City of WATERTOWN

Storm Water Quality Master Plan

December 2014

Ruekert • Mielke

Storm Water Quality Master Plan

CITY OF WATERTOWN
DODGE & JEFFERSON COUNTIES, WISCONSIN

DECEMBER, 2014

RUEKERT/MIELKE
W233 N2080 Ridgeview Parkway
Waukesha, Wisconsin 53188-1020

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CHAPTER 1 -- INTRODUCTION

Municipal officials have long recognized the hazards to public health and safety and the economic losses caused by inadequate storm water management and flood control. More recently, municipal officials have also recognized the need to protect and improve the water quality within watercourses throughout the region, including the City of Watertown. At the same time, there has been an intense desire from City staff and officials to link the City's existing and planned storm water management activities to the other amenities which make the City a desirable place to live, work and recreate.

Previous Master Planning Efforts

In November of 2006, the City of Watertown was issued their first permit from the Wisconsin Department of Natural Resources (WDNR) to discharge storm water from the Municipal Separate Storm Sewer System (MS4 permit). Among other things, this permit required the City to complete a multitude of activities aimed at improving the quality of storm water runoff entering the City's waterways.

In preparation for this initial MS4 permit, Ruekert & Mielke, Inc., working in conjunction with City staff and officials, completed the City's Storm Water Management System Plan in March of 2006. The study identified actual and potential storm water capacity, flood control and water quality concerns within the City and recommended needed corrective measures. Capital and operation and maintenance costs attendant to the recommended corrective measures were estimated, and a plan implementation program developed. In the subsequent years, the City has constructed several of the recommended improvements, including significant storm water facilities along Welsh Road and Mary Street.

Total Maximum Daily Loads in the Rock River Watershed

Section 303(d) of the Federal Clean Water Act requires each state to identify those waters within its boundaries which are not meeting their designated uses due to exceedance of water quality standards for any applicable pollutant. Essentially, the Clean Water Act required Wisconsin to identify which waterways are too polluted to function as originally intended. Section 303(d) also requires the United States Environmental Protection Agency (EPA) to develop Total Maximum Daily Loads (TMDLs) for all pollutants exceeding applicable water quality standards. There are currently approximately 860 water bodies on Wisconsin's 303(d) list of impaired waters.

A TMDL determines the maximum amount of pollutant that a water body is capable of accommodating while continuing to meet the existing water quality standard. For all pollutant sources, such loads are established at levels necessary to meet the applicable standard, with consideration given to seasonal variations and margins of safety. TMDLs provide the framework that allow states to establish and implement pollution control and management plans with the ultimate goal, as defined by the Clean Water Act, of "water quality which provides for the protection and propagation of fish, shellfish and wildlife, and recreation in and on the water wherever attainable."

The Wisconsin Department of Natural Resources, working in conjunction with the EPA, is responsible to implement Wisconsin's TMDL process. Several major TMDLs have recently been completed, including the Lower Fox River. Several more are currently under

development, including the Milwaukee River, the Wisconsin River and Upper Fox/Wolf watersheds.

The Rock River has been listed as an impaired water on the State's 303(d) list for many years. The primary pollutants of concern are excessive phosphorus and sediment concentrations which lead to nuisance algae growth, oxygen depletion, reduced submerged aquatic vegetation, water clarity problems and degraded habitat. These impairments adversely impact fish and other aquatic life, water quality, recreation and navigation. The Rock River TMDL was completed in July of 2011, addressing 62 of Wisconsin's impaired waters.

Pollutants of Concern

Although phosphorus is an essential nutrient for plant growth, excess phosphorus is a concern for most aquatic ecosystems. Where human activities do not dominate the landscape, phosphorus is generally in short supply, limiting the growth of algae and aquatic plants. When a large amount of phosphorus enters a waterway, it essentially fertilizes the aquatic system, allowing more plants and algae to grow, leading to excessive aquatic plant growth, often referred to as an algae bloom. This condition of nutrient enrichment and high plant productivity is referred to as eutrophication.

Eutrophication can be detrimental to aquatic life, reduce recreational opportunities, and affect the economic well-being of the surrounding community. Overabundant aquatic plant growth in a water body can lead to a number of undesirable consequences. Excessive growth of vegetation in a water body blocks sunlight from penetrating the water, choking out beneficial submerged aquatic vegetation. Large areas of excessive vegetation growth can inhibit or prevent access to a waterway, which restricts use of the water for fishing, boating, and swimming. A bloom of aquatic plants may include toxic blue-green algae or cyanobacteria, which are harmful to fish and pose health risks to humans. Algal blooms, particularly those that form surface scums, are visually unappealing and can have unpleasant odors. This makes recreational use of the water body undesirable, impacting the everyday quality of life for people who live close to the affected waterway. When the large masses of aquatic plants from the bloom die, the decomposition of organic matter depletes the supply of dissolved oxygen in the water, suffocating fish and other aquatic life. Depending on the severity of the low dissolved oxygen event, large fish kills can occur. Nearly all of these environmental impacts have direct economic and quality of life impacts to the City of Watertown.

Many water bodies in the Rock River watershed are also impaired by excess sediment loading. Sediment that is suspended in the water scatters and absorbs sunlight, reducing the amount of light that reaches submerged aquatic vegetation, which reduces its photosynthetic rate and growth. Bottom-rooted aquatic plants (called macrophytes) produce oxygen, provide food and habitat for fish and other aquatic life, stabilize bottom sediments, protect shorelines from erosion and take up nutrients that would otherwise contribute to nuisance algae growth. As photosynthetic rates decrease, less oxygen is released into the water by the plants. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die. As the plants are decomposed, bacteria will use up even more oxygen from the water. Reduced water clarity can also have direct impacts on aquatic fauna including fish, waterfowl, frogs, turtles, and insects. Suspended sediments interfere with the ability of fish and waterfowl to see and catch food and can clog the gills of fish and invertebrates, making it difficult for them to breathe. When sediments settle to the bottom of a river, they can smother the eggs of fish and aquatic insects, as well as suffocate newly hatched insect larvae. Settling sediments can also fill in spaces between rocks, which could have been used by aquatic organisms for homes.

Excess sediments can also cause an increase in surface water temperature. As the sediment particles absorb heat from sunlight, dissolved oxygen levels can fall even farther (warmer waters hold less dissolved oxygen), and further harm aquatic life.

In addition to its direct effects, sediment may also carry nutrients, heavy metals and other pollutants into water bodies. A large proportion of the phosphorus that moves from land to water is attached to sediment particles. This phenomenon can be seen in both spatial and temporal patterns of phosphorus and sediment movement. In general, this means that managing sediment sources can help manage phosphorus sources.

Total Maximum Daily Loads in the City of Watertown

The City of Watertown's MS4 storm water discharge permit was reissued in May of 2014, incorporating the recommendations from the Rock River TMDL study. In accordance with this permit, the City is required to review their local drainage boundaries in conjunction with the watersheds developed as part of the TMDL study. The City is also required to complete an updated water quality study to determine how close the City is to achieving the water quality objectives and pollutant allocations set forth in the TMDL study. If the City is not achieving the desired objectives, a plan outlining how compliance will be achieved is also required.

This report is intended to comply with this portion of the City's MS4 permit. It also updates the water quality portion of the City's 2006 Storm Water Management System Plan.

Planning Area

The area considered in this planning effort is shown on Exhibit 1. The planning area consists of all of the area within the corporate limits of the City of Watertown, and has an area of about 12.5 square miles. As shown on Exhibit 1, the City is located within the Upper Rock River Watershed, and is covered by three distinct "reachsheds" – Sinissippi Lake (#28), the Middle Rock River (#29) and Johnson Creek (#30).

Plan Objective

The updated storm water quality master plan is intended to improve the quality of surface waters and cost effectively comply with existing water quality concerns and permit conditions within the City. The plan is also intended to provide a roadmap for compliance with anticipated future permit requirements. More specifically, the plan and this report:

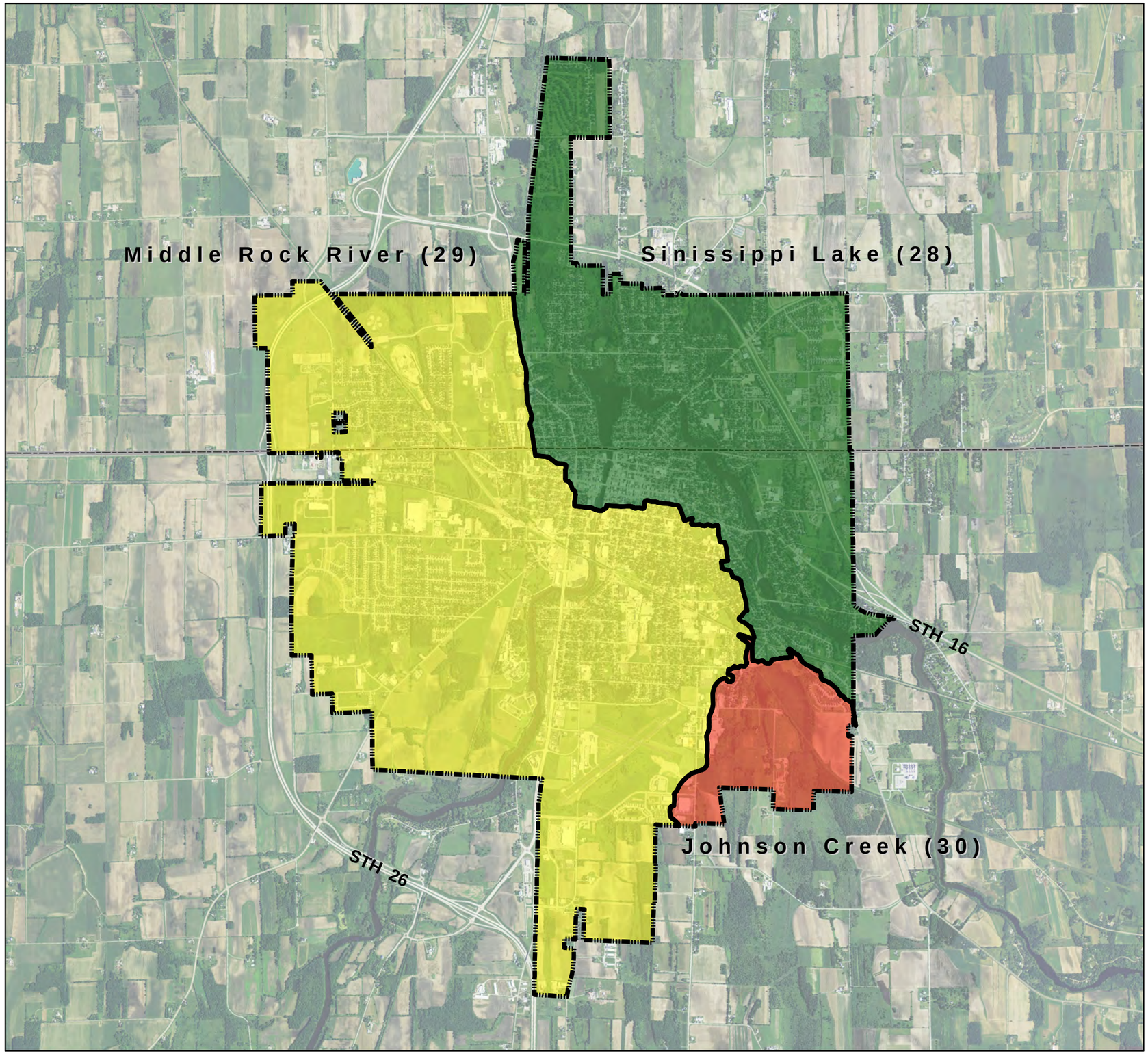
1. Describe the City's existing storm water quality management system.

2. Describe existing municipal storm water permit requirements, anticipated future permit requirements and subsequent water quality requirements.

3. Present alternative water quality best management practices which meet the requirements developed in items 1 and 2 above.

4. Provide a comparative evaluation of the technical, economic and environmental features of the alternative best management practices.

5. Recommend a cost-effective, comprehensive storm water quality master plan for the City of Watertown.



CITY OF Watertown WISCONSIN

Storm Water Management System Planning Area
Exhibit 1

Legend

- Sinissippi Lake Reachshed (28)
- Middle Rock River Reachshed (29)
- Johnson Creek Reachshed (30)
- Watertown Boundary - City Limits
- Reachshed Boundary

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CHAPTER 2 -- WATER QUALITY OBJECTIVES AND STANDARDS

MS4 Storm Water Permit Requirements

In November of 2006, the City of Watertown was issued their first MS4 storm water discharge permit from the Wisconsin Department of Natural Resources. This permit was reissued in May of 2014 and contains the following conditions:

- Update the City's storm water management maps to match the TMDL reachshed maps by March 31, 2016. Calculate the performance of the City's existing storm water management facilities in comparison to the pollutant allocations presented in the Rock River TMDL by March 31, 2018. If not in compliance, prepare a plan also by March 31, 2018 outlining how the City intends to comply with the TMDL allocations.
    - The TMDL components described above are the focus of this planning effort.
- Continue the existing public and City staff education, outreach and involvement programs to increase the awareness of storm water impacts on waters of the state. Measureable goals must be established, tracked and evaluated and the program must comply with at least the 8 specific requirements listed in the MS4 permit.
    - This program is ongoing with review and modifications at least once per year.
- Develop an illicit discharge detection and elimination program to locate and remove illegal connections to the City's storm sewer system. At a minimum, this program must include on-going dry weather field screening at all priority outfalls at least once per year, dry weather field screening at all other major (non-priority) outfalls at least once every five years, subsequent follow-up investigations if discharge is present, including removal of illicit connections and enforcement of the City's illicit discharge ordinance.
    - This program is ongoing. Modifications will be made as needed to complete priority outfall inspections every year and major, non-priority outfall inspections every five years.
- Enforce the City's construction site pollutant control ordinance, including plan review, permit issuance, compliance inspections and enforcement actions.
    - This program is ongoing. Updates will need to be made to the City's erosion control ordinance by May 1, 2016 to match recent changes to Chapters NR 151 and NR 216 of the Wisconsin Administrative Code.
- Enforce the City's post-construction storm water management ordinance, including plan review, maintenance inspections and enforcement actions.
    - This program is ongoing. Updates will need to be made to the City's storm water management ordinance by May 1, 2016 to match recent changes to Chapters NR 151 and NR 216 of the Wisconsin Administrative Code.

- Develop a pollution prevention program, including measureable goals, which includes the following:
    - Develop an inventory of all City owned or operated storm water management facilities.
    - Complete routine inspections (including any required maintenance) of each storm water management facility owned or operated by the City to maintain their pollutant removal operating efficiency.
    - Complete routine catch basin cleaning and street sweeping, including proper disposal. This plan may be modified if supported by further analysis and approved by the Department.
    - Revise the winter road deicing management plan to include contact information, truck routes, equipment descriptions, disposal locations, anti-icing and deicing strategies and actions, and monthly records of product used and weather data prior to March 31, 2016.
    - Proper collection and disposal of leaves, brush and grass clippings.
    - Develop a storm water pollution prevention plan for municipal garages, storage areas and other municipally-owned sources of storm water pollution prior to March 31, 2016. Complete annual full inspections of these facilities thereafter.
    - Development of site-specific nutrient application schedules for fertilizer applications on any City-controlled properties with more than 5 acres of pervious surface.
    - Consideration of environmentally sensitive land development designs for municipal projects, including green infrastructure and low impact development.
- Implement and maintain storm water management practices that were in place on or before July 1, 2011 to achieve a reduction in total suspended solids of at least 20%.
    - This program is ongoing.
- Maintain an updated storm sewer system map.
    - This program is ongoing.
- Complete an annual report evaluating the various storm water programs, documenting compliance with measureable goals and recommending program modifications.
    - Due March 31 of each year.

Total Maximum Daily Load Pollutant Allocations

There are two general types of water pollution: point source and nonpoint source. Point source pollution comes from identifiable, localized sources that discharge directly into a water body, usually through a distinct outfall. Industries and wastewater treatment facilities are two common point sources. Storm water runoff from certain urban areas is also considered a point source.

Nonpoint source pollution comes from land use activities such as agriculture and other non-localized sources. Most nonpoint source pollution occurs as a result of runoff. When rain or melted snow moves over and through the ground, the water carries any pollutants it comes into contact with into nearby waterways. Sources of phosphorus and sediment loading in the Rock River watershed include discharges from regulated wastewater treatment facilities, regulated industrial sites and runoff from agricultural land, urban land (both regulated and non-regulated areas), and natural areas (i.e., forests and wetlands).

As part of the Rock River TMDL, each of these sources is given specific allowable discharge limits. With regards specifically to the City of Watertown, that includes the municipal wastewater treatment facility and the municipal separate storm sewer system (MS4). The MS4 allocation is the focus of this analysis. All allocations are also broken down by reachshed (or sub-watershed), and different reachsheds may have drastically different allocations depending on the existing loadings and the ability of that section of the waterway to assimilate pollutants.

The City of Watertown is covered by the following reachsheds:

- Sinissippi Lake (#28)
- Middle Rock River (#29)
- Johnson Creek (#30)

The pollutant reduction goals specified for the three reachsheds are summarized on Table 1:

Table 1

Reachshed	Required Sediment Reduction From No Controls	Required Phosphorus Reduction From No Controls
Sinissippi Lake (#28)	40%	28%
Middle Rock River (#29)	44%	64%
Johnson Creek (#30)	40%	27%

Pollutant reduction goals are also specified in terms of annual, monthly and daily loadings. To ease implementation and address any potential bias associated with differing acreages within each reachshed, WDNR has recommended the average annual percent reductions, as presented above, be the primary compliance measure.

CHAPTER 3 -- EXISTING CONDITIONS

In any storm water system planning effort, definitive knowledge is required of the existing storm water management system. Inventories and analyses are required of such factors as the land use conditions, existing storm water ordinances, topography, drainage patterns, geology, and existing storm water facilities within the City of Watertown.

Land Use

The existing land use pattern is an important consideration in the preparation of a storm water management systems plan and is the primary data input in the water quality modeling efforts completed as part of this analysis. The City of Watertown maintains their own existing land use information, and this data is shown on Exhibit 2.

Existing Storm Water Ordinance

The City's current storm water management ordinance (Chapter 20 of the City of Watertown Municipal Code) largely follows previous versions of Chapters NR 151 and NR 216 of the Wisconsin Administrative Code, necessitating significant water quality control (80% sediment reduction for new development, 40% for redevelopment, infiltration considerations, etc.). The ordinance also requires that the rate of runoff generated by the 100 year recurrence interval rainfall event under proposed development conditions be restricted to the rate of runoff generated by the 2 year event under existing land use conditions.

In accordance with this ordinance, the redevelopment of lands currently built without storm water facilities may be expected to reduce pollutant loadings within the corresponding storm water runoff.

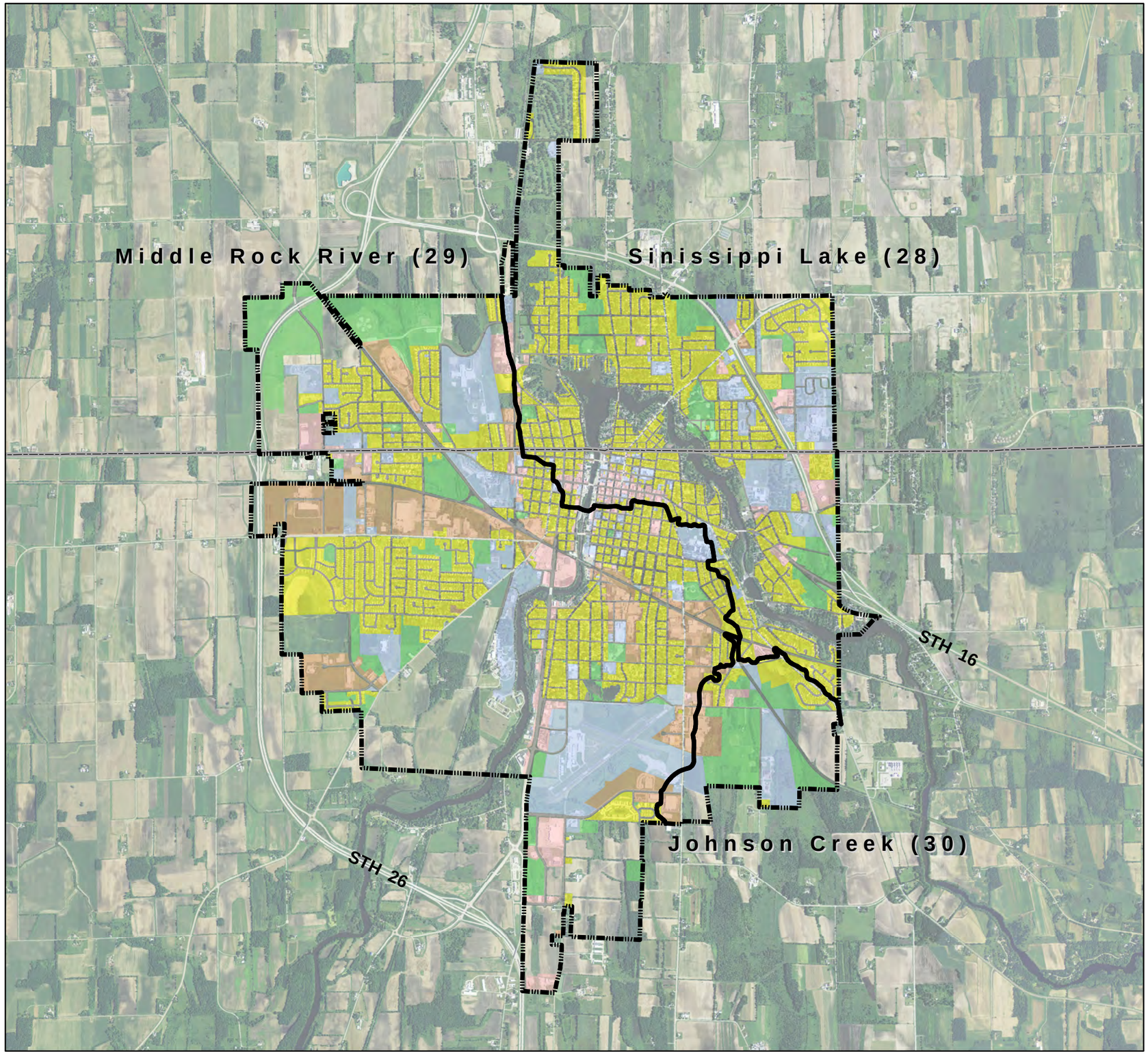
Topography and Surface Drainage Patterns

As already noted, the City of Watertown is located completely within the Upper Rock River watershed, with most of the City draining via storm sewer or directly to the Rock River. Drainage basins for the storm water planning effort were carried forward from the 2006 analysis and updated as appropriate to reflect recent drainage system modifications.

