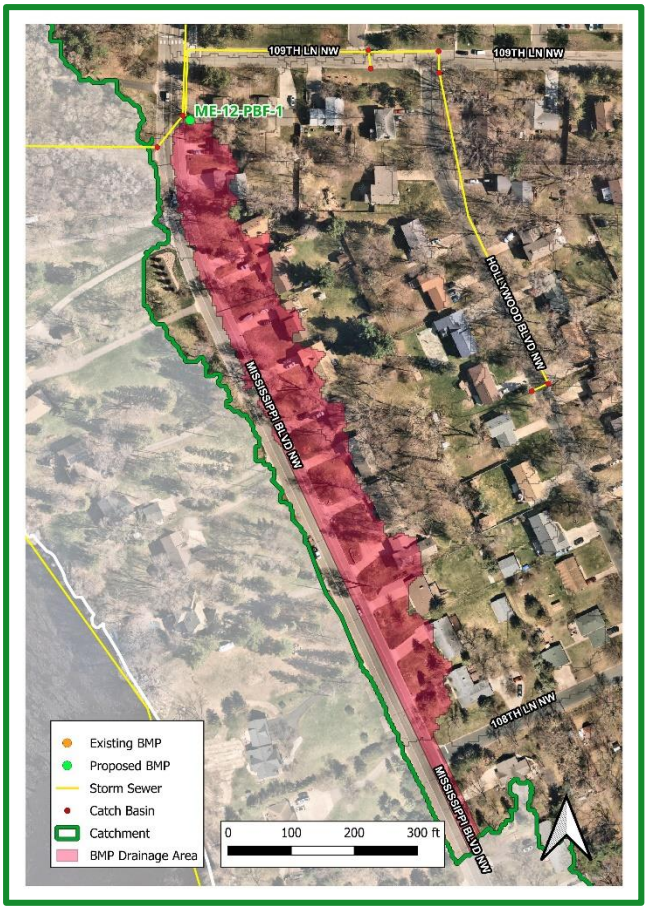
EXISTING STORMWATER TREATMENT AND RETROFIT OPPORTUNITIES



ROAD TREE CANOPY COVER

Project ID: ME-12-PBF-1

Mississippi Blvd. NW
Biofiltration Basin



Drainage Area – 2.41 acres

Location – 10925 Mississippi Blvd. NW

Property Ownership – Private

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is near the catch basin of a private residential house on Mississippi Blvd. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Mississippi Blvd. to the south. Soils in this area are classified as Hydrologic Soil Group C, which have moderately high runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

Curb-Cut Biofiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.33	1.1%
	TSS (lb/yr)	116	1.5%
	Volume (acre-feet/yr)	0.06	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$23,320
	Total Estimated Project Cost (2023)		**$23,984**
	Annual O&M***		$295
Efficiency	30-yr Average Cost/lb-TP	**$3,317**	
	30-yr Average Cost/1,000lb-TSS	**$9,435**	
	30-yr Average Cost/ac-ft Vol.	**$17,349**	

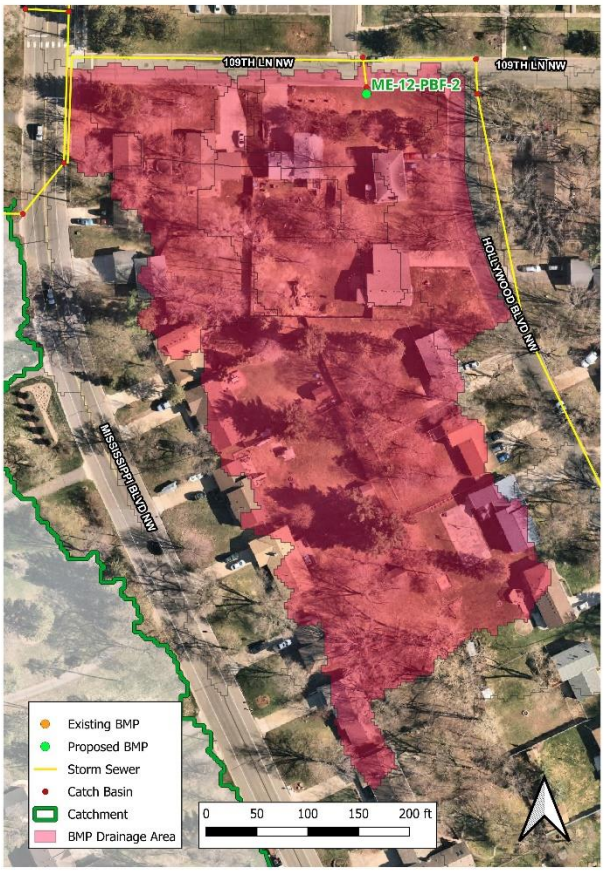
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-12-PBF-2

109th Ln. NW
Biofiltration Basin



Drainage Area – 4.11 acres

Location – 10880 Hollywood Blvd. NW

Property Ownership – Private

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is near the catch basin of a private residential house on 109th Ln. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 109th Ln. to the west and Hollywood Blvd. to the south. Soils in this area are classified as Hydrologic Soil Group C, which have moderately high runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

	Curb-Cut Biofiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	500 sq-ft	
	TP (lb/yr)	0.64	2.1%
	TSS (lb/yr)	224	2.8%
	Volume (acre-feet/yr)	0.12	0.6%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$43,320
	Total Estimated Project Cost (2023)		**$43,984**
	Annual O&M***		$295
Efficiency	**30-yr Average Cost/lb-TP**	**$2,752**	
	30-yr Average Cost/1,000lb-TSS	**$7,862**	
	30-yr Average Cost/ac-ft Vol.	**$14,568**	

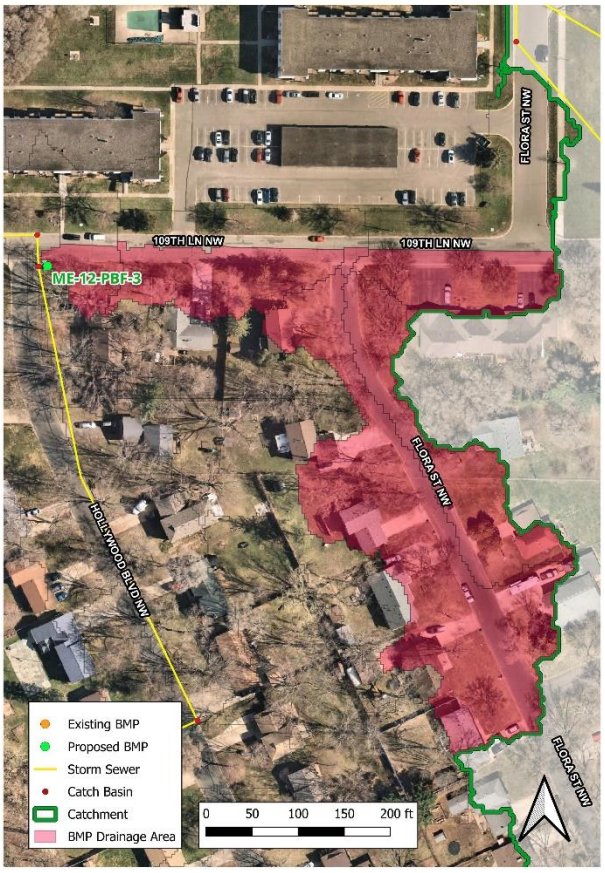
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-12-PBF-3

109th Ln. NW
Biofiltration Basin



Drainage Area – 2.48 acres

Location – 10911 Hollywood Blvd NW

Property Ownership – Private

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is near the catch basin of a private residential house on 109th Ln. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along 109th Ln. and Flora St. Soils in this area are classified as Hydrologic Soil Group C, which have moderately high runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

Curb-Cut Biofiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250	sq-ft
	TP (lb/yr)	0.31	1.0%
	TSS (lb/yr)	113	1.4%
	Volume (acre-feet/yr)	0.06	0.3%
Cost	Administration & Promotion Costs*		$664
	Design & Construction Costs**		$23,320
	Total Estimated Project Cost (2023)		**$23,984**
	Annual O&M***		$295
Efficiency	30-yr Average Cost/lb-TP	**$3,531**	
	30-yr Average Cost/1,000lb-TSS	**$9,686**	
	30-yr Average Cost/ac-ft Vol.	**$16,888**	

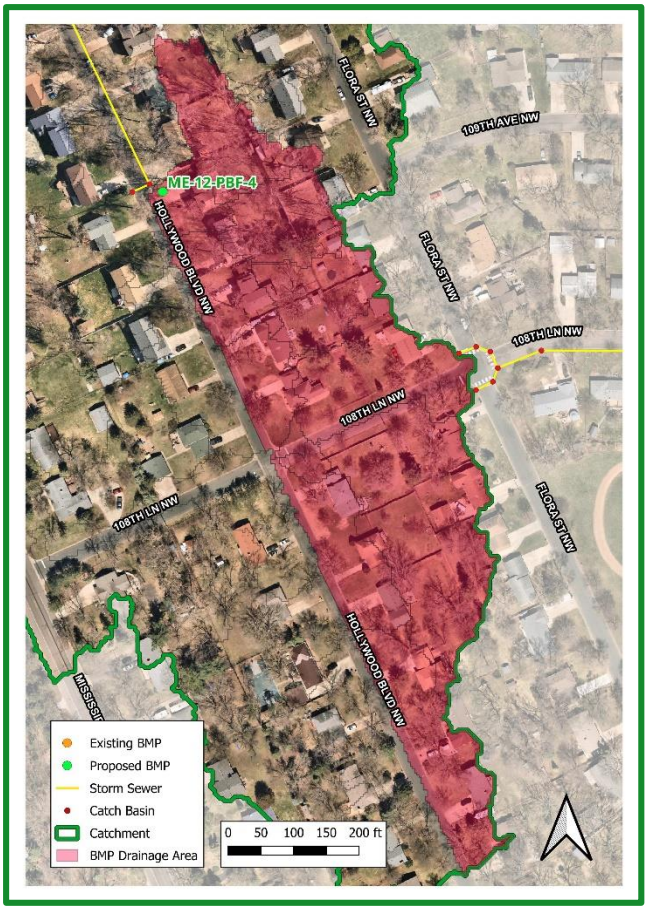
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-12-PBF-4

Hollywood Blvd. NW
Biofiltration Basin



Drainage Area – 6.14 acres

Location – 10833 Hollywood Blvd NW

Property Ownership – Private

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is near the catch basin of a private residential house on Hollywood Blvd. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Hollywood Blvd. to the south, including a section of 108th Ln. Soils in this area are classified as Hydrologic Soil Group C, which have moderately high runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

Curb-Cut Biofiltration

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Total Size of BMP (sq-ft)	250 sq-ft	
	TP (lb/yr)	0.37	1.2%
	TSS (lb/yr)	133	1.7%
	Volume (acre-feet/yr)	0.07	0.3%
Cost	Administration & Promotion Costs*	$664	
	Design & Construction Costs**	$23,320	
	Total Estimated Project Cost (2023)	**$23,984**	
	Annual O&M***	$295	
Efficiency	30-yr Average Cost/lb-TP	**$2,958**	
	30-yr Average Cost/1,000lb-TSS	**$8,229**	
	30-yr Average Cost/ac-ft Vol.	**$15,178**	

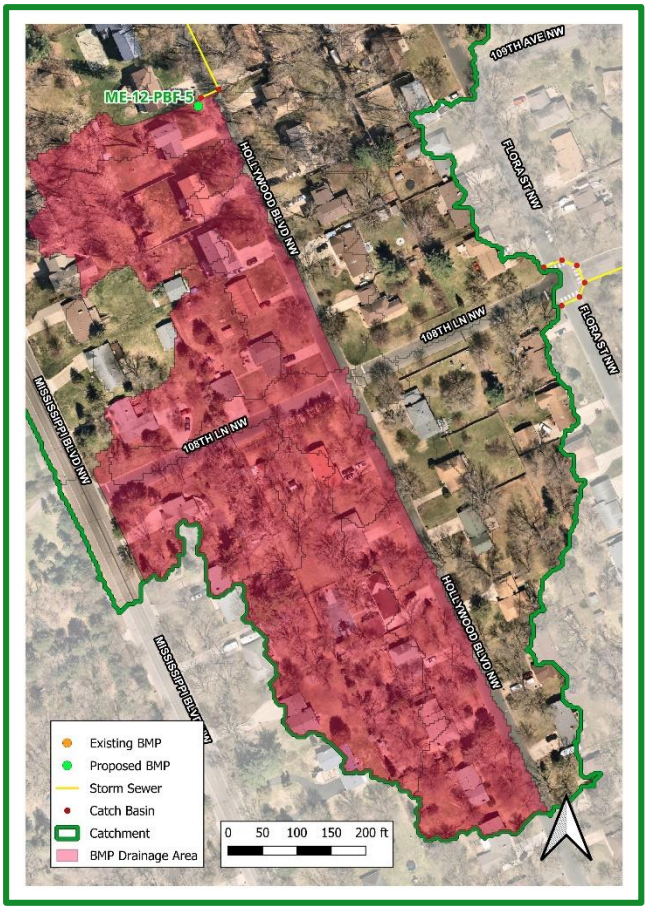
*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-12-PBF-5

Hollywood Blvd. NW
Biofiltration Basin



Drainage Area – 7.34 acres

Location – 10832 Hollywood Blvd. NW

Property Ownership – Private

Site Specific Information – An opportunity for a biofiltration basin exists at this location. The proposed location is near the catch basin of a private residential house on Hollywood Blvd. The proposed basin is a standard, single inlet rain garden that would treat stormwater collected along Hollywood Blvd. to the south, including a section of 108th Ln. Soils in this area are classified as Hydrologic Soil Group C, which have moderately high runoff potential. The proposed basin is in close proximity to the existing catch basin, which could serve as the connection point for the underdrain outlet. The table below provides pollutant removals and estimated costs.

	Curb-Cut Biofiltration		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP (sq-ft)**	250 sq-ft	
	TP (lb/yr)	0.38	1.2%
	TSS (lb/yr)	134	1.7%
	Volume (acre-feet/yr)	0.07	0.3%
Cost	**Administration & Promotion Costs***		$664
	Design & Construction Costs**		$23,320
	Total Estimated Project Cost (2023)		**$23,984**
	Annual O&M***		$295
Efficiency	**30-yr Average Cost/lb-TP**	**$2,880**	
	30-yr Average Cost/1,000lb-TSS	**$8,168**	
	30-yr Average Cost/ac-ft Vol.	**$15,121**	

*Indirect Cost: (8 hours at $83/hour base cost)

**Direct Cost: ($80/sq-ft for materials and labor) + (40 hours at $83/hour for design)

***Per BMP: ($220/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Project ID: ME-12-PHD-1

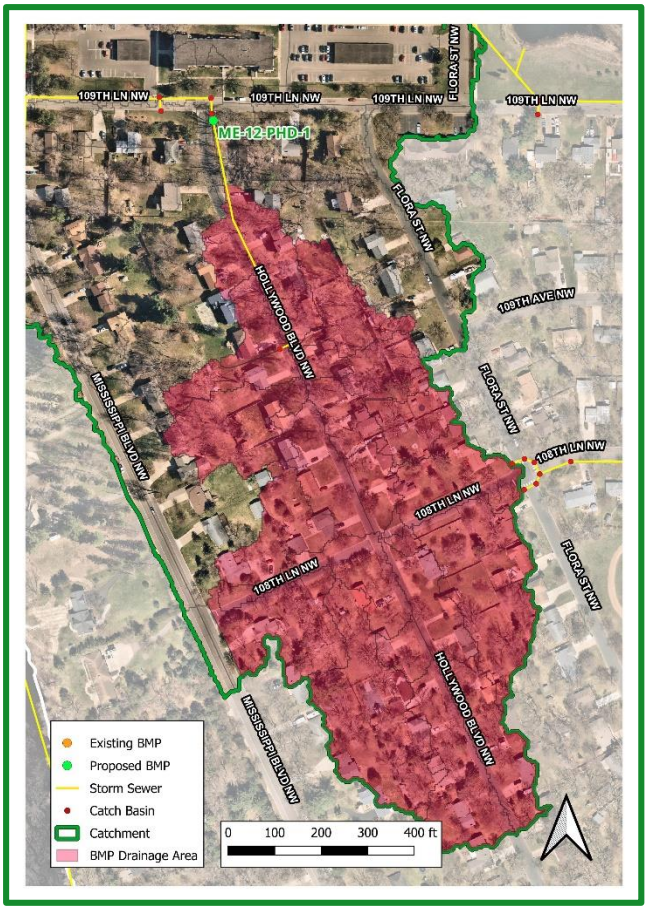
Hollywood Blvd.
Hydrodynamic Device

Drainage Area – 14.78 acres

Location – Intersection of 109th Ln. and Hollywood Blvd.

Property Ownership – City of Coon Rapids

Site Specific Information – A hydrodynamic device is proposed in line with the storm sewer line on Hollywood Blvd. A device at this location would provide treatment to stormwater runoff from both sides of Hollywood Blvd. to the south. table below provides pollutant removals and estimated costs.



	Hydrodynamic Device		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Total Size of BMP**	10	ft diameter
	TP (lb/yr)	1.12	3.6%
	TSS (lb/yr)	386	4.8%
	Volume (acre-feet/yr)	N/A	N/A
Cost	**Administration & Promotion Costs***		$3,750
	Design & Construction Costs**		$150,000
	Total Estimated Project Cost (2023)		**$153,750**
	Annual O&M***		$210
Efficiency	**30-yr Average Cost/lb-TP**	**$4,763**	
	30-yr Average Cost/1,000lb-TSS	**$13,821**	
	30-yr Average Cost/ac-ft Vol.	**N/A**	

*Indirect Cost: (25 hours at $150/hour)

**Direct Cost: ($100,000 for materials) + ($50,000 for labor and installation costs)

***Per BMP: (1 cleaning/year)*(3 hours/cleaning)*($70/hour)

References

Janke, Benjamin D., Jacques C. Finlay, and Sarah E. Hobbie. 2017. Trees and Streets as Drivers of Urban Stormwater Nutrient Pollution. Sci. Technol. DOI: 10.1021/acs.est.7b02225 Environ.

Kalinosky, P.M. 2015. Quantifying Solids and Nutrient Recovered Through Street Sweeping in a Suburban Watershed. A Thesis Submitted to the Faculty of University of Minnesota. Minneapolis, MN.

Lower St. Croix Watershed Partnership (LSCWP) and Emmons and Oliver Resources Inc. (EOR). Tree Canopy Assessment Protocol for Enhanced Street Sweeping Prioritization. 2022.

Schueler, T. and A. Kitchell. 2005. *Methods to Develop Restoration Plans for Small Urban Watersheds. Manual 2, Urban Subwatershed Restoration Manual Series*. Center for Watershed Protection. Ellicott City, MD.

Schueler, T., D. Hirschman, M. Novotney, and J. Zielinski. 2007. *Urban Stormwater Retrofit Practices. Manual 3, Urban Subwatershed Restoration Manual Series. Center for Watershed Protection*. Ellicott City, MD.

Technical documents. (2024). *Minnesota Stormwater Manual*.

Appendix A – Modeling Methods

The following sections include WinSLAMM model details for each type of best management practice modeled for this analysis.

WinSLAMM

Pollutant and volume reductions were estimated using the stormwater model Source Load and Management Model for Windows (WinSLAMM). WinSLAMM uses an abundance of stormwater data from the Upper-Midwest and elsewhere to quantify runoff volumes and pollutant loads from urban areas. It has detailed accounting of pollutant loading from various land uses, and allows the user to build a model "landscape". WinSLAMM uses rainfall and temperature data from a typical year (1959 data from Minneapolis for this analysis), routing stormwater through the user's model for each storm. WinSLAMM version 10.5.0 was used for this analysis to estimate volume and pollutant loading and reductions. Additional inputs for WinSLAMM are provided in Table 10.

Table 10: General WinSLAMM Model Inputs (i.e. Current File Data)

Parameter	File/Method
Land use acreage	ArcMap; Metropolitan Council 2020 Land Use, corrected using 2023 aerial photography
Precipitation/Temperature Data	Minneapolis 1959 – best approximation of a typical year
Winter season	Included in model. Winter dates are 11-4 to 3-13.
Pollutant probability distribution	WI_GEO01.ppd
Runoff coefficient file	WI_SL06 Dec06.rsv
Particulate solids concentration file	WI_AVG01.psc
Particle residue delivery file	WI_DLV01.prr
Street delivery files	WI files for each land use

Existing Conditions

Existing stormwater BMPs were included in the WinSLAMM model for which information was available. The practices listed below were included in the existing conditions models.

