Menasha

Memorandum

DATE: February 11, 2016

TO: Board of Public Works

FROM: Mark Radtke, Director of Public Works MR

RE: Recommendation to Accept City-Wide Storm Water Quality Management Plan

In 2013, the City of Menasha received a Wisconsin Urban Nonpoint Source Water Pollution Abatement and Storm Water Management Grant for the purpose of developing TMDL related modifications to our Storm Water Management Plan. McMahon Engineers was retained for this project work and has completed the draft City-Wide Storm Water Quality Management Plan.

McMahon's Nick Vande Hey will be at Monday's meeting to present the Plan to the Board. The Plan is hundreds of pages long so we did not make copies of the entire document for the packet. We have four copies of the entire plan available in the Clerk's office if you wish to view the entire document. Otherwise, a link to everything in the report except the appendices can be found on the City's website by first clicking on *Agendas, Minutes and Televised Meetings*, then *Board of Public Works*, and finally *2-15-2016*.

Nick will provide an overview of the Plan and outline the series of necessary steps to be taken to meet the requirements of the Lower Fox River Total Maximum Daily Load (TMDL) under which the City is permitted. It is important to understand the Plan is not an ironclad defined path to meeting the TMDL requirements. Rather, it is a report offering analysis of several options available to the City as a means to prepare a Plan of Action to achieve the TMDL objectives.

The report lists and evaluates various Best Management Practices (BMPs) that could be utilized in combination to achieve the desired results. There will be future City focus group meetings designed to formulate the initial optimal Plan of Action which will be implemented over a twenty year period or longer. The goal of Monday's meeting is to have the Board recommend acceptance of the draft Plan in order to satisfy and finalize our grant requirements.

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City-Wide Stormwater Quality Management Plan

Prepared For The

CITY OF MENASHA

CALUMET & WINNEBAGO COUNTIES, WISCONSIN

DECEMBER 1, 2015

McM. No. M0001-9-13-00563

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City-Wide Stormwater Quality Management Plan

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1.0 INTRODUCTION

At the request of the City of Menasha, McMAHON prepared the following City-Wide Stormwater Quality Management Plan. The City obtained an Urban Nonpoint Source and Stormwater Planning (UNPS&SW) Grant from the Wisconsin Department of Natural Resources (WDNR) to assist with preparation of the plan.

The purpose of the plan is to provide the City with the long-term guidance necessary to comply with Wisconsin Administrative Code NR 216 stormwater regulations and improve water quality in receiving waters. Pursuant to NR 216, the City obtained a WPDES Municipal Stormwater Discharge Permit from the WDNR on October 13, 2006. The WDNR renewed the City's WPDES Municipal Stormwater Discharge Permit on May 7, 2014. The purpose of the permit is to regulate discharges from municipal separate storm sewer systems (MS4) and reduce urban non-point source pollution.

Relationship to Other Plans

This Stormwater Quality Management Plan compliments and is part of efforts to implement recommendations contained in several existing resource management plans. These related resource management plans include the following:

- The Lower Green Bay Remedial Action Plan (RAP) recommends 50% total phosphorus reduction for the Green Bay Area of Concern. The RAP also recommends a reduction in other urban stormwater pollutants such as sediment, heavy metals, toxics, and bacteria. The RAP was finalized by WDNR in 1993. The RAP recommends that municipalities develop and implement programs for construction site erosion control, post-construction stormwater management, illicit discharges, and shoreland / wetland zoning. The RAP also recommends that municipalities develop and implement programs that preserve, restore and enhance environmental corridors, shoreline buffers, wetlands, habitat, and public access for shoreline fishing, boating and other water-based recreation. To meet these goals, the RAP recommends planning and implementation of best management practices to reduce nonpoint source pollutants. The RAP also recommends that municipalities seek innovative and alternative ways to achieve nonpoint source goals.

- The Total Maximum Daily Load (TMDL) developed for the Lower Fox River Basin identifies total suspended solids (TSS) and total phosphorus (TP) allocations for urban stormwater, wastewater, and agricultural sources located within the Lower Fox River Basin. The TMDL was approved by the U.S. Environmental Protection Agency (EPA) in 2012. More specifically, the TMDL identifies allocations for urban stormwater in the Fox River Mainstem Sub-Basin. The total phosphorus (TP) and total suspended solids (TSS) waste load allocations identified in the TMDL Report for the City's municipal boundary are summarized in Tables 4-1 and 4-2, respectively. The Upper Fox River Basin TMDL for the City's Lake Winnebago Sub-Watershed is anticipated by WDNR to be complete during late 2016 or early 2017.

- The 2030 City of Menasha Comprehensive Plan contains several recommendations related to natural resource management and stormwater management: (1) Maintain a community stormwater management system which addresses stromwater quality; (2) support the preservation of natural open spaces that minimize flooding such as wetlands and floodplains; (3) require the use of stormwater management practices to abate non-point source pollution and address water quality; (4) implement stormwater management practices at outfall locations that discharge stormwater into wetlands, aquifers, or other environmentally sensitive areas; (5) develop and implement construction site erosion control and post-construction stromwater management ordinances in accordance with state laws; (6) encourage design of regional stormwater facilities that serve a dual puropose (i.e., stormwater retention as part of park design) when practicable.

2.0 OVERVIEW OF STUDY AREA

The study area for this Stormwater Management Plan is depicted in Figure 1. The study area contains approximately 3,880 acres of area. The City of Menasha is located in Calumet & Winnebago Counties, Wisconsin. As shown in Figure 2, several Municipal Separate Storm Sewer System (MS4) jurisdictions are located within and directly adjacent to the City. The 2010 population for the City is estimated at 17,353. The City of Menasha is part of the Appleton Urbanized Area as determined by the US Census Bureau.

Basins

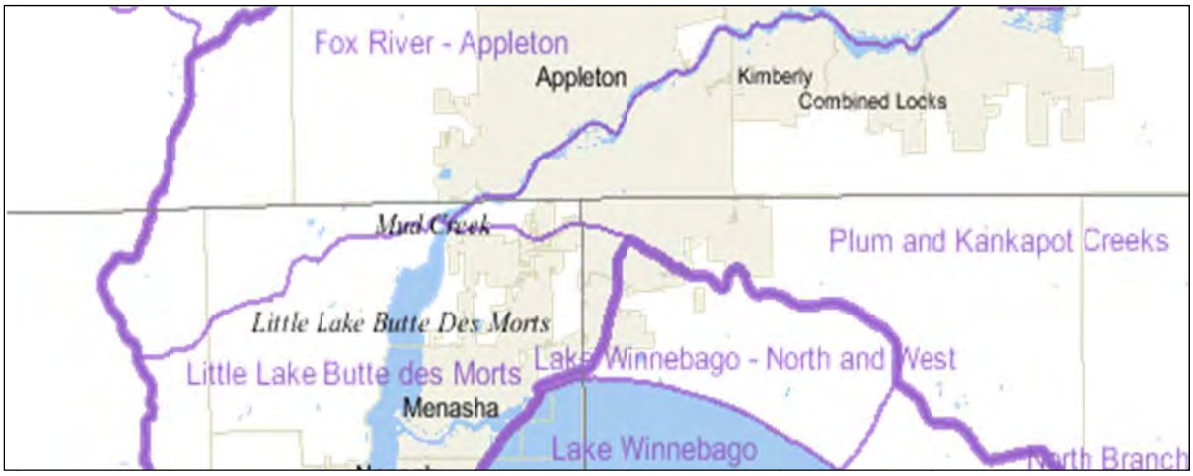
The Wisconsin Department of Natural Resources (WDNR) divided the state into 24 basins or Water Management Units (WMU). The City's study area is located in the Lower Fox and Upper Fox River Basins. The basin boundaries are similar to the federally designated 8-digit Hydrologic Unit Code (HUC) boundaries.

Exhibit 2-1: Lower & Upper Fox River Basins

Watersheds

The WDNR divided the Lower Fox River Basin into 6 watersheds and the study area is located in one of these watersheds: Little Lake Butte des Morts Watershed (LF06 -113). The WDNR divided the Upper Fox River Basin into 15 watersheds and the study area is located in one of these watersheds: Lake Winnebago - North and West (UF01 -111).

Exhibit 2-2: Little Lake Butte des Morts & Lake Winnebago - North and West Watersheds



Sub-Watersheds

For purposes of this stormwater management plan, the study area was divided into four sub-watersheds. The sub-watersheds are depicted in Figure 3 and summarized in Table 2-1. The sub-watersheds were delineated after considering the locally designated stormwater planning boundaries, federally designated 12-digit Hydrologic Unit Code (HUC) boundaries, and state designated Total Maximum Daily Load (TMDL) sub-basin boundaries.