Soil Conditions, Geology and Depth to Bedrock

The geologic conditions of an area, including depth to bedrock and depth to the groundwater table, are important considerations in any storm water management system planning effort. The glacial deposits throughout the planning area are generally relatively shallow and there are significant areas of shallow bedrock and bedrock outcrop, primarily in the northwest quadrant of the City. The overlying soils typically fall within hydrologic soil groups "B" and "C". The City generally has poor to moderate suitability for on-site infiltration, with areas of concern primarily due to high groundwater and bedrock levels.

The City is also located in an area of generally shallow depths to the groundwater table. The groundwater reservoir provided by the glacial till deposits and underlying undifferentiated limestone bedrock formations is the source of supply for the municipal wells used within the City as a source of potable water.



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Existing Land Use Map
Exhibit 2

Legend

- Residential
- Commercial
- Institutional
- Industrial
- Parks and Open Space
- Transportation
- Watertown Boundary - City Limits
- Reachshed Boundary

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Existing Storm Water Management System and Water Quality BMPs

The existing storm water management system within the City of Watertown consists of a network of pipes, inlets, catch basins, detention ponds, culverts, drainage ditches and associated overland flow paths. The location and configuration of this system is shown on Exhibit 3. The system consists of approximately 17 wet detention ponds (5 of which also have infiltration components) and 20 dry detention ponds.

The City of Watertown is acutely aware of the need to protect the valuable natural resource base located throughout the planning area while also complying with their MS4 storm water discharge permit. To reach this goal, the City is actively involved in numerous best management practices designed at protecting water quality. The current activities include:

- The City owns two vacuum street sweepers and sweeping is typically completed every 4 weeks through the entire City. Waste from these sweepers is disposed via landfill.
- The City collects leaves and brush pickup monthly. Leaves and brush are disposed of at the City's compost site along Boomer Street.
- Existing storm water facilities are inspected on a semi-regular basis, and maintenance is completed as needed.
- City staff administers an erosion control and storm water management program (including permits) following Chapter 20 of their Municipal Code.
- The City of Watertown is a member of the public information, education and involvement program administered through the Rock River Storm Water Group.
- The City completes an annual illicit discharge inspection program. This program is expected to be updated following WDNR's illicit discharge guidance.
- The City does not have a routine catch basin cleaning program. Instead, catch basins are cleaned on an as-needed basis.

Existing Conditions Water Quality Modeling

The updated water quality analysis was completed using the Source Loading and Management Model (WinSLAMM, Version 10.1). Land use was based on the City's existing GIS land use database, updated to reflect recent development. The multitude of land use codes within the City were synthesized down to align with the model's more general categories. Parameter files for WinSLAMM were used following WDNR's guidance, including use of the 1980-85 Madison rainfall data which has been determined by WDNR to be representative of a typical period of rainfall within the City of Watertown.

To more accurately replicate the City's existing development and build-out patterns, "real world" land use information was analyzed for commercial, industrial, institutional and residential land uses. This information was developed by reviewing five representative samples located throughout the City of each land use and measuring the average acreage found in each component category (e.g. rooftops, streets, sidewalk, etc.). This information was compared against the default land use breakdowns in WinSLAMM and the standard land use files within the model that were closest to the measured representations were utilized (medium industrial,

strip commercial, downtown commercial, miscellaneous institutional, medium density residential and open space).

All areas within the municipal boundary were included within the water quality model with the exception of the following areas:

- Lands zoned for agricultural use and currently being utilized as such.
- Riparian areas that directly drain to waters of the state without passing through the City's MS4.
- State and County highways that are not maintained by the City.

These excluded areas can be seen as the areas without land use overlays on Exhibit 2.

All storm water facilities were included in the existing condition model, regardless of ownership. The City recognizes that they will need to enforce maintenance provisions on those facilities which it does not own.

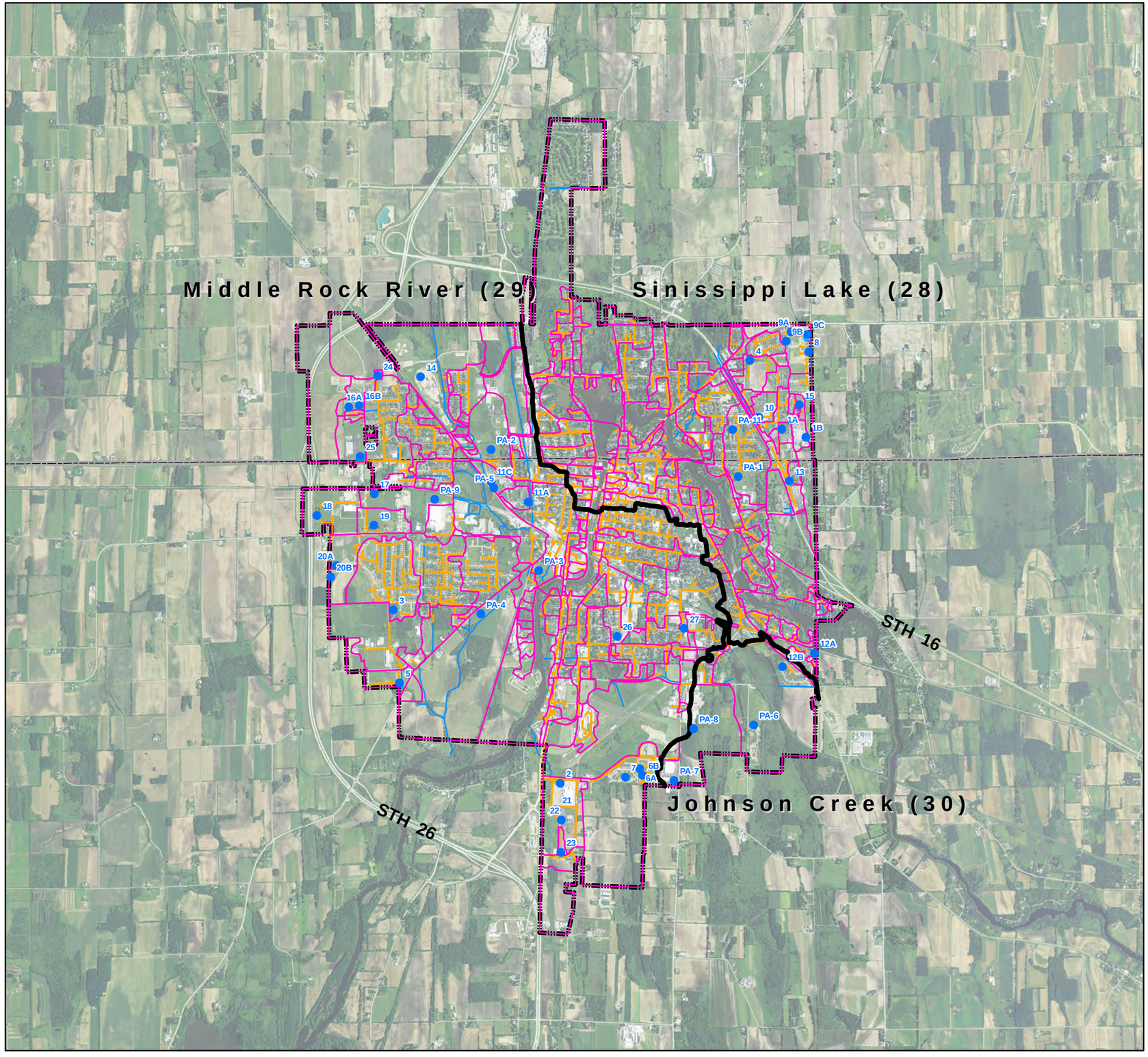
In-field infiltration testing was completed on the Benton Street grass swale on November 4, 2014. The results from these tests were used in place of the default infiltration rates for the corresponding grass swale facility. The measured rate of 4.5 inches per hour resulted in a modeled dynamic infiltration rate of 2.25 inches per hour. The detailed infiltration field test reports can be found in the Appendix.

Infiltration rates for the two sets of infiltration facilities in the City (West Side Industrial Park and Welsh Road) were based off soil boring and field test data that is available upon request.

It should be noted that the pollutant loading reduction shown on the Appendix tables associated with the existing dry ponds is reflective of the existing street sweeping within the contributing land uses. The dry ponds themselves do not provide any reduction to pollutant loadings.

The WinSLAMM model calculated the probable pollutant loadings under existing land use conditions with no storm water controls and again with existing storm water controls (street sweeping, grass swales, detention ponds, infiltration facilities, etc). The existing conditions model was developed to take advantage of the model's ability to consider best management practices in series. The results of the modeling are summarized on Table 2.

The difference in these two simulations yields the City's current pollutant reduction. The pollutant loadings are given in pounds and are equal to the amount of that pollutant that may be expected to runoff from the area concerned over the course of a year. Generally, pollutant loadings increase when the amount of critical land use (industrial, commercial, high density residential, governmental, institutional, and highways) increases; the length of curb increases; the length of grass swales decreases; the number of times catch basins are cleaned decreases; and the number of times streets are swept decreases. With the construction of best management practices, particulate solids loadings may be expected to decrease for the drainage areas that are tributary to the control measures.



Existing Storm Water Management System
Exhibit 3

Legend

- Storm Water Facility
- Ditch
- Storm Sewer
- Drainage Areas
- Watertown Boundary - City Limits
- Reachshed Boundary

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Table 2 – Summary of Annual Pollutant Loadings Under Existing Conditions

Reachshed	Area (acres)	Total Suspended Solids (TSS)				Total Phosphorus (P)			
		TSS Loading – No Controls (Pounds)	TSS Loading – With Controls (Pounds)	Actual TSS Reduction	Required TSS Reduction Per TMDL	Phosphorus Loading – No Controls (Pounds)	Phosphorus Loading – With Controls (Pounds)	Actual Phosphorus Reduction	Required Phosphorus Reduction Per TMDL
Sinissippi Lake (#28)	1784	520,237	454,914	12.56%	40%	1,697	1,560	8.09%	28%
Middle Rock River (#29)	3586	1,260,870	1,045,950	17.05%	44%	3,391	3,000	11.53%	64%
Johnson Creek (#30)	420	121,912	109,807	9.93%	40%	331	307	7.13%	27%
Overall	5790	1,903,019	1,610,671	15.36%	--	5,419	4867	10.18%	--

CHAPTER 4 -- ALTERNATIVE PLANS

The goal of the Clean Water Act, the corresponding Total Maximum Daily Load Studies, and Chapters NR 151 and 216 of the Wisconsin Administrative Code is to reduce pollutant loads carried by storm water runoff to waters of the State. Pollutants may be generated in all areas of land use, and include decomposing materials such as leaves deposited in the gutters and storm sewers, fertilizers and pesticides, heavy metals from automobiles, rooftops, and buildings; and pet litter and animal waste. These pollutants create water quality problems that not only affect the look, feel and smell of the surface waters, but also the health and safety of plants, animals and people that come in contact with the polluted waters.

As noted in Table 2, the existing storm water controls are not sufficient to meet the goals set forth in the Rock River TMDL and the City's MS4 storm water permit. To help move the City closer to compliance, alternative nonpoint source pollutant abatement measures were evaluated on the basis of the ability to comply with the City's TMDL/MS4 permit requirements and the specific needs of the receiving waterways. To the extent feasible, the water quality control measures considered were combined with other City goals such as pedestrian walkability or public education, to provide multiple benefits to a single water quality facility while also minimizing costs.

As previously described, the Source Loading and Management Model (WinSLAMM Version 10.1) was used to estimate average annual pollutant loadings under existing land use conditions with no control measures and existing control measures (consisting of monthly street sweeping and maintenance of 37 storm water detention facilities). A summary of the probable annual pollutant loadings under existing land use and both no control measures and existing control measures, organized by reachshed, is set forth in Table 3. In addition, the table presents estimated reductions for certain additional alternative control measures considered. The alternatives are presented graphically on Exhibit 4.

Sinissippi Lake Reachshed (#28)

This reachshed encompasses the northeastern portion of the City of Watertown and includes most of the City's downtown corridor. Based on the existing storm water controls, this reachshed is currently experiencing a 12.6% reduction in total suspended solids (versus a 40% TMDL goal) and an 8.1% reduction in sediment (versus a 28% TMDL goal). Two street sweeping alternatives, seven pond retrofit alternatives and construction of two new facilities were analyzed. As the wet ponds within this reachshed generally performed well, no improvements to those facilities were reviewed.

Street Sweeping Alternatives – Sinissippi Lake Reachshed

Under the schedule currently in effect within the City of Watertown, all City roadways are swept every four weeks using high efficiency vacuum sweeping equipment. With a sweeping cost estimated at $100 per mile, the existing annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation are approximately $33,300. The resulting 50 year present worth would approximate $658,000. Two street sweeping alternatives were considered to provide additional pollutant reductions.

Table 3 – Summary of Alternative BMPs for Sinissippi Lake Reachshed (#28)

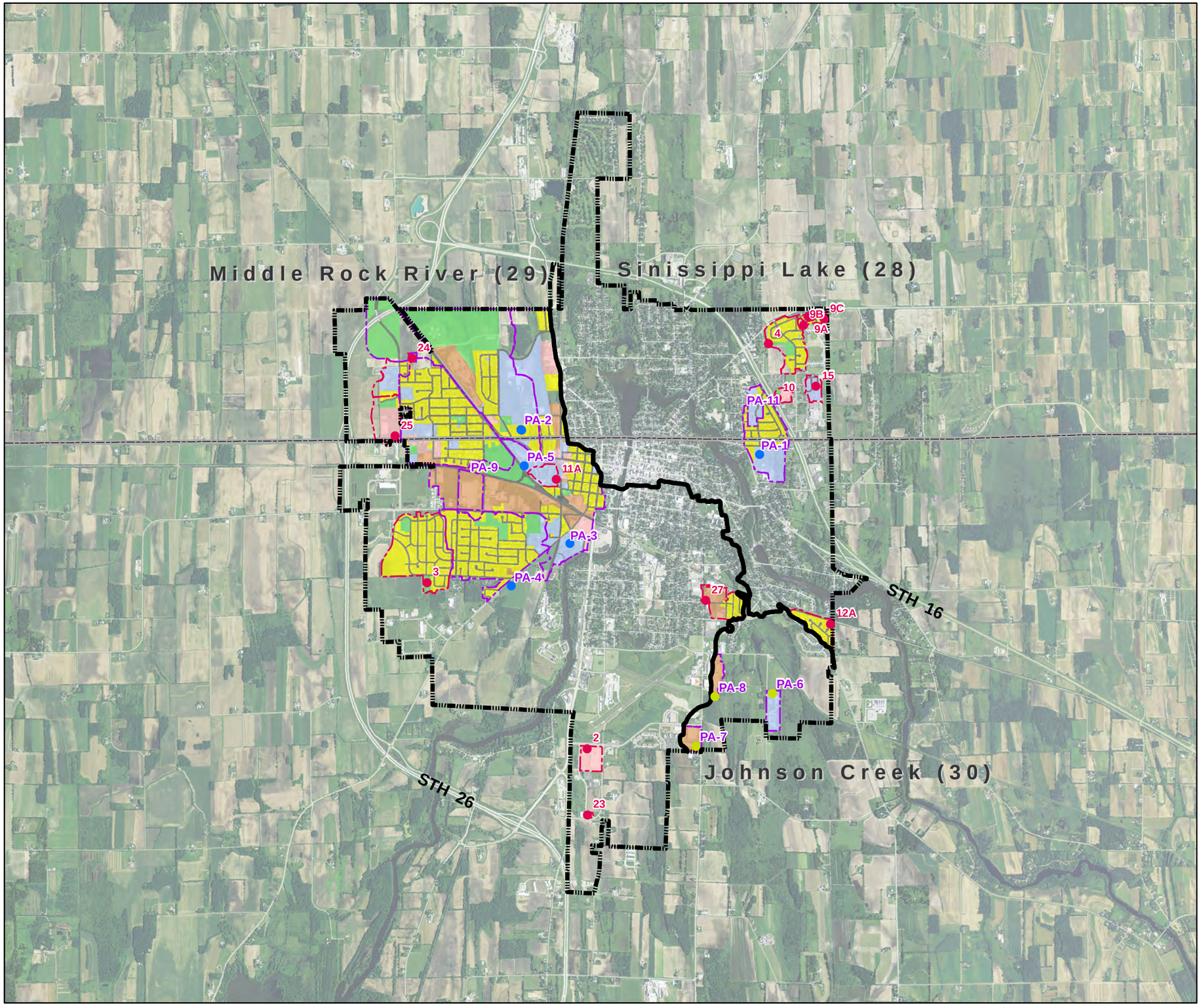
Control Measure	Total Suspended Solids (Pounds)		Total Phosphorus (Pounds)		Estimated Project Cost (Structural BMP) or Annual Cost (Sweeping)	Estimated 50 Year Present Worth	Cost Per Pound of Pollutant Removal	
	Existing Land Use	Reduction from No Controls	Existing Land Use	Reduction from No Controls			Total Suspended Solids	Phosphorus
No Controls (Total City Loading)	520,237	0%	1,697	0%	N/A	N/A	N/A	N/A
Existing Storm Water Controls	65,323	12.56%	137	8.07%	N/A	N/A	N/A	N/A
Street Sweeping Every 2 Weeks Throughout City	7,180	1.38%	22.0	1.30%	$66,600	$1,316,150	$183.31	$59,825.00
Street Sweeping Every Week Throughout City	28,753	5.53%	67.0	3.95%	$133,200	$2,632,300	$91.55	$39,288.06
Retrofit Dry Pond #4 as Wet Pond	6,600	1.27%	16.6	0.98%	$98,750	$228,100	$34.56	$13,707.93
Retrofit Dry Pond #9A as Biofiltration Facility	856	0.16%	2.7	0.16%	$50,625	$61,500	$71.85	$22,445.26
Retrofit Dry Pond #9B as Biofiltration Facility	683	0.13%	1.7	0.10%	$10,500	$14,950	$21.89	$9,006.02
Retrofit Dry Pond #9C as Biofiltration Facility	131	0.03%	0.4	0.02%	$13,300	$20,200	$154.20	$48,095.24
Retrofit Dry Pond #10 as Wet Pond	2,328	0.45%	5.5	0.32%	$26,250	$47,700	$20.49	$8,704.38
Retrofit Dry Pond #12A as Wet Pond	2,801	0.54%	6.0	0.35%	$23,750	$58,300	$20.81	$9,798.32
Retrofit Dry Pond #15 as Wet Pond	3,185	0.61%	6.8	0.40%	$20,000	$42,800	$13.44	$6,322.01
Construct New Wet Pond #PA-1	22,031	4.23%	52.0	3.06%	$1,287,025	$1,445,600	$65.62	$27,800.00
Construct New BMPs #PA-11 (Marquardt Village)	1,710	0.33%	0.6	0.04%	By Others	By Others	$0.00	$0.00

Table 3 – Summary of Alternative BMPs for Middle Rock River Reachshed (#29)

Control Measure	Total Suspended Solids (Pounds)		Total Phosphorus (Pounds)		Estimated Project Cost (Structural BMP) or Annual Cost (Sweeping)	Estimated 50 Year Present Worth	Cost Per Pound of Pollutant Removal	
	Existing Land Use	Reduction from No Controls	Existing Land Use	Reduction from No Controls			Total Suspended Solids	Phosphorus
No Controls (Total City Loading)	1,260,869	0%	3,391	0%	N/A	N/A	N/A	N/A
Existing Storm Water Controls	214,916	17.05%	390	11.50%	N/A	N/A	N/A	N/A
Street Sweeping Every 2 Weeks Throughout City	26,153	2.07%	46.0	1.36%	$133,200	$2,632,300	$100.65	$57,223.91
Street Sweeping Every Week Throughout City	71,108	5.64%	127.0	3.75%	$266,400	$5,264,600	$74.04	$41,453.54
Retrofit Dry Pond #2 as Biofiltration Facility	8,126	0.64%	18.6	0.55%	$326,100	$395,300	$48.65	$21,309.97
Retrofit Dry Pond #3 as Wet Pond	18,423	1.46%	37.7	1.11%	$292,500	$545,650	$29.62	$14,465.80
Retrofit Dry Pond #11A as Wet Pond	4,420	0.35%	6.5	0.19%	$21,250	$48,900	$11.06	$7,477.06
Retrofit Dry Pond #23 as Biofiltration Facility	576	0.05%	1.6	0.05%	$158,750	$193,300	$335.59	$119,320.99
Retrofit Dry Pond #24 as Wet Pond	6,030	0.48%	11.7	0.34%	$373,125	$480,300	$79.65	$41,121.58
Retrofit Dry Ponds #25A and 25B as Biofiltration Facility	6,984	0.55%	17.5	0.52%	$218,450	$312,300	$44.72	$17,845.71
Retrofit Dry Pond #27 as Biofiltration Facility	1,557	0.12%	0.0	0.00%	$433,625	$500,600	$321.52	--
Construct New Wet Pond #PA-2	81,580	6.47%	164.0	4.84%	$2,616,250	$2,971,000	$36.42	$18,115.85
Construct New Wet Pond #PA-3 (Stand Alone With PA-3 Acreage Only)	166,803	13.23%	299.3	8.83%	$3,603,750	$3,993,100	$23.94	$13,339.68
Construct New Wet Pond #PA-3 (Stand Alone With PA-2, PA-3 and PA-5 Acreage)	216,748	17.19%	415.8	12.26%	$3,603,750	$3,993,100	$18.42	$9,603.42
Construct New Wet Pond #PA-3 (In Series With PA-2 and PA-5)	288,039	22.84%	574.8	16.95%	$8,048,750	$9,043,800	$31.40	$15,733.82
Construct New Wet Pond #PA-4	43,563	3.45%	117.0	3.45%	$1,603,750	$1,820,150	$41.78	$15,556.84
Construct New Wet Pond #PA-5	63,244	5.02%	151.0	4.45%	$1,828,750	$2,079,700	$32.88	$13,772.85
Construct New BMPs #PA-9 (Pepsi)	15,888	1.26%	20.3	0.60%	By Others	By Others	$0.00	$0.00

Table 3 – Summary of Alternative BMPs for Johnson Creek Reachshed (#30)

Control Measure	Total Suspended Solids (Pounds)		Total Phosphorus (Pounds)		Estimated Project Cost (Structural BMP) or Annual Cost (Sweeping)	Estimated 50 Year Present Worth	Cost Per Pound of Pollutant Removal	
	Existing Land Use	Reduction from No Controls	Existing Land Use	Reduction from No Controls			Total Suspended Solids	Phosphorus
No Controls (Total City Loading)	121,912	0%	331	0%	N/A	N/A	N/A	N/A
Existing Storm Water Controls	12,105	9.93%	24	7.25%	N/A	N/A	N/A	N/A
Street Sweeping Every 2 Weeks Throughout City	1,759	1.44%	4.0	1.21%	$16,200	$320,150	$182.01	$80,037.50
Street Sweeping Every Week Throughout City	6,110	5.01%	12.0	3.63%	$32,400	$640,300	$104.80	$53,358.33
Construct New Biofiltration Facility #PA-6	7,159	5.87%	15.0	4.53%	$197,200	$221,400	$30.93	$14,760.00
Construct New Biofiltration Facility #PA-7	7,174	5.88%	10.0	3.02%	$247,200	$271,400	$37.83	$27,140.00
Construct New Biofiltration Facility #PA-8	6,804	5.58%	9.0	2.72%	$186,750	$208,500	$30.64	$23,166.67



CITY OF Watertown WISCONSIN

Alternative Storm Water Quality Facilities
Exhibit 4

Legend

- Potential New Biofiltration Facilities
- Potential New Wet Detention Facilities
- Drainage Area - Potential New Facilities
- Drainage Area - Retrofit of Existing Storm Water Facilities
- Watertown Boundary - City Limits
- Reachshed Boundary

Existing Land Use

- Residential
- Commercial
- Institutional
- Industrial
- Parks and Open Space
- Transportation

N
W E
S

0 2,000 4,000 8,000 12,000

Feet

Date: December 2014

Ruekert·Mielke

It should be noted that there are significant seasonal variations in street sweeping efficiencies. During the summer months, approximately 80 percent of the sediment load is found within 3 feet of the curb, where street sweepers are designed to operate. In the spring, when sediment loads are the heaviest, sediment loads are spread more evenly across the entire street cross section. Weekly street sweeping efficiency can range from a low of approximately 30 percent during the spring, to a high of approximately 80 percent during the summer as measured by mass removal from the street surface. The street sweeping calculations performed using the Source Loading and Management Model include these seasonal variations. The street sweeping alternatives were also calculated independently of any other proposed improvements. If street sweeping is increased in areas that drain to other storm water facilities, the benefits of the increased sweeping may be lessened.