Bioinfiltration Basins

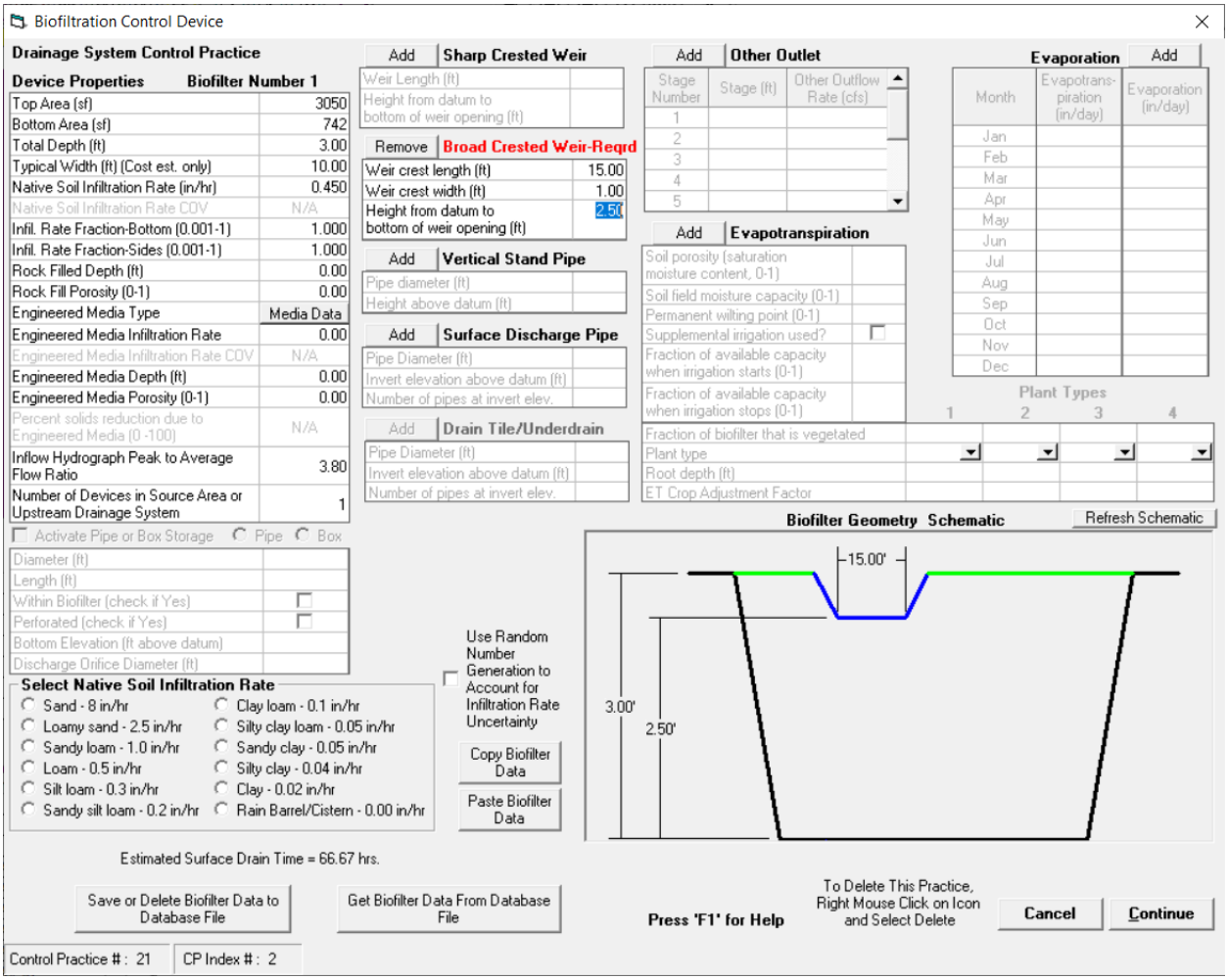


Figure 11: MW-3-EBI-1

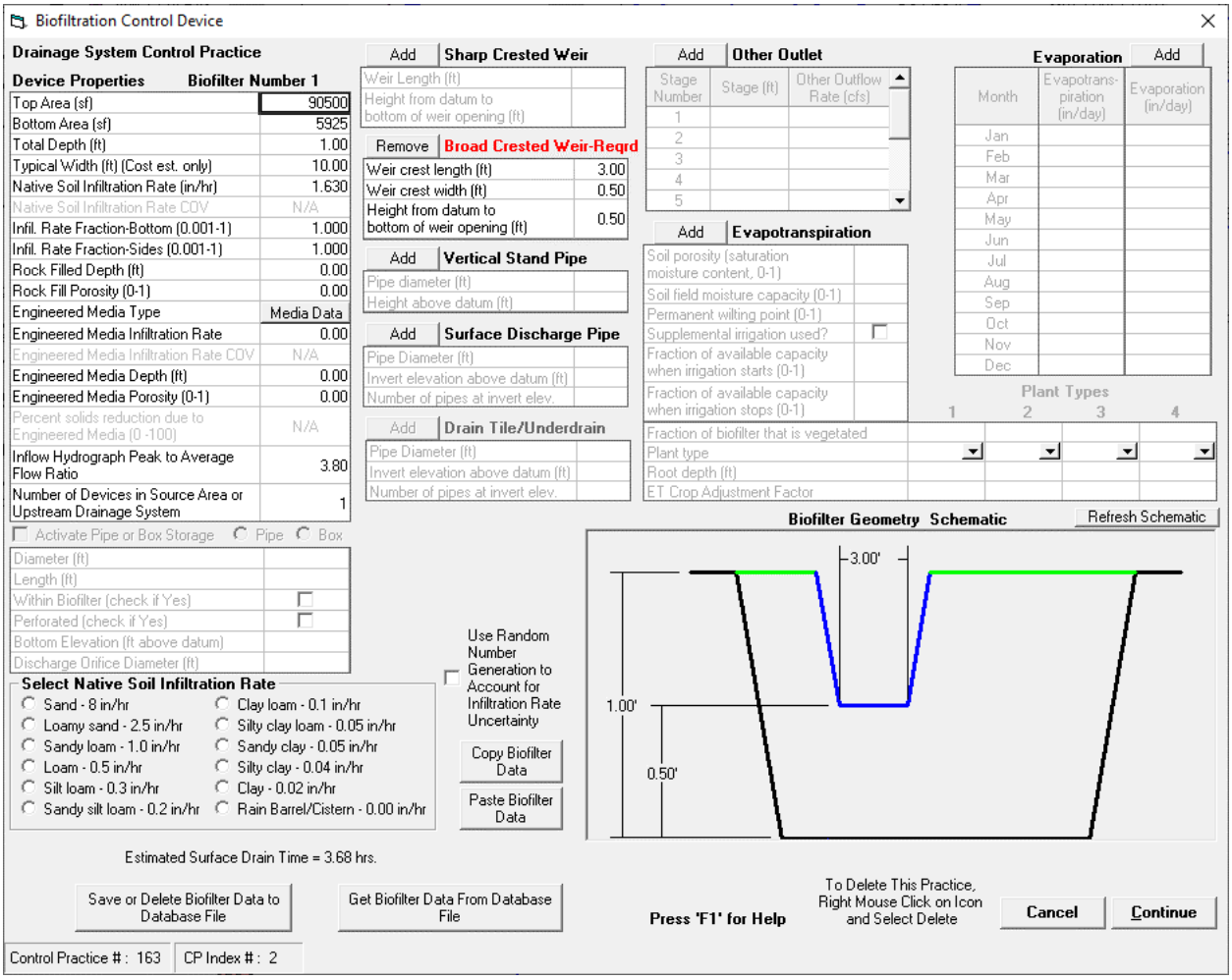


Figure 12: MW-7-EBI-1

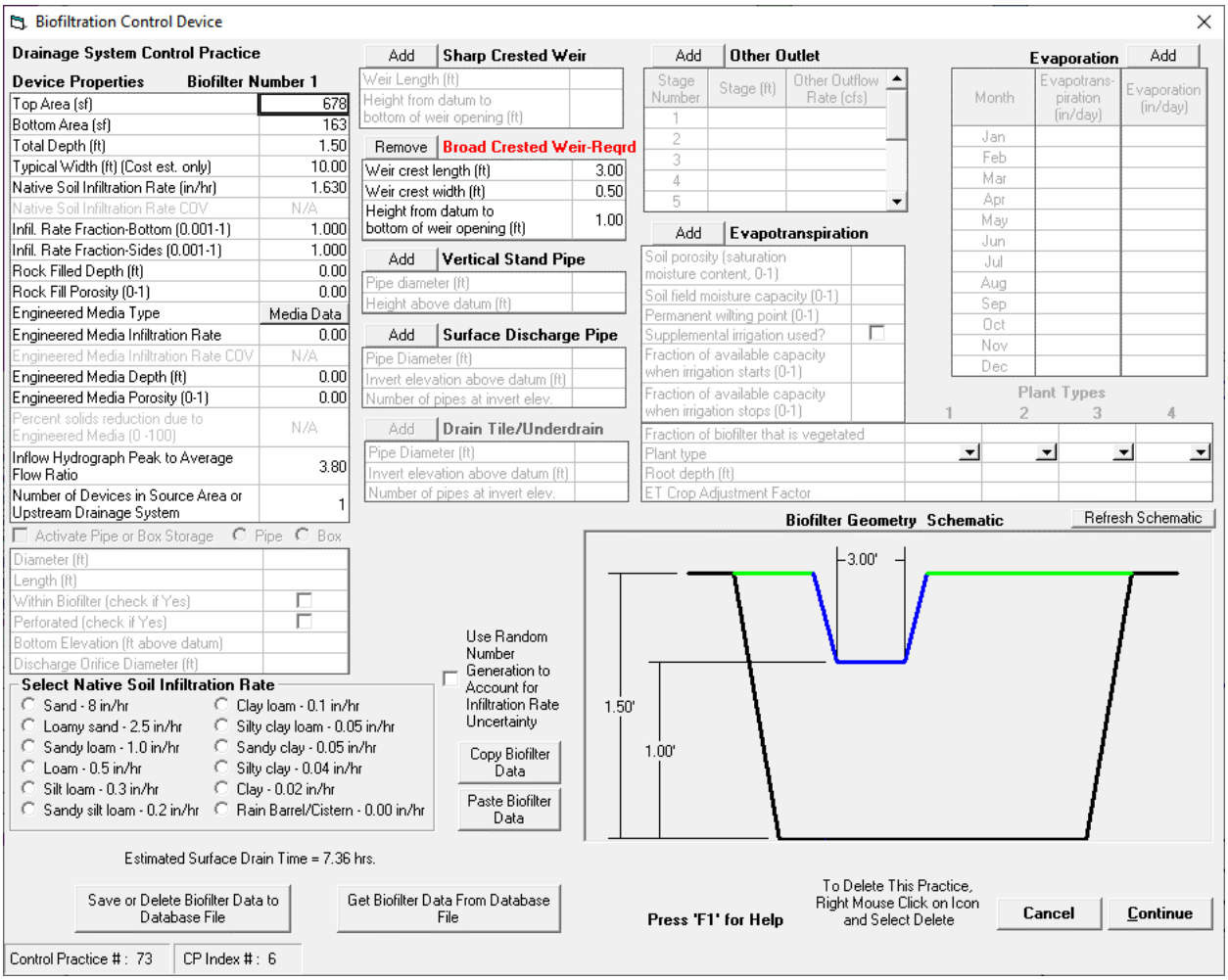


Figure 13: ME-2-EBI-1

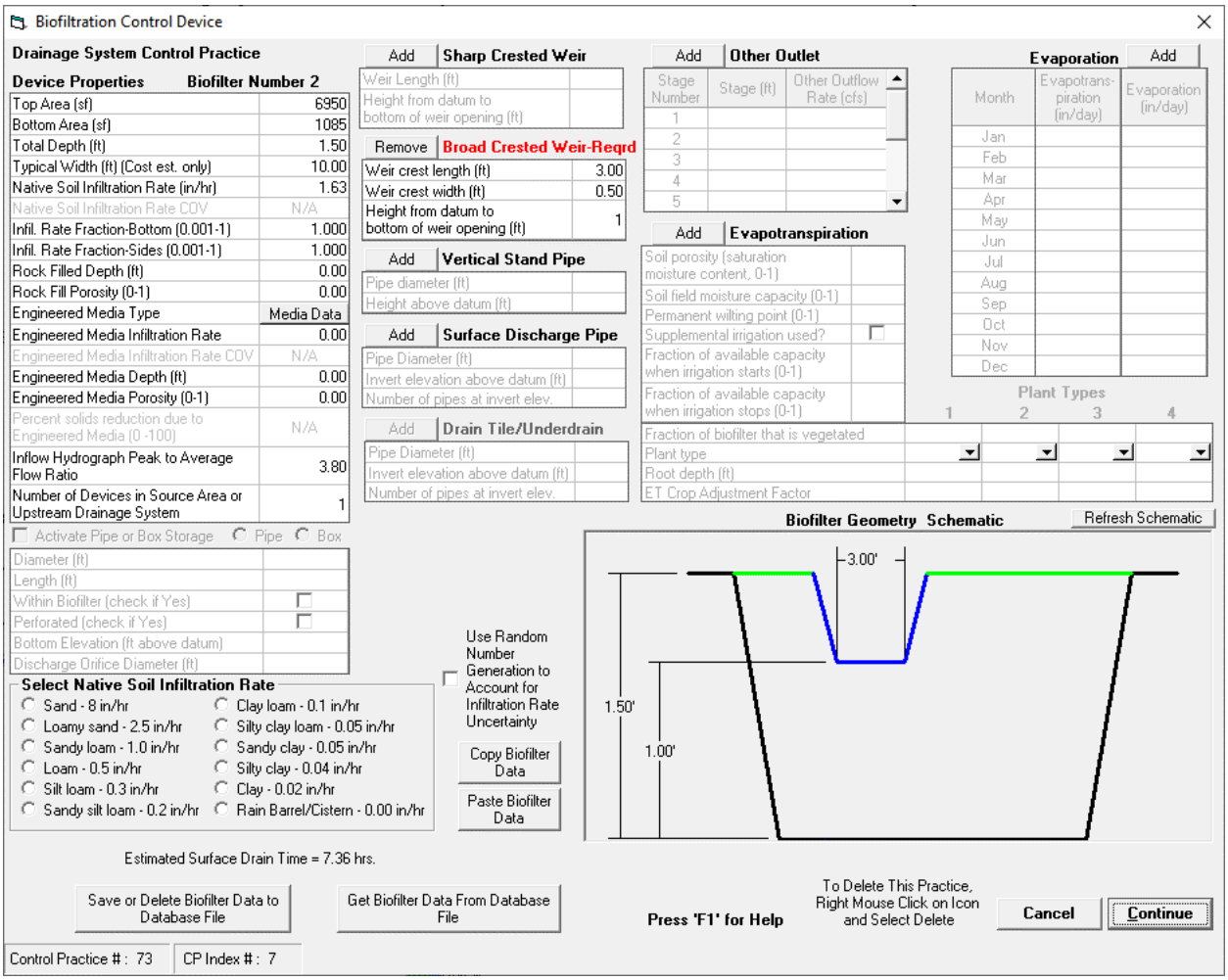


Figure 14: ME-2-EBI-2

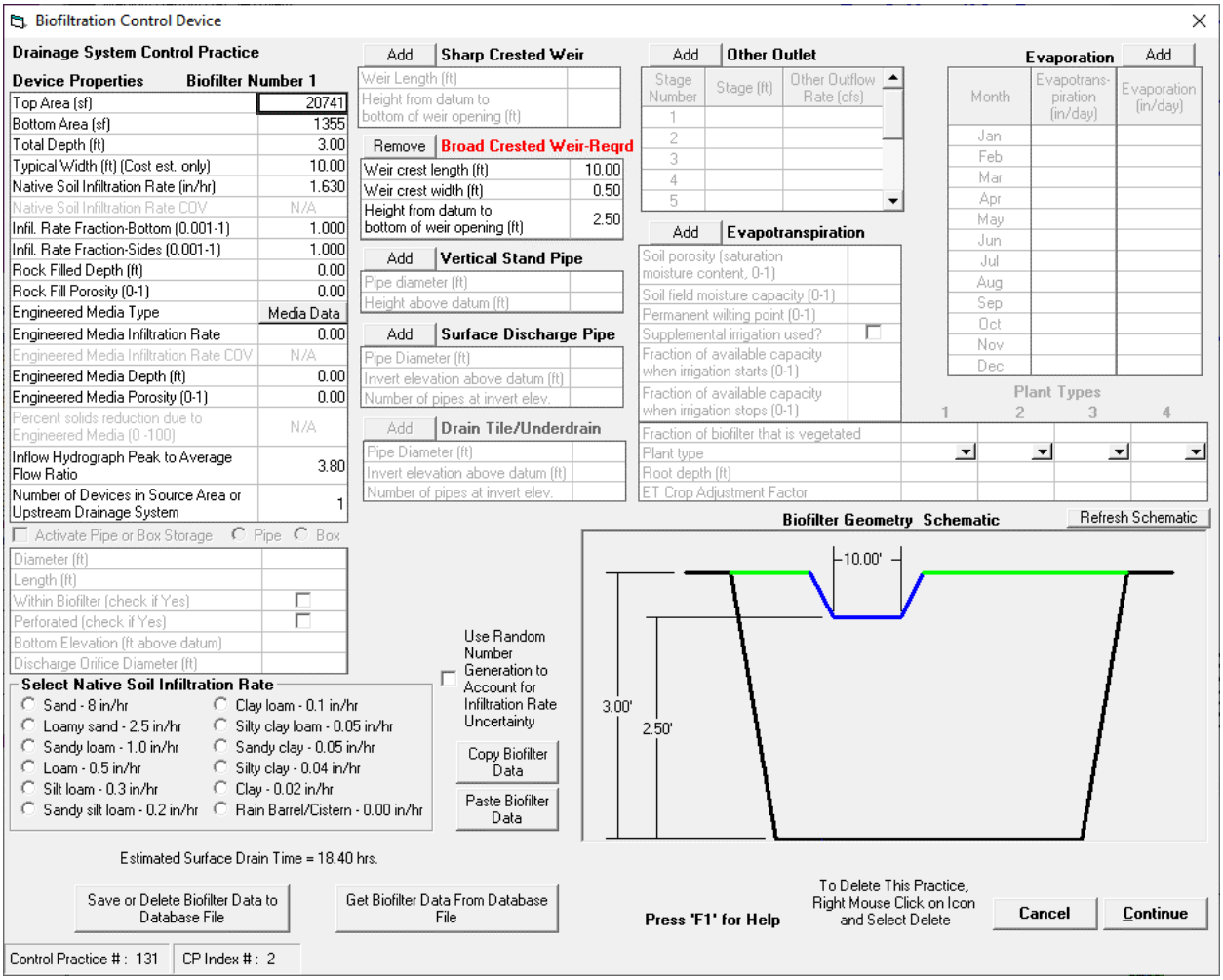


Figure 15: ME-3-EBI-1

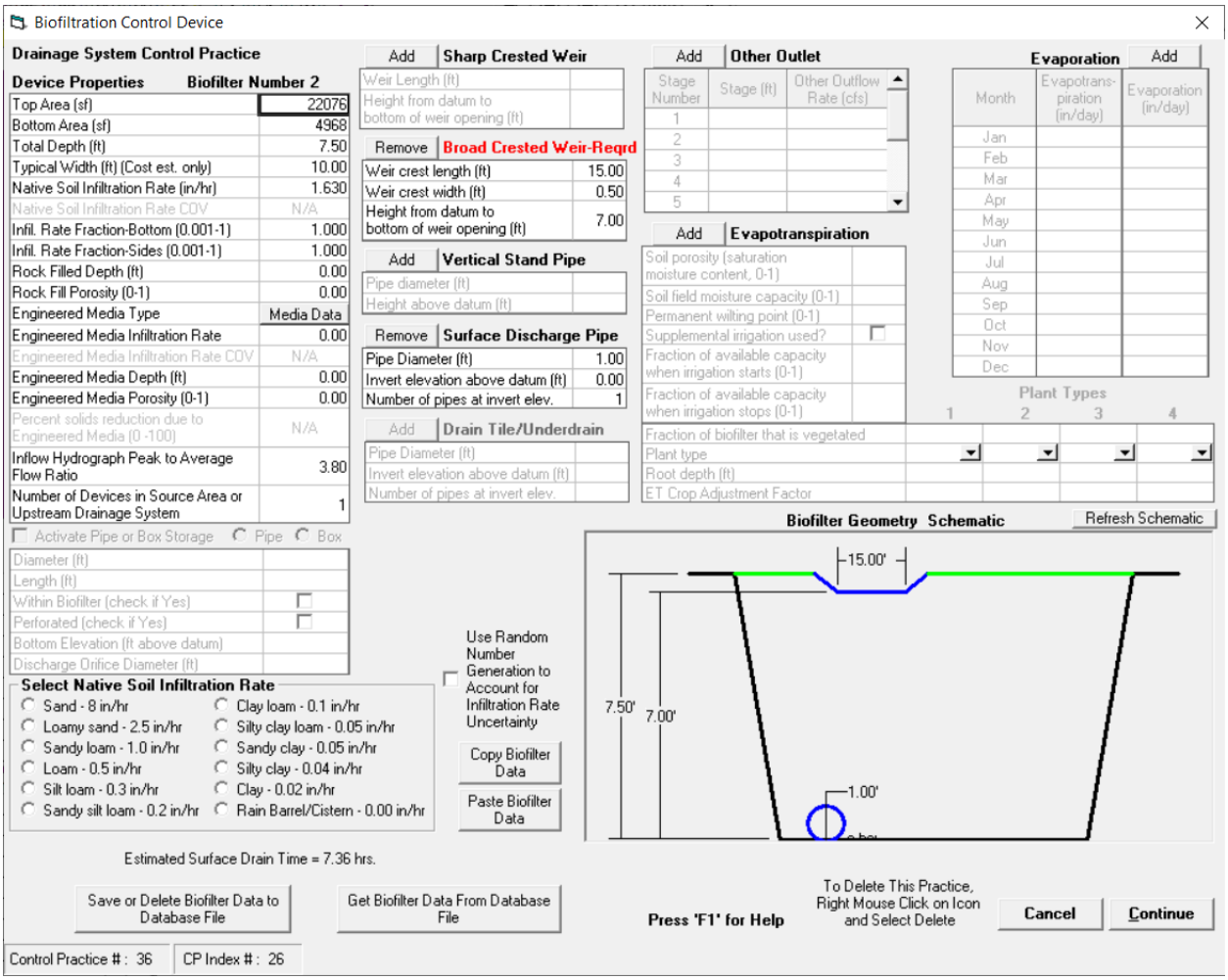