Table 2-1: Sub-Watersheds

Sub-Watershed	HUC-12	TMDL Sub-Basin Name
Fox River	Little Lake Butte des Morts 040302040201	Lower Fox River Mainstem
Lake Winnebago	City of Utowana Beach-Lake Winnebago 040302030304	TBD

Natural Resources

Natural resource features include surface waters (lakes, rivers, streams), wetlands, and endangered or threatened resources. Natural resource features located in the study area are depicted in Figure 4. Some of these natural resource features are protected with a special regulatory designation such as outstanding resource water, exceptional resource water, 303(d) impaired water, endangered species, and threatened species. Natural resource features located in the study area with one of these special regulatory designations are identified below.

Outstanding and exceptional resource waters are pristine surface waters which are not significantly impacted by human activities and provide valuable fisheries, unique hydrological or geological features, outstanding recreational opportunities, or unique environmental settings. For example, cold water trout streams and natural waterfalls are typically classified as outstanding or exceptional resource waters. The City does not discharge stormwater runoff into any outstanding resource waters or exceptional resource waters.

Impaired water bodies are degraded surface waters which are not meeting water quality standards or their potential uses, such as fishing and swimming, due to pollutants and poor water quality. The US EPA requires each state to update its 303(d) impaired waters list every two years, including Wisconsin. The City discharges stormwater runoff into four 303(d) impaired waters:

- Fox River: The Fox River is a 303(d) impaired water body due to contaminated sediment and a blend of point and non-point source pollution. Pollutants of concern include total phosphorus and polychlorobiphenyls (PCBs). Impairments include degraded habitat, low dissolved oxygen and contaminated fish tissue. The attainable use for the Fox River is

unrestricted fish consumption, and warm water sport fishery. Currently, the Fox River is not supporting its attainable use.

- Lake Winnebago: Lake Winnebago is a 303(d) impaired water body due to atmospheric deposition, contaminated sediment, and non-point source pollution. Pollutants of concern include mercury, polychlorobiphenyls, sediment/total suspended solids, and total phosphorus. Impairments include contaminated fish tissue, low dissolved oxygen, eutrophication, water quality use restrictions, and turbidity. The attainable use for Lake Winnebago is fish and aquatic life. Currently, Lake Winnebago is not supporting its attainable uses.

Endangered and threatened resources are wild animal and plant species which are either in danger of extinction throughout all or a significant portion of its range or likely to become endangered in the foreseeable future. Typically, the location of an endangered or threatened species is tracked in Wisconsin's Natural Heritage Inventory and is only identified by township. Sensitive species that are particularly vulnerable to collection or disturbance are only identified by county. The Natural Heritage Inventory maps and species lists are routinely updated by WDNR. To prevent collection or disturbance of sensitive species, endangered and threatened resources are not depicted in Figure 4.

Cultural Resources

Cultural resources are places of cultural significance. Some cultural resources are protected with a special regulatory designation such as archeological sites and historical sites. Archeological sites may be located within the study area, but cannot be disclosed by law. The State of Wisconsin maintains maps and a computer database on the location and nature of archaeological sites. Special permission is required to view these maps and databases. The location of archaeological sites is exempt from public disclosure to prevent collection or disturbance of valuable artifacts. Historical sites located within the City and listed in the Wisconsin Historical Society's register are depicted in Figure 4 and summarized in Table 2-2.

Table 2-2: Historical Sites

I.D.	Historic Name	Location	Reference No.
1	Menasha Lock	Address Restricted	93001323
2	US Post Office	84 Racine Street	86001518
3	Gustav Augustin Block	68 Racine Street	86001181
4	Menasha City Hall (Aspen)	124 Main Street	84003826
5	Brin Building	1 Main Street	86001541
6	Carl Koch Block	2 Tayco Street	86001539
7	Tayco Street Bridge	Tayco and Water Streets	86001182
8	Menasha Dam	Fox River at Mill Street	93001330
9	Ellen and George Banta Sr. Home	348 Naymut Street	97000366

Remediation & Waste Disposal Sites

Remediation sites are places where cleanup of environmental soil or groundwater contamination is ongoing or completed. Remediation sites may involve hazardous wastes, underground storage tanks, or other contaminant sources. Waste disposal sites are places where solid wastes are stored. Understanding the location of remediation and waste disposal sites is an important consideration when evaluating potential stormwater retrofit locations. The approximate location of WDNR identified remediation sites (open and closed sites) and waste disposal sites (not archived) are depicted in Figure 4.

Soils

Soil information is from the Natural Resource Conservation Service / U.S. Department of Agriculture web soil survey for Calumet & Winnebago Counties. The U.S. Department of Agriculture has classified soil types into four hydrologic soil groups (HSG). The four hydrologic soil groups (i.e. A, B, C and D) are classified according to the minimum infiltration rate of the soil column. Group A soils have the highest permeability rate or lowest runoff potential, whereas Group D soils have the lowest permeability rate or highest runoff potential. Hydrologic soil groups are depicted in Figure 5.

MS4 System

The municipal separate storm sewer system (MS4) consists of publicly owned or operated conveyance systems including streets, curbs, gutters, catch basins, storm sewers, swales, channels, culverts, and occasionally bridges. The MS4 system is depicted in Figure 6.

The MS4 system contains several structural best management practices (BMPs). The structural BMPs are depicted in Figure 7 and summarized in Table 2-3. Structural BMPs include wet detention ponds, dry detention ponds, biofilters, proprietary devices, and other devices. Some of these structural BMPs are publicly owned and others are privately owned. As part of their stormwater program, the City typically obtains maintenance authority for privately owned BMP's through maintenance agreements. Table 2-3 identifies the private BMP's the City has maintenance authority over. For purposes of this plan, only City owned BMP's or private BMP's with maintenance agreements in place were considered for the water quality analysis.

Table 2-3: Structural BMPs

BMP ID	BMP Name	Type of Structural BMP	BMP Owner	Maintenance Agreement
F1	Tayco Pond	Wet Pond	City	Yes
F2	Miron Construction	Wet Pond	Private	No
F3	Mini-Max West	Wet Pond	Private	No
F4	Mini-Max East	Wet Pond	Private	No

Table 2-3: Structural BMPs

BMP ID	BMP Name	Type of Structural BMP	BMP Owner	Maintenance Agreement
F5	WOW Logistics	Dry Pond	Private	No
F6	WOW Logistics	Dry Pond	Private	No
F7	WOW Logistics	Dry Pond	Private	No
F8	WOW Logistics	Dry Pond	Private	No
F9	Mission Village	Wet Pond	Private	Yes
F10	Praire Home Assisted Living	Dry Pond	Private	No
F11	Praire Home Assisted Living	Wet Pond	Private	No
F12	Midway Rd Development (Subway)	Wet Pond	Private	Yes
F13	Midway Rd Development (Subway)	Biofilter	Private	Yes
F14	Dollar General	Biofilter	Private	Yes
F15	Multi-Storage West	Biofilter	Private	No
F16	Multi-Storage East	Biofilter	Private	No
F17	Piggly Wiggly	Wet Pond	Private	No
F18	Fox Lodge Living Community	Wet Pond	Private	Yes
F19	Watters Plumbing	Wet Pond	Private	No
F20	Appanasha Pet Clinics	Biofilter	Private	Yes
F21	Midway Business Park	Wet Pond	City	Yes
F22	Midway Outreach Community	Dry Pond	Private	No
F23	United Way Fox Cities	Dry Pond	Private	No
F24	UW-Fox Valley	Biofilter	Private	No
F25	UW-Fox Valley	Biofilter	Private	No
F26	UW-Fox Valley	Biofilter	Private	No
F27	UW-Fox Valley	Wet Pond	Private	No
F28	UW-Fox Valley	Dry Pond	Private	No
F29	Gambsky Grove Subdivision	Dry Pond	City	Yes
F30	Boys & Girls Club	Biofilter	Private	Yes
F31	Boys & Girls Club	Biofilter	Private	Yes
F32	Boys & Girls Club	Biofilter	Private	Yes
W1	Kendison Center	Dry Pond	Private	No
W2	The Shoppes at Waverly	Wet Pond	Private	No
W3	Stone Toad	Wet Pond	Private	No
W4	Manitowoc Road Pond	Wet Pond	City	Yes
W5	N-M Fire Station 36	Biofilter	TBD	No
W6	N-M Fire Station 36	Biofilter	TBD	No
W7	Southfield West Subdivision	Wet Pond	City	Yes
W8	Nature's Way Subdivision	Wet Pond	City	Yes
W9	Barker V Subdivision	Dry Pond	Private	No
W10	Appleton Water Treatment Facility	Dry Pond	Private	No
W11	Grassy Fields Subdivision West	Dry Pond	City	Yes
W12	Grassy Fields Subdivision East	Dry Pond	City	Yes
W13	Ribblesdale Subdivision	Dry Pond	City	Yes
W14	Woodland Trails Condos	Wet Pond	Private	No

Table 2-3: Structural BMPs

BMP ID	BMP Name	Type of Structural BMP	BMP Owner	Maintenance Agreement
W15	Woodland Hills Subdivision	Wet Pond	Private	No
W16	Lake Park Villas Ph. II Pond	Wet Pond	City	Yes
W17	Lake Park Villas Ph. I Pond 5	Wet Pond	City	Yes
W18	Lake Park Villas Ph. I Pond 4	Wet Pond	City	Yes
W19	Lake Park Villas Ph. I Pond 3	Wet Pond	City	Yes
W20	Lake Park Villas Ph. I Pond 2	Wet Pond	City	Yes

The MS4 system is based on available records. The MS4 system contains three different types of surface drainage: curb & gutter, grass swales, and areas not served by a control measure. The types of surface drainage are depicted in Figure 8.