The first alternative would consist of increasing the schedule of sweeping throughout the entire City to once every 2 weeks. This alternative would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 1.38% sediment reduction and an additional 1.30% phosphorous reduction. With a sweeping cost of $100 per mile, this alternative may be expected to increase the annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation from $33,300 to $66,600 The resulting 50 year present worth would approximate $1,316,150 or $183 per pound of additional sediment removed and $59,800 per pound of additional phosphorous removed.

The second alternative would consist of increasing the schedule of sweeping throughout the entire City to once every week. This alternative would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 5.53% sediment reduction and an additional 3.95% phosphorous reduction. With a sweeping cost of $100 per mile, this alternative may be expected to increase the annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation from $33,300 to $133,200. The resulting 50 year present worth would approximate $2,632,300, or $92 per pound of additional sediment removed and $39,300 per pound of additional phosphorous removed.

The modeling has shown that more frequent street sweeping dramatically increases the cost, while only providing minimal further sediment reductions. As a result, no additional street sweeping options were pursued.

Retrofit Existing Dry Ponds – Sinissippi Lake Reachshed

This series of alternatives would consist of retrofitting seven existing dry ponds to provide improved water quality benefits. Facilities were retrofit as either wet ponds or biofiltration devices, depending on site specific circumstances. The locations of these ponds, numbered 4, 9A, 9B, 9C, 10, 12A and 15, are shown on Exhibit 4 and example cross sections of the retrofit alternatives can be found in the Appendix.

- Retrofit Dry Pond #4 (Grandview Heights Park) as Wet Pond: This alternative involves the retrofit of the existing dry pond #4 as a wet pond located northwest of Grandview Heights Park and south of Windsor Circle. Under this alternative, this facility would be designed to increase the sediment reduction performance from 11% under existing conditions to 66% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 1.27% sediment reduction and an additional 0.98% phosphorous reduction. As proposed, this

facility would have a project cost approximating $98,750, a present worth approximating $228,100 and a present worth of $35 per additional pound of sediment removed.

- Retrofit Dry Pond #9A (Schuman Drive North) as Biofiltration Facility: This alternative involves the retrofit of the existing dry pond #9A as a biofiltration facility located east of the Schuman Drive / Wedgewood Drive intersection. Under this alternative, this facility would be designed to increase the sediment reduction performance from 13% under existing conditions to 88% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.16% sediment reduction and an additional 0.16% phosphorous reduction. As proposed, this facility would have a project cost approximating $50,625, a present worth approximating $61,500 and a present worth of $72 per additional pound of sediment removed.

- Retrofit Dry Pond #9B (Schuman Drive South) as Biofiltration Facility: This alternative involves the retrofit of the existing dry pond #9B as a biofiltration facility located east of the Schuman Drive and south of Wedgewood Drive extended. Under this alternative, this facility would be designed to increase the sediment reduction performance from 11% under existing conditions to 64% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.13% sediment reduction and an additional 0.10% phosphorous reduction. As proposed, this facility would have a project cost approximating $10,500, a present worth approximating $14,950 and a present worth of $22 per additional pound of sediment removed.

- Retrofit Dry Pond #9C (Kimberly Court) as Biofiltration Facility: This alternative involves the retrofit of the existing dry pond #9C as a biofiltration facility located west of Kimberly Court. Under this alternative, this facility would be designed to increase the sediment reduction performance from 14% under existing conditions to 89% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.03% sediment reduction and an additional 0.02% phosphorous reduction. As proposed, this facility would have a project cost approximating $13,300, a present worth approximating $20,200 and a present worth of $154 per additional pound of sediment removed.

- Retrofit Dry Pond #10 (Piggly Wiggly) as Wet Pond: This alternative involves the retrofit of the existing dry pond #10 as a wet pond located west of the Piggly Wiggly parking lot and north of Memorial Drive. Under this alternative, this facility would be designed to increase the sediment reduction performance from 11% under existing conditions to 62% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.45% sediment reduction and an additional 0.32% phosphorous reduction. As proposed, this facility would have a project cost approximating $26,250, a present worth approximating $47,700 and a present worth of $20 per additional pound of sediment removed.

- Retrofit Dry Pond #12A (Canadian Court) as Wet Pond: This alternative involves the retrofit of the existing dry pond #12A as a wet pond located north of Canadian Court. Under this alternative, this facility would be designed to increase the sediment reduction performance from 11% under existing conditions to 58% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit

would equate to an additional 0.54% sediment reduction and an additional 0.35% phosphorous reduction. As proposed, this facility would have a project cost approximating $23,750, a present worth approximating $58,300 and a present worth of $21 per additional pound of sediment removed.

- Retrofit Dry Pond #15 (Homestead Lane) as Wet Pond: This alternative involves the retrofit of the existing dry pond #15 as a wet pond located east of Homestead Lane. Under this alternative, this facility would be designed to increase the sediment reduction performance from 9% under existing conditions to 57% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.61% sediment reduction and an additional 0.40% phosphorous reduction. As proposed, this facility would have a project cost approximating $20,000, a present worth approximating $42,800 and a present worth of $13 per additional pound of sediment removed.

New Storm Water Quality Control Facilities - Sinissippi Lake Reachshed

Well-maintained storm water quality control facilities, including but not limited to wet ponds, artificial wetlands, infiltration basins, bioretention / biofiltration facilities and rain gardens are an effective way to reduce pollutant loadings in a watershed. Typically, the area contributing to these facilities may benefit by 80 to 100 percent reductions in the annual loadings of sediment and 40 to 100 percent reductions in phosphorus.

Regional storm water facilities are constructed and operated with significant efficiency advantages over individual onsite facilities. Based on these benefits, the City of Watertown will pursue the implementation of regional facilities wherever practical. Construction costs for regional facilities are generally borne by the City, although these costs may be charged back to developers and landowners that contribute or benefit from the facility.

This series of alternatives would consist of constructing two new wet detention facilities to provide improved water quality benefits. The locations of these ponds, numbered PA-1 and PA-11 are shown on Exhibit 4.

- Riverside Middle School Wet Pond (PA-1): This alternative involves construction of a wet pond on the campus of Riverside Middle School (south of Boughton Street and east or west of Hall Street), identified as PA-1 on Exhibit 4. The land is currently owned by the Watertown Unified School District. Under this alternative, this facility would be designed to reduce the sediment loadings in the contributing area (84 acres) by 81%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 4.23% sediment reduction and an additional 3.06% phosphorous reduction. As proposed, this facility would have a project cost approximating $1,287,025, a present worth approximating $1,445,600 and a present worth of $66 per additional pound of sediment removed.

  If facility PA-1 were located west of Hall Street, potential wetland, floodplain and environmental corridor concerns should be evaluated with WDNR prior to proceeding with this alternative. Based on available mapping, these environmental concerns would not impact a site located east of Hall Street.

By locating the facility near a school, the City could potentially work with the school and incorporate maintenance and/or educational components of the facility into the school's curriculum. This would also benefit the information and education components of the City's MS4 storm water permit.

- Marquardt Village BMPs (PA-11): This alternative involves reconstruction of the Marquardt Village senior living center along Highland Avenue and Hill Street, identified as PA-11 on Exhibit 4. The project is currently underway as of the date of this planning effort and pollutant reduction values were taken directly from the owner's storm water management plan. Under this alternative, this facility would be designed to reduce the sediment loadings in the contributing area (14 acres) by 54%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 0.33% sediment reduction and an additional 0.04% phosphorous reduction. There would be no cost to this alternative, as the project is being funded by the property owners.

Middle Rock River Reachshed (#29)

This reachshed encompasses the western portion of the City of Watertown, including the airport and the commercial corridor along Highway 26. Based on the existing storm water controls, this reachshed is currently experiencing a 17.1% reduction in total suspended solids (versus a 44% TMDL goal) and an 11.5% reduction in sediment (versus a 64% TMDL goal). Two street sweeping alternatives, seven pond retrofit alternatives and construction of five new wet ponds were analyzed. As the wet ponds within this reachshed generally performed well, no improvements to those facilities were reviewed.

Street Sweeping Alternatives – Middle Rock River Reachshed

Under the schedule currently in effect within the City of Watertown, all City roadways are swept every four weeks using high efficiency vacuum sweeping equipment. With a sweeping cost estimated at $100 per mile, the existing annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation are approximately $66,600. The resulting 50 year present worth would approximate $1,316,150. Two street sweeping alternatives were considered to provide additional pollutant reductions.

The first street sweeping alternative would consist of increasing the schedule of sweeping throughout the entire City to once every 2 weeks. This alternative would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 2.07% sediment reduction and an additional 1.36% phosphorous reduction. With a sweeping cost of $100 per mile, this alternative may be expected to increase the annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation from $66,600 to $133,200. The resulting 50 year present worth would approximate $2,632,300, or $101 per pound of additional sediment removed and $57,200 per pound of additional phosphorous removed.

The second alternative would consist of increasing the schedule of sweeping throughout the entire City to once every week. This alternative would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 5.64% sediment reduction and an additional 3.75% phosphorous reduction. With a sweeping cost of $100 per mile, this alternative may be expected to increase the annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation from $66,600 to

$266,400. The resulting 50 year present worth would approximate $5,264,600, or $74 per pound of additional sediment removed and $41,500 per pound of additional phosphorous removed.

The modeling has shown that more frequent street sweeping dramatically increases the cost, while only providing minimal further sediment reductions. As a result, no additional street sweeping options were pursued.

Retrofit Existing Dry Ponds – Middle Rock River Reachshed

This series of alternatives would consist of retrofitting seven existing dry ponds to provide improved water quality benefits. Facilities were retrofit as either wet ponds or biofiltration devices, depending on site specific circumstances. The locations of these ponds, numbered 2, 3, 11A, 23, 24, 25A/B and 27, are shown on Exhibit 4 and example cross sections of the retrofit alternatives can be found in the Appendix.

- Retrofit Dry Pond #2 (Wal-Mart) as Biofiltration Facility: This alternative involves the retrofit of the existing dry pond #2 as a biofiltration facility located west of Wal-Mart and south of Air Park Drive. Under this alternative, this facility would be designed to increase the sediment reduction performance from 10% under existing conditions to 79% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.64% sediment reduction and an additional 0.55% phosphorous reduction. As proposed, this facility would have a project cost approximating $326,100, a present worth approximating $395,300 and a present worth of $49 per additional pound of sediment removed.

- Retrofit Dry Pond #3 (Belmont Drive) as Wet Pond: This alternative involves the retrofit of the existing dry pond #3 as a wet pond located southwest of the Belmont Drive / Shamrock Lane intersection. Under this alternative, this facility would be designed to increase the sediment reduction performance from 11% under existing conditions to 73% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 1.46% sediment reduction and an additional 1.11% phosphorous reduction. As proposed, this facility would have a project cost approximating $292,500, a present worth approximating $545,650 and a present worth of $30 per additional pound of sediment removed.

- Retrofit Dry Pond #11A (Maranatha East) as Wet Pond: This alternative involves the retrofit of the existing dry pond #11A as a wet pond located on the eastern edge of Maranatha's campus. Under this alternative, this facility would be designed to increase the sediment reduction performance from 9% under existing conditions to 62% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.35% sediment reduction and an additional 0.19% phosphorous reduction. As proposed, this facility would have a project cost approximating $21,250, a present worth approximating $48,900 and a present worth of $11 per additional pound of sediment removed.

- Retrofit Dry Pond #23 (Fastenal) as Biofiltration Facility: This alternative involves the retrofit of the existing dry pond #23 as a biofiltration facility located at the Fastenal building at the northeast corner of Market Way and Gateway Drive. Under this alternative, this facility would be designed to increase the sediment reduction

performance from 10% under existing conditions to 97% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.05% sediment reduction and an additional 0.05% phosphorous reduction. As proposed, this facility would have a project cost approximating $158,750, a present worth approximating $193,300 and a present worth of $336 per additional pound of sediment removed.

- Deepen Wet Pond #24 (Welsh Road North): This alternative involves the deepening of the existing wet pond #24 located north of the northern terminus of Old Settlement Drive and east of Welsh Road. Under this alternative, this facility would be designed to increase the sediment reduction performance from 11% under existing conditions to 71% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.48% sediment reduction and an additional 0.34% phosphorous reduction. As proposed, this facility would have a project cost approximating $373,125, a present worth approximating $480,300 and a present worth of $80 per additional pound of sediment removed. Bedrock is anticipated at this location, leading to the higher construction costs.

- Retrofit Constructed Wetlands #25A and 25B (Welsh Road South / Farm & Fleet) as Biofiltration Facilities: This alternative involves the retrofit of the existing constructed wetlands #25A/B as biofiltration facilities located northwest of the Main Street / Welsh Road intersection. Under this alternative, the facilities would be designed to increase the sediment reduction performance from 47% under existing conditions to 92% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.55% sediment reduction and an additional 0.52% phosphorous reduction. As proposed, this facility would have a project cost approximating $218,450, a present worth approximating $312,300 and a present worth of $45 per additional pound of sediment removed.

- Retrofit Dry Pond #27 (Mary Street East) as Biofiltration Facility: This alternative involves the retrofit of the existing dry pond #27 as a biofiltration facility located northeast of the Mary Street / 12th Street intersection. This facility performs in series with pond 26. Under this alternative, this facility would be designed to increase the sediment reduction performance of the overall system (ponds 26 and 27) from 81% under existing conditions to 85% within the contributing drainage area. When analyzed on a reachshed basis and compared to no controls, the retrofit would equate to an additional 0.12% sediment reduction and only minimal additional phosphorous reduction. As proposed, this facility would have a project cost approximating $433,625, a present worth approximating $500,600 and a present worth of $322 per additional pound of sediment removed.

New Storm Water Quality Control Facilities – Middle Rock River Reachshed

This series of alternatives would consist of constructing five new wet detention facilities to provide improved water quality benefits. The locations of these ponds, numbered PA-2, PA-3, PA-4, PA-5 and PA-9 are shown on Exhibit 4.

- Watertown High School Wet Pond (PA-2): This alternative involves construction of a wet pond on the south end of Watertown High School's campus (north of Division Street, west of Freemont Street), identified as PA-2 on Exhibit 4. The facility could potentially

be located on land owned by the High School, or immediately to the south on land currently owned by Maranatha. Under this alternative, this facility would be designed to reduce the sediment loadings in the contributing area (411 acres) by 82%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 6.47% sediment reduction and an additional 4.84% phosphorous reduction. As proposed, this facility would have a project cost approximating $2,616,250, a present worth approximating $2,971,000 and a present worth of $36 per additional pound of sediment removed.

By locating the facility near a school, the City could potentially work with the school and incorporate maintenance and/or educational components of the facility into the school's curriculum. This would also benefit the information and education components of the City's MS4 storm water permit.

A ditch / potential navigable stream may be located west of this alternative. Given the potential location of this waterway, further discussion with WDNR is advised before proceeding with this alternative to verify that runoff from the contributing area can feasibly be directed into the facility.

- Bethesda Wet Pond (PA-3): This alternative involves construction of a wet pond on land currently owned by Bethesda Lutheran Homes (bound by Bernard Street, Milford Street, Fairview Drive and Hoffman Road), identified as PA-3 on Exhibit 4. This facility could either be constructed in series with alternative facilities PA-2 and PA-5 or as a standalone facility.

  If constructed as a standalone facility with only drainage area PA-3 contributing to it (499 acres), this facility would be designed to reduce the sediment loadings in the contributing area runoff by 71%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 13.23% sediment reduction and an additional 8.83% phosphorous reduction.

  If constructed as a standalone facility with drainage areas PA-2, PA-3 and PA-5 contributing to it (1233 acres), this facility would be designed to reduce the sediment loadings in the contributing area runoff by 52%. When analyzed on a reachshed basis and compared to no controls, the larger drainage area contributing to the new facility would equate to an additional 17.19% sediment reduction and an additional 12.26% phosphorous reduction.

  If constructed in series with facilities PA-2 and PA-5 (with the full 1233 acres draining to it), the combination of these three facilities would reduce the sediment loadings in the contributing area runoff by 69%. When analyzed on a reachshed basis and compared to no controls, the combination of these 3 new facilities would equate to an additional 22.84% sediment reduction and an additional 16.95% phosphorous reduction.

  As proposed, this facility (standalone) would have a project cost approximating $3,603,750, a present worth approximating $3,993,100 and a present worth of $18 to $31 per additional pound of sediment removed.

  A ditch / potential navigable stream may be located in the vicinity of this alternative. Given the potential location of this waterway, further discussion with WDNR is advised

before proceeding with this alternative to verify that runoff from the contributing area can feasibly be directed into the facility.

- Milford Street Wet Pond (PA-4): This alternative involves construction of a wet pond on land currently owned by Bethesda Lutheran Homes. The potential site is located east of the intersection of South and Milford Streets and is identified as PA-4 on Exhibit 4. Under this alternative, this facility would be designed to reduce the sediment loadings in the contributing area (228 acres) by 81 percent. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 3.45% sediment reduction and an additional 3.45% phosphorous reduction. As proposed, this facility would have a project cost approximating $1,603,750, a present worth approximating $1,820,150 and a present worth of $42 per additional pound of sediment removed.

  A ditch / potential navigable stream may be located in the vicinity of this alternative. Given the potential location of this waterway, further discussion with WDNR is advised before proceeding with this alternative to verify that runoff from the contributing area can feasibly be directed into the facility.

- Maranatha Wet Pond (PA-5): This alternative involves construction of a wet pond on land currently owned by Maranatha. The potential site is located south of Main Street, east of Dayton Street and either east or west of the railroad tracks. It is identified as PA-5 on Exhibit 4. Under this alternative, this facility would be designed to reduce the sediment loadings in the contributing area (283 acres) by 77 percent. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 5.02% sediment reduction and an additional 4.45% phosphorous reduction. As proposed, this facility would have a project cost approximating $1,828,750, a present worth approximating $2,079,700 and a present worth of $33 per additional pound of sediment removed.

  Facility PA-5 would be located around numerous environmental resources potentially including wetlands, floodplain, environmental corridor and a navigable waterway. Given those concerns, further discussion with WDNR is advised before proceeding with this alternative.

- Pepsi / Wis-Pak BMPs (PA-9): This alternative involves addition of a storm water facility to the Wis-Pak site located at 860 West Street, identified as PA-9 on Exhibit 4. At the time of this planning effort, the property owners were moving forward with design of additional water quality best management practices on the site. Under this alternative, this facility would be designed to reduce the sediment loadings in the contributing area (34 acres) by 80%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 1.26% sediment reduction and an additional 0.60% phosphorous reduction. There would be no cost to this alternative, as the project is being funded by the property owners, although there will be a corresponding reduction on the owner's storm water utility bill.

Johnson Creek Reachshed (#30)

This reachshed encompasses the southeastern portion of the City of Watertown. Based on the existing storm water controls, this reachshed is currently experiencing a 9.9% reduction in total suspended solids (versus a 40% TMDL goal) and an 7.1% reduction in sediment (versus a 27% TMDL goal). Two street sweeping alternatives and construction of three new wet ponds were analyzed. As the wet pond within this reachshed generally performed well, no improvements to that facility was reviewed.

Street Sweeping Alternatives – Johnson Creek Reachshed

Under the schedule currently in effect within the City of Watertown, all City roadways are swept every four weeks using high efficiency vacuum sweeping equipment. With a sweeping cost estimated at $100 per mile, the existing annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation are approximately $8,100. The resulting 50 year present worth would approximate $160,100. Two street sweeping alternatives were considered to provide additional pollutant reductions.

The first street sweeping alternative would consist of increasing the schedule of sweeping throughout the entire City to once every 2 weeks. This alternative would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 1.44% sediment reduction and an additional 1.21% phosphorous reduction. With a sweeping cost of $100 per mile, this alternative may be expected to increase the annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation from $8,100 to $16,200. The resulting 50 year present worth would approximate $320,150, or $182 per pound of additional sediment removed and $80,000 per pound of additional phosphorous removed.

The second alternative would consist of increasing the schedule of sweeping throughout the entire City to once every week. This alternative would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 5.01% sediment reduction and an additional 3.63% phosphorous reduction. With a sweeping cost of $100 per mile, this alternative may be expected to increase the annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation from $8,100 to $32,400. The resulting 50 year present worth would approximate $640,300, or $105 per pound of additional sediment removed and $53,400 per pound of additional phosphorous removed.

The modeling has shown that more frequent street sweeping dramatically increases the cost, while only providing minimal further sediment reductions. As a result, no additional street sweeping options were pursued.

New Storm Water Quality Control Facilities – Johnson Creek Reachshed

This series of alternatives would consist of constructing three new wet detention facilities to provide improved water quality benefits. The locations of these ponds, numbered PA-6, PA-7 and PA-8, are shown on Exhibit 4.

- City Compost Site Biofiltration Facility (PA-6): This alternative involves construction of a biofiltration facility on the north end of the Watertown compost site / pet exercise park (east of Boomer Street), identified as PA-6 on Exhibit 4. The facility would be located on land owned by the City of Watertown. Under this alternative, this facility would be

designed to reduce the sediment loadings in the contributing area (19 acres) by 81%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 5.87% sediment reduction and an additional 4.53% phosphorous reduction. As proposed, this facility would have a project cost approximating $197,200, a present worth approximating $221,400 and a present worth of $31 per additional pound of sediment removed.