Figure 16: ME-6-EBI-1

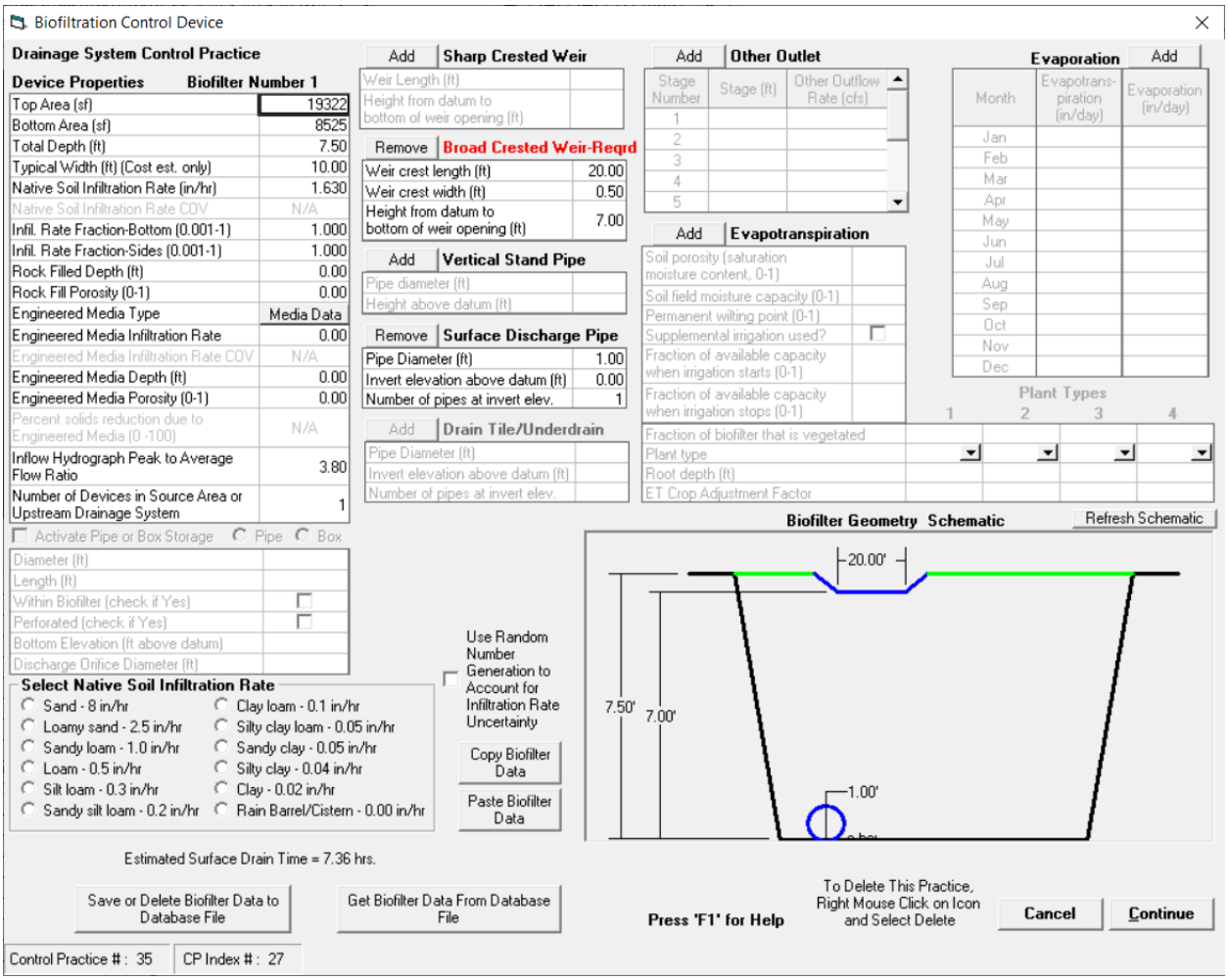


Figure 17: ME-6-EBI-2

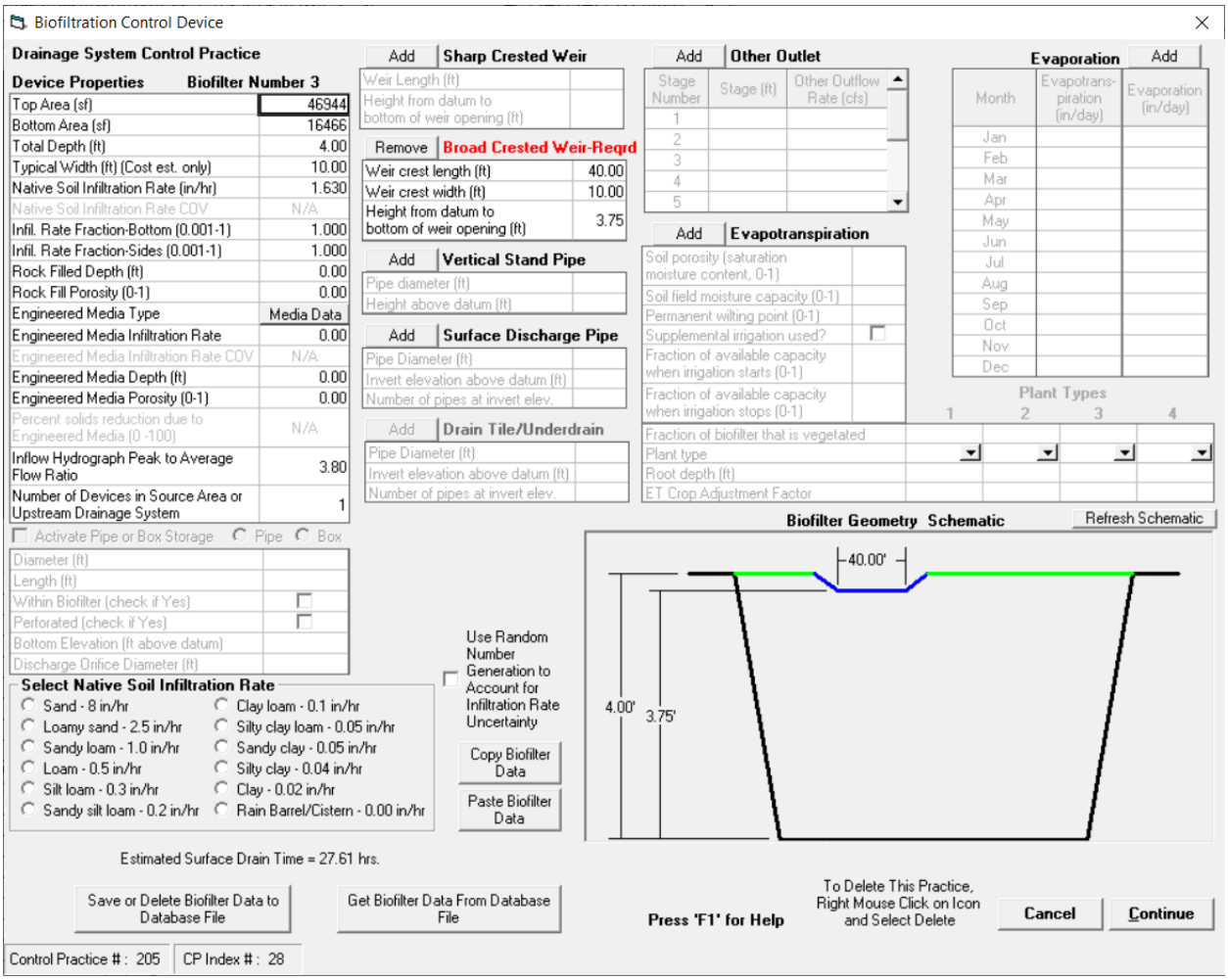


Figure 18: ME-6-EBI-3

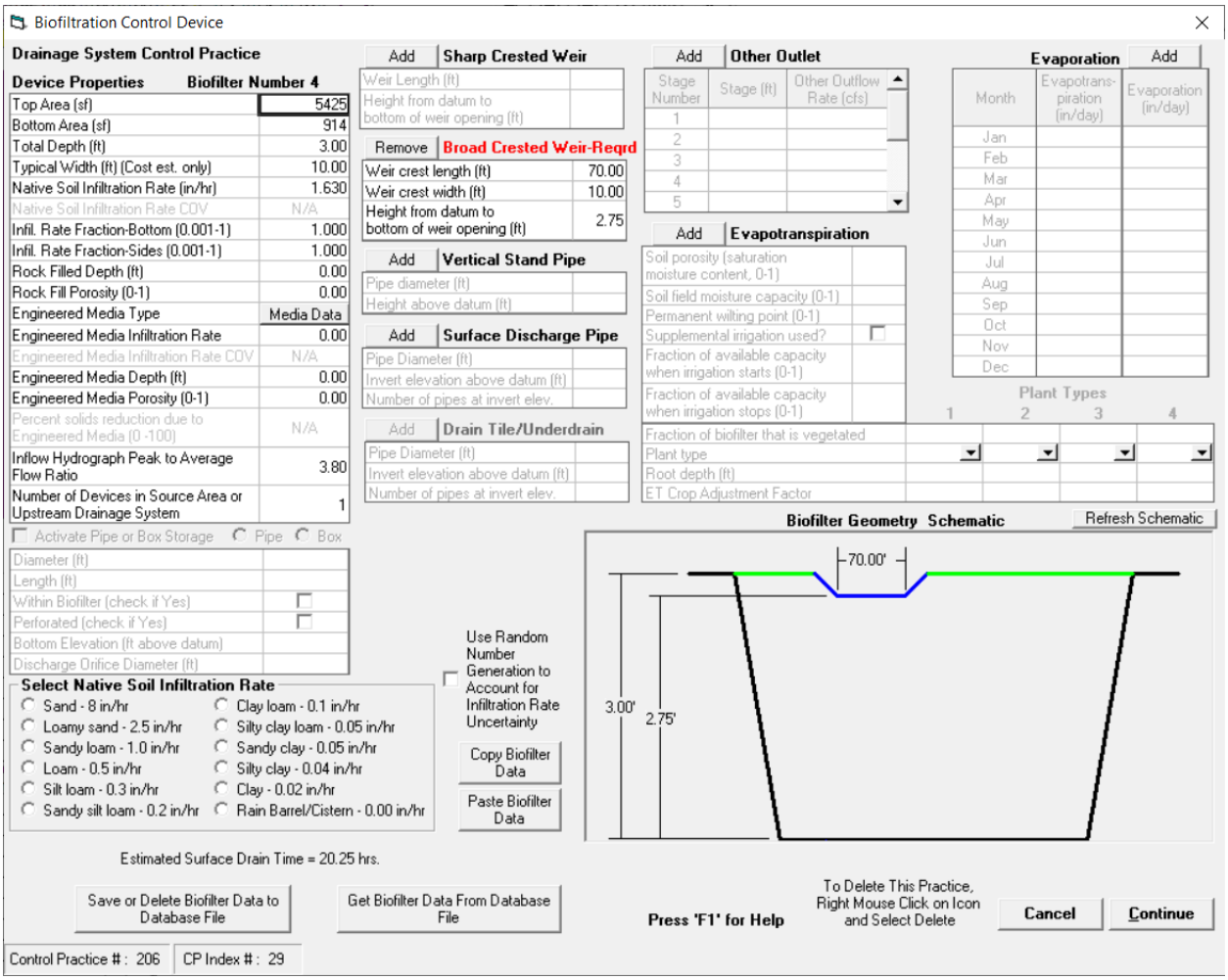


Figure 19: ME-6-EBI-4

Hydrodynamic Devices

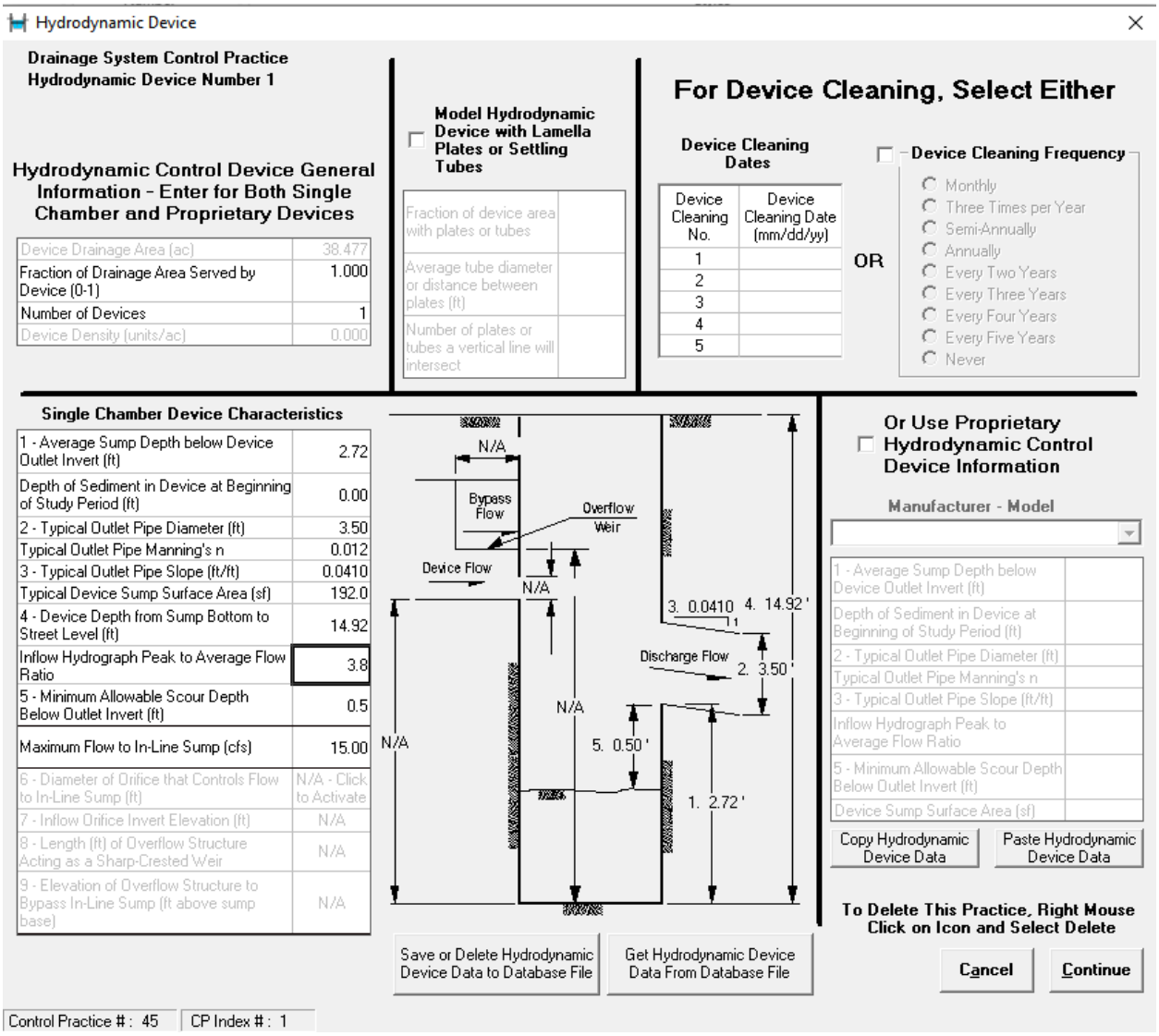


Figure 20: MW-6-EHD-1

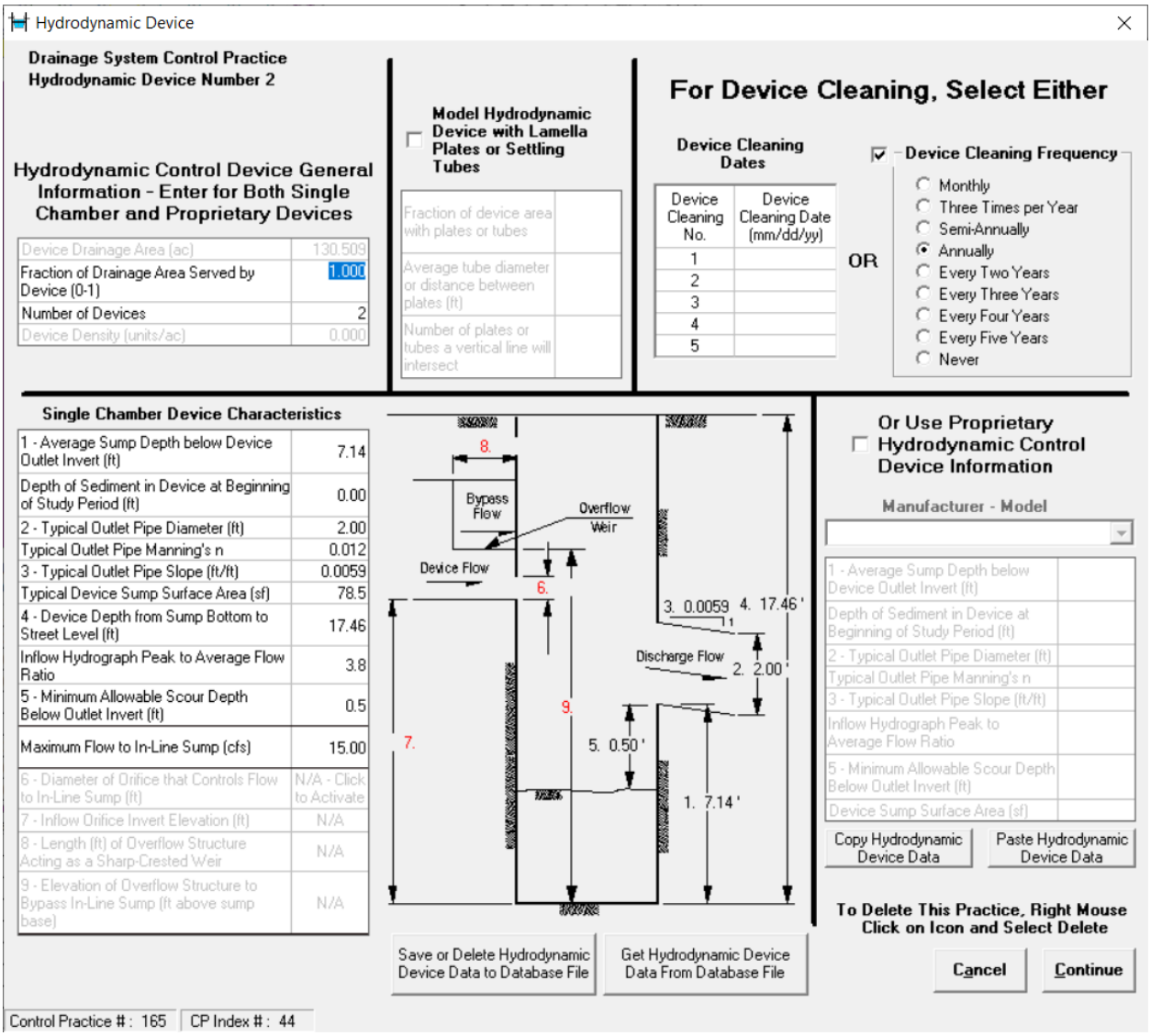


Figure 21: MW-7-EHD-1 (Primary MH 44-5)