WPDES Industrial Permits

As shown in Figure 9 and summarized in Table 2-4, there are 14 industrial operations with coverage under a WPDES Industrial Permit that are currently located within the City. WPDES Industrial Permits are regulated by the WDNR. Some WPDES Industrial Permits may allow discharges into the MS4 system during dry weather. Understanding the location of the WPDES Industrial Permitted sites is important to effective implementation of the City's stormwater program.

Table 2-4: WPDES Industrial Permits

I.D.	Facility Name	Facility Address
1	Coveris - Menasha Plant	271 River St
2	General Chemical LLC	388 Ahnaip Street
3	George A Whiting Paper Co	100 River St
4	Gold Cross Ambulance Service Inc	1055 Wittmann Drive
5	Graphic Packaging International	160 Washington St
6	Intertape Polymer Group	741 Fourth Street
7	Lamers Bus Lines Inc	1825 Novak Drive
8	Mondi Packaging Akrosil, LLC	206 Garfield Avenue
9	N-M Sewerage Commission WWTF	101 Garfield Avenue
10	ORBIS Corporation - Menasha	1320 and 1328 Earl St
11	Paper Valley Recycling Center	1420 Earl St
12	SCA Tissue North America LLC	190 3rd Street
13	Sonoco U S Mills Inc Menasha Mill	69 Washington Street
14	Sun Chemical - Menasha	450 Milwaukee Street

Drinking Water System

The City of Menasha obtains drinking water from Lake Winnebago. Water is filtered and treated at the Water Filtration Plant located on Manitowoc Street and distributed to customers through the water distribution system. The Menasha Water Utility upgraded its treatment facilities in 2007. This project added new water filters, granular activated carbon filtering, and ultraviolet disinfection. The Wisconsin DNR establishes water quality standards with respect to public waters, and an examining program for the certification of the waterworks plant operators, laboratory certification, and setting certain standards as may be necessary for health and safety purposes. The WDNR developed a Source Water Assessment Plan (SWAP) for the Menasha Water Utility. The SWAP indicates the Menasha Water Utility system has a relatively high susceptibility to contamination. The physical characteristics of Lake Winnebago and the high concentrations of urbanized and agricultural land in the eastern and southern portions of the source water area make Menasha's source water particularly susceptible to microbial, volatile organic and synthetic organic contaminants, along with precursors of treatment byproduct contaminants. The SWAP recommends that source water protection begin with the formation of a team composed of local, regional and state members to more completely assess impacts to source water and implement best management practices to prevent source water contamination. Initial source water protection efforts of this team should focus on managing the following:

- Storm water runoff from urban and waterfront developments near Lake Winnebago.
- Storm water runoff from agricultural activities within watershed.
- Landfills and industrial activities near Lake Winnebago.
- Boating related activities in Lake Winnebago.

Land Uses

The location of publicly owned parks, recreational areas, open lands, and municipal facilities are depicted in Figure 9. Understanding the location of publicly owned land is important to effective implementation of the municipal stormwater program.

Land uses on or before October 1, 2004 are depicted in Figure 10 and summarized in Table 2-5. Table 2-5 summarizes the 2004 land uses located within the study area. For purposes of the NR 151 pollutant analysis, undeveloped sites less than 5 acres are shown to be developed based on adjoining land uses. Undeveloped sites greater than 5 acres are shown as agriculture, woods, grass, or another undeveloped open space, as appropriate.

2014 land uses are depicted in Figure 11 and summarized in Table 2-5 for the study area. For purposes of the Total Maximum Daily Load (TMDL) pollutant analysis, the undeveloped in-fill sites are shown as agriculture, grass, woods, wetland or another undeveloped open space, as appropriate.

Future land uses are depicted in Figure 12 and summarized in Table 2-5 for the study area. For purposes of the Total Maximum Daily Load (TMDL) pollutant analysis, the future land uses

generally match the 2014 land uses, except the appropriate undeveloped sites are converted to a future land use based on adjoining land uses and information from the City.

Table 2-5: Land Uses

Land Use	2004 Land Use		2014 Land Use		Future Land Use	
	(acres)	(%)	(acres)	(%)	(acres)	(%)
Residential						
High Density	37	1.0%	40	1.0%	40	1.0%
High Rise	1	0.0%	1	0.0%	1	0.0%
Low Density	165	4.2%	183	4.7%	207	5.3%
Med Density	1,510	38.9%	1,578	40.7%	1,758	45.3%
Mobile Home	68	1.7%	68	1.7%	68	1.7%
Multi-Family	105	2.7%	111	2.9%	113	2.9%
Suburban	40	1.0%	37	1.0%	37	1.0%
Commercial						
Commercial Strip	157	4.0%	158	4.1%	228	5.9%
Commercial Downtown	27	0.7%	27	0.7%	27	0.7%
Office Park	69	1.8%	84	2.2%	85	2.2%
Shopping Center	17	0.4%	17	0.4%	17	0.4%
Institutional						
Hospital	32	0.8%	32	0.8%	47	1.2%
Misc. Institutional	85	2.2%	87	2.2%	89	2.3%
School	69	1.8%	67	1.7%	70	1.8%
Industrial						
Light Industrial	266	6.9%	266	6.9%	334	8.6%
Medium Industrial	106	2.7%	104	2.7%	106	2.7%
Quarry	17	0.4%	17	0.4%	17	0.4%
Open Space						
Cemetery	3	0.1%	3	0.1%	4	0.1%
[1]Park	229	5.9%	239	6.2%	245	6.3%
Railroad	33	0.9%	33	0.9%	33	0.9%
[2]Undeveloped	684	17.6%	567	14.6%	197	5.1%
Highway/Freeway	160	4.1%	159	4.1%	159	4.1%
Total:	3,880	100.0%	3,880	100.0%	3,880	100.0%

[1]Includes grass and water associated with stormwater ponds/facilities.

[2]Undeveloped land includes agriculture, grass, woods, wetlands, and open water.

3.0 NR 151 POLLUTANT ANALYSIS

Performance Standard

Pursuant to the Municipal Stormwater Discharge (MS4) Permit and NR 151.13, the City is required to reduce the total suspended solids (TSS) load by 20% and 40% for urban areas developed before October 1, 2004. The TSS reductions are calculated from a baseline load that does not include any stormwater best management practices (BMPs), such as street sweeping and wet ponds. The compliance schedules for the required TSS reductions are as follows:

- A 20% TSS reduction is required within 2 years of receiving MS4 Permit coverage. The City received permit coverage from the WDNR on October 13, 2006. As such, the City is required to achieve the 20% TSS reduction before October 13, 2008.

- A 40% TSS reduction is required before March 31, 2013. If the 40% reduction cannot be achieved by March 31, 2013, the City is required to prepare a long-term stormwater management plan that identifies the control measures already implemented, the control measures to be implemented, and a schedule for achieving the 40% TSS reduction. As part the MS4 Permit, the City is required to track phosphorus, but no NR 151.13 performance standard is provided for phosphorus.

The 2011 Wisconsin Act 32 modified the compliance schedule for the NR 151.13 performance standards. According to Wisconsin Act 32, the WDNR may enforce the City's compliance date for achieving the required 20% TSS reduction, but the WDNR is currently prohibited from enforcing a specific compliance date for achieving the required 40% TSS reduction. Also, the 2011 Wisconsin Act 32 requires that the pollutant reduction benefits associated with all structural BMPs implemented before July 1, 2011 must be maintained.

Methodology

The NR 151 pollutant analysis uses the Source Loading and Management Model for Windows (version 10.1.6). WinSLAMM is a stormwater quality model that predicts runoff volumes and non-point source pollution loads for urban land uses. WinSLAMM also calculates the amount of pollutant removal provided by BMPs such as street sweeping, catch basin cleaning, grass swales, grass filter strips, biofiltration, infiltration basins, wet detention ponds, permeable pavement, proprietary devices, and other BMPs. The NR 151 pollutant analysis uses the series of small rainfall events that occurred between March 29, 1968 and November 25, 1972 in Green Bay, Wisconsin. For purposes of MS4 Permit compliance, this 5-year rainfall series was determined by the WDNR to represent an average annual rainfall condition for municipalities located in Northeast Wisconsin.