- Symbol Mattress Biofiltration Facility (PA-7): This alternative involves construction of a biofiltration facility on the east end of the Symbol Mattress site (east of 12th Street), identified as PA-7 on Exhibit 4. Under this alternative, this facility would be designed to reduce the sediment loadings in the contributing area (16 acres) by 81%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 5.88% sediment reduction and an additional 3.02% phosphorous reduction. As proposed, this facility would have a project cost approximating $247,200, a present worth approximating $271,400 and a present worth of $38 per additional pound of sediment removed.

- Baso Gas Biofiltration Facility (PA-8): This alternative involves construction of a biofiltration facility on the south end of property immediately south of the Baso Gas property (east of 12th Street and south of Boomer Street), identified as PA-8 on Exhibit 4. The facility would be located on land owned by the City of Watertown. Under this alternative, this facility would be designed to reduce the sediment loadings in the contributing area (15 acres) by 80%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 5.58% sediment reduction and an additional 2.72% phosphorous reduction. As proposed, this facility would have a project cost approximating $186,750, a present worth approximating $208,500 and a present worth of $31 per additional pound of sediment removed.

Catch Basin Cleaning

Under the schedule currently in effect within the City of Watertown, catch basins are cleaned as needed, resulting in minimal pollutant reductions. Since the water quality modeling guidance published by the Department does not allow communities to take credit for both street sweeping and catch basin cleaning and minimal pollutant reductions, no changes to the existing cleaning schedule were analyzed. Catch basins should still be maintained, as needed, to prevent the resuspension of trapped sediment.

Impacts of Future Development / Storm Water Ordinance Updates

The densely developed urban sections of the City of Watertown have seen a recent uptick in redevelopment. It can be reasonably assumed that 0.5% of each reachshed will redevelop in any given year. With the City's current storm water ordinance requiring 40% sediment control during all significant redevelopments, redevelopment activities may be expected to improve sediment loadings by approximately 0.20% annually. The City's current ordinance is silent on phosphorous control for redevelopment scenarios.

The City may desire to revise their ordinance to a level more stringent than current WDNR regulations. If the redevelopment ordinance was modified to require 80% sediment control and 50% phosphorous control, redevelopment activities may be expected to improve sediment loadings by approximately 0.40% annually and phosphorous loadings by approximately 0.25%

annually. While there would be no direct cost to the City for these modifications, the more stringent ordinances would increase developer costs and likely dissuade certain redevelopment activities.

Similarly, the City may desire to revise their new development ordinance to require something above 80% sediment control and also require a to-be-determined level of phosphorous control on new development sites.

Water Quality Trading and Adaptive Management

The Wisconsin Department of Natural Resources has developed pollutant trading and adaptive management programs to allow permit holders implement another option to meet their pollutant allocations and regulatory goals. While the programs are somewhat similar, there are several key differentiators:

- Pollutants: Water quality trading can be used to comply with a range of pollutants, whereas adaptive management focuses on compliance with phosphorus water quality based effluent limitations (WQBELs) solely.

- Adaptive management and trading have different end goals: Adaptive management focuses on achieving water quality criterion for phosphorus in the surface water; trading focuses on offsetting phosphorus (or other pollutants) from a discharge to comply with a permit limit.

- Monitoring: Because adaptive management focuses on water quality improvements, in-stream monitoring is required under adaptive management; this is not required under trading.

- Timing: Practices used to generate reductions in a trading strategy must be established before the phosphorus limit takes affect; adaptive management is a watershed project that can be implemented throughout the permit term.

- Quantifying reductions needed: Trading requires trade ratios be used to quantify reductions used to offset a permit limit; the reductions needed for adaptive management are based on the receiving water, not the effluent, and trade ratios are not necessary in this calculation.

- Eligibility: Adaptive management and trading have different eligibility.

It should be noted that the Watertown Wastewater Treatment Facility (WWTF) has preliminarily indicated that they may have excess pollutant credit available, allowing them to more easily meet their NR 217 phosphorous limits and/or their TMDL allocations. As a component of compliance, it will likely be desirable to work with the WWTF to ascertain the availability of potential pollutant credits.

Although a detailed analysis of pollutant trading and adaptive management was beyond the scope of this planning effort, it is recommended that the City investigate the applicability of both potential compliance options.

Economic Evaluation

It is customary to evaluate plans for water resource development projects on the basis of benefits and costs. This is particularly appropriate if the prospective development represents opportunities for investments to provide economic return to the public and if a comparison of alternative investments is desirable. In the case of storm water management systems, however, it is assumed that such systems must be provided to fulfill a fundamental need of the community, and consequently, they do not compete with alternatives of investment in other economic sectors. Accordingly, it is assumed that the least costly alternative system that meets the storm water management objectives set forth in this plan will be the most desirable alternative economically.

The economic evaluations conducted under this storm water management planning program include capital cost estimates and annual operation and maintenance cost estimates. Capital costs include construction contract costs plus engineering, inspection and contract administration costs, were estimated on the basis of experience within the greater Milwaukee / Madison area and are expressed in December, 2014 actual dollars.

CHAPTER 5 – RECOMMENDED PLAN

The preparation of the recommended storm water management system plan for the City of Watertown involved a synthesis of corrective measures selected from among the alternatives considered and described in Chapter Four and based primarily upon a comparative economic analysis. In the selection, however, consideration was also given to the level of performance provided, to the anticipated ease of construction, to potential environmental impacts and to fulfillment with other City objectives.

The recommended corrective measures within the City were prioritized, and a capital improvement program developed on the basis of this prioritization and estimates of potentially available funding. Following formal adoption of the recommended plan by the City of Watertown, realization of the plan will require a long-term commitment to the objectives of the plan, and a high degree of coordination and cooperation among City officials and staff, Wisconsin Department of Natural Resources staff, developers and concerned citizens.

The systems-level storm water management plan presented in this report is intended to serve as a guide to the future design and construction of storm water management facilities. Detailed engineering design should examine in greater depth and detail potential variations in the technical, economic and environmental features of the recommended solutions identified in the system plan in order to determine the best means of carrying out the plan. The resulting facility development plans, however, should be fully consistent with the system plan recommendations presented in this report.

The recommended plan encompasses the entire City of Watertown but is broken down by reachshed to match the TMDL pollutant allocations. The recommended plan is presented in summary form on Table 4 based on December, 2014 actual dollars and is graphically summarized on Exhibit 5. The plan recommendations for new facilities are shown in greater detail on Exhibits 6 through 12.

Compliance with Total Maximum Daily Load Pollutant Allocations

It is clear that compliance with the City's TMDL allocations will be challenging to achieve, but should not be considered impossible. It will require creative thinking, innovation, patience and collaboration will all stakeholders (neighboring governmental agencies, regulatory agencies, the development community, public officials, residents, staff, etc). It will also require incredible diligence from City of Watertown staff to champion the City's new storm water program.

The recommendation presented herein shall not be considered absolute. As technology and regulations change, the plan will need to be periodically updated. That said, the current plan will allow the City to begin their compliance journey with a clear picture of the initial steps, and an understanding of the journey the City is about to embark on.

Table 4 – Prioritization of Recommended Storm Water Management Improvements

Sinissippi Lake Reachshed (#28)

Priority	Control Measure	Total Suspended Solids (Pounds)		Total Phosphorus (Pounds)		Estimated Project Cost (Structural BMP) or Annual Cost (Sweeping)	Estimated 50 Year Present Worth	Cost Per Pound of Pollutant Removal	
		Existing Land Use	Reduction from No Controls	Existing Land Use	Reduction from No Controls			Total Suspended Solids	Phosphorus
1	Update SW Ordinances and Promote Redevelopment	0.40% Annually		0.25% Annually		-	-	-	-
2	Marquardt Village Reconstruction (PA-11)	1,710	0.33%	0.6	0.04%	By Others	By Others	$0	$0
3	Street Sweeping Every Week	28,753	5.53%	67.0	3.95%	$133,200	$2,632,300	$92	$39,288
4	Retrofit Dry Pond #15 As Wet Pond (Homestead Ln.)	3,185	0.61%	6.8	0.40%	$20,000	$42,800	$13	$6,322
5	Retrofit Dry Pond #10 As Wet Pond (Piggly Wiggly)	2,328	0.45%	5.5	0.32%	$26,250	$47,700	$20	$8,704
6	Retrofit Dry Pond #12A As Wet Pond (Canadian Ct.)	2,801	0.54%	6.0	0.35%	$23,750	$58,300	$21	$9,798
7	Retrofit Dry Pond #9B As Biofiltration Facility (Schuman Drive South)	683	0.13%	1.7	0.10%	$10,500	$14,950	$22	$9,006
8	Retrofit Dry Pond #4 As Wet Pond (Grandview Heights Park)	6,600	1.27%	16.6	0.98%	$98,750	$228,100	$35	$13,708
9	Construct New Wet Pond PA-1 (Riverside Middle School)	22,031	4.23%	52.0	3.06%	$1,287,025	$1,445,600	$66	$27,800
10	Retrofit Dry Pond #9A As Biofiltration Facility (Schuman Drive North)	856	0.16%	2.7	0.16%	$50,625	$61,500	$72	$22,445
11	Retrofit Dry Pond #9C As Biofiltration Facility (Kimberly Court)	131	0.03%	0.4	0.02%	$13,300	$20,200	$154	$48,095
	SINISSIPPI LAKE REACHSHED TOTALS	**69,078**	**13.28%**	**159.3**	**9.38%**	**$1,663,400**	**$4,551,450**	**$66**	**$28,572**

Table 4 – Prioritization of Recommended Storm Water Management Improvements

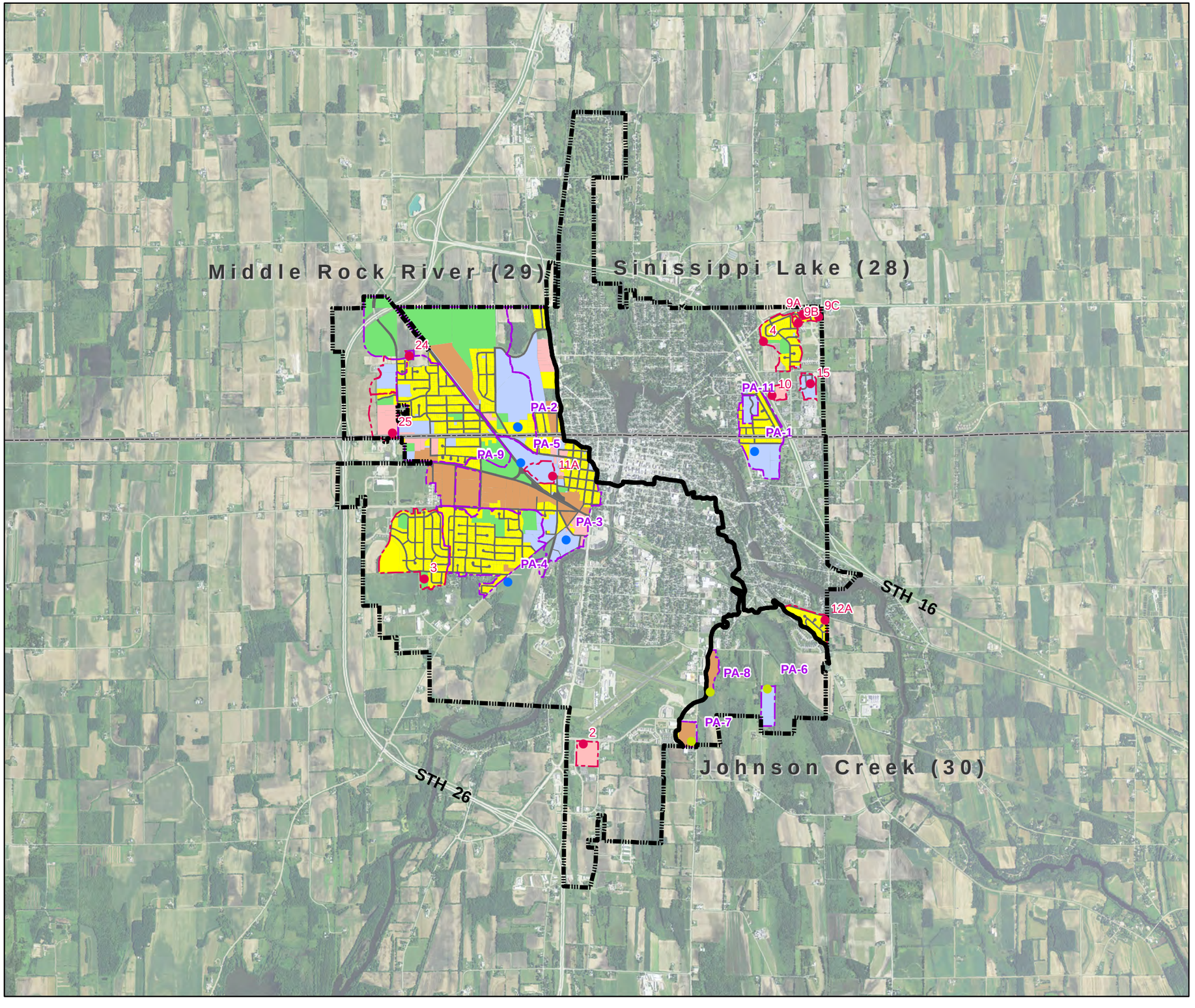
Middle Rock River Reachshed (#29)

Priority	Control Measure	Total Suspended Solids (Pounds)		Total Phosphorus (Pounds)		Estimated Project Cost (Structural BMP) or Annual Cost (Sweeping)	Estimated 50 Year Present Worth	Cost Per Pound of Pollutant Removal	
		Existing Land Use	Reduction from No Controls	Existing Land Use	Reduction from No Controls			Total Suspended Solids	Phosphorus
1	Update SW Ordinances and Promote Redevelopment	0.40% Annually		0.25% Annually		-	-	-	-
2	Pepsi / Wis-Pak BMPs (PA-9)	15,888	1.26%	20.3	0.60%	By Others	By Others	$0	$0
3	Street Sweeping Every Week	71,108	5.64%	127.0	3.75%	$266,400	$5,264,600	$74	$41,454
4	Retrofit Dry Pond #11A As Wet Pond (Maranatha East)	4,420	0.35%	6.5	0.19%	$21,250	$48,900	$11	$7,477
5	Retrofit Dry Pond #3 As Wet Pond (Belmont Drive)	18,423	1.46%	37.7	1.11%	$292,500	$545,650	$30	$14,466
6	Construct New Wet Ponds PA-2, PA-3 and PA-5 In Series (High School, Bethesda, Maranatha)	288,039	22.84%	574.8	16.95%	$8,048,750	$9,043,800	$31	$15,734
7	Construct New Wet Pond PA-4 (Milford Street)	43,563	3.45%	117.0	3.45%	$1,603,750	$1,820,150	$42	$15,557
8	Retrofit Dry Pond #25A/B As Biofiltration Facility (Welsh Road South / Farm & Fleet)	6,984	0.55%	17.5	0.52%	$218,450	$312,300	$45	$17,846
9	Retrofit Dry Pond #2 As Biofiltration Facility (Wal-Mart)	8,126	0.64%	18.6	0.55%	$326,100	$395,300	$49	$21,310
10	Retrofit Dry Pond #24 As Wet Pond (Welsh Road North)	6,030	0.48%	11.7	0.34%	$373,125	$480,300	$80	$41,122
MIDDLE ROCK RIVER REACHSHED TOTALS		**462,581**	**36.67%**	**931.1**	**27.46%**	**$11,150,325**	**$17,911,000**	**$39**	**$19,236**

Table 4 – Prioritization of Recommended Storm Water Management Improvements

Johnson Creek Reachshed (#30)

Priority	Control Measure	Total Suspended Solids (Pounds)		Total Phosphorus (Pounds)		Estimated Project Cost (Structural BMP) or Annual Cost (Sweeping)	Estimated 50 Year Present Worth	Cost Per Pound of Pollutant Removal	
		Existing Land Use	Reduction from No Controls	Existing Land Use	Reduction from No Controls			Total Suspended Solids	Phosphorus
1	Update SW Ordinances and Promote Redevelopment	0.40% Annually		0.25% Annually		-	-	-	-
2	Street Sweeping Every Week	6,110	5.01%	12.0	3.63%	$32,400	$640,300	$105	$53,358
3	Construct New Biofiltration Facility PA-6 (Compost Site)	7,159	5.87%	15.0	4.53%	$197,200	$221,400	$31	$14,760
4	Construct New Biofiltration Facility PA-8 (Baso Gas)	6,804	5.58%	9.0	2.72%	$186,750	$208,500	$31	$23,167
5	Construct New Biofiltration Facility PA-7 (Symbol Mattress)	7,174	5.88%	10.0	3.02%	$247,200	$271,400	$38	$27,140
JOHNSON CREEK REACHSHED TOTALS		**27,247**	**22.34%**	**46.0**	**13.90%**	**$663,550**	**$1,341,600**	**$49**	**$29,165**



CITY OF Watertown WISCONSIN

Recommended Plan
Exhibit 5

Legend

- Recommended New Biofiltration Facilities
- Recommended New Wet Detention Facilities
- Drainage Area - Recommended New Facilities
- Drainage Area - Retrofit of Existing Storm Water Facilities
- Watertown Boundary - City Limits
- Reachshed Boundary

Existing Land Use

- Residential
- Commercial
- Institutional
- Industrial
- Parks and Open Space
- Transportation

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Feet

Date: December 2014

Ruekert·Mielke

Recommended Plan – Sinissippi Lake Reachshed (#28)

The City of Watertown is currently obtaining a 12.56% reduction in total suspended solids loading and an 8.07% reduction in phosphorous within the Sinissippi Lake Reachshed based on the existing storm water controls currently in place. The recommended plan summarized below moves the City to a 25.84% reduction in total suspended solids loading and a 17.45% reduction in phosphorous; which is still significantly below the 40% sediment and 28% phosphorous reduction TMDL goals.

Street Sweeping Recommendations – Sinissippi Lake Reachshed

Under the schedule currently in effect, all City roadways are swept every 4 weeks using high efficiency vacuum sweeping equipment at an annual cost of approximately $33,300, including labor, benefits, equipment, operation, maintenance and depreciation.

The recommended street sweeping schedule consists of sweeping the entire City once every week, focusing on the critical land uses. This recommendation would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 5.53% sediment reduction and an additional 3.95% phosphorous reduction. With a sweeping cost of $100 per mile, this recommendation is expected to increase the annual street sweeping costs to $133,200.

It is also recommended that alternative street sweeping technologies be evaluated as they are developed for application throughout the City. These technologies will likely include more efficient street sweepers and the application of polymers to the roadways prior to sweeping. The City should also continue to track the sweeping routes completed and the debris collected throughout the City for inclusion in their annual report.

Dry Pond Retrofit Recommendations – Sinissippi Lake Reachshed

Seven retrofits of existing dry ponds are recommended. The retrofits are prioritized based on cost per pound of sediment removed, although construction of these facilities will likely also be dictated by maintenance needs in the associated ponds. Each of the proposed dry pond retrofit recommendations would need to be reviewed for hydraulic performance prior to construction to verify no adverse impact on the neighboring properties. Details of the recommended retrofits are provided on Table 4.

In total, the retrofits will provide a pollutant loading reduction in the reachshed of an additional 3.19% sediment reduction and an additional 2.33% phosphorous reduction. The facility retrofits would have a project cost approximating $243,175.

New Storm Water Facility Recommendations – Sinissippi Lake Reachshed

Two new storm water quality facilities are recommended within this reachshed.

- Riverside Middle School Wet Pond (PA-1): This facility, labeled PA-1 on Exhibit 5 and shown in more detail on Exhibit 6, would be a wet pond on the campus of Riverside Middle School (south of Boughton Street and east or west of Hall Street). This facility would be approximately 4 acres in size and would reduce total suspended solids from the 84 acre contributing drainage area by 81%. This facility would require land acquisition, as the property is currently owned by the Watertown Unified School District.

When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 4.23% sediment reduction and an additional 3.06% phosphorous reduction. This facility would have a project cost approximating $1,287,025.

If facility PA-1 were located west of Hall Street, potential environmental concerns should be evaluated with WDNR prior to proceeding. Due to the proximity of this facility to the Rock River, floodplain, wetland, Chapter 30 permitting and other environmental considerations must be carefully evaluated and considered before and during detailed project design. Based on available mapping, these environmental concerns would not impact a site located east of Hall Street.

By locating the facility near a school, the City could potentially work with the school and incorporate maintenance and/or educational components of the facility into the school's curriculum. This would also benefit the information and education components of the City's MS4 storm water permit.

- Marquardt Village BMPs (PA-11): This facility, labeled PA-11 on Exhibit 5, involves reconstruction of the Marquardt Village senior living center along Highland Avenue and Hill Street. The project is currently underway as of the date of this study and pollutant reduction values were taken directly from the owner's storm water management plan. This facility would reduce total suspended solids from the new roads and parking areas within the 14 acre contributing drainage area by 54%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 0.33% sediment reduction and an additional 0.04% phosphorous reduction. There would be no cost to this alternative, as the project is being funded by the property owners.

Recommended Plan – Middle Rock River Reachshed (#29)

The City of Watertown is currently obtaining a 17.05% reduction in total suspended solids loading and an 11.50% reduction in phosphorous within the Middle Rock River Reachshed based on the existing storm water controls currently in place. The recommended plan summarized below moves the City to a 53.72% reduction in total suspended solids loading and a 38.96% reduction in phosphorous, which is above the 44% TMDL sediment reduction goal but significantly below the 64% phosphorous reduction TMDL goal.

Street Sweeping Recommendations – Middle Rock River Reachshed

The recommended street sweeping schedule consists of sweeping the entire City once every week, focusing on the critical land uses. This recommendation would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 5.64% sediment reduction and an additional 3.75% phosphorous reduction. With a sweeping cost of $100 per mile, this recommendation is expected to increase the annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation, to $266,400.

Dry Pond Retrofit Recommendations – Middle Rock River Reachshed

Five retrofits of existing dry ponds are recommended. The retrofits are prioritized based on cost per pound of sediment removed, although construction of these facilities will likely also be dictated by maintenance needs in the associated ponds. Each of the proposed dry pond retrofit

recommendations would need to be reviewed for hydraulic performance prior to construction to verify no adverse impact on the neighboring properties. Details of the recommended retrofits are provided on Table 4.

In total, the retrofits will provide a pollutant loading reduction in the reachshed of an additional 3.48% sediment reduction and an additional 2.71% phosphorous reduction. The facility retrofits would have a project cost approximating $1,231,425.

New Storm Water Facility Recommendations – Middle Rock River Reachshed

Five new storm water quality facilities are recommended within this reachshed.

- Watertown High School Wet Pond (PA-2), Bethesda Wet Pond (PA-3) and Maranatha Wet Pond (PA-5): These three wet ponds (summarized below), labeled PA-2, PA-3 and PA-5 on Exhibit 5 and shown in more detail on Exhibits 7 and 8, would be constructed in series such that the ouflow from ponds PA-2 and PA-5 would drain into pond PA-3.