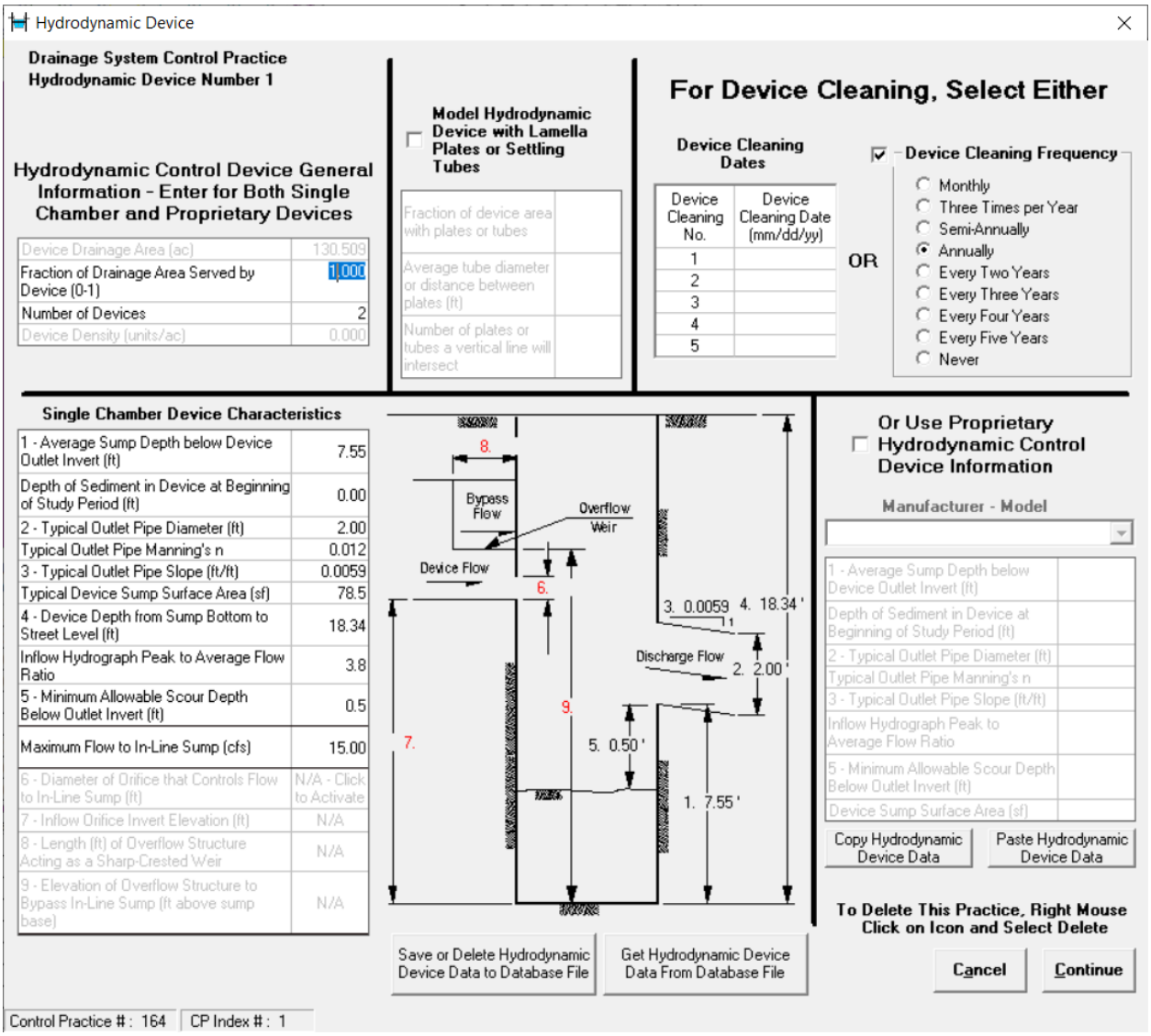


Figure 22: MW-7-EHD-1 (Primary MH 44-3)