The NR 151 pollutant analysis uses data files developed by the United States Geological Survey (USGS) and WDNR for the WinSLAMM model. The data files identify typical runoff volumes, pollutant concentrations, pollutant distributions, pollutant deliveries, and pollutant particle size

distributions for typical urban stormwater runoff. The WinSLAMM data files obtained from the USGS and used in the NR 151 pollutant analysis are as follows:

- WisReg - Green Bay Five Year Rainfall.ran
- WI_GEO03.ppdx
- WI_SL06 Dec06.rsv
- V10.1 WI_avg01.pscx
- WI_Res and Other Urban Dec06.std
- WI_Com Inst Indust Dec06.std
- Freeway Dec06.std
- Nurp.cpz

The NR 151 pollutant analysis is based on the standard land use files developed by the WDNR for WinSLAMM. The standard land use files identify the amount of roof, parking lot, driveway, sidewalk, street, and lawn source areas which are typical for each standard land use. The standard land use files also identify the amount of connected imperviousness for each source area.

The NR 151 pollutant analysis uses the WinSLAMM batch processor to generate baseline (no-controls) pollutant loads for each standard land use file. Baseline pollutant loads for each drainage and BMP catchment area are calculated using batch processor database files and GIS. A WinSLAMM model is developed for each existing and proposed structural BMP to determine the BMP's pollutant reduction. The pollutant reduction provided by each BMP is then applied to each drainage or BMP catchment area, as appropriate.

Analysis Area

The NR 151 pollutant analysis uses the study area depicted in Figure 1 and the 2004 land uses depicted in Figure 10. For purposes of the NR 151 pollutant analysis, the study area contains 3,880 acres. The NR 151 pollutant analysis also uses the developed urban area depicted on the 2010 US Census Bureau Map, including contiguous developed urban areas. Per WDNR guidance, the following areas are either prohibited from inclusion or classified as optional for inclusion in the NR 151 pollutant analysis.

- Agricultural Areas: Lands zoned for agricultural use and operating as such are prohibited from inclusion in the NR 151 pollutant analysis. Of the 3,880 acres within the study area, 245 acres are classified as agriculture and consequently, are excluded from the analysis.

- Internally Drained Areas: Internally drained areas with natural infiltration are optional to include within the TMDL pollutant analysis. There is one internally drained area within the study area and it's the quarry (formerly Badger Highways) located north of Ninth Street and west of Appleton Road (STH 47). Of the 3,880 acres within the study area, 17 acres were classified as quarry/internally drained and consequently, are excluded from the analysis.

- Waters of the State: Waters of the state are optional for inclusion in the NR 151 pollutant analysis. Lakes, rivers, streams and mapped wetlands are classified as "waters of the state". Of the 3,880 acres within the study area, 182 acres are classified as "waters of the state" and consequently, are excluded from the analysis.

- Undeveloped lands over 5 acres: Undeveloped lands over 5 acres are prohibited from inclusion in the NR 151 pollutant analysis. These areas will be classified as new development in the future and subject to NR 151.12 or 151.24 performance standards when developed. Of the 3,880 acres within the study area, 257 acres are classified as undeveloped lands over 5 acres and consequently, are excluded from the analysis.

- State & County Highways: State freeways, state trunk highways, and county highways are typically excluded from the NR 151 pollutant analysis. The Wisconsin Department of Transportation (WisDOT) is responsible for pollutant loads from state freeway and state trunk highway right-of-ways and Calumet & Winnebago Counties are responsible for pollutant loads from county highway right-of-ways. The only time the City is responsible for pollutant loads from a state or county highway right-of-way is if the highway is classified as a "connecting highway" by the WisDOT or if the City has a bridge structure that allows a City street to cross over the state or county highway. Of the 3,880 acres within the study area, 108 acres are classified as State (WisDOT) MS4 jurisdiction and 24 acres are classified as County MS4 jurisdiction. The combined 132 acres of state and county highway right-of-way are excluded from the analysis.

- Riparian Areas: Riparian areas are optional to include in the NR 151 pollutant analysis. Riparian areas are private properties that do not discharge runoff into the City's MS4, but rather discharge directly into a river, stream, or lake. Riparian areas that discharge directly into the Fox River, Lake Winnebago or other navigable streams without passing through the City's MS4 are depicted in Figure 8. Of the 3,880 acres within the study area, 409 acres are classified as riparian and consequently, are excluded from the analysis.

- MS4 "A" to "B": Areas that discharge into an adjacent municipality's MS4 (Municipality B) without passing through the City's MS4 (Municipality A) are optional to include in the NR 151 pollutant analysis. Many of these areas are located along state and county right-of-ways where runoff from private property drains directly into a State or County MS4 and then discharges directly into a river, stream, or lake. Of the 3,880 acres within the study area, 46 acres are classified as MS4 "A" to "B" and consequently, are excluded from the analysis.

- WPDES Industrial Permits: Industrial facilities permitted under NR 216 are optional to include in the NR 151 pollutant analysis. The City plans to achieve the required TSS and TP reductions for these industrial permitted areas for the following reasons: the City has legal authority to regulate stormwater runoff; the City has legal authority to charge a stormwater utility fee; it is difficult to determine which portions of an industrial site are covered by a WPDES Industrial Permit; and the pollutant load is the City's responsibility if the WPDES

Industrial Permit is terminated or certified "No Exposure" in the future. For purposes of the NR 151 pollutant analysis, industrial areas with coverage under a WDPES Industrial Permit are included in the analysis.

Based on the prohibited and optional areas mentioned above, the NR 151 pollutant analysis will apply to the remaining 2,592 acres of developed urban areas that existed on October 1, 2004.

Baseline Condition

The NR 151 baseline loads for the 2,592 acres of developed urban area are summarized in Table 3-1. These baseline or "no control" loads exclude the pollutant reduction benefits of existing BMPs. Per NR 151.13, the baseline or "no control" loads are used to determine the required 20% and 40% TSS load reduction.

Table 3-1: NR 151 Pollutant Analysis - Baseline Loadings (WinSLAMM)

Sub-Watershed	Urban Area (acres)	Baseline TSS Load (lbs/yr)	Required Load Reduction				Baseline TP Load (lbs/yr)
			TSS (%)	TSS (lbs/yr)	TSS (%)	TSS (lbs/yr)	
Fox River	2,144	569,427	20%	113,885	40%	227,771	1,742
Lake Winnebago	449	94,317	20%	18,863	40%	37,727	340
Total:	2,592	663,744	20%	132,749	40%	265,498	2,081

As shown in Table 3-1, the baseline TSS and total phosphorus (TP) loads are 663,744 pounds per year and 2,081 pounds per year, respectively. Based on the total TSS baseline load, the City is required to achieve a composite 132,749 pound per year TSS reduction in order to achieve compliance with the required 20% TSS reduction.

2004 Best Management Practices

Several BMPs qualified for NR 151 pollutant reduction credit in 2004: street sweeping (mechanical sweeper, once per month, no parking controls), grass swales, and two wet detention ponds. The 2004 BMPs are depicted in Figure 13. As shown in Table 3-2, the 2004 BMPs provided a 41,272 pound per year TSS reduction and an 88 pound per year TP reduction. As such, the 2004 BMPs provided a 6% TSS reduction and 4% total phosphorus TP reduction for the developed urban area during 2004.

Table 3-2: NR 151 Pollutant Analysis - 2004 BMPs (WinSLAMM)

Sub-Watershed	Urban Area (acres)	Total Suspended Solids (TSS)			Total Phosphorus (TP)		
		Baseline Load (lbs/yr)	Load Reduction		Baseline Load (lbs/yr)	Load Reduction	
			(lbs/yr)	(%)		(lbs/yr)	(%)
Fox River	2,144	569,427	25,040	4%	1,742	48	3%
Lake Winnebago	449	94,317	16,232	17%	340	40	12%
Total:	2,592	663,744	41,272	6%	2,081	88	4%

2008 Best Management Practices

Several BMPs qualified for NR 151 pollutant reduction credit in 2008: street sweeping (mechanical sweeper, once per month, no parking controls), grass swales, and six wet detention ponds. The 2008 BMPs are depicted in Figure 14. As shown in Table 3-3, the 2014 BMPs provided a 9% TSS reduction and a 6% TP reduction for the developed urban area during 2014. As such, additional BMPs are needed within the City's 2004 developed urban area to satisfy the required 20% TSS reduction.

Table 3-3: NR 151 Pollutant Analysis - 2008 BMPs (WinSLAMM)

Sub-Watershed	Urban Area (acres)	Total Suspended Solids (TSS)			Total Phosphorus (TP)		
		Baseline Load (lbs/yr)	Load Reduction		Baseline Load (lbs/yr)	Load Reduction	
			(lbs/yr)	(%)		(lbs/yr)	(%)
Fox River	2,144	569,427	28,600	5%	1,742	55	3%
Lake Winnebago	449	94,317	30,405	32%	340	78	23%
Total:	2,592	663,744	59,004	9%	2,081	133	6%

2014 Best Management Practices

Several BMPs qualified for NR 151 pollutant reduction credit in 2014: street sweeping (mechanical sweeper, once per month, no parking controls), grass swales, ten wet detention ponds, and four biofilters. The 2014 BMPs are depicted in Figure 15. As shown in Table 3-4, the 2014 BMPs provided a 24% TSS reduction and an 18% TP reduction for the developed urban area during 2014. As such, the City has achieved compliance with the required 20% TSS reduction for the developed urban area.