    - PA-2
        - Location: South end of Watertown High School campus.
        - Pond Size: Approximately 5.5 acres.
        - Land Ownership: Could be located either on property currently owned by the Watertown Unified School District or Maranatha.
        - Environmental Concerns: A ditch / potential navigable stream may be located west of this facility. Given the potential location of this waterway, further discussion with WDNR is advised to verify that the facility can be constructed as intended.
        - Approximate Project Cost: $2,616,250.

    - PA-3
        - Location: Area bound by Bernard Street, Milford Street, Fairview Drive and Hoffman Road.
        - Pond Size: Approximately 6 acres.
        - Land Ownership: Bethesda Lutheran Homes.
        - Environmental Concern: A ditch / potential navigable stream may be located in the vicinity of this facility. Given the potential location of this waterway, further discussion with WDNR is advised to verify that the facility can be constructed as intended.
        - Approximate Project Cost: $3,603,750.

    - PA-5
        - Location: South of Main Street, east of Dayton Street and either east or west of the railroad tracks.
        - Pond Size: Approximately 4 acres
        - Land Ownership: Maranatha.
        - Environmental Concerns: This facility would be located around numerous environmental resources potentially including wetlands, floodplain, environmental corridor and a navigable waterway. Given those concerns, further discussion with WDNR is advised before proceeding.
        - Approximate Project Cost: $1,828,750.

The combination of these three facilities would reduce the sediment loadings in the contributing area (1233 acres) by 69%. When analyzed on a reachshed basis and compared to no controls, the new facilities would equate to an additional 22.84% sediment reduction and an additional 16.95% phosphorous reduction. The combined facilities would have a project cost approximating $8,048,750.

Due to the proximity of facilities PA-2, PA-3 and PA-5 to numerous environmental resources, floodplain, wetland, Chapter 30 permitting and other environmental considerations must be carefully evaluated and considered prior to and during detailed project design.

By locating two of the facilities near schools, the City could potentially work with the schools and incorporate maintenance and/or educational components of the facility into the school's curriculum. This would also benefit the information and education components of the City's MS4 storm water permit.

- Milford Street Wet Pond (PA-4): This facility, labeled PA-4 on Exhibit 5 and shown in more detail on Exhibit 9, would be a wet pond located east of the intersection of South and Milford Streets. This facility would be approximately 3.5 acres in size and would reduce total suspended solids from the 228 acre contributing drainage area by 81%. This facility would require land acquisition, as the property is currently owned by the Bethesda Lutheran Homes. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 3.45% sediment reduction and an additional 3.45% phosphorous reduction. This facility would have a project cost approximating $1,603,750.

  As a ditch / potential navigable waterway may be located in the vicinity of this site, environmental concerns should be evaluated with WDNR prior to proceeding. In particular, floodplain, wetland, Chapter 30 permitting and other environmental considerations must be carefully evaluated and considered before and during detailed project design.

- Pepsi / Wis-Pak BMPs (PA-9): This facility, labeled PA-9 on Exhibit 5, involves addition of a storm water facility to the Wis-Pak site located at 860 West Street. At the time of this planning effort, the property owners were moving forward with design of additional water quality best management practices on the site. This facility would reduce total suspended solids from the 34 acre contributing drainage area by 80%. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 1.26% sediment reduction and an additional 0.60% phosphorous reduction. There would be no cost to this alternative, as the project is being funded by the property owners, although there will be a corresponding reduction on the owner's storm water utility bill.

Recommended Plan – Johnson Creek Reachshed (#30)

The City of Watertown is currently obtaining a 9.93% reduction in total suspended solids loading and a 7.25% reduction in phosphorous within the Johnson Creek Reachshed based on the existing storm water controls currently in place. The recommended plan summarized below moves the City to a 32.27% reduction in total suspended solids loading and a 21.15% reduction

in phosphorous; which is still significantly below the 40% sediment and 27% phosphorous reduction TMDL goals.

Street Sweeping Recommendations – Johnson Creek Reachshed

The recommended street sweeping schedule consists of sweeping the entire City once every week, focusing on the critical land uses. This recommendation would provide a pollutant loading reduction when compared to the current sweeping program in the reachshed of an additional 5.01% sediment reduction and an additional 3.63% phosphorous reduction. With a sweeping cost of $100 per mile, this recommendation is expected to increase the annual street sweeping costs, including labor, benefits, equipment, operation, maintenance and depreciation, to $32,400.

New Storm Water Facility Recommendations – Johnson Creek Reachshed

Three new storm water quality facilities are recommended within this reachshed.

- City Compost Site Biofiltration Facility (PA-6): This facility, labeled PA-6 on Exhibit 5 and shown in more detail on Exhibit 10, would be a biofiltration facility on the north end of the Watertown compost site / pet exercise park (east of Boomer Street). This facility would be approximately 1 acre in size and would reduce total suspended solids from the 19 acre contributing drainage area by 81%. This facility would not require land acquisition, as the property is currently owned by the City of Watertown. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 5.87% sediment reduction and an additional 4.53% phosphorous reduction. This facility would have a project cost approximating $197,200.

- Symbol Mattress Biofiltration Facility (PA-7): This facility, labeled PA-7 on Exhibit 5 and shown in more detail on Exhibit 11, would be a biofiltration facility on the east end of Symbol Mattress site (east of 12th Street). This facility would be approximately 1 acre in size and would reduce total suspended solids from the 16 acre contributing drainage area by 81%. This facility would require land acquisition, as the property is currently owned by a private owner. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 5.88% sediment reduction and an additional 3.02% phosphorous reduction. This facility would have a project cost approximating $247,200.

- Baso Gas Biofiltration Facility (PA-8): This facility, labeled PA-8 on Exhibit 5 and shown in more detail on Exhibit 12, would be a biofiltration facility on the south end of the property immediately south of Baso Gas property (east of 12th Street and south of Boomer Street). This facility would be approximately 1 acre in size and would reduce total suspended solids from the 15 acre contributing drainage area by 80%. This facility would not require land acquisition, as the property is currently owned by the City of Watertown. When analyzed on a reachshed basis and compared to no controls, the new facility would equate to an additional 5.58% sediment reduction and an additional 2.72% phosphorous reduction. This facility would have a project cost approximating $186,750.

Storm Water Ordinance Updates

As part of their MS4 storm water discharge permit, the City of Watertown is required to update their erosion control and storm water management ordinances to match NR 151 and NR 216 no later than May 1, 2016. To help move the City closer to compliance with the TMDL pollutant allocations, it is recommended that the City consider modifications to their ordinances beyond what is required by WDNR.

The densely developed urban sections of the City of Watertown have seen a recent uptick in redevelopment. It can be reasonably assumed that 0.5% of each reachshed will redevelop in any given year. With the City's current storm water ordinance requiring 40% sediment control during all significant redevelopments, redevelopment activities may be expected to improve sediment loadings by approximately 0.20% annually. The City's current ordinance is silent on phosphorous control for redevelopment scenarios. To maximize the potential water quality benefits of this development activity, the following modifications should be considered:

- Require that redevelopment sites provide 80% sediment control and 50% phosphorous control on the entire redevelopment site. This potential change may be expected to improve sediment loadings by approximately 0.40% annually and phosphorous loadings by approximately 0.25% annually. While there would be no direct cost to the City for these modifications, the more stringent ordinances would increase developer costs and likely dissuade certain redevelopment activities.

- Require that new development sites provide 90% sediment control and 40% to 60% phosphorous control.

Water Quality Trading and Adaptive Management

Although a detailed analysis of pollutant trading and adaptive management was beyond the scope of this planning effort, it is recommended that the City investigate the applicability of both potential compliance options.

It should be noted that the Watertown Wastewater Treatment Facility (WWTF) has preliminarily indicated that they may have excess pollutant credit available, allowing them to more easily meet their NR 217 phosphorous limits and/or their TMDL allocations. As a component of compliance, it will likely be desirable to work with the WWTF to ascertain the availability of potential pollutant credits.

Maintenance of Storm Water Quality Control Facilities

The City of Watertown is required to develop an inventory of each post-construction storm water management facility within the City and then complete annual inspections of each facility, including any required maintenance thereafter. If these inspections are not completed and the performance of the facilities verified, the City may stand to lose the pollutant reduction credit from the corresponding facilities, necessitating the need for construction of additional facilities to meet the sediment reduction permit requirements. Ruekert & Mielke completed initial inspections of the City's storm water facilities in November of 2008.

Most of the City's residential storm water facilities are located on outlots controlled by homeowner's associations and in common ownership with all subdivision property owners. The City of Watertown will need to determine whether maintenance responsibilities will remain with

the homeowners associations or if the City will take them over. If the associations remain in control, a significant amount of staff time will be expended coordinating and enforcing maintenance activities and there will be little assurance maintenance will be done uniformly or correctly throughout the City. Most of the City's commercial, industrial and institutional storm water facilities are located on land owned by the respective business owners and would face a similar decision.

For all storm water quality facilities, it is recommended that the City begin determination of which facilities hold valid maintenance agreements. Once this is understood, City staff can begin working with property owners to facilitate completion of the required maintenance activities until the above issue is resolved.

MS4 Permit Compliance

- Continue the existing public and City staff education, outreach and involvement programs to increase the awareness of storm water impacts on waters of the state. Measureable goals must be established, tracked and evaluated and the program must comply with at least the 8 specific requirements listed in the MS4 permit.
    - This program is ongoing with review and modifications at least once per year.
- Develop an illicit discharge detection and elimination program to locate and remove illegal connections to the City's storm sewer system. At a minimum, this program must include on-going dry weather field screening at all priority outfalls at least once per year, dry weather field screening at all other major (non-priority) outfalls at least once every five years, subsequent follow-up investigations if discharge is present, including removal of illicit connections and enforcement of the City's illicit discharge ordinance.
    - This program is ongoing. Modifications will be made as needed to complete priority outfall inspections every year and major, non-priority outfall inspections every five years.
- Enforce the City's construction site pollutant control ordinance, including plan review, permit issuance, compliance inspections and enforcement actions.
    - This program is ongoing. Updates will need to be made to the City's erosion control ordinance by May 1, 2016 to match recent changes to Chapters NR 151 and NR 216 of the Wisconsin Administrative Code.
- Enforce the City's post-construction storm water management ordinance, including plan review, maintenance inspections and enforcement actions.
    - This program is ongoing. Updates will need to be made to the City's storm water management ordinance by May 1, 2016 to match recent changes to Chapters NR 151 and NR 216 of the Wisconsin Administrative Code.
- Develop a pollution prevention program, including measureable goals, which includes the following:
    - Develop an inventory of all City owned or operated storm water management facilities.

  - Complete routine inspections (including any required maintenance) of each storm water management facility owned or operated by the City to maintain their pollutant removal operating efficiency.

  - Complete routine catch basin cleaning and street sweeping, including proper disposal. This plan may be modified if supported by further analysis and approved by the Department.

  - Revise the winter road deicing management plan to include contact information, truck routes, equipment descriptions, disposal locations, anti-icing and deicing strategies and actions, and monthly records of product used and weather data prior to March 31, 2016.

  - Proper collection and disposal of leaves, brush and grass clippings.

  - Develop a storm water pollution prevention plan for municipal garages, storage areas and other municipally-owned sources of storm water pollution prior to March 31, 2016. Complete annual full inspections of these facilities thereafter.

  - Development of site-specific nutrient application schedules for fertilizer applications on any City-controlled properties with more than 5 acres of pervious surface.

  - Consideration of environmentally sensitive land development designs for municipal projects, including green infrastructure and low impact development.

- Implement and maintain storm water management practices that were in place on or before July 1, 2011 to achieve a reduction in total suspended solids of at least 20%.

  - This program is ongoing.

- Maintain an updated storm sewer system map.

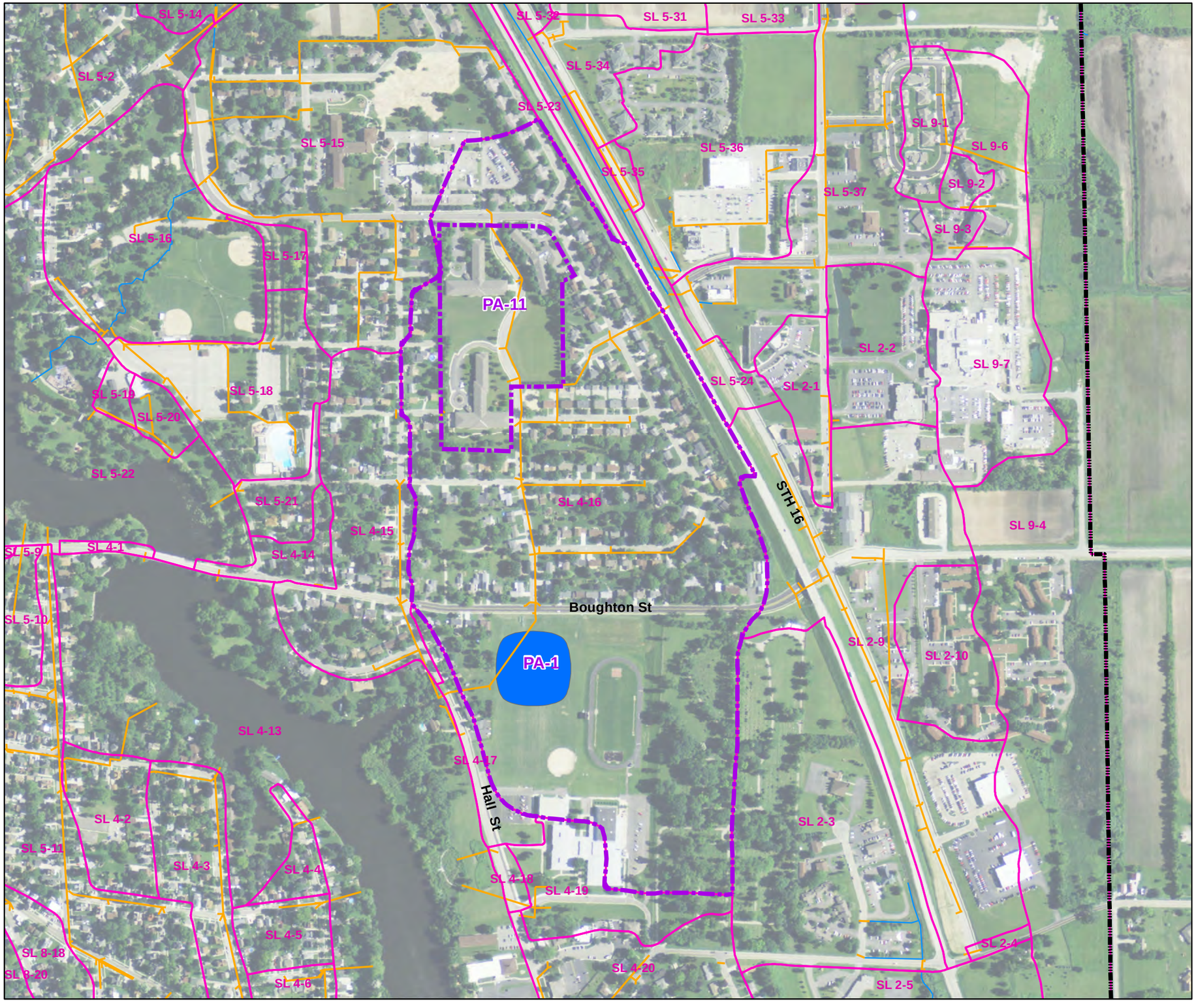
  - This program is ongoing.

- Complete an annual report evaluating the various storm water programs, documenting compliance with measureable goals and recommending program modifications.

  - Due March 31 of each year.

Plan Costs

The recommended storm water system plan for the City of Watertown has an estimated capital cost of $13.05 million, an increase in annual operation and maintenance costs of $117,560 and an increase in annual street sweeping costs of $324,000. Cost estimates for each recommended improvement are provided in the Appendix.



CITY OF Watertown WISCONSIN

Proposed Wet Detention Facility PA-1
Sinissippi Lake Reachshed
Exhibit 6

Legend

- Existing Ditch
- Existing Storm Sewer
- Water Quality Device Drainage Area
- Proposed Wet Detention Facility
- Drainage Areas
- Watertown Boundary - City Limits

N
W E
S

0 250 500 1,000 1,500
Feet

Date: December 2014

Ruekert·Mielke

CITY OF Watertown WISCONSIN

Proposed Wet Detention Facility
PA-3 (Stand Alone)
Middle Rock River Reachshed
Exhibit 7

Legend

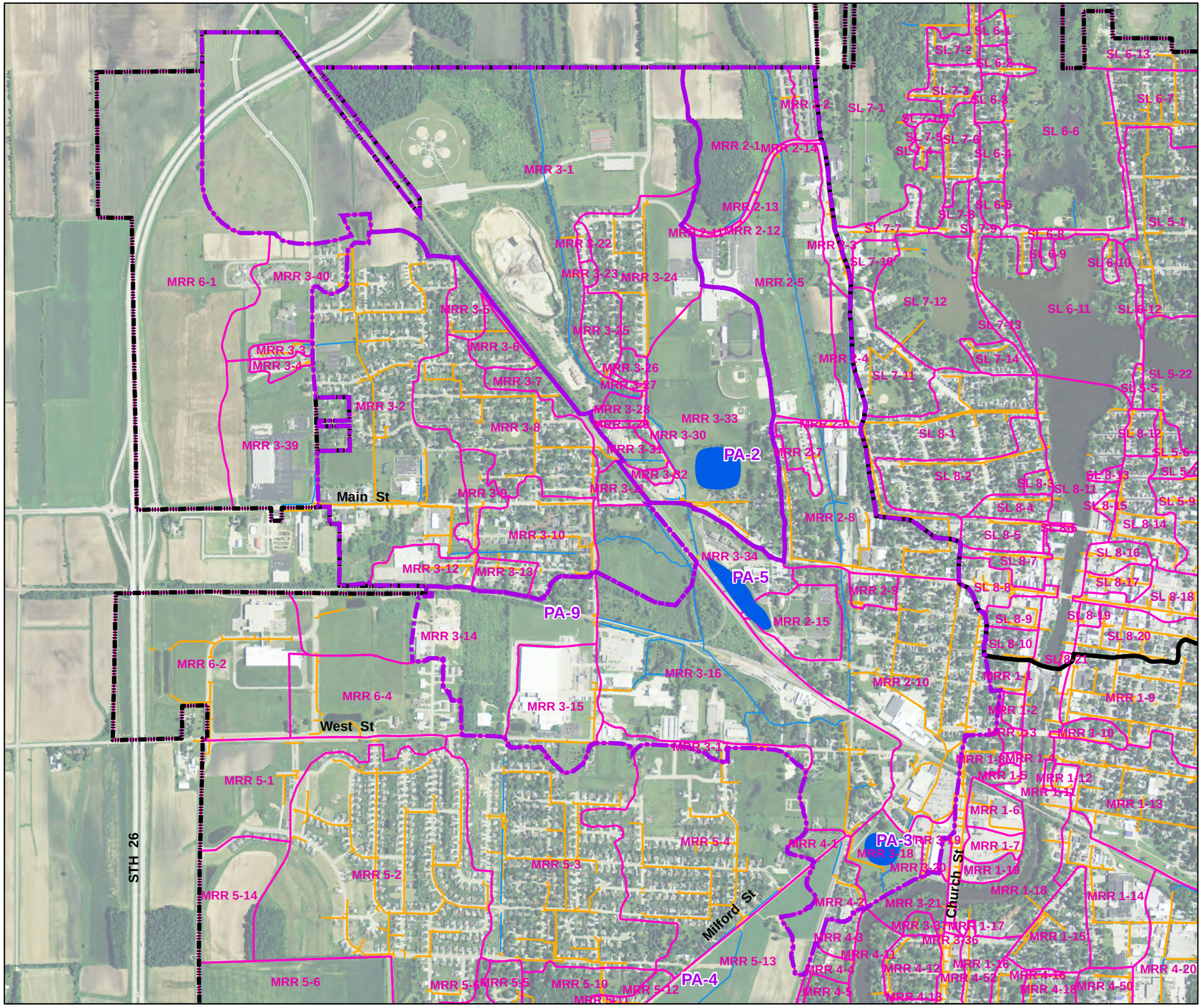
- Existing Ditch
- Existing Storm Sewer
- Water Quality Device Drainage Area
- Proposed Wet Detention Facility
- Drainage Areas
- Watertown Boundary - City Limits
- Reachshed Boundary

N
W E
S

0 600 1,200 2,400 3,600
Feet

Date: December 2014

Ruekert·Mielke



CITY OF Watertown WISCONSIN

Proposed Wet Detention Facilities PA-2, PA-3 and PA-5 (In Series) Middle Rock River Reachshed Exhibit 8

Legend

- Existing Ditch
- Existing Storm Sewer
- Water Quality Device Drainage Area
- Proposed Wet Detention Facility
- Drainage Areas
- Watertown Boundary - City Limits
- Reachshed Boundary