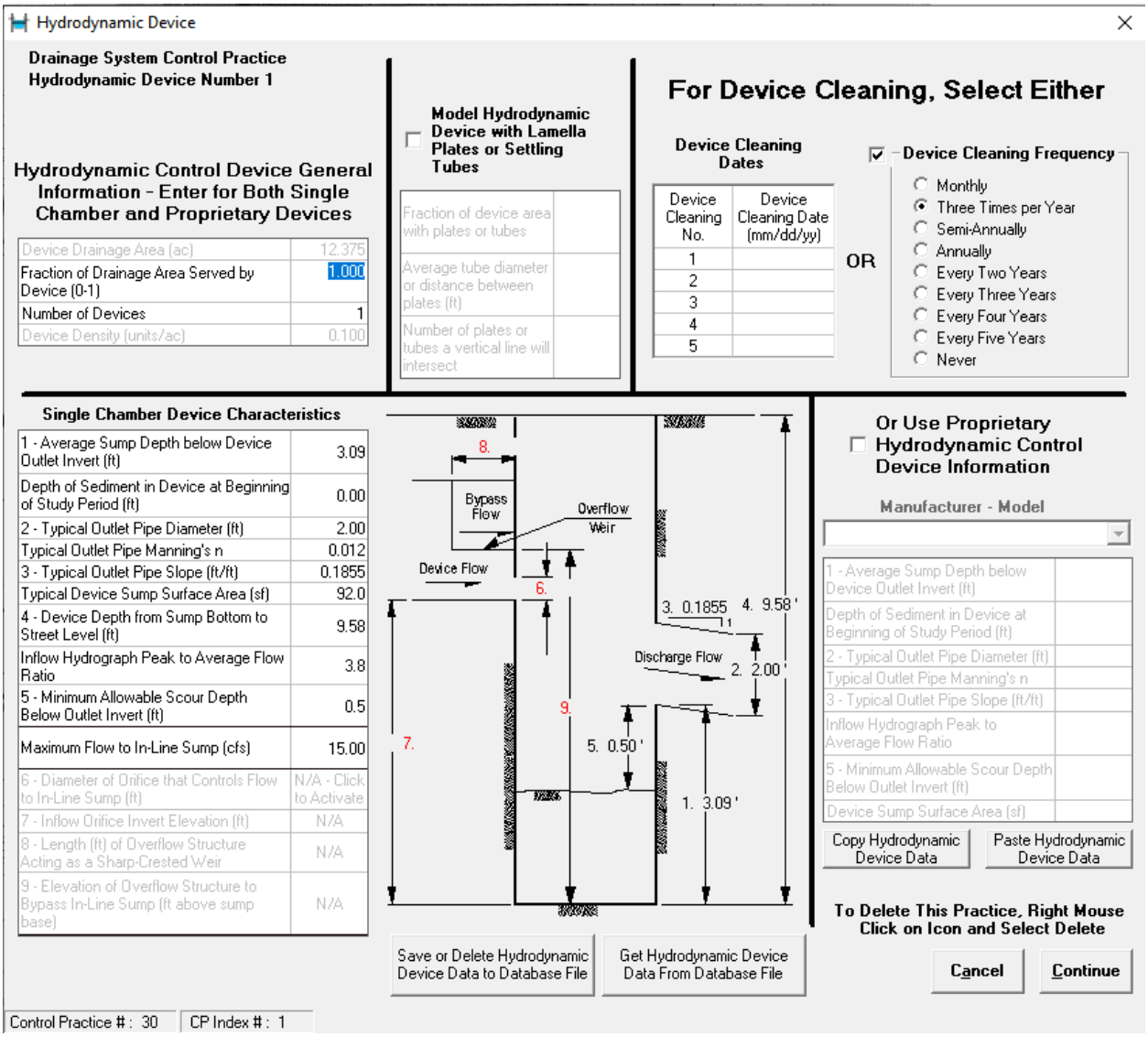


Figure 23: ME-1-EHD-1

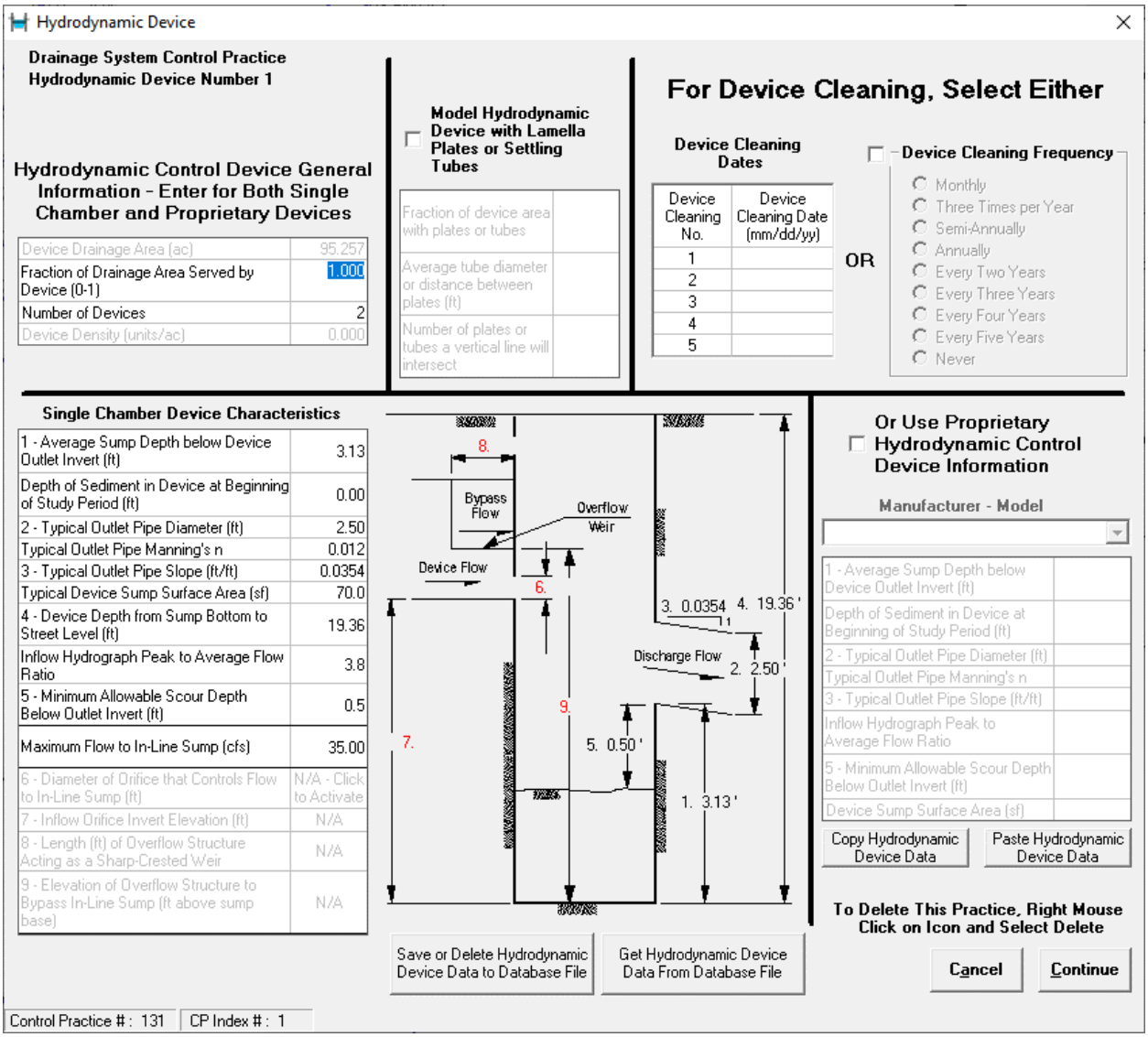


Figure 24: ME-3-EHD-1

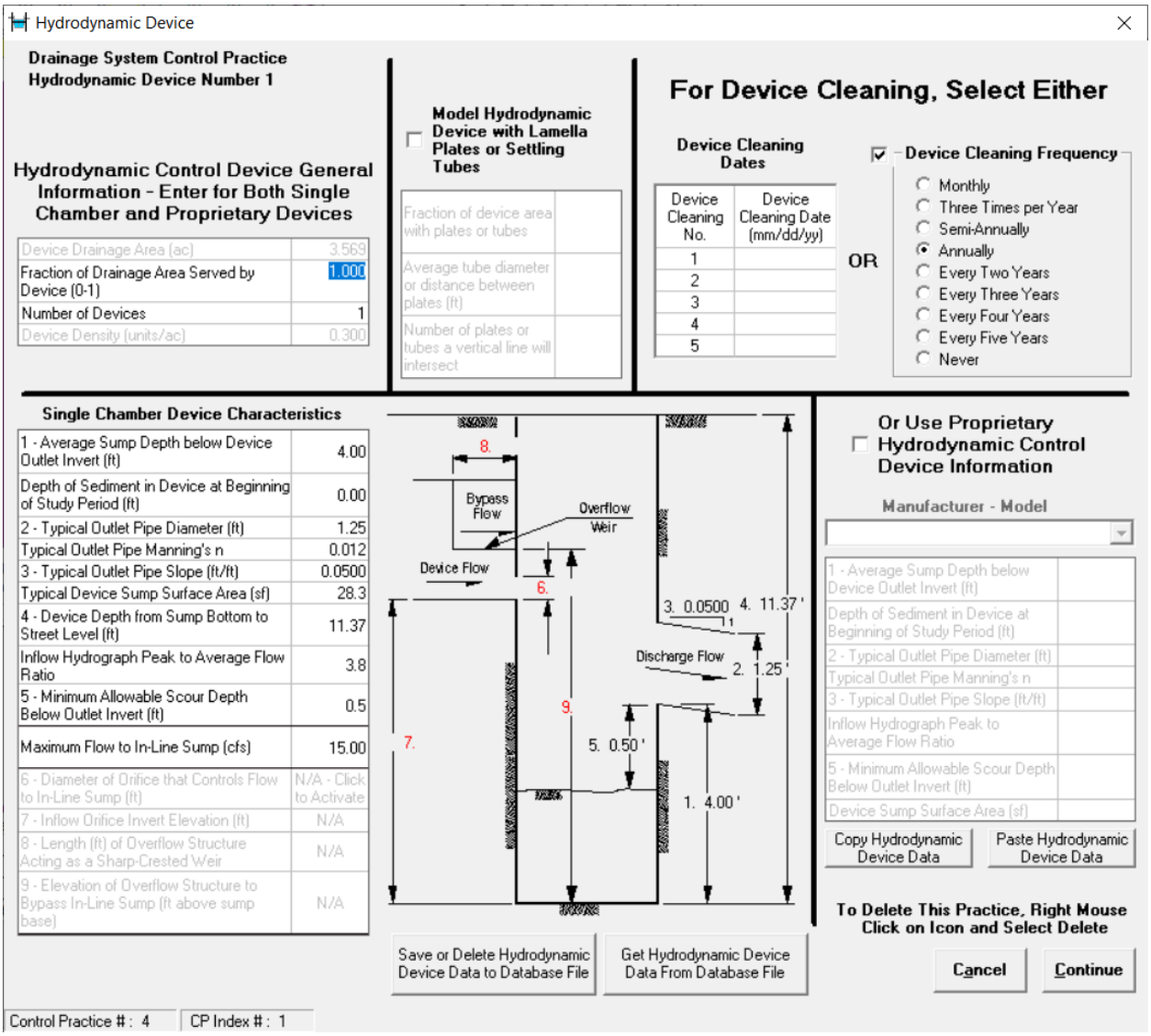


Figure 25: ME-4-EHD-1

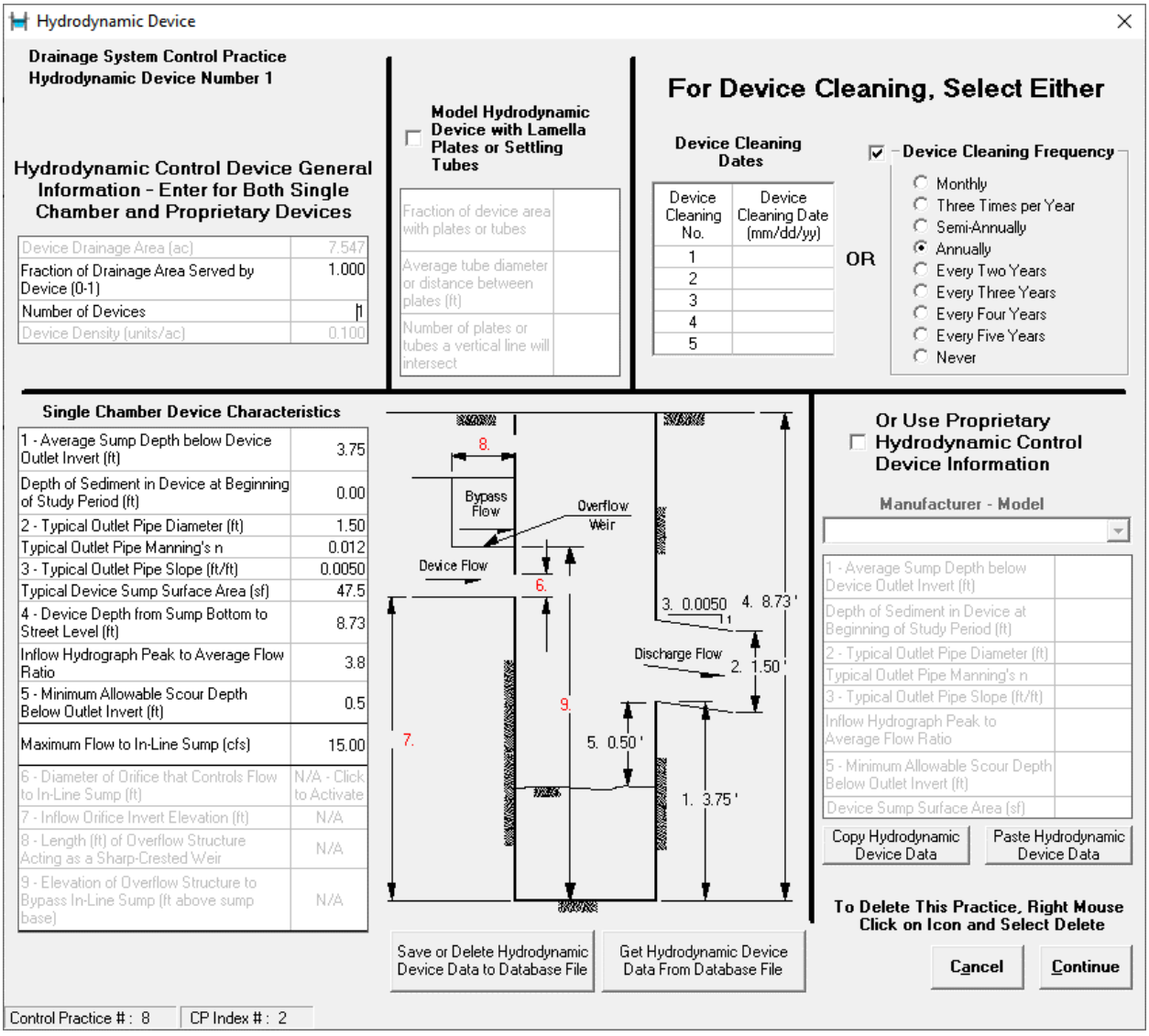


Figure 26: ME-5-EHD-1

Grass Swales

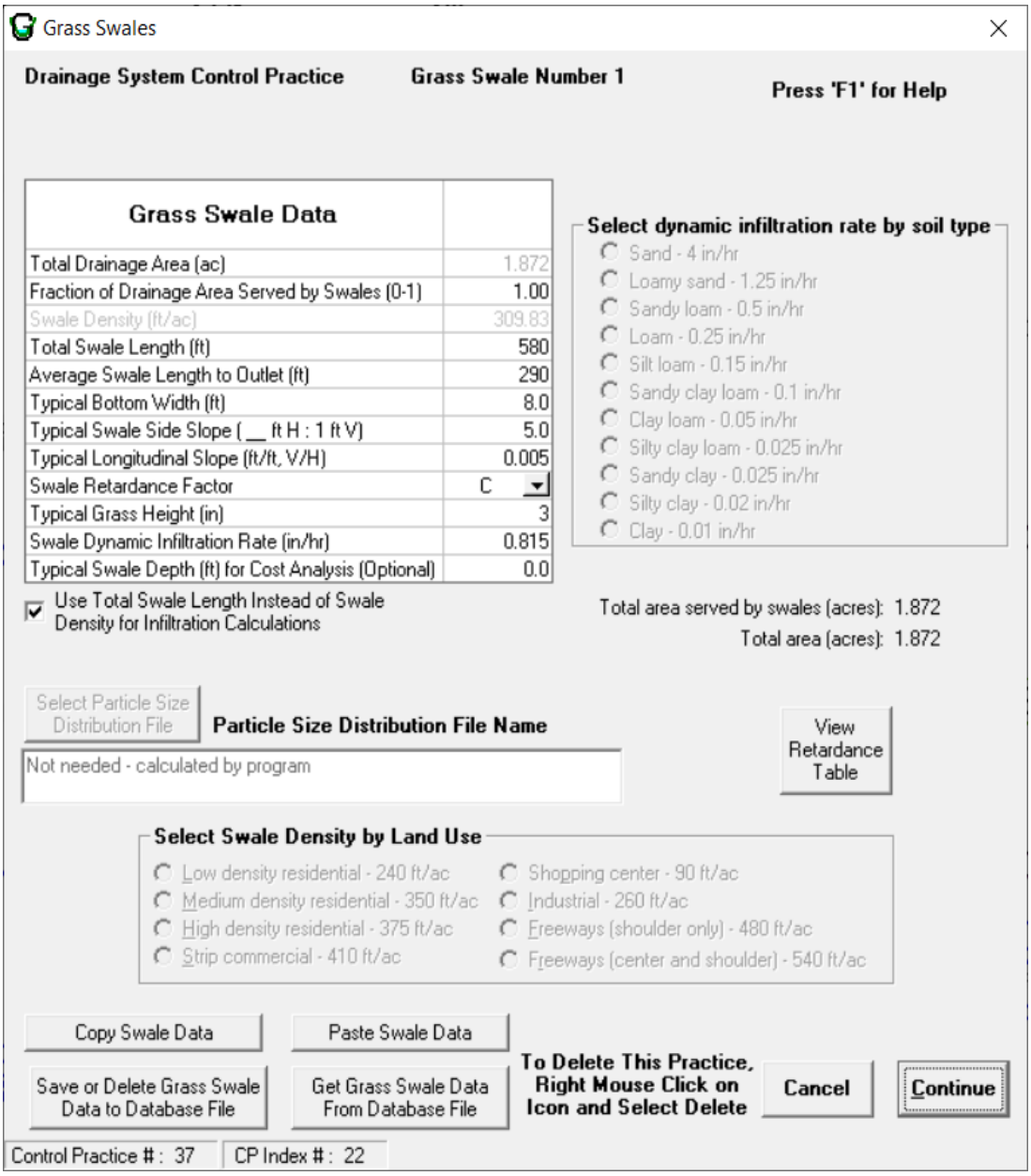


Figure 27: ME-6-GS-1

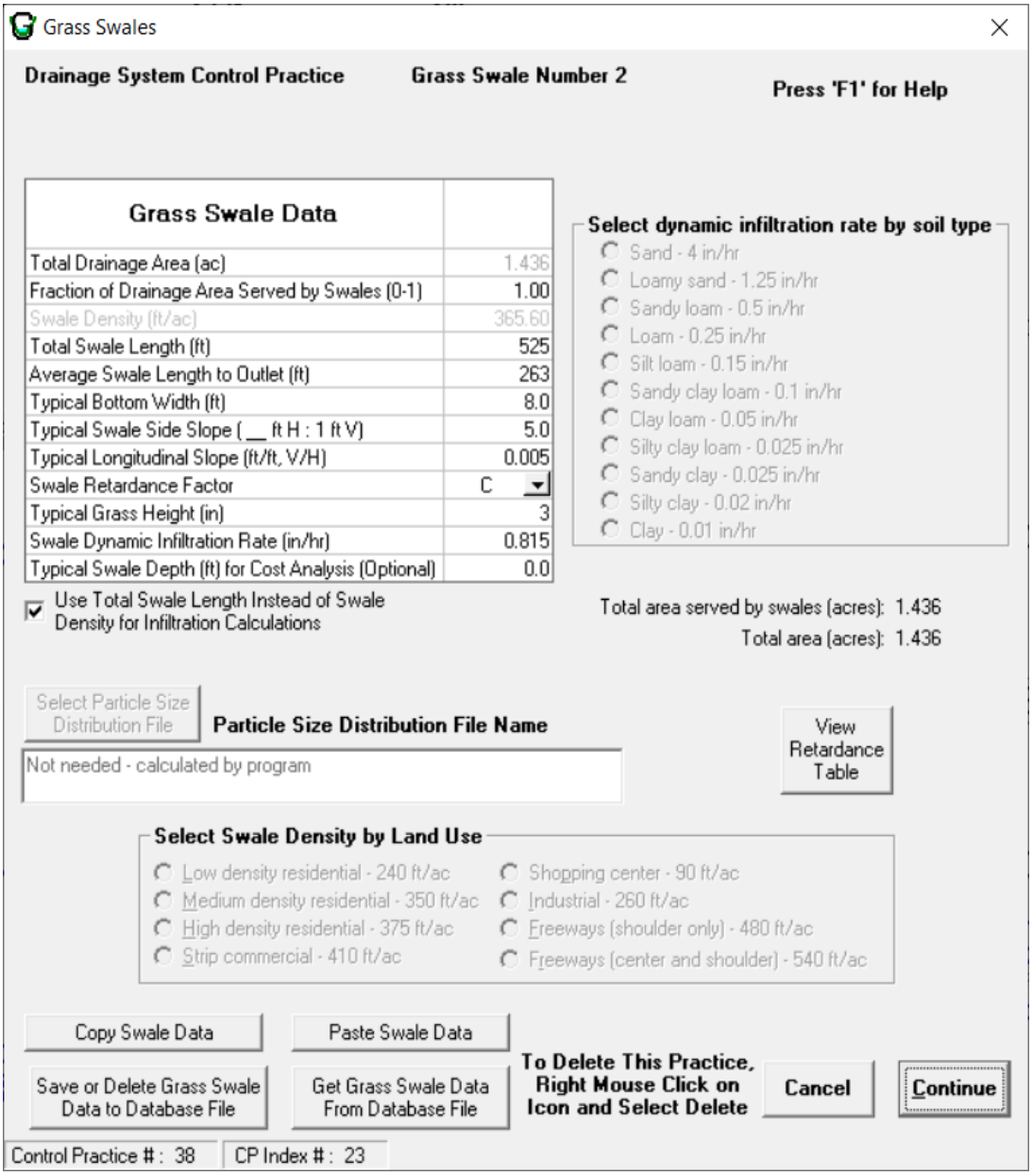


Figure 28: ME-6-GS-2

Street Cleaning

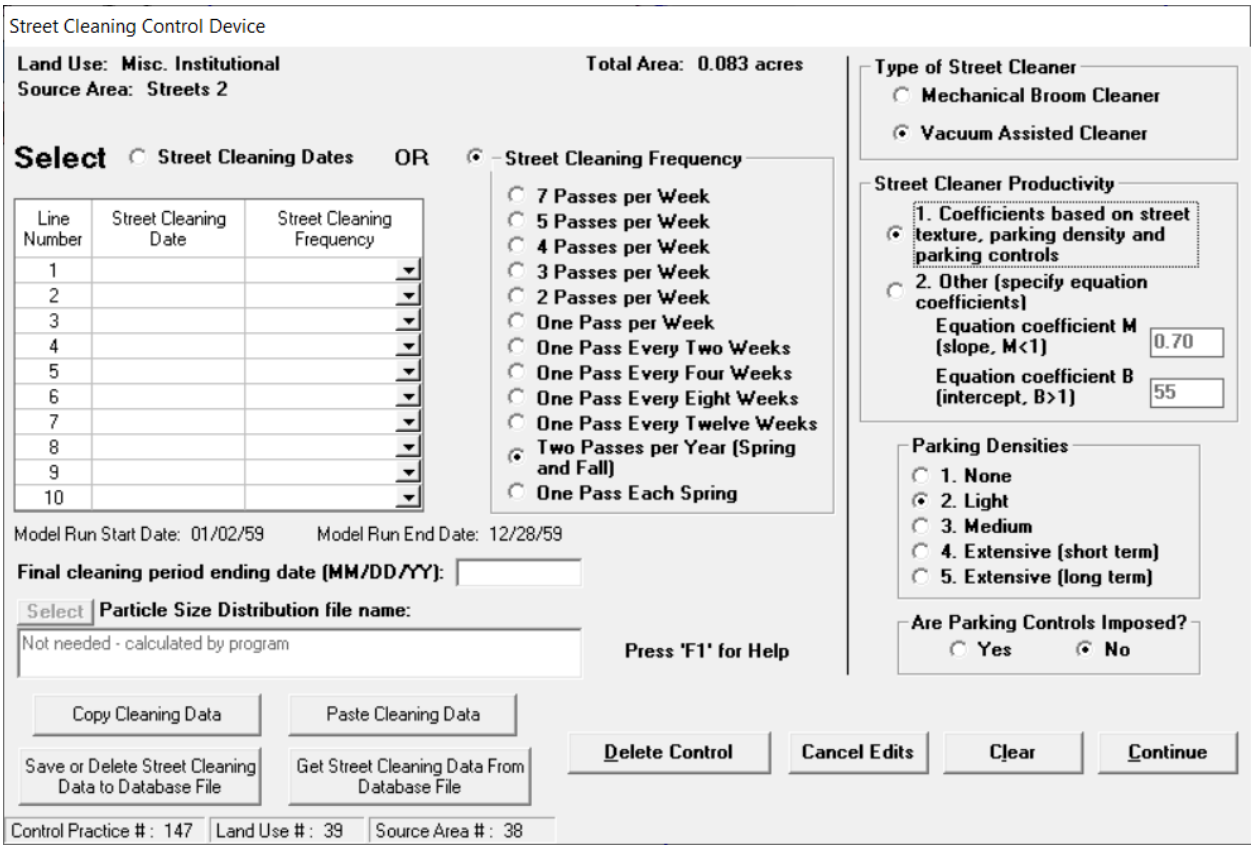


Figure 29: Typical street cleaning parameters for the City of Anoka. Street cleaning occurs twice per year; once in early spring and once in mid-summer. For the City of Anoka, street sweeping in WinSLAMM was modeled as two passes per year in the spring and fall. For the purposes of modeling, there was no distinction between the default street cleaning frequency in the spring/fall and a custom date street cleaning frequency in the spring/summer.

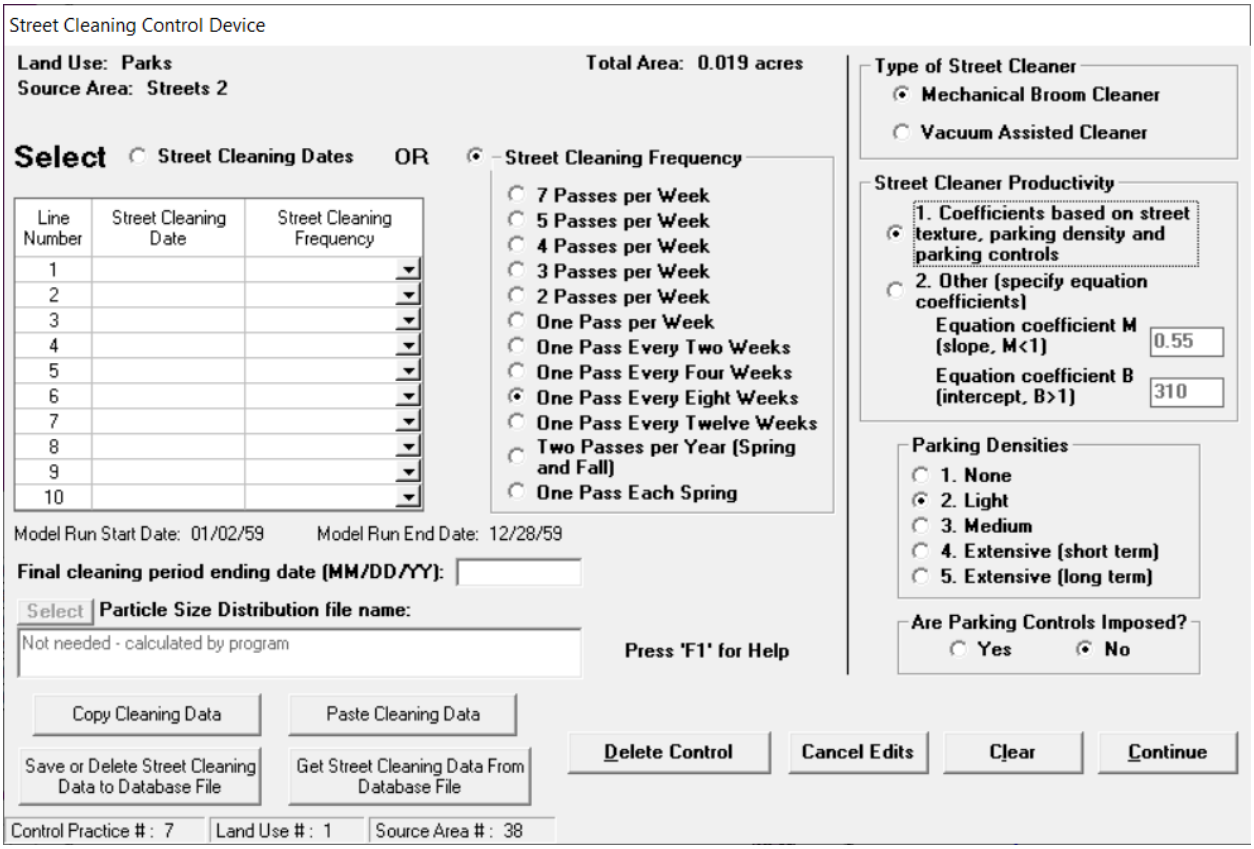


Figure 30: Typical street cleaning parameters for the City of Coon Rapids. Street cleaning occurs five times per year; twice in spring, once in summer, and twice in fall.

Wet Ponds

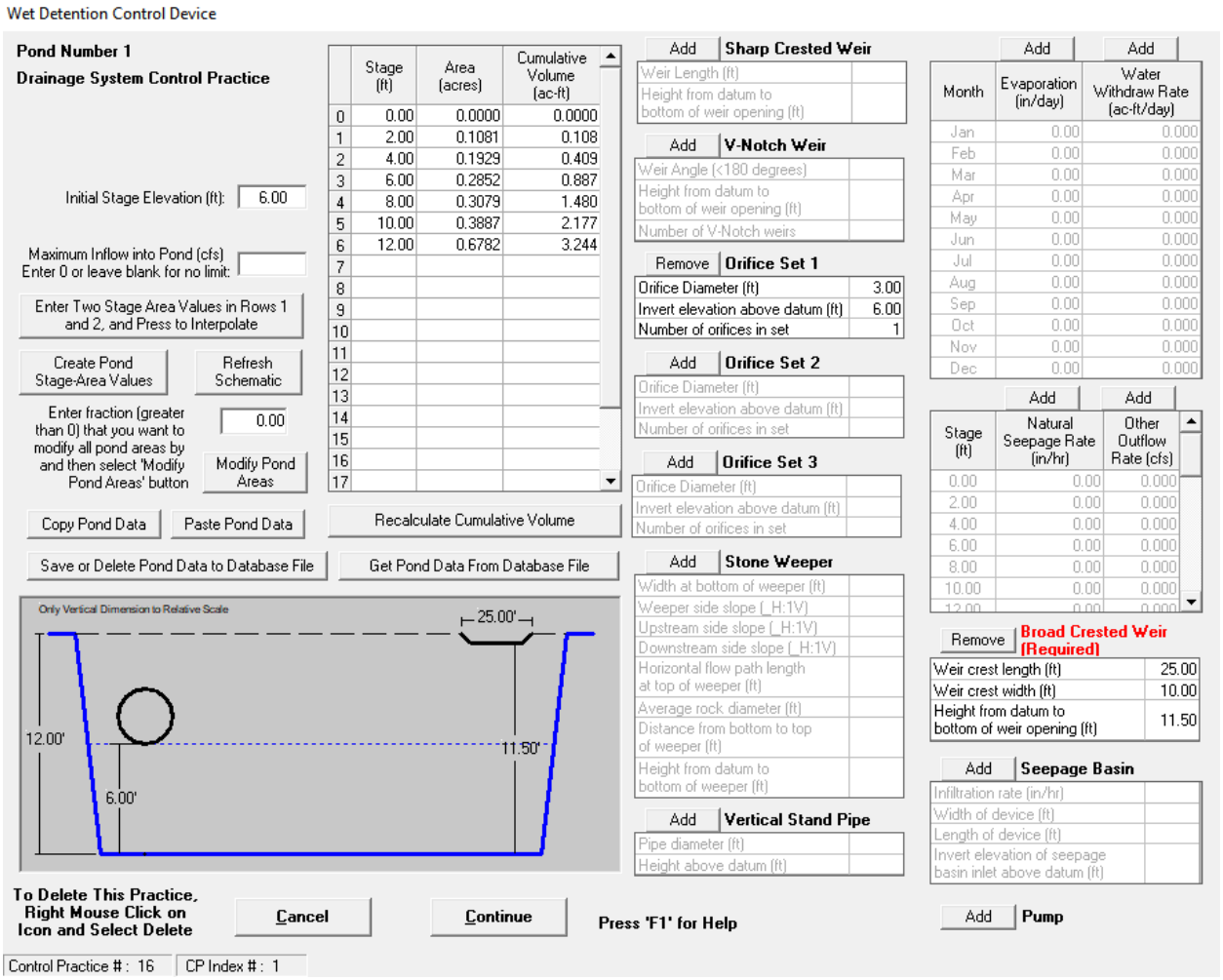


Figure 31: MW-2-EWP-1

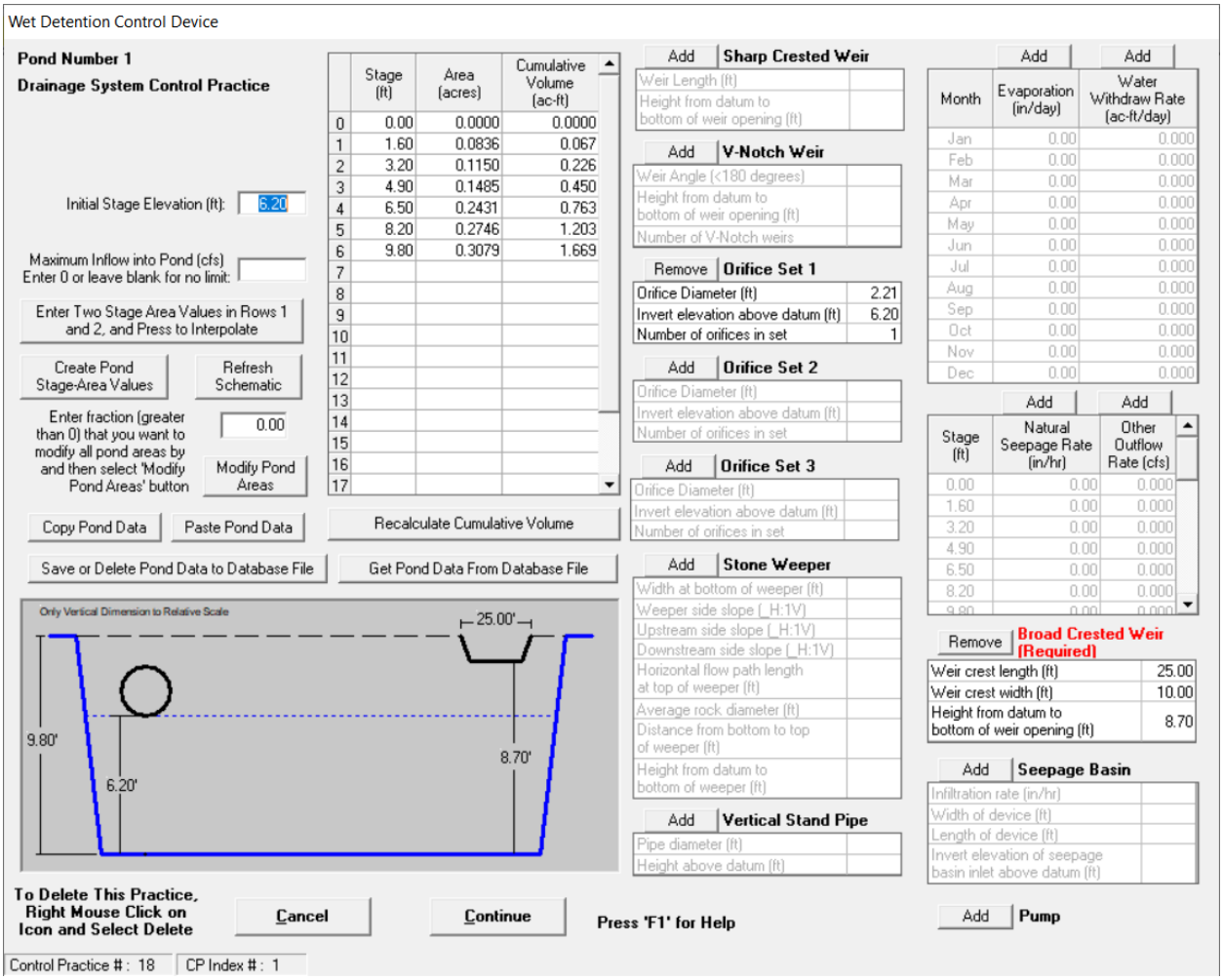


Figure 32: MW-9-EWP-1

Proposed Conditions

The practices listed below were included in the proposed conditions WinSLAMM models.