Table 3-4: NR 151 Pollutant Analysis - 2014 BMPs (WinSLAMM)

Sub-Watershed	Urban Area (acres)	Total Suspended Solids (TSS)			Total Phosphorus (TP)		
		Baseline Load (lbs/yr)	Load Reduction		Baseline Load (lbs/yr)	Load Reduction	
			(lbs/yr)	(%)		(lbs/yr)	(%)
Fox River	2,144	569,427	129,246	23%	1,742	286	16%
Lake Winnebago	449	94,317	30,405	32%	340	78	23%
Total:	2,592	663,744	159,650	24%	2,081	364	18%

For reference, more detailed water quality results for the NR 151 analysis can be found in Appendix B.

4.0 TMDL POLLUTANT ANALYSIS

A Total Maximum Daily Load (TMDL) is the maximum amount of a pollutant that a water body can receive and still meet water quality standards. The goal of a TMDL is to improve water quality so the impaired water body meets it's loading capacity and is no longer considered impaired. A TMDL for total phosphorus and total suspended solid pollutants was developed by the WDNR for the Lower Fox River Basin. The TMDL for the Lower Fox River Basin was approved by the US Environmental Protection Agency (EPA) on May 18, 2012.

The Lower Fox River Basin has 14 streams and rivers that are impaired by phosphorus and/or sediment pollutants. Excessive amounts of these pollutants cause poor water clarity, increase algae, impact swimming, and degrade aesthetics. The top photograph depicts Fox River algae during 2008 (WDNR photo) and the bottom photograph depicts sediment discharging into Green Bay during 2011 (Steve Seilo photo).

The Lower Fox River Basin TMDL was calibrated and developed using stream, river and lake monitoring data collected by the United States Geological Survey, WDNR, University of Wisconsin-Green Bay, UW-Milwaukee, and NEW Water (Green Bay MSD).

As shown in Figure 6, the City's storm sewer system discharges to two impaired waterways: Fox River and Lake Winnebago. The Fox River is specifically included in the Lower Fox River Basin TMDL. The portion of the City's storm sewer system discharging into Lake Winnebago is not part of the Lower Fox River Basin TDML, but rather is part of the Upper Fox River Basin TDML. The Upper Fox River Basin TMDL for the City's Lake Winnebago Sub-Watershed is anticipated by WDNR to be complete during late 2016 or early 2017. As such, the City's Stormwater Quality Management Plan will need to be updated following completion of the Upper Fox River Basin TDML. Although no TMDL pollutant load reductions are currently identified for the City's Lake Winnebago Sub-Watershed, baseline pollutant loadings and current BMP reductions for the sub-watershed are included in this TMDL analysis.

Performance Standard

The TMDL Report developed for the Lower Fox River Basin states that a Municipal Stormwater Discharge Permit (MS4) Permit cannot be reissued without a waste load allocation that is consistent with an EPA approved TMDL. WPDES General Permit WI-S050075-2 became effective May 1, 2014 and now includes language for MS4's that discharge to receiving waters with an approved TMDL. The WDNR renewed the City's WPDES Municipal Stormwater Discharge Permit on May 7, 2014.

The TMDL Report developed for the Lower Fox River Basin identifies waste load allocations for the City's MS4 area. The TMDL requires specific total phosphorus (TP) and total suspended solids (TSS) reductions that vary by sub-watershed. The TP and TSS waste load allocations and reductions identified in the TMDL Report for the City's municipal boundary are summarized in Tables 4-1 and 4-2, respectively.

Table 4-1: Phosphorus Allocations from TMDL Report

TMDL Sub-Watershed	City Urban Area (acres)	Total Phosphorus (TP)			
		Baseline (lbs/yr)	Allocated (lbs/yr)	Reduction (lbs/yr)	Reduction (%)
Fox River	2,857	1,638	1,146.6	491.4	30.0%

Table 4-2: Sediment Allocations from TMDL Report

TMDL Sub-Watershed	City Urban Area (acres)	Total Suspended Solids (TSS)			
		Baseline (lbs/yr)	Allocated (lbs/yr)	Reduction (lbs/yr)	Reduction (%)
Fox River	2,857	1,060,370	368,996	691,374	65.2%

As shown in Tables 4-1 and 4-2, the TMDL Report expresses the MS4 allocation as both a load reduction (pounds per year) and a percent reduction. Based on WDNR guidance, the TMDL's percent reduction should be used for MS4 permit compliance, rather than the TMDL's load reduction (pounds per year). However, the TMDL's percent reduction requires adjustment to a "no controls" condition before using for MS4 permit compliance. WDNR guidance describes the TMDL adjustment methodology in greater detail.

Table 4-3 summarizes the adjusted TP and TSS percent reductions for the City. The adjusted TMDL percent reductions in Table 4-3 are based on the "no-controls" condition and are used for evaluating alternatives for MS4 permit compliance.

Table 4-3: Adjusted TMDL Percent Reductions

TMDL Sub-Watershed	Adjusted TP Reduction from No-Controls	Adjusted TSS Reduction from No-Controls
Fox River	40.5%	72.2%
Lake Winnebago	TBD	TBD

Methodology

The TMDL pollutant analysis uses the Source Loading and Management Model for Windows (WinSLAMM version 10.1.6). WinSLAMM is a stormwater quality model that predicts runoff volumes and non-point source pollution loads for urban land uses. WinSLAMM also calculates the amount of pollutant removal provided by Best Management Practices (BMPs) such as street sweeping, catch basin cleaning, grass swales, grass filter strips, biofiltration, infiltration basins, wet ponds, proprietary devices, and other BMPs.

The TMDL pollutant analysis uses the series of small rainfall events that occurred between March 29, 1968 and November 25, 1972 in Green Bay, Wisconsin. For purposes of MS4 Permit compliance, this 5-year rainfall series was determined by the WDNR to represent an average annual rainfall condition for municipalities located in Northeast Wisconsin.

The TMDL pollutant analysis uses data files developed by the United States Geological Survey (USGS) and WDNR for the WinSLAMM model. The data files identify typical runoff volumes, pollutant concentrations, pollutant distributions, pollutant deliveries, and pollutant particle size distributions for typical urban stormwater runoff. The WinSLAMM data files obtained from the USGS and used in the TMDL pollutant analysis are as follows:

- WisReg - Green Bay Five Year Rainfall.ran
- WI_GEO03.ppdx
- WI_SL06 Dec06.rsv
- V10.1 WI_avg01.pscx
- WI_Res and Other Urban Dec06.std
- WI_Com Inst Indust Dec06.std
- Freeway Dec06.std
- Nurp.cpz

The TMDL pollutant analysis is based on the standard land use files developed by the WDNR for WinSLAMM. The standard land use files identify the amount of roof, parking lot, driveway, sidewalk, street, and lawn source areas which are typical for each standard land use. The standard land use files also identify the amount of connected imperviousness for each source area.

The TMDL pollutant analysis uses the WinSLAMM batch processor to generate baseline (no-controls) pollutant loads for each standard land use file. Baseline pollutant loads for each drainage and BMP catchment area are calculated using batch processor database files and GIS. A WinSLAMM model is developed for each existing and proposed structural BMP to determine the BMP's pollutant reduction. The pollutant reduction provided by each BMP is then applied to each drainage or BMP catchment area, as appropriate.

Analysis Area

The TMDL pollutant analysis uses the study area depicted in Figure 1, the sub-watersheds depicted in Figure 3, and the 2014 land uses depicted in Figure 11. For purposes of the TMDL pollutant analysis, the study area contains 3,880 acres. The TMDL pollutant analysis also uses the developed urban area depicted on the 2010 US Census Bureau Map, including contiguous developed urban areas. Per WDNR guidance, the following areas are either prohibited from inclusion or classified as optional for inclusion in the TMDL pollutant analysis.

- Agricultural Areas: Lands zoned for agricultural use and operating as such are optional to include in the TMDL pollutant analysis. Of the 3,880 acres within the study area, 169 acres are classified as agriculture and consequently, are excluded from the analysis.

- Internally Drained Areas: Internally drained areas with natural infiltration are optional to include within the TMDL pollutant analysis. There is one internally drained area within the study area and it's the quarry (formerly Badger Highways) located north of Ninth Street and west of Appleton Road (STH 47). Of the 3,880 acres within the study area, 17 acres were classified as quarry/internally drained and consequently, are excluded from the analysis.

- Waters of the State: Waters of the state are optional for inclusion in the TMDL pollutant analysis. Lakes, rivers, streams and mapped wetlands are classified as "waters of the state". Of the 3,880 acres within the study area, 181 acres are classified as "waters of the state" and consequently, are excluded from the analysis.