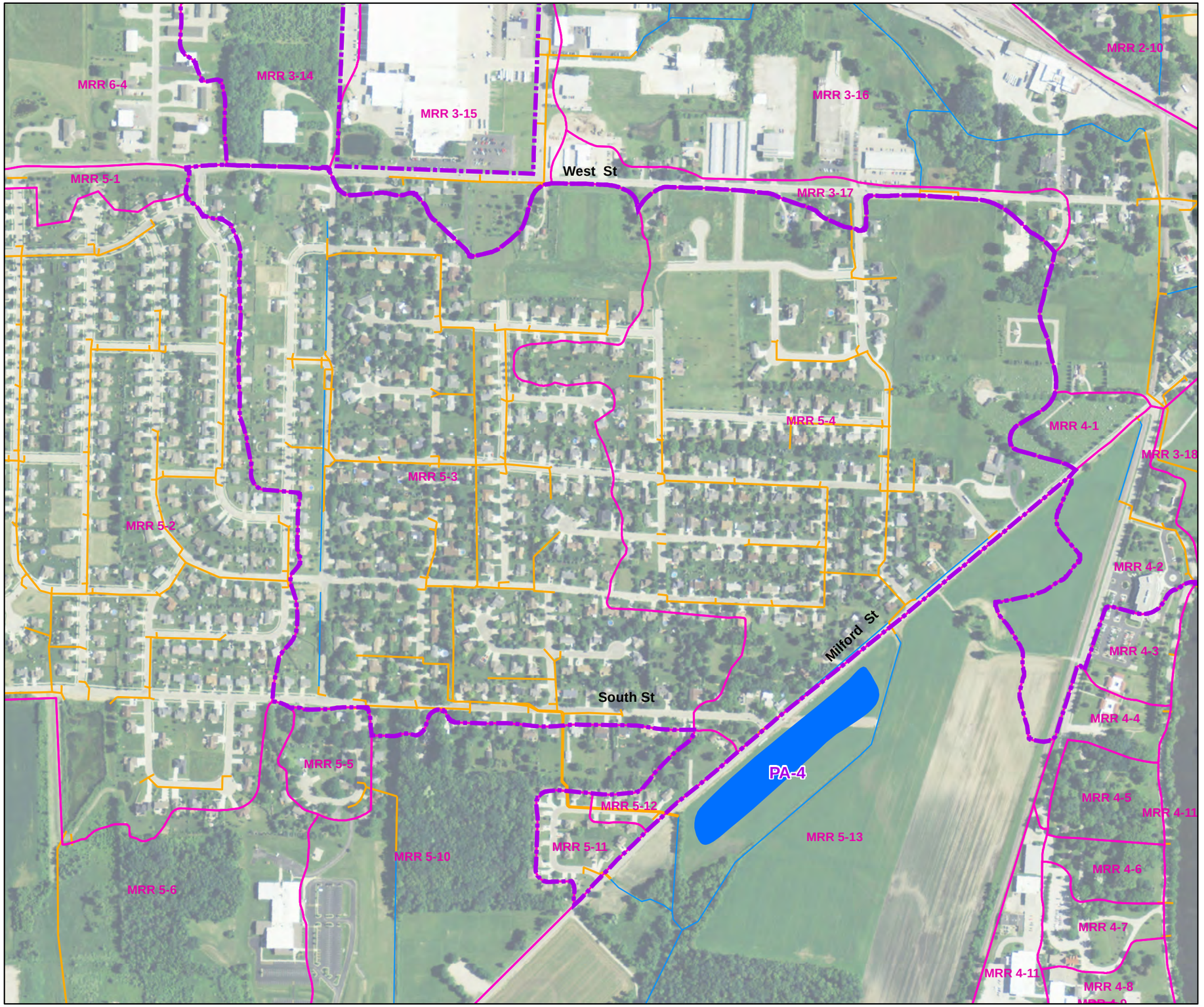
N
W E
S

0 600 1,200 2,400 3,600

Feet

Date: December 2014

Ruekert·Mielke



CITY OF Watertown WISCONSIN

Proposed Wet Detention Facility PA-4
Middle Rock River Reachshed
Exhibit 9

Legend

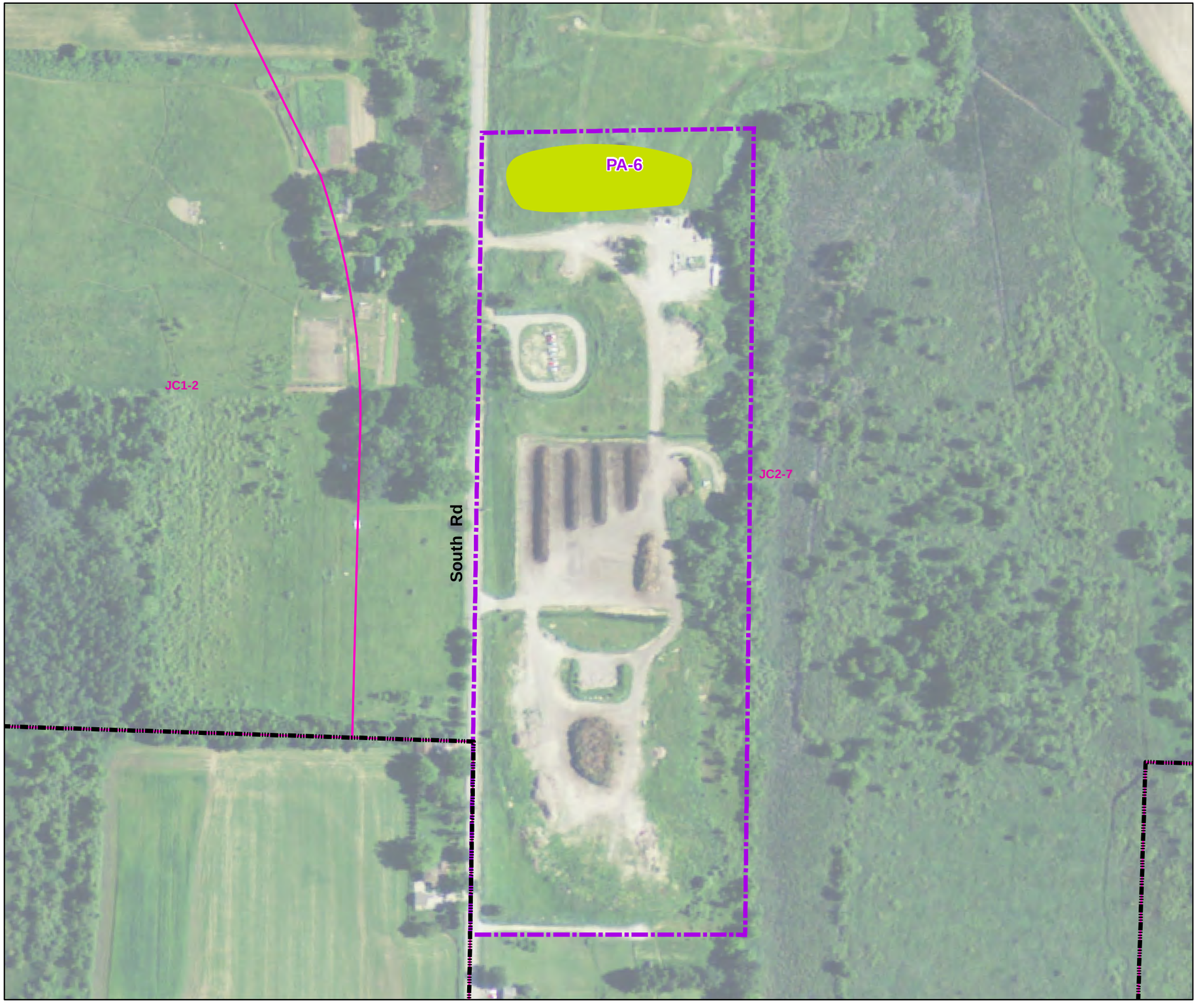
- Existing Ditch
- Existing Storm Sewer
- Water Quality Device Drainage Area
- Proposed Wet Detention Facility
- Drainage Areas
- Watertown Boundary - City Limits

N
W E
S

0 250 500 1,000 1,500
Feet

Date: December 2014

Ruekert·Mielke



CITY OF Watertown WISCONSIN

Proposed Biofiltration Facility PA-6
Johnson Creek Reachshed
Exhibit 10

Legend

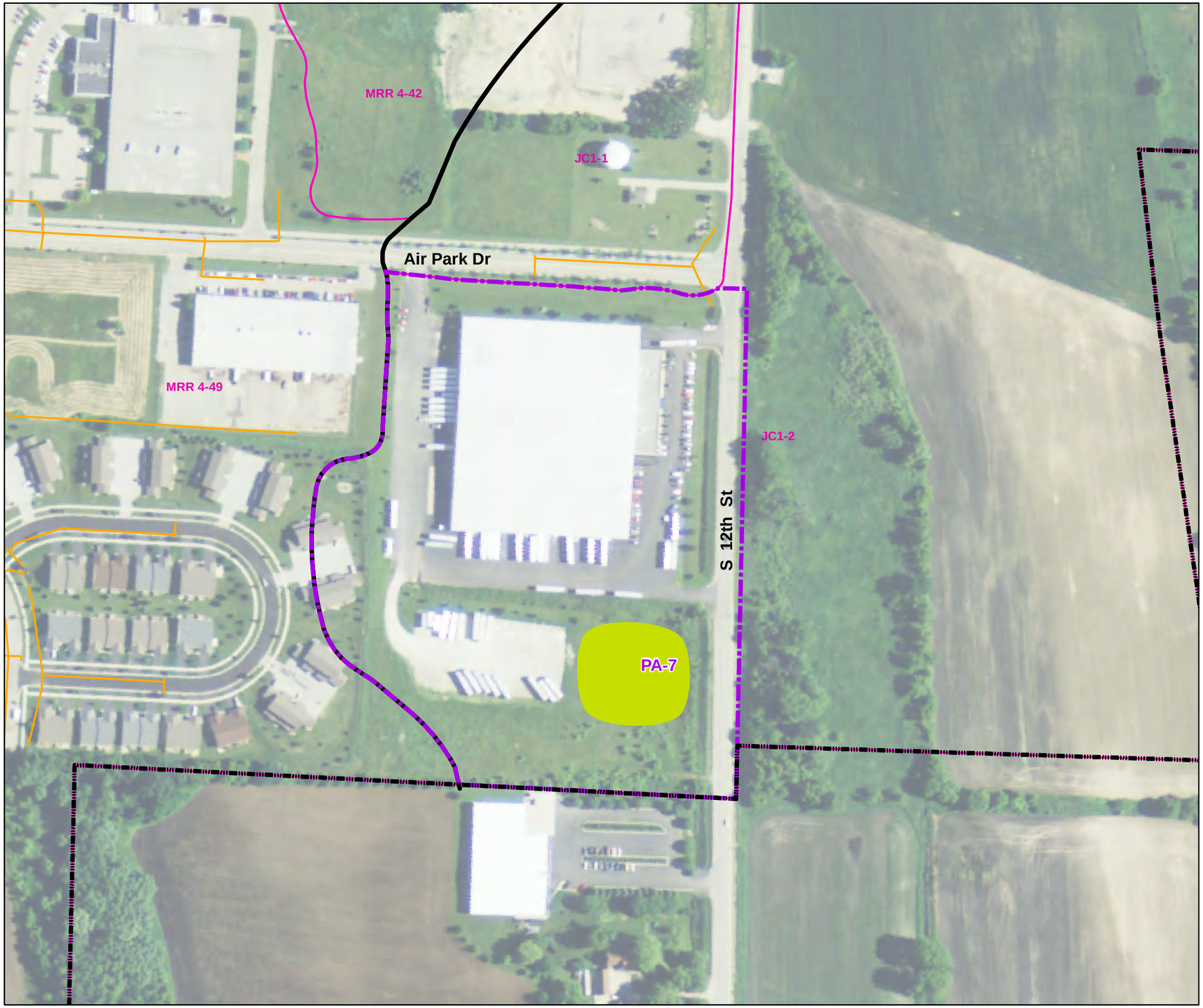
- Exisitng Ditch
- Existing Storm Sewer
- Water Quality Device Drainage Area
- Proposed Biofiltration Facility
- Drainage Areas
- Watertown Boundary - City Limits

N
W E
S

0 100 200 400 600
Feet

Date: December 2014

Ruekert·Mielke



CITY OF Watertown WISCONSIN

Proposed Biofiltration Facility PA-7
Johnson Creek Reachshed
Exhibit 11

Legend

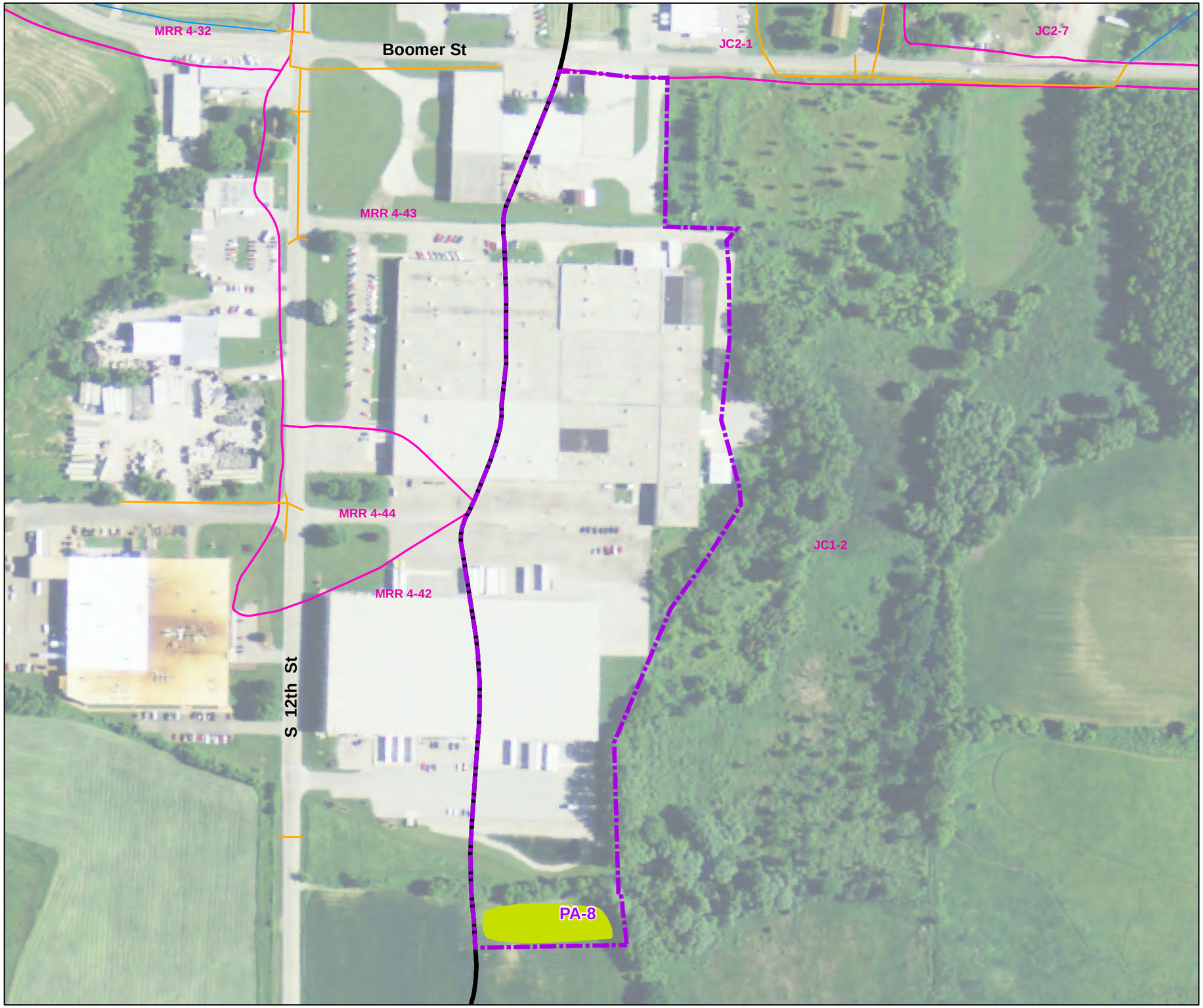
- Existing Ditch
- Exisitng Storm Sewer
- Water Quality Device Drainage Area
- Proposed Biofiltration Facility
- Drainage Areas
- Watertown Boundary - City Limits
- Reachshed Boundary

N
W E
S

0 100 200 400 600
Feet

Date: December 2014

Ruekert·Mielke



CITY OF Watertown WISCONSIN

Proposed Biofiltration Facility PA-8
Johnson Creek Reachshed
Exhibit 12

Legend

- Existing Ditch
- Existing Storm Sewer
- Water Quality Device Drainage Area
- Proposed Biofiltration Facility
- Drainage Areas
- Watertown Boundary - City Limits
- Reachshed Boundary

N
W E
S

0 100 200 400 600
Feet

Date: December 2014

Ruekert·Mielke

Summary of City Wide-MS4 Modeling Results
City of Watertown

Watershed	Area (acres)	Total Suspended Solids				Total Phosphorus			
		Discharge No Controls (pounds)	Discharge With Controls (pounds)	TSS Reduction (%)	TMDL Reduction (%)	Discharge No Controls (pounds)	Discharge With Controls (pounds)	Phosphorus Reduction (%)	TMDL Reduction (%)
Sinissippi Lake #28	1784.12	520237	454914	12.56%	40.00%	1697	1560	8.09%	28.00%
Middle Rock River #29	3586.12	1260869	1045953	17.05%	44.00%	3391	3001	11.51%	64.00%
Johnson Creek #30	420.07	121912	109807	9.93%	40.00%	331	307	7.13%	27.00%
Overall	**5790.31**	**1903018**	**1610674**	**15.36%**		**5419**	**4868**	**10.17%**	

Summary of MS4 Modeling Results

Sinissippi Lake Watershed #28	Area (acres)	Total Suspended Solids: Discharge no controls (pounds)	Total Suspended Solids: Discharge with controls (pounds)	Total Suspended Solids: TSS Control (%)	Total Phosphorus: Discharge no controls (pounds)**	Total Phosphorus: Discharge with controls (pounds)**	Total Phosphorus: P Control (%)**	Stormwater Practices Employed: Primary (WP, SW, etc.)	Stormwater Practices Employed: Other (WP, GS, etc.)
Residential	1004.29	241376.00	215663.20	10.65%	787.27	739.37	6.08%	VS	
Institutional	302.33	140296.70	128293.50	8.56%	457.59	439.83	3.88%	VS	
Commercial	123.27	73571.48	65876.88	10.46%	239.96	225.85	5.88%	VS	
Industrial	8.49	4925.70	4737.26	3.83%	16.07	16.24	-1.09%	VS	
Open	177.70	9333.51	7612.71	18.44%	30.44	26.10	14.27%	VS	
Subtotal	**1616.08**	**469503.39**	**422183.55**	**10.08%**	**1531.33**	**1447.39**	**5.48%**		
Wet Pond #1A	9.46	4326.92	765.60	82.31%	14.11	2.62	81.40%	WP	VS
Wet Pond #1B	11.10	5124.40	1447.00	71.76%	16.71	4.96	70.32%	WP	VS
Dry Pond #4	52.88	11967.88	10687.40	10.70%	39.03	36.64	6.13%	DC	VS
Wet Pond #8	28.04	7101.88	1236.40	82.59%	23.16	4.24	81.70%	WP	VS
Dry Pond #9A	4.75	1141.56	996.40	12.72%	3.72	3.42	8.25%	DC	VS
Dry Pond #9B	4.90	1291.97	1151.00	10.91%	4.21	3.95	6.36%	DC	VS
Dry Pond #9C	0.73	175.44	151.18	13.83%	0.57	0.52	9.42%	DC	VS
Dry Pond #10	8.74	4514.29	4036.60	10.58%	14.72	13.84	6.01%	DC	VS
Dry Pond #12A	24.70	5923.00	5290.80	10.67%	19.32	18.14	6.11%	DC	VS
Wet Pond #13	8.56	2585.96	951.00	63.22%	8.43	3.26	61.34%	WP	VS
Dry Pond #15	14.18	6580.40	6017.40	8.56%	21.46	20.63	3.88%	DC	VS
Subtotal	**168.04**	**50733.70**	**32730.78**	**35.49%**	**165.47**	**112.21**	**32.19%**		
Overall	**1784.12**	**520237.09**	**454914.33**	**12.56%**	**1696.80**	**1559.60**	**8.09%**		

Land Use Areas:
R: residential
I: institutional
C: commercial
D: industrial
O: open urban

Stormwater Practices:
WD: wet detention
SW: street sweeping
VS: vacuum streets
B: biofiltration
I: infiltration
C: catch basin
DC: drainage control
O: other control
GS: grass swales

** = Phosphorous loadings for individual areas and BMPs are prorated based on the model output listed in the "Overall" line.

Summary of MS4 Modeling Results

Middle Rock River Watershed #29	Area (acres)	Total Suspended Solids: Discharge no controls (pounds)	Total Suspended Solids: Discharge with controls (pounds)	Total Suspended Solids: TSS Control (%)	Total Phosphorus: Discharge no controls (pounds)**	Total Phosphorus: Discharge with controls (pounds)**	Total Phosphorus: P Control (%)**	Stormwater Practices Employed: Primary (WP, SW, etc.)	Stormwater Practices Employed: Other (WP, GS, etc.)
Residential	1021.43	245497.00	219397.86	10.63%	660.32	629.44	4.68%	VS	
Institutional	813.04	377293.20	345096.02	8.53%	1014.82	990.07	2.44%	VS	
Commercial	156.49	72122.56	67447.55	6.48%	193.99	193.50	0.25%	VS	
Industrial	537.45	311815.40	299769.14	3.86%	838.70	860.03	-2.54%	VS	
Open	448.37	23549.85	19212.46	18.42%	63.34	55.12	12.98%	VS	
Subtotal	**2976.78**	**1030278.01**	**950923.03**	**7.70%**	**2771.17**	**2728.16**	**1.55%**		
Dry Pond #2	19.78	11805.20	10572.94	10.44%	31.75	30.33	4.47%	DC	VS
Dry Pond #3	129.12	29364.35	26206.89	10.75%	78.98	75.19	4.81%	DC	VS
Wet Pond #5	20.64	3772.90	1124.67	70.19%	10.15	3.23	68.20%	WP	VS
Wet Pond #6A	16.48	5991.37	2295.55	61.69%	16.12	6.59	59.13%	WP	VS
Wet Pond #7	14.70	3440.30	459.31	86.65%	9.25	1.32	85.76%	WP	VS
Dry Pond #11A	17.93	8321.60	7611.03	8.54%	22.38	21.84	2.44%	DC	VS
Wet Pond #11C	22.50	10439.40	3769.90	63.89%	28.08	10.82	61.48%	WP	VS
Wet Pond #17	21.99	11719.34	995.84	91.50%	31.52	2.86	90.94%	WP	VS
Wet Pond #18	65.74	38060.80	7721.85	79.71%	102.37	22.15	78.36%	WP	VS
Wet Pond #19	41.54	22597.26	3362.41	85.12%	60.78	9.65	84.13%	WP	VS
Wet Pond #20A&B	64.07	15272.62	4317.24	71.73%	41.08	12.39	69.85%	WP	VS
Wet Pond #21	6.51	3873.20	1444.95	62.69%	10.42	4.15	60.21%	WP	VS
Wet Pond #22	4.67	2764.40	758.58	72.56%	7.44	2.18	70.73%	WP	VS
Dry Pond #23	1.11	662.48	593.34	10.44%	1.78	1.70	4.47%	DC	VS
Dry Pond #24	25.06	9982.52	8920.14	10.64%	26.85	25.59	4.69%	DC	VS
Dry Pond #25A&B	31.76	15573.14	8291.19	46.76%	41.89	23.79	43.21%	DC	VS
WP 26 & DP #27	93.73	34063.58	6563.78	80.73%	91.62	18.83	79.45%	WP	VS
Grass Swale 1	12.01	2886.55	20.36	99.29%	7.76	0.06	99.25%	GS	
Subtotal	**609.34**	**230591.00**	**95029.97**	**58.79%**	**620.23**	**272.64**	**56.04%**		
Overall	**3586.12**	**1260869.01**	**1045952.99**	**17.05%**	**3391.40**	**3000.80**	**11.52%**		

Land Use Areas:
R: residential
I: institutional
C: commercial
D: industrial
O: open urban

Stormwater Practices:
WD: wet detention
SW: street sweeping
VS: vacuum streets
B: biofiltration
I: infiltration
C: catch basin
DC: drainage control
O: other control
GS: grass swales

** = Phosphorous loadings for individual areas and BMPs are prorated based on the model output listed in the "Overall" line.