Bioinfiltration Basins

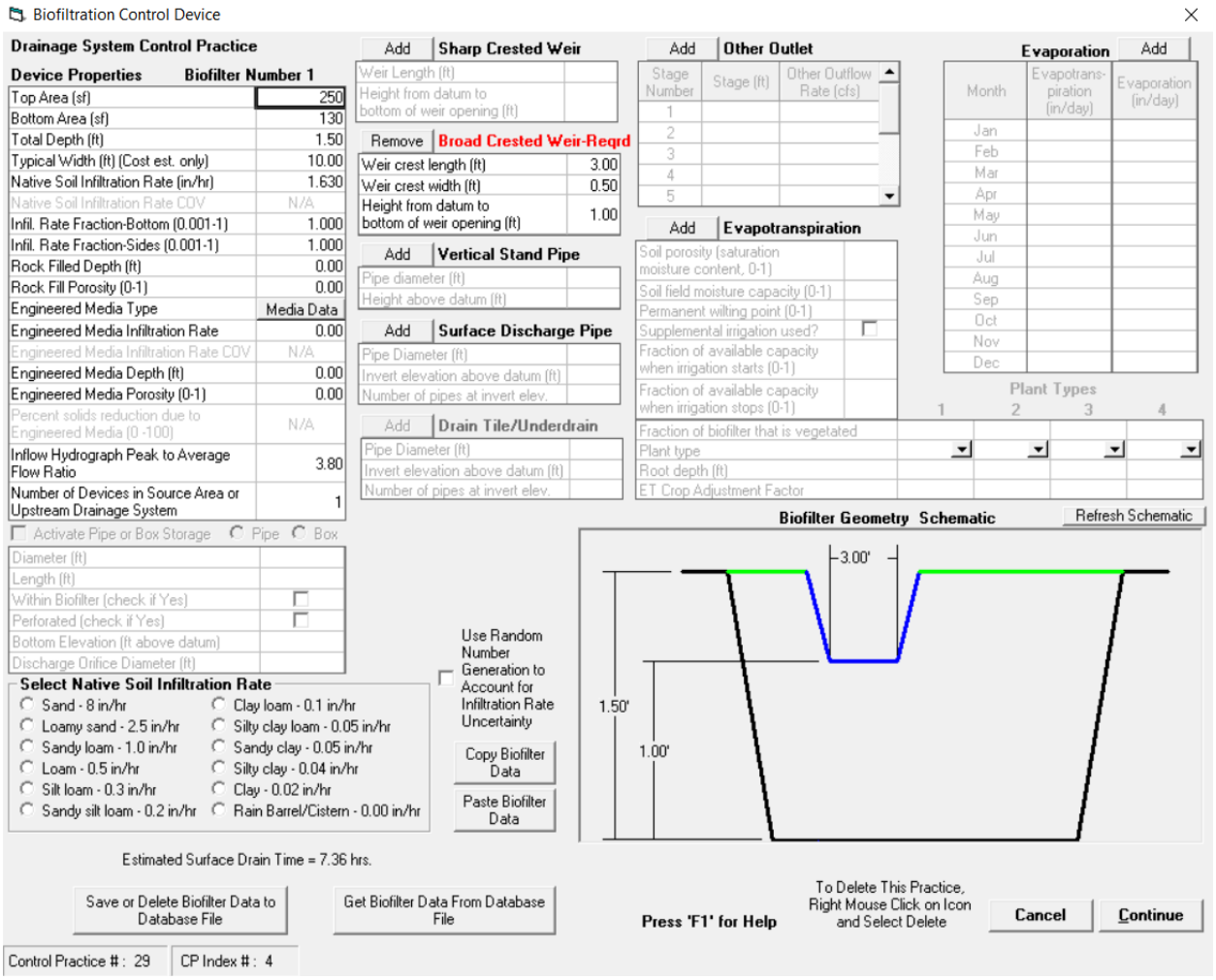


Figure 33: Typical parameters for a standard-sized, single inlet bioinfiltration basin.

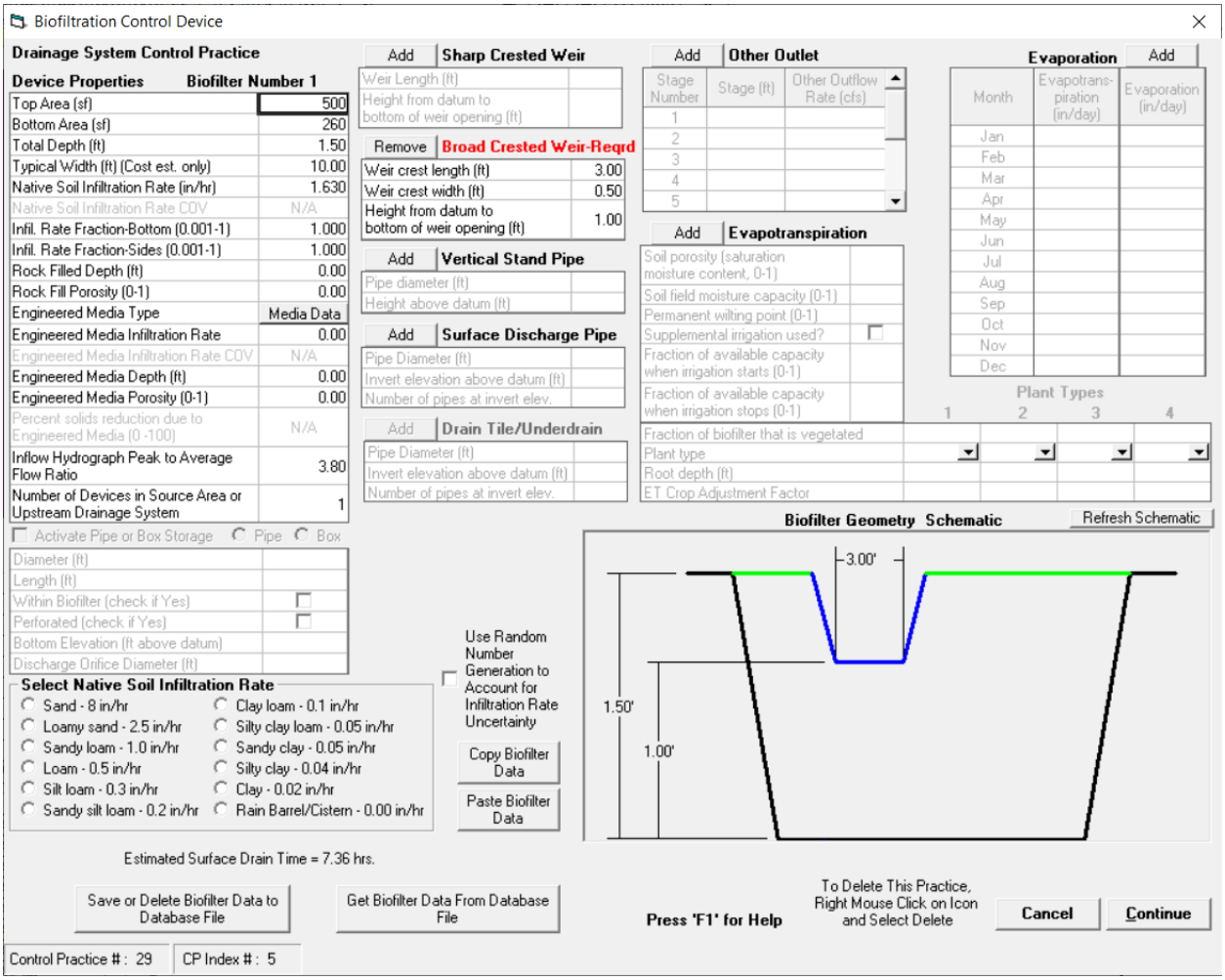


Figure 34: Typical parameters for a large-sized, double-inlet bioinfiltration basin.

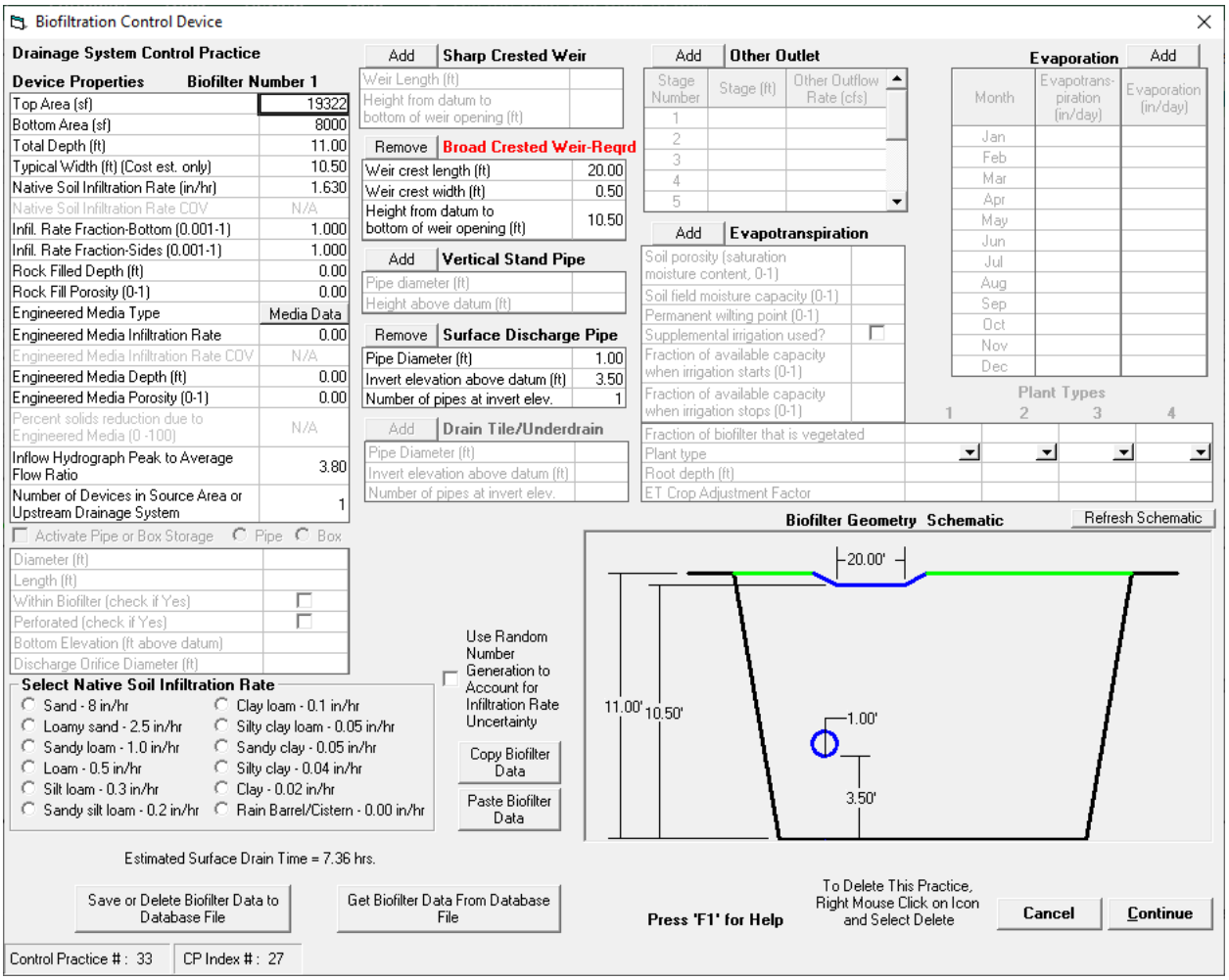


Figure 35: ME-6-EBI-2 retrofitted with increased storage capacity.

Biofiltration Basins

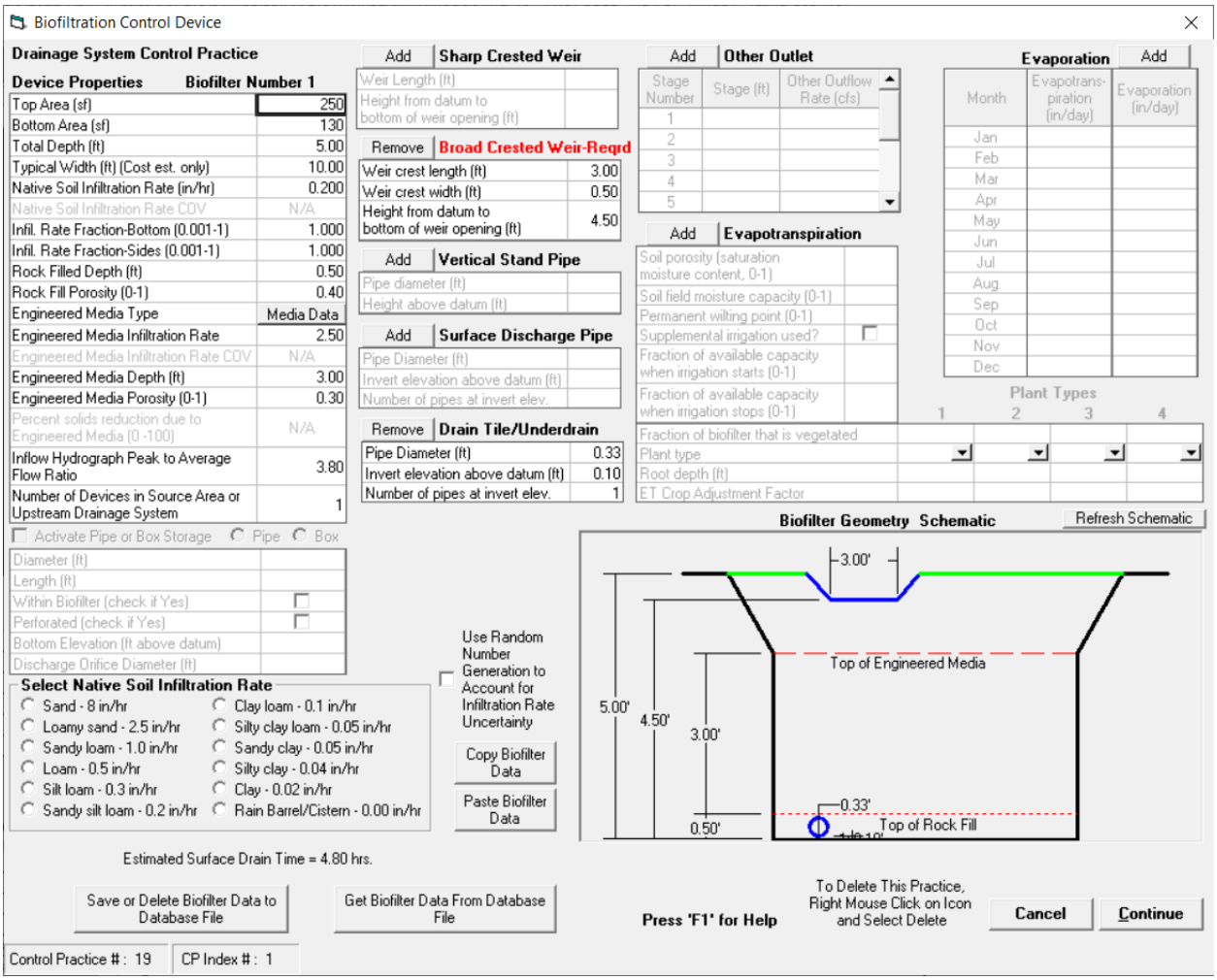


Figure 36: Typical parameters for a standard-sized, single inlet biofiltration basin.

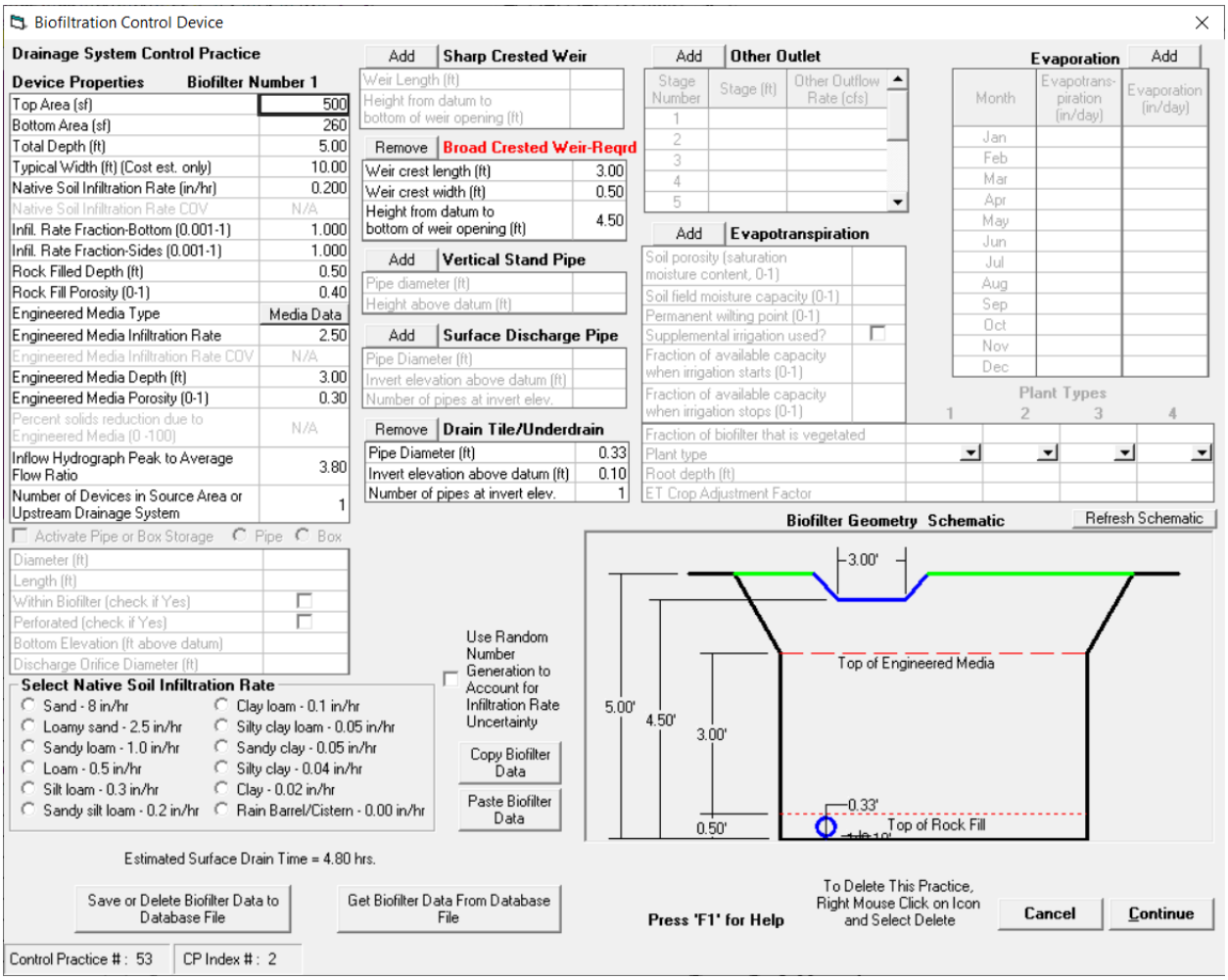


Figure 37: Typical parameters for a large-sized, double-inlet biofiltration basin.