- State & County Highways: State freeways, state truck highways, and county highways are typically excluded from the TMDL pollutant analysis. The Wisconsin Department of Transportation (WisDOT) is responsible for pollutant loads from state freeway and state trunk highway right-of-ways and Calumet & Winnebago Counties are responsible for pollutant loads from county highway right-of-ways. The only time the City is responsible for pollutant loads from a state or county highway right-of-way is if the highway is classified as a "connecting highway" by the WisDOT or if the City has a bridge structure that allows a City street to cross over the state or county highway. Of the 3,880 acres within the study area, 108 acres are State (WisDOT) MS4 jurisdiction and 24 acres are County MS4 jurisdiction. The combined 132 acres of state and county highway right-of-way are excluded from the analysis.

- Riparian Areas: Riparian areas are optional to include in the TMDL pollutant analysis. Riparian areas are private properties that do not discharge runoff into the City's MS4, but rather discharge directly into a river, stream, or lake. Riparian areas that discharge directly into the Fox River, Lake Winnebago, or other navigable streams without passing through the City's MS4 are depicted in Figure 8. Of the 3,880 acres within the study area, 451 acres are classified as riparian and consequently, are excluded from the analysis.

- MS4 "A" to "B": Areas that discharge into an adjacent municipality's MS4 (Municipality B) without passing through the City's MS4 (Municipality A) are optional to include in the TMDL pollutant analysis. Many of these areas are located along state and county right-of-ways where runoff from private property drains directly into a State or County MS4 and then discharges directly into a river, stream, or lake. Of the 3,880 acres within the study area, 53 acres are classified as MS4 "A" to "B" and consequently, are excluded from the analysis.

- WPDES Industrial Permits: Industrial facilities permitted under NR 216 are optional to include in the TMDL pollutant analysis. The City plans to achieve the required TSS and TP reductions for these industrial permitted areas for the following reasons: the City has legal authority to regulate stormwater runoff; the City has legal authority to charge a stormwater utility fee; it is difficult to determine which portions of an industrial site are covered by a WPDES Industrial Permit; and the pollutant load is the City's responsibility if the WPDES Industrial Permit is terminated or certified "No Exposure" in the future. For purposes of the TMDL pollutant analysis, industrial areas with coverage under a WDPES Industrial Permit are included in the analysis.

Based on the prohibited and optional areas mentioned above, the TMDL pollutant analysis will apply to the remaining 2,878 acres of developed urban areas that existed in 2014.

Baseline Condition

The TMDL baseline loads for the 2,878 acres of developed urban area are summarized in Table 4-4. These baseline or "no control" loads exclude the pollutant reduction benefits of existing BMPs. Per WDNR guidance, the "no control" loads are used in conjunction with the adjusted TP and TSS percent reductions to determine the required load reductions.

Table 4-4: TMDL Pollutant Analysis – Baseline Condition (WinSLAMM)

Sub-Watershed	Urban Area (acres)	Total Phosphorus (TP)			Total Suspended Solids (TSS)		
		Baseline Load (lbs/yr)	Required TMDL Load Reduction		Baseline Load (lbs/yr)	Required TMDL Load Reduction	
			(%)	(lbs/yr)		(%)	(lbs/yr)
Fox River	2,241	1,773.3	40.5%	718	573,168	72.2%	413,598
Lake Winnebago	637	454.6	N/A	N/A	122,242	N/A	N/A

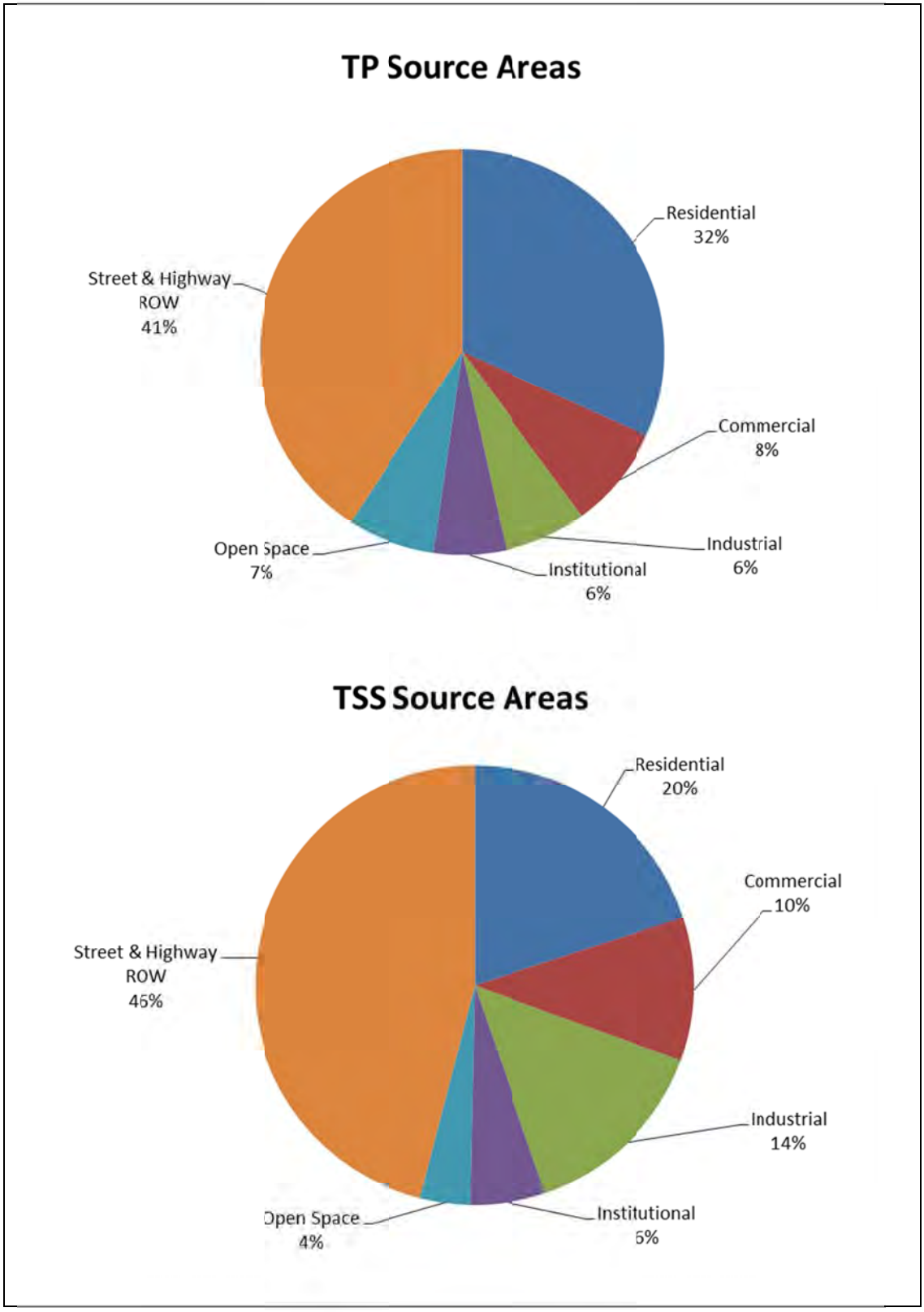
The TMDL baseline loads from WinSLAMM are also summarized by land use in Table 4-5 and Exhibit 4-1. These baseline or "no control" loads exclude the pollutant reduction benefits of existing BMPs. As shown in Table 4-5 and Exhibit 4-1, residential land use comprises the majority of land area, but street and highway land use generates a larger portion of the pollutant loads.

Table 4-5: TMDL Baseline Loads by Land Use (WinSLAMM)

Land Use	Area (acres)	Area (%)	TP (lbs/yr)	TP (%)	TSS (lbs/yr)	TSS (%)
Residential	1,361	47%	708	32%	138,949	20%
Commercial	227	8%	182	8%	73,599	11%
Industrial	232	8%	147	7%	98,665	14%
Institutional	162	6%	128	6%	38,869	6%
Open Space	373	13%	155	7%	25,270	4%
Street & Highway ROW	524	18%	908	41%	320,059	46%
Total	2,878	100%	2,228	100%	695,411	100%

Appendix A contains a list of TMDL baseline pollutant yields (pounds per acre per year) and baseline loads (pounds per year) from WinSLAMM for total phosphorus and total suspended solids. The baseline pollutant yields and loads are ranked by both drainage area and BMP catchment area from highest to lowest within the Fox River and Lake Winnebago Sub-Watersheds. Figures in Appendix A depict the TMDL baseline pollutant yields and loads by drainage area and BMP catchment area.

Exhibit 4-1: TMDL Baseline Loads by Land Use (WinSLAMM)



2014 Best Management Practices

Several BMPs qualified for TMDL pollutant reduction credit in 2014: street sweeping (mechanical sweeper, once per month, no parking controls), grass swales, ten wet detention ponds, and four biofilters. The 2014 BMPs are depicted in Figure 15. Water quality results for each sub-watershed are summarized below.