Summary of MS4 Modeling Results

Johnson Creek Watershed #30	Area (acres)	Total Suspended Solids: Discharge no controls (pounds)	Total Suspended Solids: Discharge with controls (pounds)	Total Suspended Solids: TSS Control (%)	Total Phosphorus: Discharge no controls (pounds)**	Total Phosphorus: Discharge with controls (pounds)**	Total Phosphorus: P Control (%)**	Stormwater Practices Employed: Primary (WP, SW, etc.)	Stormwater Practices Employed: Other (WP, GS, etc.)
Residential	60.71	14591.25	13037.05	10.65%	39.62	36.50	7.87%	VS	
Institutional	116.81	54205.44	49567.82	8.56%	147.18	138.77	5.71%	VS	
Commercial	9.78	5836.83	5226.43	10.46%	15.85	14.63	7.67%	VS	
Industrial	61.53	35698.65	34311.48	3.89%	96.93	96.06	0.90%	VS	
Open	157.27	8260.89	6737.68	18.44%	22.43	18.86	15.90%	VS	
Subtotal	**406.10**	**118593.05**	**108880.46**	**8.19%**	**322.00**	**304.82**	**5.34%**		
Wet Pond #12B	13.97	3318.82	926.20	72.09%	9.01	2.59	71.22%	WP	VS
Subtotal	**13.97**	**3318.82**	**926.20**	**72.09%**	**9.01**	**2.59**	**71.22%**		
Overall	**420.07**	**121911.87**	**109806.66**	**9.93%**	**331.01**	**307.41**	**7.13%**		

Land Use Areas:
R: residential
I: institutional
C: commercial
D: industrial
O: open urban

Stormwater Practices:
WD: wet detention
SW: street sweeping
VS: vacuum streets
B: biofiltration
I: infiltration
C: catch basin
DC: drainage control
O: other control
GS: grass swales

** = Phosphorous loadings for individual areas and BMPs are prorated based on the model output listed in the "Overall" line.

Summary of City Wide Alternatives-MS4 Modeling Results
City of Watertown

Watershed	Total Suspended Solids			Total Phosphorus		
	Discharge No Controls (pounds)	Discharge With Controls (pounds)	TSS Reduction (%)	Discharge No Controls (pounds)**	Discharge With Controls (pounds)**	Phosphorus Reduction (%)**
Street Sweeping W/Existing Controls						
Sinissippi Lake Watershed #28						
Existing-Once Every Four Weeks	520237	454914	12.56%	1696.80	1559.60	8.09%
Increase Sweeping to Once Every Two Weeks	520237	447734	13.94%	1696.80	1538.20	9.35%
Increase Sweeping to Once Per Week	520237	426161	18.08%	1696.80	1493.00	12.01%
Street Sweeping W/Existing Controls						
Middle Rock River Watershed #29						
Existing-Once Every Four Weeks	1260869	1045953	17.05%	3391.00	3000.80	11.51%
Increase Sweeping to Once Every Two Weeks	1260869	1019800	19.12%	3391.00	2955.40	12.85%
Increase Sweeping to Once Per Week	1260869	974845	22.68%	3391.00	2874.20	15.24%
Street Sweeping W/Existing Controls						
Johnson Creek Watershed #30						
Existing-Once Every Four Weeks	121912	109807	9.93%	331.01	307.41	7.13%
Increase Sweeping to Once Every Two Weeks	121912	108048	11.37%	331.01	303.40	8.34%
Increase Sweeping to Once Per Week	121912	103697	14.94%	331.01	295.40	10.76%
Sinissippi Lake Watershed #28						
Wet Detention Facility #4	11968	4087	65.85%	39.03	20.00	48.75%
Biofiltration Facility #9A	1142	140	87.78%	3.72	0.68	81.65%
Biofiltration Facility #9B	1292	468	63.79%	4.21	2.29	45.62%
Biofiltration Facility #9C	175	20	88.70%	0.57	0.10	82.98%
Wet Detention Facility #10	4514	1709	62.13%	14.72	8.36	43.17%
Wet Detention Facility #12A	5923	2490	57.96%	19.32	12.19	36.93%
Wet Detention Facility #15	6580	2832	56.96%	21.46	13.86	35.42%
Subtotal	**31595**	**11746**	**62.82%**	**103.03**	**57.48**	**44.21%**
Wet Detention Facility #PA-1	27228	5197	80.91%	85.74	33.61	60.80%
Subtotal	**27228**	**5197**	**80.91%**	**85.74**	**33.61**	**60.80%**
Total	**58823**	**16943**	**71.20%**	**188.77**	**91.09**	**51.75%**
Middle Rock River Watershed #29						
Biofiltration Facility #2	11805	2447	79.27%	31.75	11.78	62.90%
Wet Detention Facility #3	29364	7784	73.49%	78.98	37.47	52.56%
Wet Detention Facility #11A	8322	3191	61.65%	22.38	15.36	31.36%
Biofiltration Facility #23	662	17	97.39%	1.78	0.08	95.33%
Wet Detention Facility #24	9983	2890	71.05%	26.85	13.91	48.18%
Biofiltration Facility #25A&B	15573	1307	91.61%	41.89	6.29	84.98%
Biofiltration Facility #27 and WP#26	34064	5007	85.30%	91.62	24.10	73.69%
Subtotal	**109773**	**22644**	**79.37%**	**295.25**	**109.00**	**63.08%**
Wet Detention Facility #PA-2	100037	18457	81.55%	295.60	132.43	55.20%
Wet Detention Facility #PA-3 In Series w/ PA-2 and PA-5	418000	129961	68.91%	1113.60	538.80	51.62%
Wet Detention Facility #PA-3 Stand Alone w/ PA2 & PA5 Acreage	418000	201252	51.85%	1113.60	697.80	37.34%
Wet Detention Facility #PA-3 Stand Alone w/ Partial Acreage	235916	69113	70.70%	550.60	251.26	54.37%
Wet Detention Facility #PA-4	53940	10377	80.76%	197.76	81.38	58.85%
Wet Detention Facility #PA-5	82148	18904	76.99%	267.60	117.41	56.12%
Subtotal	**472042**	**116851**	**75.25%**	**1312**	**582**	**55.59%**
Total	**581815**	**139495**	**76.02%**	**1606.81**	**691.48**	**56.97%**

Summary of City Wide Alternatives-MS4 Modeling Results
City of Watertown

Watershed	Total Suspended Solids			Total Phosphorus		
	Discharge No Controls (pounds)	Discharge With Controls (pounds)	TSS Reduction (%)	Discharge No Controls (pounds)**	Discharge With Controls (pounds)**	Phosphorus Reduction (%)**
Johnson Creek Watershed #30						
Biofiltration Facility #PA-6	8887	1728	80.56%	21.58	7.15	
Biofiltration Facility #PA-7	8892	1718	80.68%	15.54	5.84	
Biofiltration Facility #PA-8	8504	1700	80.01%	14.56	5.55	
Total	**26283**	**5146**	**80.42%**	**51.68**	**18.54**	**64.13%**
Pending Water Quality Improvements by Others						
PA-9 (Pepsi)	19860	3972	80.00%	33.28	13.00	60.94%
PA-10 (Hart Street)						
PA-11 (Marquardt Village)	3147	1437	54.34%	7.00	3.60	48.57%
Subtotal	**23007**	**5409**	**76.49%**	**40.28**	**16.60**	**58.79%**
Overall Reduction for Water Quality Device Alternatives W/Existing Street Sweeping	**689927**	**166993**	**75.80%**	**1888**	**818**	**56.68%**

** = Phosphorous loadings for BMP retrofits are prorated based on the model output listed in the "Overall" line.

Summary of MS4 Modeling Results

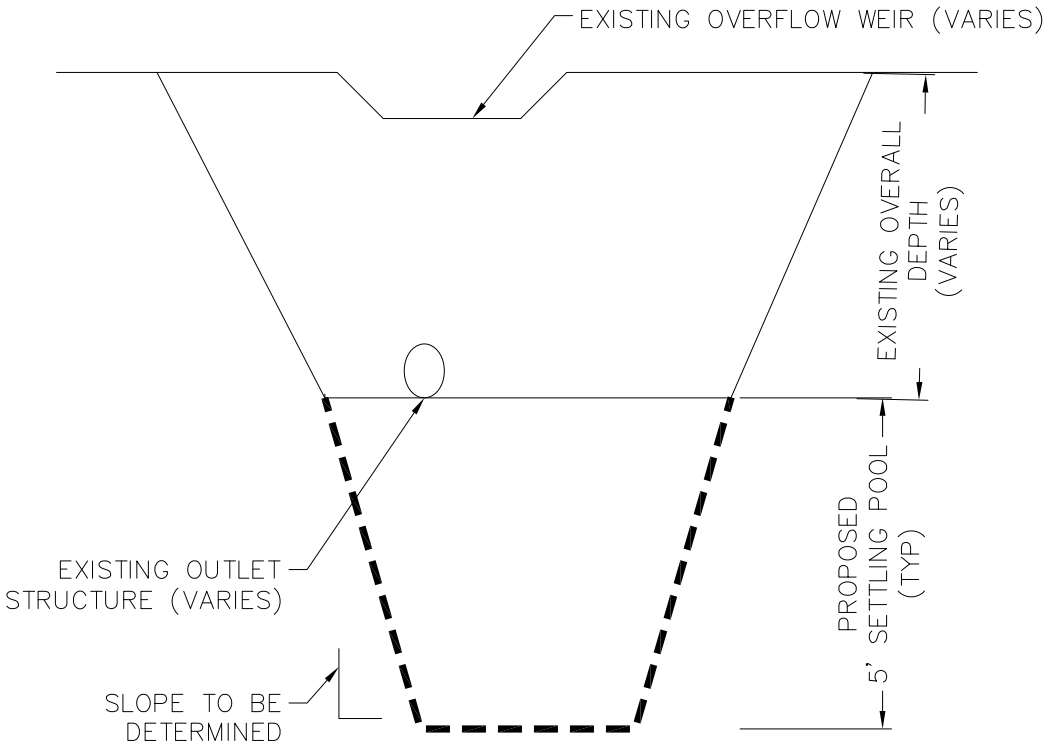
Proposed Alternatives	Area (acres)	Total Suspended Solids: Discharge no controls (pounds)	Total Suspended Solids: Discharge with controls (pounds)	Total Suspended Solids: TSS Control (%)	Total Phosphorus: Discharge no controls (pounds)	Total Phosphorus: Discharge with controls (pounds)	Total Phosphorus: P Control (%)	Stormwater Practices Employed: Primary (WP, SW, etc.)	Stormwater Practices Employed: Other (WP, GS, etc.)
Sinissippi Lake PA-1	84.10	27228.30	5197.25	80.91%	85.74	33.61	60.80%	WP	VS
Middle Rock River PA-2	411.22	100037.48	18457.43	81.55%	295.60	132.43	55.20%	WP	VS
Middle Rock River PA-3 (Stand Alone Partial Acreage)	498.50	235916.40	69112.79	70.70%	550.60	251.26	54.37%	WP	VS
Middle Rock River PA-3 (Stand Alone With PA-5 & PA-2 Acreage)	1233.39	418000.00	201252.00	51.85%	1113.60	697.80	37.34%	WP	VS
Middle Rock River PA-3 (In Series with PA-2 & PA-5)	1233.39	418000.00	129961.00	68.91%	1113.60	538.80	51.62%	WP	VS
Middle Rock River PA-4	227.60	53939.60	10377.49	80.76%	197.76	81.38	58.85%	WP	VS
Middle Rock River PA-5	283.24	82148.14	18903.74	76.99%	267.60	117.41	56.13%	WP	VS
Johnson Creek PA-6	19.15	8886.80	1727.81	80.56%	21.58	7.15	66.88%	DC	VS
Johnson Creek PA-7	16.00	8892.04	1718.21	80.68%	15.54	5.84	62.41%	DC	VS
Johnson Creek PA-8	14.83	8504.06	1699.61	80.01%	14.56	5.55	61.85%	DC	VS
PA-9 (By Others)	34.23	19859.60	3972.95	79.99%	33.30	13.91	58.22%	Unknown	VS
PA-10 (By Others)									
PA-11 (By Others)	14.15	3147.00	1437.00	54.34%	1.40	0.80	42.84%	DC	VS
Overall	**1603.02**	**548559.42**	**132604.28**	**75.83%**	**1483.68**	**649.34**	**56.23%**		

Land Use Areas:
R: residential
I: institutional
C: commercial
D: industrial
O: open urban

Stormwater Practices:
WD: wet detention
SW: street sweeping
VS: vacuum streets
B: biofiltration
I: infiltration
C: catch basin
DC: drainage control
O: other control
GS: grass swales

RM811PB

CITY OF Watertown WISCONSIN



WET POND ALTERNATIVE
TYPICAL CROSS-SECTION

NO SCALE

CGDT-WETPOND DEVICE 24

Dec 29, 2014 1:32pm
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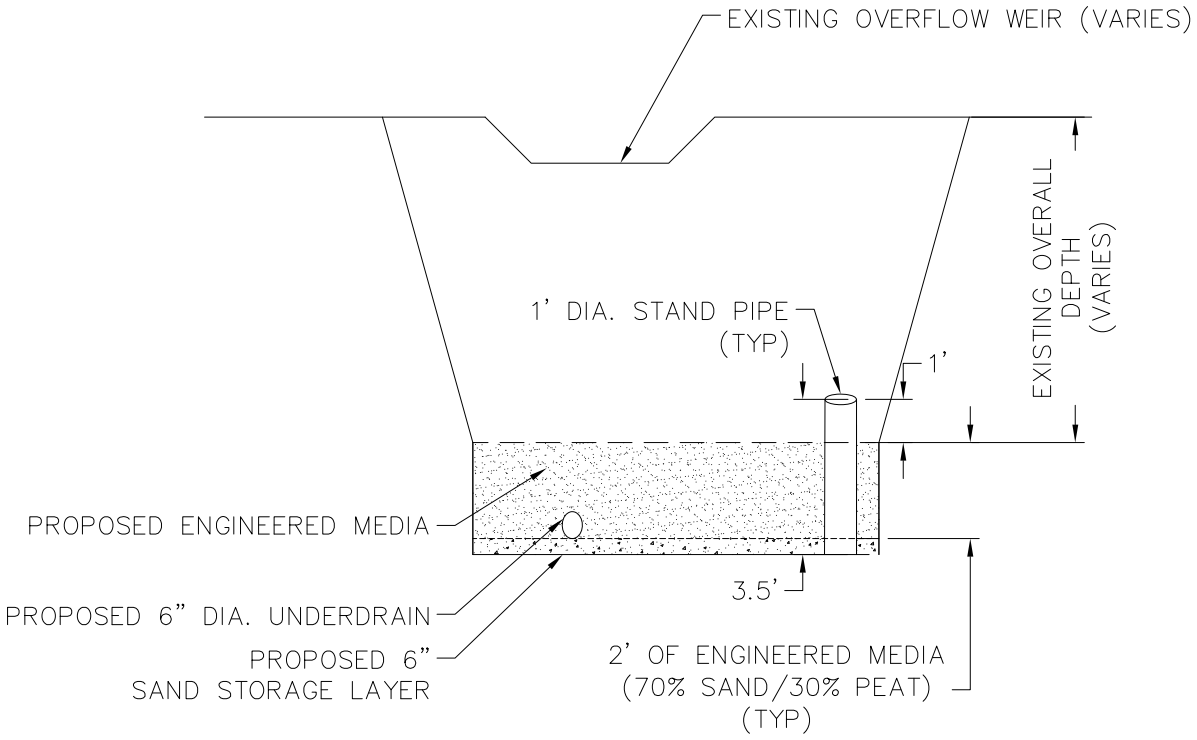

BIO-RETENTION DEVICE ALTERNATIVE TYPICAL CROSS-SECTION

NO SCALE

CGDT-BIOFILTRATION DEVICE 24

City of Watertown Storm Water Quality Alternatives

Present Worth Cost Estimate Summary -- December, 2014

Watershed	Component Description	Project Cost	Incremental Annual O & M Cost	Present Worth Cost
City Wide Street Sweeping	Increase Sweeping to Once Every Two Weeks	-	$216,000	$4,268,594
	Increase Sweeping to Once Per Week	-	$432,000	$8,537,187
Sinissippi Lake #28	Sinissippi Lake-Wet Detention Facility #4	$98,750	$6,545	$228,092
	Sinissippi Lake-Biofiltration Facility #9A	$50,625	$550	$614,494
	Sinissippi Lake-Biofiltration Facility #9B	$10,500	$225	$14,946
	Sinissippi Lake-Biofiltration Facility #9C	$13,281	$350	$20,198
	Sinissippi Lake-Wet Detention Facility #10	$26,250	$1,085	$47,692
	Sinissippi Lake-Wet Detention Facility #12A	$23,750	$1,750	$58,334
	Sinissippi Lake-Wet Detention Facility #15	$20,000	$1,155	$42,825
	Sinissippi Lake-Wet Detention Facility #PA-1	$1,287,025	$8,025	$1,445,615
Middle Rock River #29	Middle Rock River-Biofiltration Facility #2	$326,063	$3,500	$395,230
	Middle Rock River-Wet Detention Facility #3	$292,500	$12,810	$545,651
	Middle Rock River-Wet Detention Facility #11A	$21,250	$1,400	$48,917
	Middle Rock River-Biofiltration Facility #23	$158,750	$1,750	$193,334
	Middle Rock River-Wet Detention Facility #24	$373,125	$5,425	$480,334
	Middle Rock River-Biofiltration Facility #25A&B	$218,438	$4,750	$312,307
	Middle Rock River-Biofiltration Facility #27	$433,625	$3,390	$500,618
	Middle Rock River-Wet Detention Facility #PA-2	$2,616,250	$17,950	$2,970,978
	Middle Rock River-Wet Detention Facility #PA-3	$3,603,750	$19,700	$3,993,062
	Middle Rock River-Wet Detention Facility #PA-4	$1,603,750	$10,950	$1,820,144
	Middle Rock River-Wet Detention Facility #PA-5	$1,828,750	$12,700	$2,079,728
Johnson Creek #30	Johnson Creek-Biofiltration Facility #PA-6	$197,188	$1,225	$221,396
	Johnson Creek-Biofiltration Facility #PA-7	$247,188	$1,225	$271,396
	Johnson Creek-Biofiltration Facility #PA-8	$186,750	$1,100	$208,488

City of Watertown
Economic Analysis of the Existing Street Sweeping Program
Street Sweeping Once Every Four Weeks - Sinissippi Lake Reachshed

Description: Street Sweeping Once Every Four Weeks

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Four Weeks (9x/year; 37 miles/pass)	Mile	$ 100.00	37.0		$ 33,300.00	50
			Totals	$ -	$33,300.00	
			Present Worth Factor		19.7620	
			Present Worth	$ -	$ 658,074.86	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	-
Legal, Engineering, & Contingencies (25%)		-
Subtotal - Estimated Project Cost	$	-
Present Worth of O&M (50 Year)		658,074.86
Total Present Worth	**$**	**658,074.86**

City of Watertown
Economic Analysis of the Recommended Improvements for Street Sweeping
Street Sweeping Once Every Two Weeks - Sinissippi Lake Reachshed

Description: Street Sweeping Once Every Two Weeks

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Two Weeks (18x/year; 37 miles/pass)	Mile	$ 100.00	37.0		$ 66,600.00	50
			Totals	$ -	$66,600.00	
			Present Worth Factor		19.7620	
			Present Worth	$ -	$ 1,316,149.72	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	-
Legal, Engineering, & Contingencies (25%)		-
Subtotal - Estimated Project Cost	$	-
Present Worth of O&M (50 Year)		1,316,149.72
Total Present Worth	**$**	**1,316,149.72**

City of Watertown
Economic Analysis of the Recommended Improvements for Street Sweeping
Street Sweeping Once Every Week - Sinissippi Lake Reachshed

Description: Street Sweeping Once Every Week

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Week (36x/year; 37 miles/pass)	Mile	$ 100.00	37.0		$ 133,200.00	50
			Totals	$ -	$133,200.00	
			Present Worth Factor		19.7620	
			Present Worth	$ -	$ 2,632,299.44	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$ -
Legal, Engineering, & Contingencies (25%)	-
Subtotal - Estimated Project Cost	$ -
Present Worth of O&M (50 Year)	2,632,299.44
Total Present Worth	**$ 2,632,299.44**

City of Watertown
Economic Analysis of the Recommended Improvements for Sinissippi Lake #4
Retrofit Existing Dry Detention Facility to a Wet Detention Facility

Description: Retrofit Existing Dry Detention Facility to a Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Wet Detention Area Construction	C.Y.	$ 20.00	3950.0	$ 79,000.00	$ 6,545.00	50
		Totals		$ 79,000.00	$6,545.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 79,000.00	$ 129,342.34	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	79,000.00
Legal, Engineering, & Contingencies (25%)		19,750.00
Subtotal - Estimated Project Cost	$	98,750.00
Present Worth of O&M (50 Year)		129,342.34
Total Present Worth	**$**	**228,092.34**

City of Watertown

Economic Analysis of the Recommended Improvements for Sinissippi Lake #9A

Retrofit Existing Dry Detention Facility to a Biofiltration Facility

Description: Retrofit Existing Dry Detention Facility to a Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	2700.0	$ 13,500.00		50
6-Inch Underdrain	L.F.	$ 25.00	60.0	$ 1,500.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	250.0	$ 17,500.00	$ 550.00	50
Biofiltration Area Construction	C.Y.	$ 20.00	250.0	$ 5,000.00		50
		Totals		$ 40,500.00	$550.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 40,500.00	$ 10,869.10	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	40,500.00
Legal, Engineering, & Contingencies (25%)		10,125.00
Subtotal - Estimated Project Cost	$	50,625.00
Present Worth of O&M (50 Year)		10,869.10
Total Present Worth	**$**	**61,494.10**

City of Watertown
Economic Analysis of the Recommended Improvements for Sinissippi Lake #9B
Retrofit Existing Dry Detention Facility to a Biofiltration Facility

Description: Retrofit Existing Dry Detention Facility to a Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	350.0	$ 1,750.00		50
6-Inch Underdrain	L.F.	$ 25.00	20.0	$ 500.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	35.0	$ 2,450.00	$ 225.00	50
Biofiltration Area Construction	C.Y.	$ 20.00	35.0	$ 700.00		50
		Totals		$ 8,400.00	$225.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 8,400.00	$ 4,446.45	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	8,400.00
Legal, Engineering, & Contingencies (25%)		2,100.00
Subtotal - Estimated Project Cost	$	10,500.00
Present Worth of O&M (50 Year)		4,446.45
Total Present Worth	**$**	**14,946.45**

City of Watertown
Economic Analysis of the Recommended Improvements for Sinissippi Lake #9C
Retrofit Existing Dry Detention Facility to a Biofiltration Facility