Hydrodynamic Devices

Table 11: Hydrodynamic Device Sizing Criteria

Drainage Area (acres)	Peak Q (cfs)	Hydrodynamic Device Diameter (ft)
1	1.97	4
2	3.90	6
3	5.83	6
4	7.77	6
5	9.72	8
6	11.68	8
7	13.65	8
≥8	15.63	10

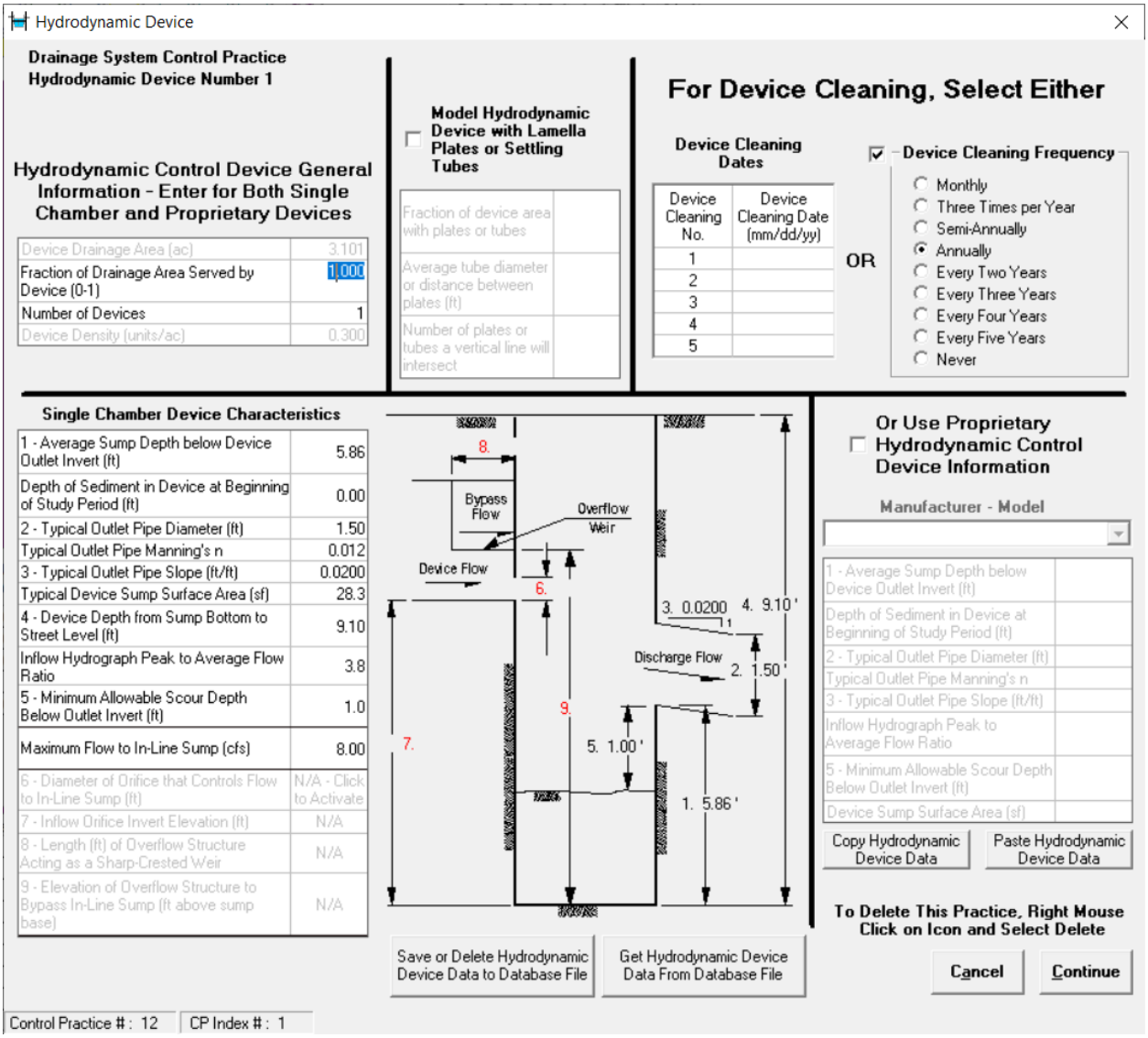


Figure 38: Typical parameters for 6-ft diameter hydrodynamic device.

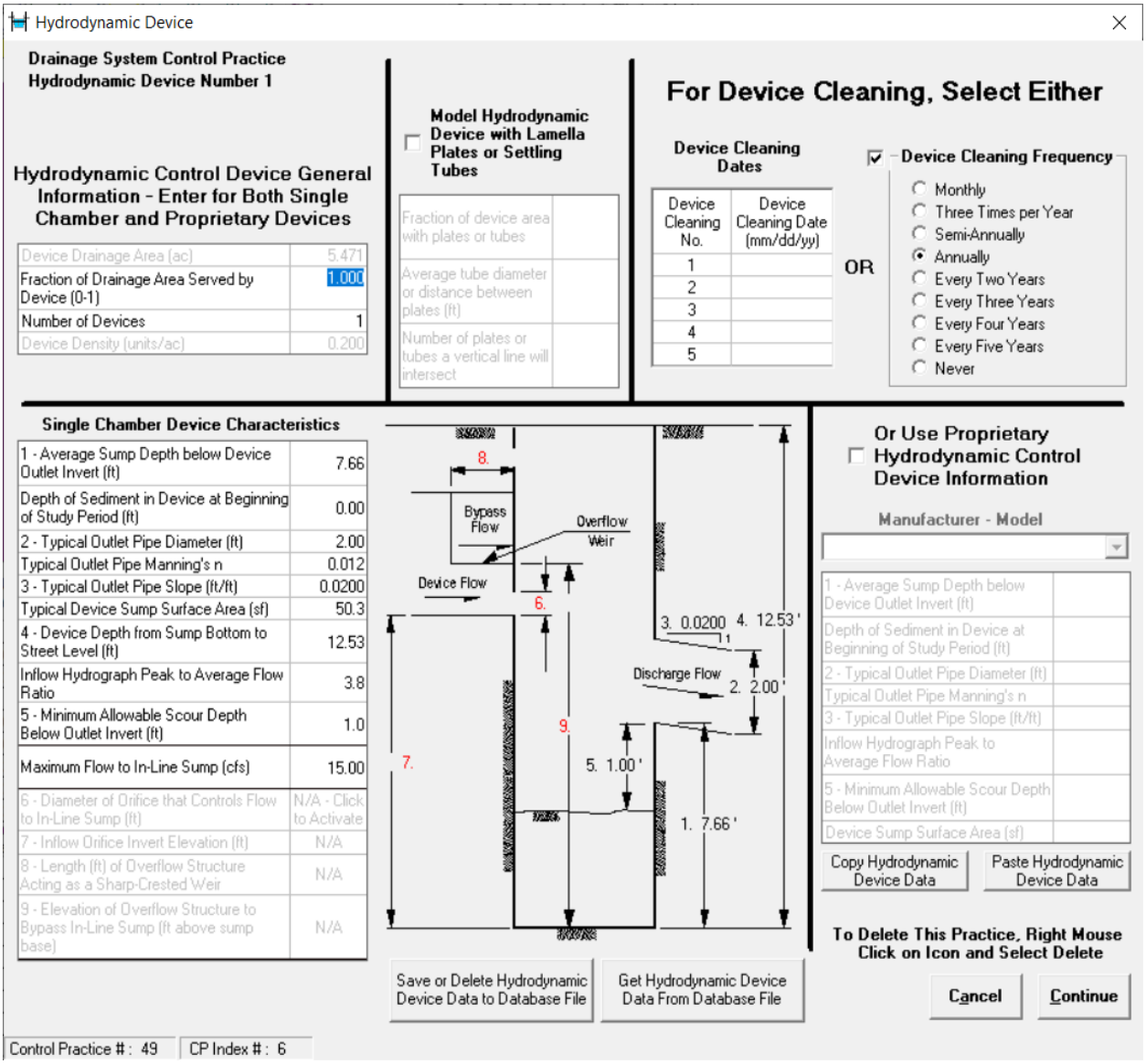


Figure 39: Typical parameters for 8-ft diameter hydrodynamic device.

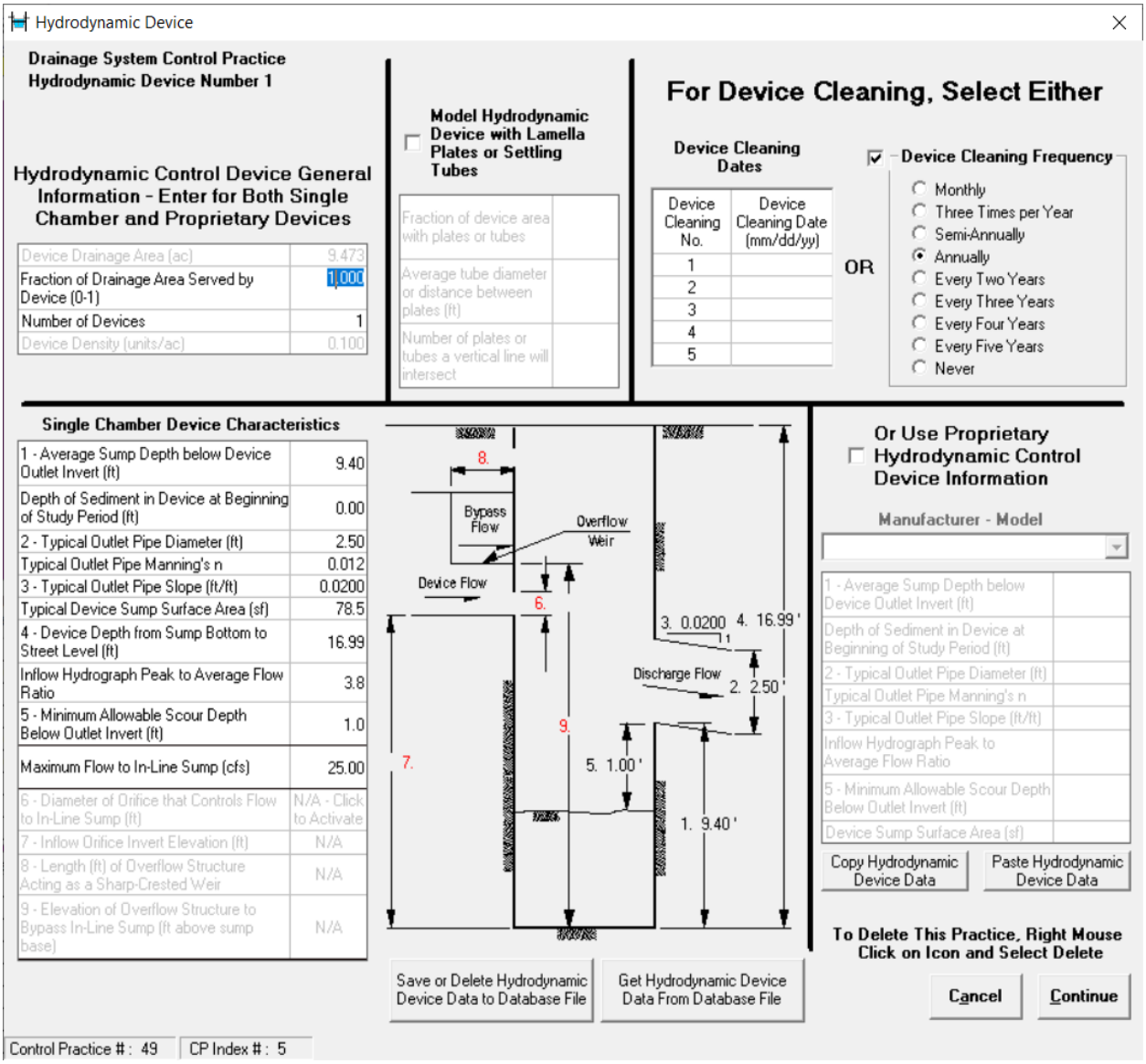


Figure 40: Typical parameters for 10-ft diameter hydrodynamic device.

Underground Structure

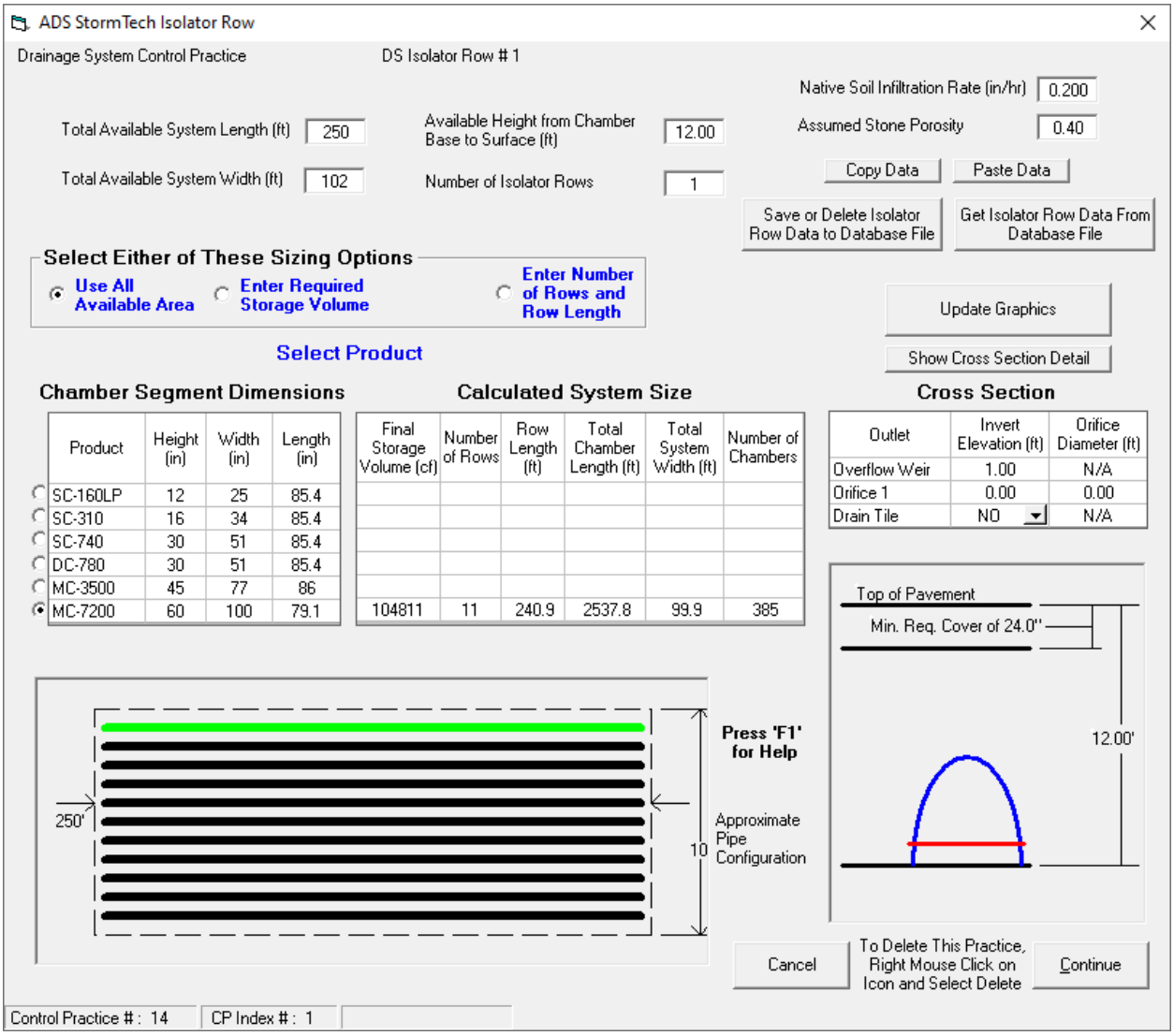


Figure 41: ME-11-PUG-1

Wet Ponds

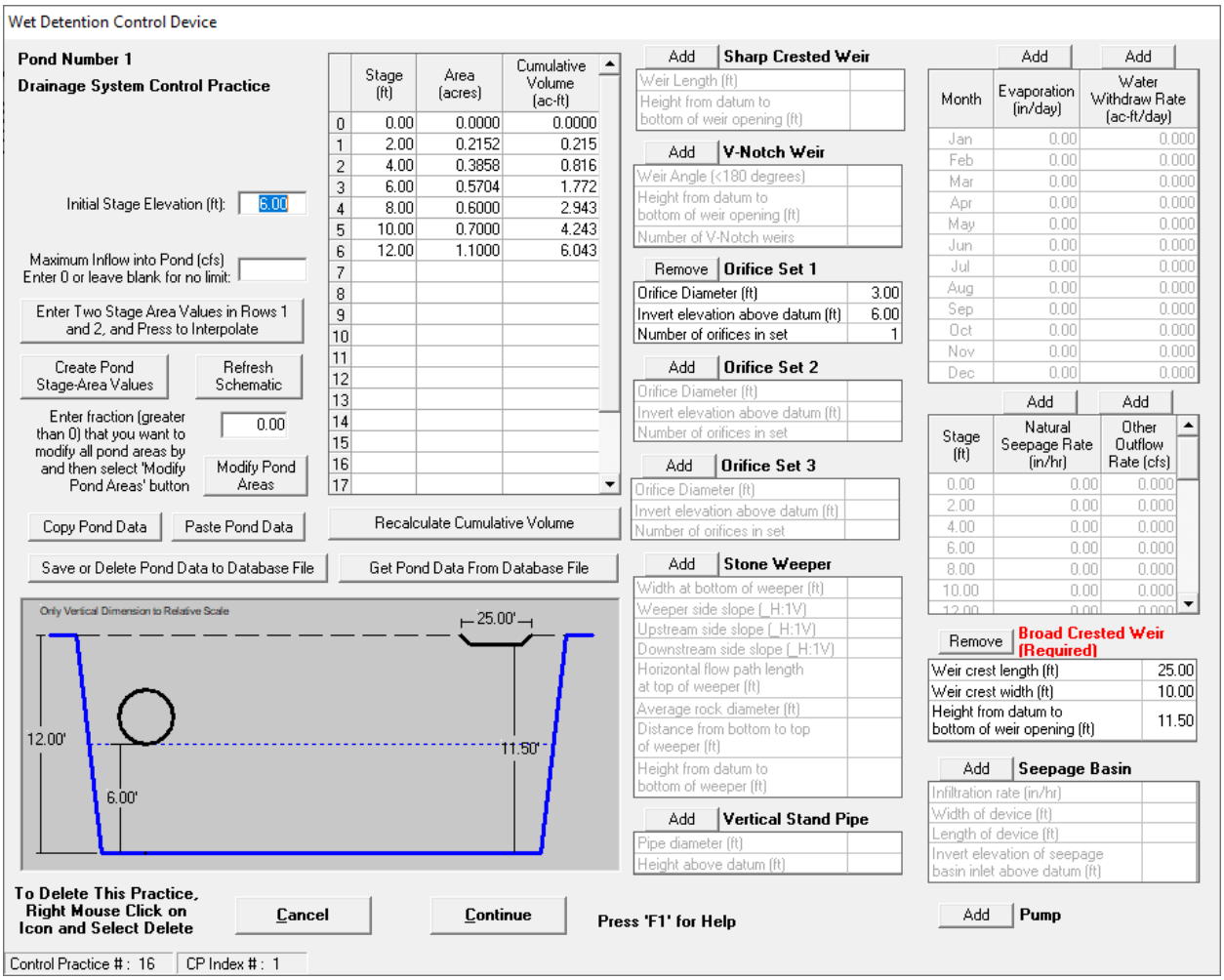


Figure 42: MW-2-EWP-1 Expansion

Appendix B – Project Cost Estimates

The 'Cost Estimates' section explains the elements of cost that were considered and the amounts and assumptions that were used. In addition, each project type concludes with budget assumptions listed in the footnotes. This appendix is a compilation of tables that shows in greater detail the calculations made and quantities used to arrive at the cost estimates for practices where the information provided elsewhere in the document is insufficient to reconstruct the budget.

Table 12: ME-6-EBI-2 Retrofit

Activity	Units	Unit Price	Quantity	Unit Price
Design	Each	$ 83	60	$ 4,980
Mobilization	Each	$ 5,000	1	$ 5,000
30" Riser/Baffle	Each	$ 1,000	1	$ 1,000
Enhancement Excavation	Each	$ 15,000	1	$ 15,000
Site Restoration/Revegetation	Each	$ 2,000	1	$ 2,000
			Total for project =	$ 27,980

Table 13: ME-11-PUG-1

Activity	Units	Unit Price	Quantity	Unit Price
Feasability Study & Design	Each	$ 83	100	$ 8,300
Mobilization	Each	$ 15,000	1	$ 15,000
Excavation	Each	$ 35	11,300	$ 395,500
Fill	Each	$ 25	6,600	$ 165,000
Chambers	Each	$ 1,500	385	$ 577,500
End Cap	Eac h	$ 500	22	$ 11,000
20% Cost Contingency	Eac h	$ 234,460	1	$ 234,460
			Total for project =	$ 1,406,760

Table 14: MW-2-EWP-1 Expansion

Activity	Units	Unit Price	Quantity	Unit Price
Feasability Study & Project Design	Each	$ 83	120	$ 9,960
Mobilization	Each	$ 15,000	1	$ 15,000
Clearing and Grubbing	Each	$ 5,000	1	$ 5,000
Control of Water	Each	$ 15,000	1	$ 15,000
Site Prep	Each	$ 20,000	1	$ 20,000
Enhancement Excavation	Each	$ 35	5,000	$ 175,000
Site Restoration/Revegetation	Each	$ 5,000	1	$ 5,000
20% Cost Contigency	Each	$ 48,992	1	$ 48,992
		Total for project =		$ 293,952

Appendix C – Soil Information

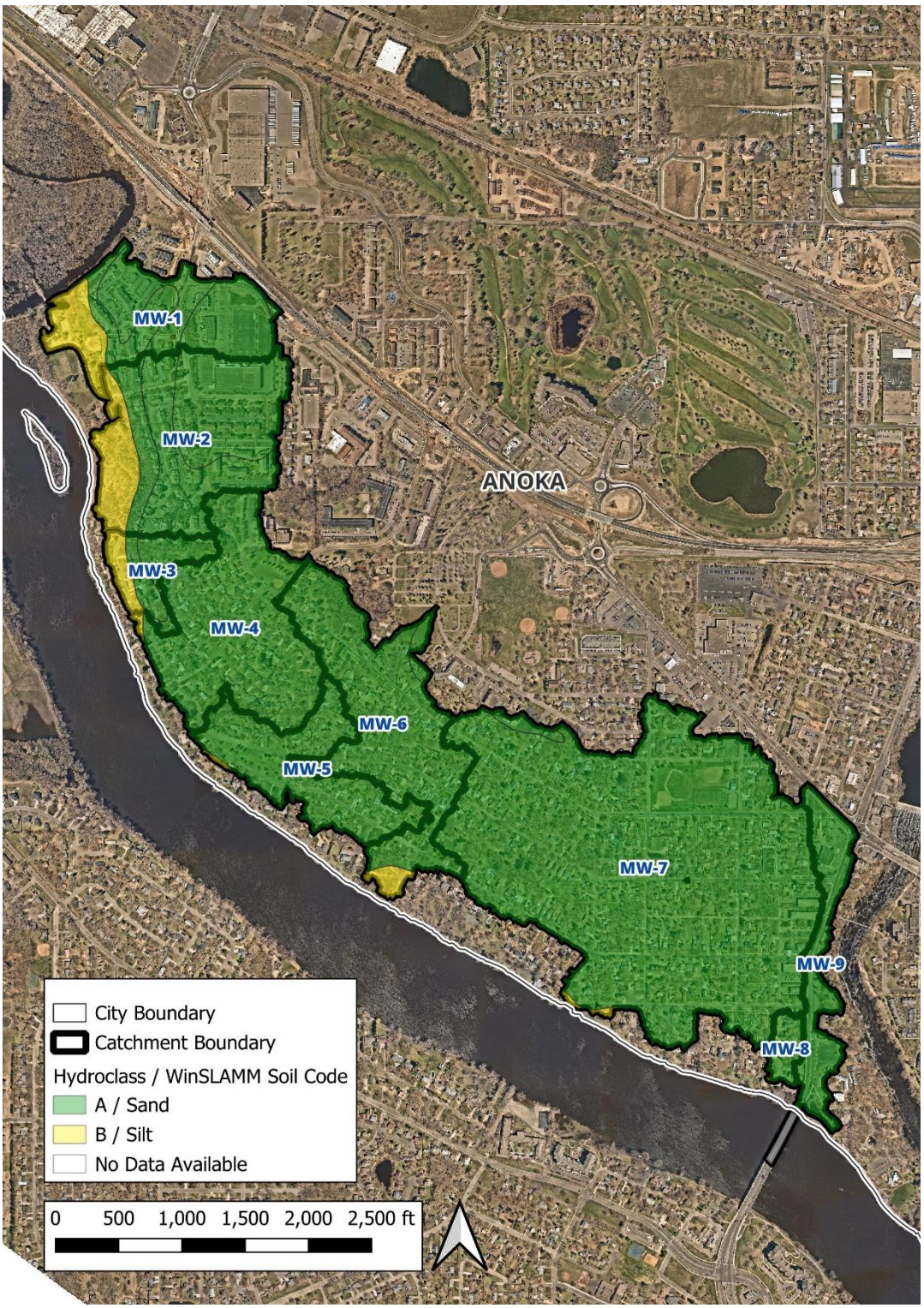


Figure 43: Mississippi River (West) subwatershed soil hydroclass and texture used for WinSLAMM model.