- Fox River: Table 4-6 indicates the 2014 BMPs provided a 16.7% TP reduction within the Fox River Sub-Watershed, which does not satisfy the 40.5% TP reduction required in Table 4-3. Also, Table 4-6 indicates the 2014 BMPs provided a 22.9% TSS reduction within the Fox River Sub-Watershed, which does not satisfy the 72.2% TSS reduction required in Table 4-3. As such, additional BMPs are needed within the Fox River Sub-Watershed.

- Lake Winnebago: Table 4-6 indicates the 2014 BMPs provided a 27.4% TP reduction within the Lake Winnebago Sub-Watershed. Also, Table 4-6 indicates the 2014 BMPs provided a 38.4% TSS reduction within the Lake Winnebago Sub-Watershed. Once the Upper Fox River Basin TMDL is completed, the City can compare Table 4-6 to the required pollutant load reductions for the Lake Winnebago Sub-Watershed to determine if additional BMP's are required.

Table 4-6: TMDL Pollutant Analysis - 2014 BMPs (WinSLAMM)

Sub-Watershed	City MS4 (acres)	Total Phosphorus (TP)			Total Suspended Solids (TSS)		
		Baseline Load (lbs/yr)	Load Reduction		Baseline Load (lbs/yr)	Load Reduction	
			(lbs/yr)	(%)		(lbs/yr)	(%)
Fox River	2,241	1,773.3	296.7	16.7%	573,168	131,343	22.9%
Lake Winnebago	637	454.6	124.7	27.4%	122,242	46,941	38.4%

For reference, more detailed water quality results for the TMDL analysis can be found in Appendix B.

5.0 POLLUTANT REDUCTION ANALYSIS

WinSLAMM (version 10.1.6) was used in conjunction with national literature to analyze the stormwater quality benefits and cost-effectiveness of proposed urban stormwater BMPs such as street sweeping, catch basin cleaning, grass swales, grass filter strips, biofiltration, infiltration basins, wet detention ponds, proprietary devices, and mechanical / biological treatment.

The capital costs contained in Tables 5-1 through 5-17 include the estimated present value capital costs for the BMP. The capital costs include an allowance for construction, land acquisition, engineering, legal, and contingency costs. The 20-year costs provided in the tables are the estimated present value costs per pound of TSS removed during a 20-year period. The 20-year costs include an allowance for capital costs and long-term operation and maintenance costs. The 20-year period was determined to be a reasonable life cycle or planning period for evaluating BMP cost-effectiveness. A longer planning period would improve the cost-effectiveness of structural BMPs (e.g. wet detention pond) as compared to non-structural BMPs (e.g. street sweeping). The results of the pollutant reduction analysis are summarized herein. More detailed water quality results are provided in Appendix B.

Street Sweeping

Street sweeping is effective at collecting large sediment particles (sand sized particles), trash, debris and leaves. Limited pollutant removal occurs for fine-grained particles such as silt, clay, metals and nutrients. Research indicates that street pollutants tend to accumulate within 3 feet of the street's curb and gutter. Wind turbulence from traffic tends to blow pollutants toward the curb. The curb acts as a barrier and traps pollutants. For streets without curb, wind turbulence generated by a passing vehicle tends to blow pollutants onto the adjacent grass area. As such, for street sweeping to be effective, the street must have curb.

The effectiveness of a municipal street sweeping program depends on the type of street sweeper, number of curb-miles, sweeping frequency, traffic volume, time of year, rainfall, and operator knowledge. In addition, the benefits of sweeping are significantly reduced when vehicles are parked along the curb. Whenever a street sweeper needs to maneuver around a parked car, the pollutants under the car are not removed. As such, the more cars parked along a street, the less pollutant removal.

There are two types of street sweeper: mechanical and high efficiency. Mechanical street sweepers use a broom to remove pollutants from the street surface and high efficiency street sweepers use a vacuum system to remove pollutants. Typically, the high efficiency sweeper is more effective at removing pollutants as compared to the mechanical sweeper. The City currently owns a mechanical street sweeper. The City currently sweeps once every month with no parking controls. In the future, it is recommended the City purchase a high efficiency sweeper and adopt a parking control ordinance to restrict parking along the street during sweeping operations. Table 5-1 summarizes the average annual TSS and TP costs per pound

reduced for various City-wide sweeping routines. Table 5-1 identifies the percent reduction for the street corridors only.

Table 5-1: Street Sweeping

Sweeper Type, Frequency & Parking Controls for Street Corridor Land Uses	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)
	TSS (%)	TP (%)	
H.E. Sweeper (Every 4 weeks, with parking ordinance)	22%	16%	$1.30
Mech. Sweeper (Every 4 weeks, with parking ordinance)	17%	12%	$1.71
H.E. Sweeper (Every 2 weeks, with parking ordinance)	31%	22%	$1.87
H.E. Sweeper (Every week, with parking ordinance)	41%	30%	$3.08
Mech. Sweeper (Every 4 weeks, no parking ordinance)*	9%	6%	$3.13
H.E. Sweeper (Twice each week, with parking ordinance)	46%	34%	$5.46
Mech. Sweeper (Every week, with parking ordinance)	23%	16%	$5.56
Mech. Sweeper (Every week, no parking ordinance)	14%	9%	$9.20

*Current sweeping routine

As shown in Table 5-1, street sweeping every 4 weeks with a high efficiency street sweeper and adoption of a parking control ordinance is the most cost effective street sweeping alternative. However, street sweeping every 2 weeks with a high efficiency street sweeper and adoption of a parking control ordinance is still cost effective as compared to other BMP's and provides much greater TSS and TP reduction that the every 4 weeks routine. For reference, more detailed water quality results for various street sweeping routines within the City can be found in Appendix B.

Catch Basin Cleaning

Catch basin cleaning is effective at collecting large sediment particles (sand sized particles), trash, debris and leaves. Limited pollutant removal occurs for fine-grained particles such as silt, clay, metals and nutrients. Catch basin sumps are effective for parking lots and streets that serve a small drainage area (less than 1 acre). Ideally, a catch basin sump has a minimum 3 foot depth to prevent scouring of previously settled pollutants during a rainfall.

The City currently does not have any known catch basin sumps within their MS4 system. Table 5-2 summarizes the average annual TSS and TP costs per pound reduced for street catch basin cleaning, including the costs to add catch basin sumps as part of a street retrofit or reconstruction project for various land use corridors.

Table 5-2: Street Catch Basin Cleaning

Street Corridor Land Use	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)		
	TSS (%)	TP (%)	Cleaning	Retrofit & Cleaning	Reconstruct & Cleaning
Commercial Corridors	16%	14%	$0.3	$2.0	$1.6
Industrial Corridors	16%	9%	$0.2	$1.2	$1.0
Institutional Corridors	18%	16%	$0.2	$1.5	$1.3
Residential Corridors	13%	11%	$0.5	$2.2	$1.8
Open Space Corridors	9%	7%	$0.3	$1.1	$0.9

Table 5-3 summarizes the average annual TSS and TP costs per pound reduced for parking lot catch basin cleaning, including the costs to add catch basin sumps as part of a parking lot retrofit or reconstruction project for various land use corridors.

Table 5-3: Parking Lot Catch Basin Cleaning

Street Corridor Land Use	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)		
	TSS (%)	TP (%)	Cleaning	Retrofit & Cleaning	Reconstruct & Cleaning
Commercial Corridors	15%	13%	$0.5	$3.8	$3.2
Industrial Corridors	14%	10%	$0.3	$2.1	$1.7
Institutional Corridors	17%	14%	$0.5	$4.1	$3.4
Residential Corridors	14%	11%	$1.4	$5.7	$4.9
Open Space Corridors	12%	8%	$0.8	$2.9	$2.5

Based on WDNR Guidance, the City cannot obtain water quality credit for both catch basin cleaning and street sweeping. In the City, street sweeping is a priority since sweeping helps maintain aesthetics, reduces public complaints, and reduces catch basin grate clogging. For these reasons, the City prefers street sweeping as compared to catch basin cleaning.

Grass Swales

Grass swales remove pollutants from concentrated stormwater by filtration through the grass and infiltration into the soil. The filtering capacity depends on the flow depth in the swale as compared to the grass height. Typically, when the flow depth is above the grass, filtering is minimal and scouring of previously settled pollutants is a concern. The water quality benefits of a grass swale are largely determined by the infiltrating capacity of underlying soils and depth to groundwater. For instance, a grass swale located in sandy soil has a much higher pollutant removal as compared to a grass swale located in clay soil. Other factors influencing grass swale performance include longitudinal swale slope, swale cross section, and flow volume. WDNR Technical Standard 1005 – Vegetated Infiltration Swale discusses design criteria for grass swales.

Grass swales are typically located along streets. As shown in Figure 8, most streets in the City are drained via curb and gutter, rather than grass swales. As shown in Figure 5, soils in the City are predominately clay (hydrologic soil group C and D). As such, the infiltrating capacity of the underlying soils is minimal. Figures I-12a through I-12f within Appendix B depict the City's existing grass swales and associated catchment areas. Detailed water quality results and costs for the City's existing grass swales can also be found in Appendix B. Table 5-4 summarizes the cost and water quality benefits of the City constructing grass swales along an urban street as a street retrofit or reconstruction project.