Description: Retrofit Existing Dry Detention Facility to a Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	500.0	$ 2,500.00		50
6-Inch Underdrain	L.F.	$ 25.00	25.0	$ 625.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	50.0	$ 3,500.00	$ 350.00	50
Biofiltration Area Construction	C.Y.	$ 20.00	50.0	$ 1,000.00		50
		Totals		$ 10,625.00	$350.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 10,625.00	$ 6,916.70	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	10,625.00
Legal, Engineering, & Contingencies (25%)		2,656.25
Subtotal - Estimated Project Cost	$	13,281.25
Present Worth of O&M (50 Year)		6,916.70
Total Present Worth	**$**	**20,197.95**

City of Watertown
Economic Analysis of the Recommended Improvements for Sinissippi Lake #10
Retrofit Existing Dry Detention Facility to a Wet Detention Facility

Description: Retrofit Existing Dry Detention Facility to a Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Wet Detention Area Construction	C.Y.	$ 20.00	1050.0	$ 21,000.00	$ 1,085.00	50
		Totals		$ 21,000.00	$1,085.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 21,000.00	$ 21,441.78	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	21,000.00
Legal, Engineering, & Contingencies (25%)		5,250.00
Subtotal - Estimated Project Cost	$	26,250.00
Present Worth of O&M (50 Year)		21,441.78
Total Present Worth	**$**	**47,691.78**

City of Watertown
Economic Analysis of the Recommended Improvements for Sinissippi Lake #12A
Retrofit Existing Dry Detention Facility to a Wet Detention Facility

Description: Retrofit Existing Dry Detention Facility to a Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Wet Detention Area Construction	C.Y.	$ 20.00	950.0	$ 19,000.00	$ 1,750.00	50
		Totals		$ 19,000.00	$1,750.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 19,000.00	$ 34,583.51	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	19,000.00
Legal, Engineering, & Contingencies (25%)		4,750.00
Subtotal - Estimated Project Cost	$	23,750.00
Present Worth of O&M (50 Year)		34,583.51
Total Present Worth	**$**	**58,333.51**

City of Watertown
Economic Analysis of the Recommended Improvements for Sinissippi Lake #15
Retrofit Existing Dry Detention Facility to a Wet Detention Facility

Description: Retrofit Existing Dry Detention Facility to a Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Wet Detention Area Construction	C.Y.	$ 20.00	800.0	$ 16,000.00	$ 1,155.00	50
		Totals		$ 16,000.00	$1,155.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 16,000.00	$ 22,825.12	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	16,000.00
Legal, Engineering, & Contingencies (25%)		4,000.00
Subtotal - Estimated Project Cost	$	20,000.00
Present Worth of O&M (50 Year)		22,825.12
Total Present Worth	**$**	**42,825.12**

City of Watertown
Economic Analysis of the Recommended Improvements for Sinissippi Lake PA-1
Construct New Wet Detention Facility

Description: Construct New Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Wet Detention Facility Land Acquisition	Acres	$ 80,000.00	4.0	$ 320,000.00		50
Wet Detention Facility Construction	C.Y.	$ 20.00	32831.0	$ 656,620.00	$ 7,875.00	50
Various Inlet/Outlet Ditching and Storm Sewer	L.S.	$ 50,000.00	1.0	$ 50,000.00	$ 150.00	50
			Totals	$ 1,029,620.00	$8,025.00	
			Present Worth Factor		19.7620	
			Present Worths	$ 1,029,620.00	$ 158,590.11	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	1,029,620.00
Legal, Engineering, & Contingencies (25%)		257,405.00
Subtotal - Estimated Project Cost	$	1,287,025.00
Present Worth of O&M (50 Year)		158,590.11
Total Present Worth	**$**	**1,445,615.11**

City of Watertown
Economic Analysis of the Existing Street Sweeping Program
Street Sweeping Once Every Four Weeks - Middle Rock River Reachshed

Description: Street Sweeping Once Every Four Weeks

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Four Weeks (9x/year; 74 miles/pass)	Mile	$ 100.00	74.0		$ 66,600.00	50
			Totals	$ -	$66,600.00	
			Present Worth Factor		19.7620	
			Present Worth	$ -	$ 1,316,149.72	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	-
Legal, Engineering, & Contingencies (25%)		-
Subtotal - Estimated Project Cost	$	-
Present Worth of O&M (50 Year)		1,316,149.72
Total Present Worth	**$**	**1,316,149.72**

City of Watertown
Economic Analysis of the Recommended Improvements for Street Sweeping
Street Sweeping Once Every Two Weeks - Middle Rock River Reachshed

Description: Street Sweeping Once Every Two Weeks

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Two Weeks (18x/year; 74 miles/pass)	Mile	$ 100.00	74.0		$ 133,200.00	50
			Totals	$ -	$133,200.00	
			Present Worth Factor		19.7620	
			Present Worth	$ -	$ 2,632,299.44	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$ -
Legal, Engineering, & Contingencies (25%)	-
Subtotal - Estimated Project Cost	$ -
Present Worth of O&M (50 Year)	2,632,299.44
Total Present Worth	**$ 2,632,299.44**

City of Watertown
Economic Analysis of the Recommended Improvements for Street Sweeping
Street Sweeping Once Every Week - Middle Rock River Reachshed

Description: Street Sweeping Once Every Week

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Week (36x/year; 74 miles/pass)	Mile	$ 100.00	74.0		$ 266,400.00	50
			Totals	$ -	$266,400.00	
			Present Worth Factor		19.7620	
			Present Worth	$ -	$ 5,264,598.87	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	-
Legal, Engineering, & Contingencies (25%)		-
Subtotal - Estimated Project Cost	$	-
Present Worth of O&M (50 Year)		5,264,598.87
Total Present Worth	**$**	**5,264,598.87**

City of Watertown

Economic Analysis of the Recommended Improvements for Middle Rock River #2

Retrofit Existing Dry Detention Facility to a Biofiltration Facility

Description:Retrofit Existing Dry Detention Facility to a Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	19100.0	$ 95,500.00		50
6-Inch Underdrain	L.F.	$ 25.00	140.0	$ 3,500.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	1765.0	$ 123,550.00	$ 3,500.00	50
Biofiltration Area Construction	C.Y.	$ 20.00	1765.0	$ 35,300.00		50
		Totals		$ 260,850.00	$3,500.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 260,850.00	$ 69,167.03	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	260,850.00
Legal, Engineering, & Contingencies (25%)		65,212.50
Subtotal - Estimated Project Cost	$	326,062.50
Present Worth of O&M (50 Year)		69,167.03
Total Present Worth	**$**	**395,229.53**

City of Watertown
Economic Analysis of the Recommended Improvements for Middle Rock River #3
Retrofit Existing Dry Detention Facility to a Wet Detention Facility

Description: Retrofit Existing Dry Detention Facility to a Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Wet Detention Area Construction	C.Y.	$ 20.00	11700.0	$ 234,000.00	$ 12,810.00	50
		Totals		$ 234,000.00	$12,810.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 234,000.00	$ 253,151.32	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	234,000.00
Legal, Engineering, & Contingencies (25%)		58,500.00
Subtotal - Estimated Project Cost	$	292,500.00
Present Worth of O&M (50 Year)		253,151.32
Total Present Worth	**$**	**545,651.32**

City of Watertown

Economic Analysis of the Recommended Improvements for Middle Rock River #11A

Retrofit Existing Dry Detention Facility to a Wet Detention Facility

Description: Retrofit Existing Dry Detention Facility to a Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Wet Detention Area Construction	C.Y.	$ 20.00	850.0	$ 17,000.00	$ 1,400.00	50
		Totals		$ 17,000.00	$1,400.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 17,000.00	$ 27,666.81	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	17,000.00
Legal, Engineering, & Contingencies (25%)		4,250.00
Subtotal - Estimated Project Cost	$	21,250.00
Present Worth of O&M (50 Year)		27,666.81
Total Present Worth	**$**	**48,916.81**

City of Watertown

Economic Analysis of the Recommended Improvements for Middle Rock River #23

Retrofit Existing Dry Detention Facility to a Biofiltration Facility

Description:Retrofit Existing Dry Detention Facility to a Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	9000.0	$ 45,000.00		50
6-Inch Underdrain	L.F.	$ 25.00	100.0	$ 2,500.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	850.0	$ 59,500.00	$ 1,750.00	50
Biofiltration Area Construction	C.Y.	$ 20.00	850.0	$ 17,000.00		50
		Totals		$ 127,000.00	$1,750.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 127,000.00	$ 34,583.51	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	127,000.00
Legal, Engineering, & Contingencies (25%)		31,750.00
Subtotal - Estimated Project Cost	$	158,750.00
Present Worth of O&M (50 Year)		34,583.51
Total Present Worth	**$**	**193,333.51**

City of Watertown
Economic Analysis of the Recommended Improvements for Middle Rock River #24
Retrofit Existing Dry Detention Facility to a Wet Detention Facility

Description: Retrofit Existing Dry Detention Facility to a Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Wet Detention Area Construction	C.Y.	$ 20.00	3675.0	$ 73,500.00	$ 5,425.00	50
Rock Excavation	C.Y.	$ 75.00	3000.0	$ 225,000.00		50
		Totals		$ 298,500.00	$5,425.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 298,500.00	$ 107,208.89	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	298,500.00
Legal, Engineering, & Contingencies (25%)		74,625.00
Subtotal - Estimated Project Cost	$	373,125.00
Present Worth of O&M (50 Year)		107,208.89
Total Present Worth	**$**	**480,333.89**

City of Watertown

Economic Analysis of the Recommended Improvements for Middle Rock River #25A&B

Retrofit Existing Dry Detention Facility to a Biofiltration Facility

Description:Retrofit Existing Dry Detention Facility to a Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Remove and Reuse Existing Plantings	E.A.	$ 1.50	16500.0	$ 24,750.00		50
6-Inch Underdrain	L.F.	$ 25.00	180.0	$ 4,500.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	2.0	$ 6,000.00		50
Engineered Soil	C.Y.	$ 70.00	1550.0	$ 108,500.00	$ 4,750.00	50
Biofiltration Area Construction	C.Y.	$ 20.00	1550.0	$ 31,000.00		50
		Totals		$ 174,750.00	$4,750.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 174,750.00	$ 93,869.54	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	174,750.00
Legal, Engineering, & Contingencies (25%)		43,687.50
Subtotal - Estimated Project Cost	$	218,437.50
Present Worth of O&M (50 Year)		93,869.54
Total Present Worth	**$**	**312,307.04**

City of Watertown

Economic Analysis of the Recommended Improvements for Middle Rock River #27

Retrofit Existing Dry Detention Facility to a Biofiltration Facility

Description:Retrofit Existing Dry Detention Facility to a Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	25500.0	$ 127,500.00		50
6-Inch Underdrain	L.F.	$ 25.00	160.0	$ 4,000.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	2360.0	$ 165,200.00	$ 3,390.00	50
Biofiltration Area Construction	C.Y.	$ 20.00	2360.0	$ 47,200.00		50
		Totals		$ 346,900.00	$3,390.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 346,900.00	$ 66,993.21	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	346,900.00
Legal, Engineering, & Contingencies (25%)		86,725.00
Subtotal - Estimated Project Cost	$	433,625.00
Present Worth of O&M (50 Year)		66,993.21
Total Present Worth	**$**	**500,618.21**

City of Watertown
Economic Analysis of the Recommended Improvements for Middle Rock River PA-2
Construct New Wet Detention Facility

Description: Construct New Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Wet Detention Facility Land Acquisition	Acres	$ 80,000.00	5.5	$ 440,000.00		50
Wet Detention Facility Construction	C.Y.	$ 20.00	75000.0	$ 1,500,000.00	$ 17,500.00	50
Various Inlet/Outlet Ditching and Storm Sewer	L.S.	$ 150,000.00	1.0	$ 150,000.00	$ 450.00	50
		Totals		$ 2,093,000.00	$17,950.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 2,093,000.00	$ 354,728.04	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	2,093,000.00
Legal, Engineering, & Contingencies (25%)		523,250.00
Subtotal - Estimated Project Cost	$	2,616,250.00
Present Worth of O&M (50 Year)		354,728.04
Total Present Worth	**$**	**2,970,978.04**

City of Watertown
Economic Analysis of the Recommended Improvements for Middle Rock River PA-3
Construct New Wet Detention Facility

Description: Construct New Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Wet Detention Facility Land Acquisition	Acres	$ 80,000.00	6.0	$ 480,000.00		50
Wet Detention Facility Construction	C.Y.	$ 20.00	112500.0	$ 2,250,000.00	$ 19,250.00	50
Various Inlet/Outlet Ditching and Storm Sewer	L.S.	$ 150,000.00	1.0	$ 150,000.00	$ 450.00	50
		Totals		$ 2,883,000.00	$19,700.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 2,883,000.00	$ 389,311.55	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	2,883,000.00
Legal, Engineering, & Contingencies (25%)		720,750.00
Subtotal - Estimated Project Cost	$	3,603,750.00
Present Worth of O&M (50 Year)		389,311.55
Total Present Worth	**$**	**3,993,061.55**

City of Watertown
Economic Analysis of the Recommended Improvements for Middle Rock River PA-4
Construct New Wet Detention Facility

Description: Construct New Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Wet Detention Facility Land Acquisition	Acres	$ 80,000.00	3.5	$ 280,000.00		50
Wet Detention Facility Construction	C.Y.	$ 20.00	42500.0 #	$ 850,000.00	$ 10,500.00	50
Various Inlet/Outlet Ditching and Storm Sewer	L.S.	$ 150,000.00	1.0	$ 150,000.00	$ 450.00	50
		Totals		$ 1,283,000.00	$10,950.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 1,283,000.00	$ 216,393.99	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	1,283,000.00
Legal, Engineering, & Contingencies (25%)		320,750.00
Subtotal - Estimated Project Cost	$	1,603,750.00
Present Worth of O&M (50 Year)		216,393.99
Total Present Worth	**$**	**1,820,143.99**

City of Watertown
Economic Analysis of the Recommended Improvements for Middle Rock River PA-5
Construct New Wet Detention Facility

Description: Construct New Wet Detention Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Wet Detention Facility Land Acquisition	Acres	$ 80,000.00	4.0	$ 320,000.00		50
Wet Detention Facility Construction	C.Y.	$ 20.00	49500.0	$ 990,000.00	$ 12,250.00	50
Various Inlet/Outlet Ditching and Storm Sewer	L.S.	$ 150,000.00	1.0	$ 150,000.00	$ 450.00	50
		Totals		$ 1,463,000.00	$12,700.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 1,463,000.00	$ 250,977.50	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	1,463,000.00
Legal, Engineering, & Contingencies (25%)		365,750.00
Subtotal - Estimated Project Cost	$	1,828,750.00
Present Worth of O&M (50 Year)		250,977.50
Total Present Worth	**$**	**2,079,727.50**

City of Watertown
Economic Analysis of the Existing Street Sweeping Program
Street Sweeping Once Every Four Weeks - Johnson Creek Reachshed

Description: Street Sweeping Once Every Four Weeks

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Four Weeks (9x/year; 9 miles/pass)	Mile	$ 100.00	9.0		$ 8,100.00	50
			Totals	$ -	$8,100.00	
			Present Worth Factor		19.7620	
			Present Worth	$ -	$ 160,072.26	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	-
Legal, Engineering, & Contingencies (25%)		-
Subtotal - Estimated Project Cost	$	-
Present Worth of O&M (50 Year)		160,072.26
Total Present Worth	**$**	**160,072.26**

City of Watertown
Economic Analysis of the Recommended Improvements for Street Sweeping
Street Sweeping Once Every Two Weeks - Johnson Creek Reachshed

Description: Street Sweeping Once Every Two Weeks

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Two Weeks (18x/year; 9 miles/pass)	Mile	$ 100.00	9.0		$ 16,200.00	50
		Totals		$ -	$16,200.00	
		Present Worth Factor			19.7620	
		Present Worth		$ -	$ 320,144.53	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	-
Legal, Engineering, & Contingencies (25%)		-
Subtotal - Estimated Project Cost	$	-
Present Worth of O&M (50 Year)		320,144.53
Total Present Worth	**$**	**320,144.53**

City of Watertown
Economic Analysis of the Recommended Improvements for Street Sweeping
Street Sweeping Once Every Week - Johnson Creek Reachshed

Description: Street Sweeping Once Every Week

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Street Sweeping Once Every Week (36x/year; 9 miles/pass)	Mile	$ 100.00	9.0		$ 32,400.00	50
			Totals	$ -	$32,400.00	
			Present Worth Factor		19.7620	
			Present Worth	$ -	$ 640,289.05	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	-
Legal, Engineering, & Contingencies (25%)		-
Subtotal - Estimated Project Cost	$	-
Present Worth of O&M (50 Year)		640,289.05
Total Present Worth	**$**	**640,289.05**

City of Watertown
Economic Analysis of the Recommended Improvements for Johnson Creek PA-6
Construct a New Biofiltration Facility

Description:Construct a New Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	7500.0	$ 37,500.00		50
6-Inch Underdrain	L.F.	$ 25.00	90.0	$ 2,250.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	700.0	$ 49,000.00	$ 1,125.00	50
Biofiltration Facility Construction	C.Y.	$ 20.00	2300.0	$ 46,000.00		50
Biofiltration Facility Land Acquisition (City - Owned)	Acre			$ -		50
Various Inlet/Outlet Ditching and Storm Sewer	L.S.	$ 20,000.00	1.0	$ 20,000.00	$ 100.00	50
			Totals	$ 157,750.00	$1,225.00	
			Present Worth Factor		19.7620	
			Present Worths	$ 157,750.00	$ 24,208.46	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	157,750.00
Legal, Engineering, & Contingencies (25%)		39,437.50
Subtotal - Estimated Project Cost	$	197,187.50
Present Worth of O&M (50 Year)		24,208.46
Total Present Worth	**$**	**221,395.96**

City of Watertown
Economic Analysis of the Recommended Improvements for Johnson Creek PA-7
Construct a New Biofiltration Facility

Description:Construct a New Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	7500.0	$ 37,500.00		50
6-Inch Underdrain	L.F.	$ 25.00	90.0	$ 2,250.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	700.0	$ 49,000.00	$ 1,125.00	50
Biofiltration Facility Land Acquisition	Acre	$ 80,000.00	0.5	$ 40,000.00		50
Biofiltration Facility Construction	C.Y.	$ 20.00	2300.0	$ 46,000.00		50
Various Inlet/Outlet Ditching and Storm Sewer	L.S.	$ 20,000.00	1.0	$ 20,000.00	$ 100.00	50
		Totals		$ 197,750.00	$1,225.00	
		Present Worth Factor			19.7620	
		Present Worths		$ 197,750.00	$ 24,208.46	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$ 197,750.00
Legal, Engineering, & Contingencies (25%)	49,437.50
Subtotal - Estimated Project Cost	$ 247,187.50
Present Worth of O&M (50 Year)	24,208.46
Total Present Worth	**$ 271,395.96**

City of Watertown
Economic Analysis of the Recommended Improvements for Johnson Creek PA-8
Construct a New Biofiltration Facility

Description:Construct a New Biofiltration Facility

i= 4.500% Item Description	Unit	Unit Price	Initial Quantity	Initial Cost	Annual Incremental O & M	Serv. Life
Plantings	E.A.	$ 5.00	6100.0	$ 30,500.00		50
6-Inch Underdrain	L.F.	$ 25.00	80.0	$ 2,000.00		50
Standpipe Outlet Structure	E.A.	$ 3,000.00	1.0	$ 3,000.00		50
Engineered Soil	C.Y.	$ 70.00	570.0	$ 39,900.00	$ 975.00	50
Biofiltration Facility Construction	C.Y.	$ 20.00	1950.0	$ 39,000.00		50
Biofiltration Facility Land Acquisition (City - Owned)	Acre			$ -		50
Various Inlet/Outlet Ditching and Storm Sewer	L.S.	$ 35,000.00	1.0	$ 35,000.00	$ 125.00	50
			Totals	$ 149,400.00	$1,100.00	
			Present Worth Factor		19.7620	
			Present Worths	$ 149,400.00	$ 21,738.21	

Summary of Estimated Present Worth Costs

Total Estimated Construction Cost	$	149,400.00
Legal, Engineering, & Contingencies (25%)		37,350.00
Subtotal - Estimated Project Cost	$	186,750.00
Present Worth of O&M (50 Year)		21,738.21
Total Present Worth	**$**	**208,488.21**

Infiltration Rate Field Test -- Data Summary

Test # 20141104 BEF 01	**Air Temp: 58**	**Water Temp: 50**	**Outer ring: 24" Diameter**	Ruekert·Mielke engineering solutions for a working world
Date: 11/04/2014	**Testers Initials: BEF**	**Weather: Cloudy**	**Inner ring: 12" Diameter**	
Client: City of Watertown		**Test Location: West Side of Benton St. Between Crestview Dr. and Oakwood Ln.**		

Time of Day (Military)		Incremental Time (hours)	Cumulative Time (hours)	Water Level Before Filling (inches)		Water Added (inches)		Water Level After Filling (inches)		Cumulative Infiltration (inches)		Inner Ring Infiltration Rate (inches/hour)	
Hrs.	Min.			Outer Ring	Inner Ring	Outer Ring	Inner Ring	Outer Ring	Inner Ring	Outer Ring	Inner Ring	Incremental Rate	Cumulative Rate
10	15		0.00	15.00	15.00			15.00	15.00				
11	0	0.75	0.75	12.00	10.00	3.00	5.00	15.00	15.00	3.00	5.00	6.67	6.67
11	45	0.75	1.50	10.00	13.00	5.00	2.00	15.00	15.00	8.00	7.00	2.67	4.67
12	15	0.50	2.00	12.00	11.50	0.00	0.00	12.00	11.50	11.00	10.50	7.00	5.25
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00

Infiltration Rate Field Test -- Data Summary

Test # 20141104 BEF 02	**Air Temp: 58**	**Water Temp: 50**	**Outer ring: 24" Diameter**	
Date: 11/04/2014	**Testers Initials: BEF**	**Weather: Cloudy**	**Inner ring: 12" Diameter**	
Client: City of Watertown		**Test Location: West Side of Benton St. Between South St. and Crestview Dr.**		

Ruekert·Mielke — engineering solutions for a working world

Time of Day (Military)		Incremental Time (hours)	Cumulative Time (hours)	Water Level Before Filling (inches)		Water Added (inches)		Water Level After Filling (inches)		Cumulative Infiltration (inches)		Inner Ring Infiltration Rate (inches/hour)	
Hrs.	Min.			Outer Ring	Inner Ring	Outer Ring	Inner Ring	Outer Ring	Inner Ring	Outer Ring	Inner Ring	Incremental Rate	Cumulative Rate
10	30		0.00	15.00	15.00			15.00	15.00				
11	15	0.75	0.75	12.00	10.00	3.00	5.00	15.00	15.00	3.00	5.00	6.67	6.67
12	0	0.75	1.50	11.00	12.00	4.00	3.00	15.00	15.00	7.00	8.00	4.00	5.33
12	30	0.50	2.00	11.00	11.50	0.00	0.00	11.00	11.50	11.00	11.50	7.00	5.75
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00					0.00	0.00	0.00	0.00	0.00	0.00