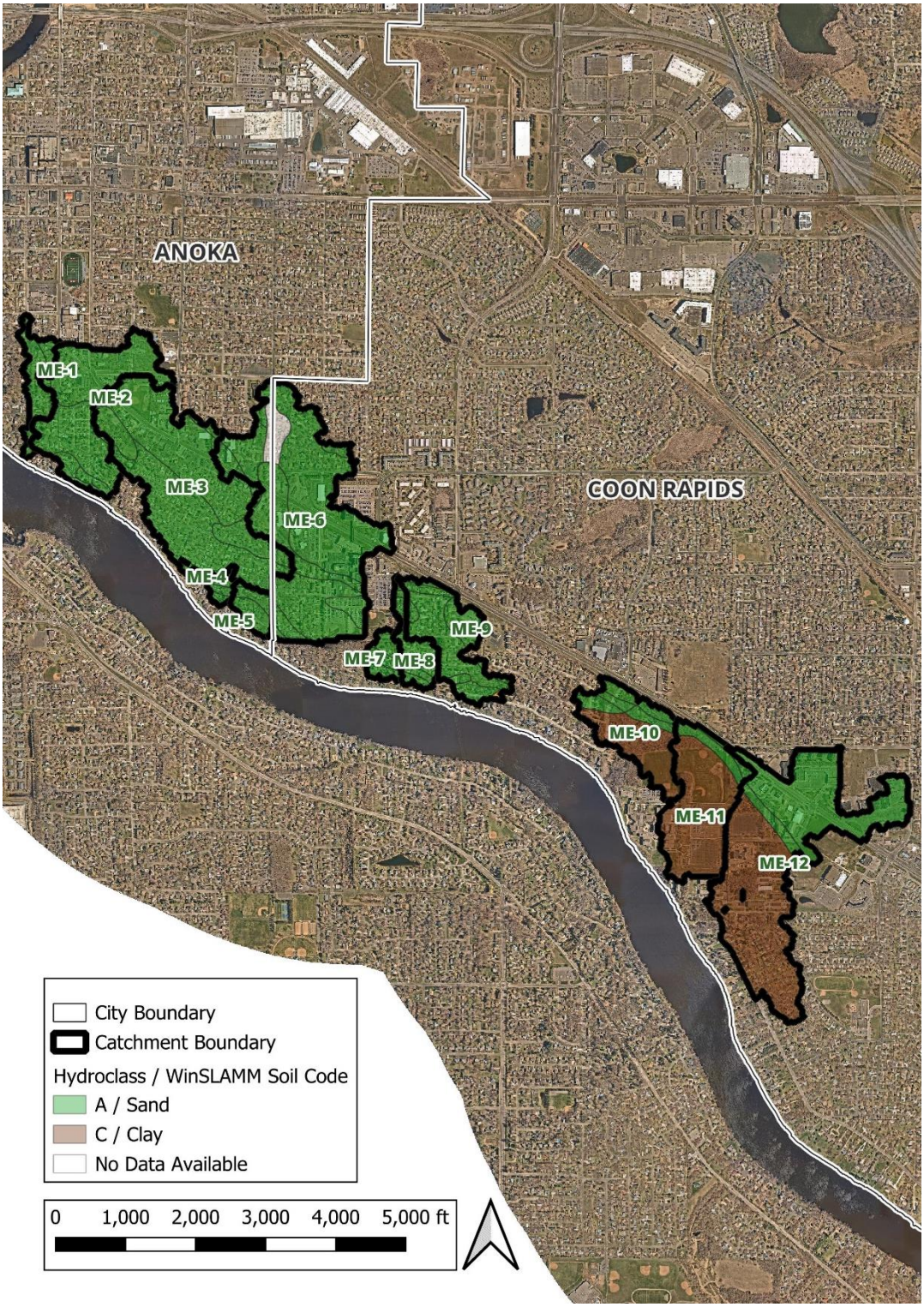


Figure 44: Mississippi River (East) subwatershed soil hydroclass and texture used for WinSLAMM model.

Appendix D – Wellhead Protection Areas

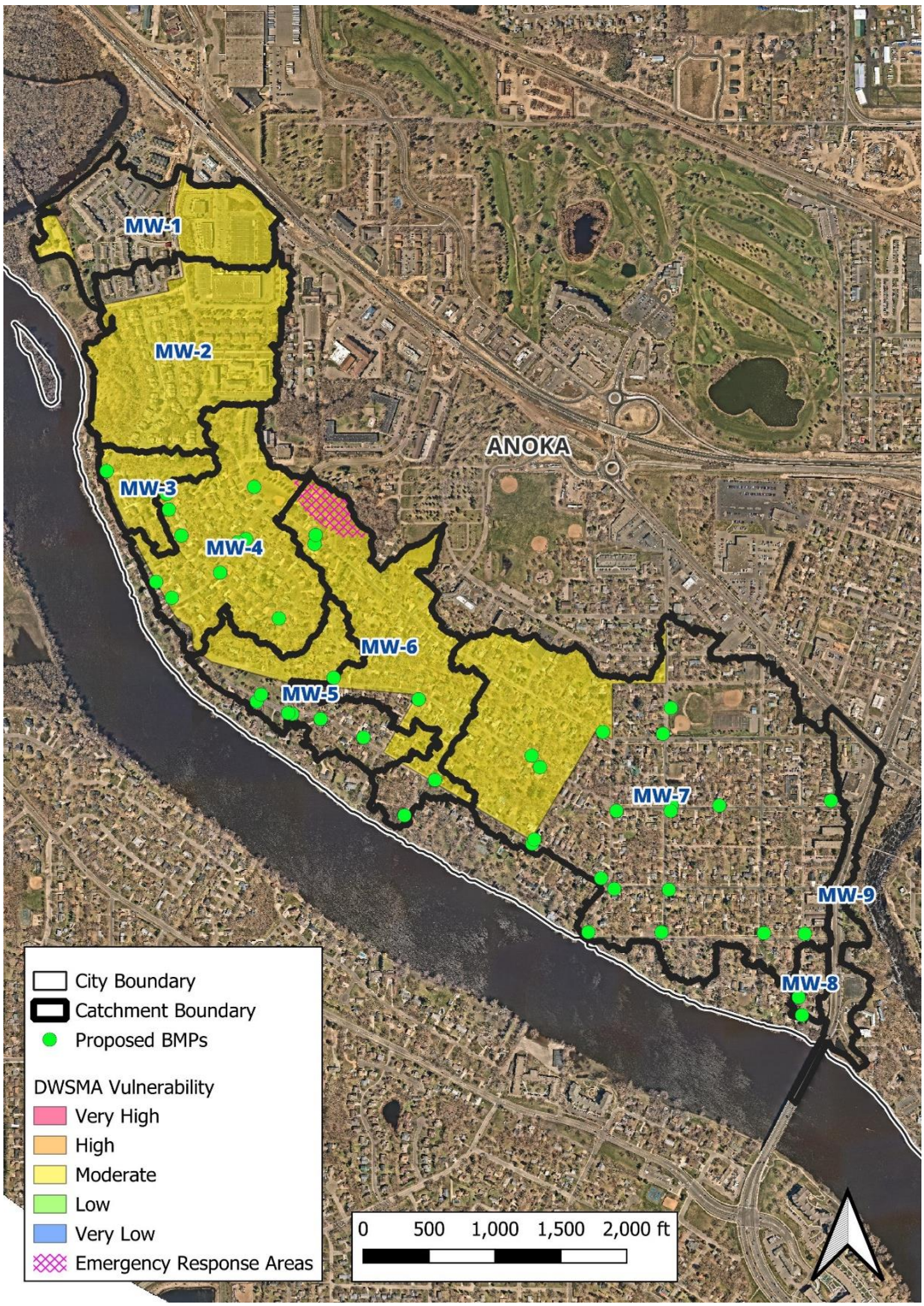


Figure 45: Mississippi River (West) Drinking Water Supply Management Area (DWSMA) Vulnerability and Emergency Response Areas

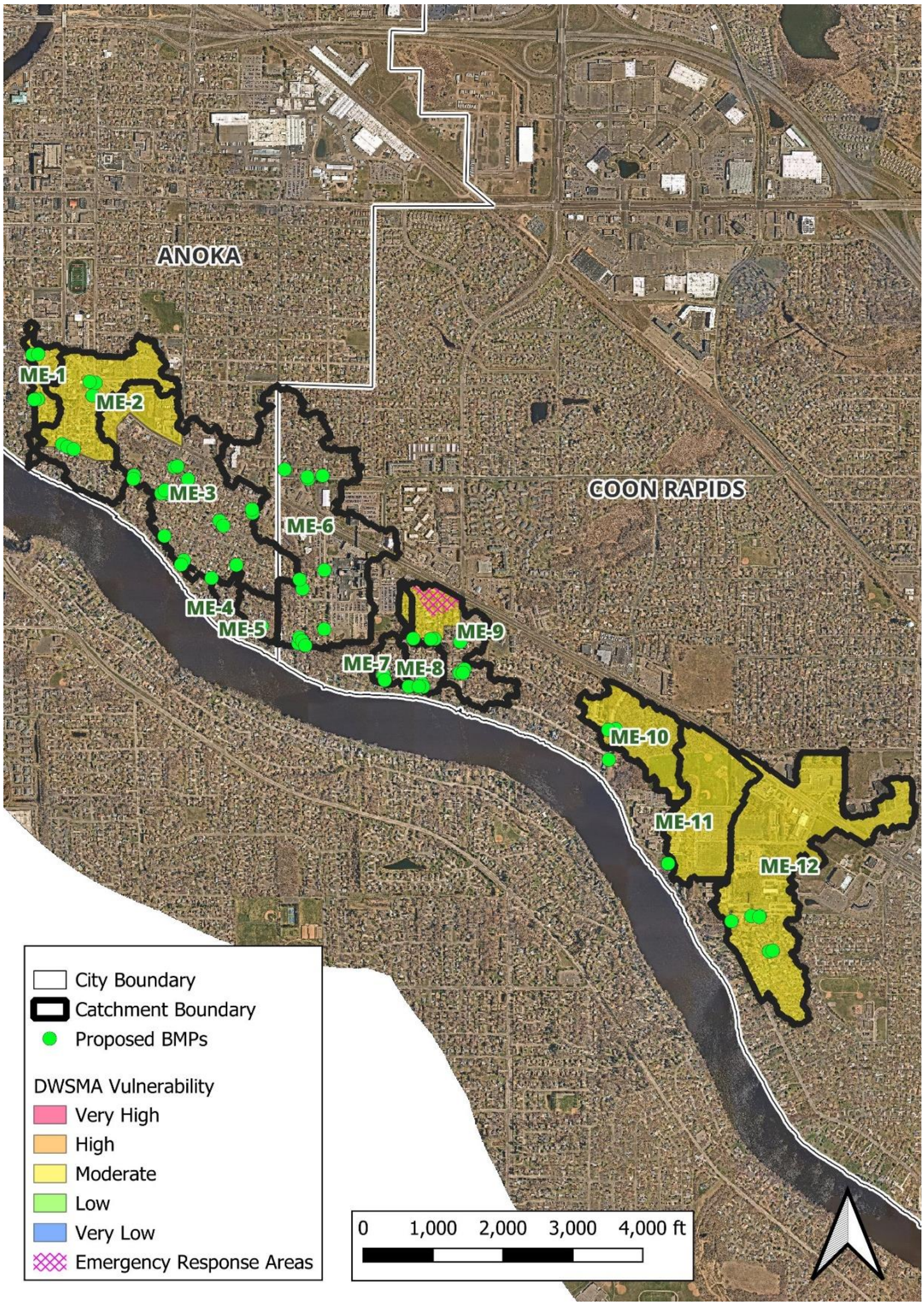


Figure 46: Mississippi River (East) Drinking Water Supply Management Area (DWSMA) Vulnerability and Emergency Response Areas

Appendix E – Enhanced Street Cleaning Calculator

Table 15: Recover calculator input values

Route ID	Curb-miles	Average % Canopy Cover	Unique Cost ($/curb-mile)
MW-1	0.55	27.36	100
MW-2	2.11	29.28	100
MW-3	0.26	32.73	100
MW-4	2.31	40.18	100
MW-5	1.53	41.61	100
MW-6	2.48	45.02	100
MW-7	8.06	43.36	100
MW-8	0.18	35.60	100
MW-9	1.21	23.80	100
ME-1	0.94	43.95	100
ME-2	3.14	38.75	100
ME-3	5.83	40.98	100
ME-4	0.13	51.15	100
ME-5	0.58	64.64	100
ME-6	5.48	45.43	100
ME-7	0.29	28.09	100
ME-8	0.77	54.83	100
ME-9	1.66	46.93	100
ME-10	0.54	45.40	100
ME-11	0.48	19.72	100
ME-12	3.93	45.16	100

The unique cost ($/curb-mile) was selected at $100/curb-mile as a representative number. This is approximately the median value collected from case studies for street sweeping (Minnesota Stormwater Manual, 2023).

Table 16: Current conditions (twice per year in Anoka, five times per year in Coon Rapids)

Route	Predicted Annual				
	Wet solids, lb	Dry solids, lb	Nitrogen, lb	Phosphorus, lb	Cost, $
MW-1 - 2x per year	1493	997	7.3	0.9	$ 110.00
MW-2 - 2x per year	6198	4107	32.6	3.6	$ 422.00
MW-3 - 2x per year	880	575	5.2	0.5	$ 52.00
MW-4 - 2x per year	10603	6727	82.9	6.3	$ 462.00
MW-5 - 2x per year	7446	4697	61.4	4.5	$ 306.00
MW-6 - 2x per year	13878	8636	129	8	$ 496.00
MW-7 - 2x per year	42139	26397	370.1	25.5	$ 1,612.00
MW-8 - 2x per year	685	443	4.5	0.4	$ 36.00
MW-9 - 2x per year	2840	1923	12.2	1.6	$ 242.00
ME-1 - 2x per year	5035	3146	45.2	3.0	$ 188.00
ME-2 - 2x per year	13593	8673	100.9	8.1	$ 628.00
ME-3 - 2x per year	27650	17486	222.7	16.6	$ 1,166.00
ME-4 - 2x per year	935	568	11	1	$ 26.00
ME-5 - 2x per year	7247	4171	138.1	4.7	$ 116.00
ME-6 - 5x per year	49444	31913	564.8	30.7	$ 2,740.00
ME-7 - 5x per year	1286	890	7.8	0.8	$ 145.00
ME-8 - 5x per year	10209	6347	164.2	6.5	$ 385.00
ME-9 - 5x per year	15926	10218	192.1	9.9	$ 830.00
ME-10 - 5x per year	4866	3141	55.5	3.0	$ 270.00
ME-11 - 5x per year	1511	1081	6.8	0.9	$ 240.00
ME-12 - 5x per year	35069	22659	396.7	21.8	$ 1,965.00

Table 17: Proposed enhanced street sweeping conditions (five times per year in Anoka)

Route	Predicted Annual				
	Wet solids, lb	Dry solids, lb	Nitrogen, lb	Phosphorus, lb	Cost, $
MW-1 - 5x per year	2368	1642	14.0	1.4	$ 275.00
MW-2 - 5x per year	9827	6765	62.4	5.8	$ 1,055.00
MW-3 - 5x per year	1395	947	10.0	0.8	$ 130.00
MW-4 - 5x per year	16811	11080	158.6	10.3	$ 1,155.00
MW-5 - 5x per year	11806	7737	117.4	7.3	$ 765.00
MW-6 - 5x per year	22004	14225	247.6	13.7	$ 1,240.00
MW-7 - 5x per year	66813	43480	707.8	41.3	$ 4,030.00
MW-8 - 5x per year	1086	729	8.7	0.7	$ 90.00
MW-9 - 5x per year	4503	3168	23.4	2.6	$ 605.00
ME-1 - 5x per year	7983	5183	86.4	4.9	$ 470.00
ME-2 - 5x per year	21552	14285	193.1	13.1	$ 1,570.00
ME-3 - 5x per year	43841	28802	425.9	26.9	$ 2,915.00
ME-4 - 5x per year	1482	935	20.9	0.9	$ 65.00
ME-5 - 5x per year	11491	6870	264.1	7.6	$ 290.00
ME-6 - 5x per year *	N/A	N/A	N/A	N/A	N/A
ME-7 - 5x per year *	N/A	N/A	N/A	N/A	N/A
ME-8 - 5x per year *	N/A	N/A	N/A	N/A	N/A
ME-9 - 5x per year *	N/A	N/A	N/A	N/A	N/A
ME-10 - 5x per year *	N/A	N/A	N/A	N/A	N/A
ME-11 - 5x per year *	N/A	N/A	N/A	N/A	N/A
ME-12 - 5x per year *	N/A	N/A	N/A	N/A	N/A

* Enhanced street cleaning is already conducted in Coon Rapids five times per year.

Table 18: Annual load recovery and cost effectiveness from 2x per year to 5x per year*

Catchment ID	Wet solids, lb	Dry solids, lb	Nitrogen, lb	Phosphorus, lb	Cost/lb-TP
MW-1	874.5	645.3	6.7	0.5	$309
MW-2	3629.3	2657.7	29.8	2.2	$284
MW-3	515.1	372.0	4.8	0.3	$244
MW-4	6208.4	4353.1	75.7	3.9	$176
MW-5	4360.0	3039.7	56.0	2.8	$165
MW-6	8126.1	5588.9	118.2	5.2	$142
MW-7	24674.4	17083.0	337.8	15.8	$153
MW-8	401.0	286.4	4.1	0.3	$215
MW-9	1663.0	1244.7	11.2	1.0	$361
ME-1	2948.0	2036.2	41.2	1.9	$149
ME-2	7959.1	5612.6	92.1	5.0	$187
ME-3	16190.4	11316.0	203.2	10.3	$170
ME-4	547.5	367.5	10.0	0.4	$109
ME-5	4243.6	2699.2	126.0	2.9	$60
ME-6	N/A	N/A	N/A	N/A	N/A
ME-7	N/A	N/A	N/A	N/A	N/A
ME-8	N/A	N/A	N/A	N/A	N/A
ME-9	N/A	N/A	N/A	N/A	N/A
ME-10	N/A	N/A	N/A	N/A	N/A
ME-11	N/A	N/A	N/A	N/A	N/A
ME-12	N/A	N/A	N/A	N/A	N/A

*NOTE: Values do not account for existing BMP treatment.