Table 5-4: Grass Swales

BMP	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)			
			Retrofit		Reconstruct	
	TSS (%)	TP (%)	Sand	Clay	Sand	Clay
Grass Swales	14%	11%	$8,951	$48,716	$3,517	$18,716

The percent reductions provided in Table 5-4 are for clay soils, but the cost per pound provides a range depending on soil type.

Grass Filter Strips

Grass filter strips remove pollutants from stormwater by filtration through the grass and infiltration into the soil. The filtering capacity of a grass filter strip depends on its longitudinal slope, length and grass density. The water quality benefits of a grass filter strip are largely determined by the infiltrating capacity of underlying soils. A grass filter strip located in sandy soil has a higher pollutant removal as compared to a grass filter strip located in clay soil.

Grass filter strips are effective for parking lots that serve small drainage areas (less than 1 acre). Typically, grass filter strips need to be a minimum of 20 feet long, but at least as long as the contributing impervious surface length. A 64 foot wide parking lot would typically require a 64 foot long grass filter strip. As such, grass filter strips require a significant amount of land area as compared to other BMPs.

In order for a grass filter strip to be effective, the stormwater flowing into the filter strip cannot be concentrated within a swale, ditch, channel, gutter, or other similar conveyance system. Rather, the stormwater must be flowing across the surface of a parking lot, lawn or other ground surface in a very thin sheet of dispersed water.

As shown in Figure 8, the City does not currently have any grass filter strips. As shown in Figure 5, soils in the City are predominately clay (hydrologic soil group C and D), but there are limited areas of sand and silt soils (hydrologic soil group A and B). Due to the land requirements and

predominately clay soils in the City, the construction and land costs to retrofit a grass filter strip are high as compared to the water quality benefit provided. Table 5-5 summarizes the cost and water quality benefits of a grass filter strip retrofit of a parking lot.

Table 5-5: Grass Filter Strips

BMP	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)
	TSS (%)	TP (%)	
Grass Filter Strips – Retrofit Parking Lot (Clay Soil)	95%	91%	$4.0

Biofiltration Devices

Biofiltration devices remove pollutants from stormwater by filtration through an engineered soil mixture. Typically, the engineered soil is a minimum of two feet deep and consists of a sand and compost mixture. A diverse mix of prairie flowers, grasses, shrubs and/or trees are typically planted in a mulch layer located above the engineered soil. During a rainfall, stormwater is temporarily stored above the mulch layer until it can be filtered through the engineered soil. A perforated underdrain pipe located beneath the engineered soil collects the filtered water and discharges it into an adjacent storm sewer or other conveyance system. Biofiltration devices are effective for small drainage areas (less than 2 acres). Biofiltration devices are able to obtain 100% TSS and TP credit for stormwater that is infiltrated into the underlying soil and an 80% TSS and 0% TP removal credit for stormwater that is filtered through the engineered soil layer and is discharged via an underdrain. Therefore, in clay soils, a biofiltration device is an effective BMP for TSS reduction, but is ineffective for TP reduction due to limited soil infiltration. Biofiltration is much more effective for TP reduction in sandy soils due to higher soil infiltration rates (refer to following “bioretention” device discussion). As shown in Figure 5, the City is comprised of mostly clay soils.

Biofiltration devices are called a “bioretention” device when the native soils located beneath the engineered soil layer are permeable and the majority of stormwater infiltrates into the native soils. In sandy soils, it may be feasible to eliminate the perforated underdrain pipe to further increase infiltration. Bioretention devices are used to recharge groundwater and improve stormwater quality, whereas biofiltration devices are primarily used to improve stormwater quality. WDNR Technical Standard 1004 – Bioretention for Infiltration discusses design criteria for bioretention and biofiltration.

Biofiltration devices are sometimes called a “bio-swale” if the device contains a longitudinal slope to facilitate flow conveyance. Bio-swales are typically installed within parking lots or along streets and have a linear configuration. Bio-swales can be used to recharge groundwater and/or improve stormwater quality. As such, a bio-swale may or may not include a perforated underdrain pipe.

The costs to incorporate biofiltration into a street retrofit or reconstruction project are summarized in Table 5-6 for sand and clay soils. The percent reductions provided in Table 5-6 are for clay soils, but the cost per pound provides a range depending on soil type.

Table 5-6: Street Biofiltration

Street Corridor Land Use	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)			
	TSS (%)	TP (%)	Retrofit		Reconstruct	
			Sand	Clay	Sand	Clay
Commercial Corridors	80%	0%	$2.6	$7.9	$1.5	$5.0
Industrial Corridors	80%	0%	$1.6	$5.0	$0.9	$3.1
Institutional Corridors	80%	0%	$1.7	$5.1	$0.9	$3.2
Residential Corridors	80%	0%	$3.3	$9.4	$1.8	$5.8
Open Space Corridors	80%	0%	$3.2	$8.9	$1.7	$5.5

The costs to incorporate biofiltration into a parking lot retrofit or reconstruction project are summarized in Table 5-7 for sand and clay soils. The percent reductions provided in Table 5-7 are for clay soils, but the cost per pound provides a range depending on soil type.

Table 5-7: Parking Lot Biofiltration

Parking Lot Land Use	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)			
	TSS (%)	TP (%)	Retrofit		Reconstruct	
			Sand	Clay	Sand	Clay
Commercial Corridors	80%	0%	$10.8	$38.2	$6.8	$23.8
Industrial Corridors	80%	0%	$5.9	$36.9	$3.6	$22.5
Institutional Corridors	80%	0%	$10.4	$28.2	$6.3	$17.2
Residential Corridors	80%	0%	$12.5	$38.4	$7.6	$23.4
Open Space Corridors	80%	0%	$5.0	$18.4	$3.0	$11.2

Proprietary biofiltration devices are also available to achieve pollutant reductions. The proprietary devices are pre-manufactured structures which are typically placed along a street or within a parking lot island. The structure is filled with engineered soil with an underdrain system for biofiltration. Examples of proprietary biofiltration devices include Filterra®, TreePod™, UrbanGreen™, and many other products. The costs to incorporate proprietary biofiltration into a street or parking lot retrofit or reconstruction project for sand and clay soils are summarized in Table 5-8. The percent reductions provided in Table 5-8 are for clay soils, but the cost per pound provides a range depending on soil type.

Table 5-8: Proprietary Biofiltration

BMP Location	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)			
			Retrofit		Reconstruct	
	TSS (%)	TP (%)	Sand	Clay	Sand	Clay
Proprietary Biofiltration-Street	80%	0%	$5.6	$18.9	$5.0	$16.8
Proprietary Biofiltration-Parking Lot	80%	0%	$21.1	$76.5	$18.2	$66.4

Sand Filters

A sand filter is similar to a biofiltration device except the engineered soil consists of 100% sand meeting one of the gradation options specified in Technical Standard 1004. Per WNDR guidance, a sand filter may obtain 80% TSS and 35% TP reduction for the filtering component of the devices. The WDNR is currently researching development of an engineered soil mixture that would achieve a greater TP removal credit than a sand filter. The costs to incorporate a sand filters into a street or parking lot retrofit or reconstruction project will be primarily the same as the biofiltration costs listed in Tables 5-6 and 5-7. The only difference between sand filters and biofiltration is that sand filters provide some level of TP removal for the filtered component.

Rain Gardens

Bioretention devices are sometimes called a "rain garden" if the device does not contain an engineered soil layer. Although pollutant removal is provided, rain gardens are typically installed for groundwater recharge purposes rather than stormwater pollutant removal. Often, runoff from a residential roof, patio, sidewalk or driveway is directed to a rain garden. These residential source areas have a low pollutant load but generate a significant amount of runoff volume. Whenever a source area has a high pollutant load (i.e. street or parking lot), an engineered soil layer is recommended to provide a higher capacity filter media. A high capacity filter media reduces the device's surface area, ponding duration, and clogging potential. If stormwater is allowed to pond on the surface of a rain garden, bioretention device, or biofiltration device for more than 24 hours, the plants may become diseased or die due to wet conditions or poor system hydrology. The costs to retrofit rain gardens on private residential property are summarized in Table 5-9.

Table 5-9: Rain Gardens

BMP	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)
	TSS (%)	TP (%)	
Rain Garden – Retrofit Residential Lot	98%	98%	$72

Infiltration Basins

An infiltration basin is a water impoundment constructed over a highly permeable soil. The purpose of an infiltration basin is to temporarily store stormwater and allow it to infiltrate through the bottom and sides of the infiltration basin. Pollutants are removed by the filtering action of the underlying soil. The primary functions of an infiltration basin are to provide groundwater recharge, reduce runoff volumes, and reduce peak discharge rates. The secondary function of an infiltration basin is water quality. WDNR Technical Standard 1003 – Infiltration Basin discusses design criteria for infiltration basins.

Infiltration basins require pretreatment to prevent clogging and failure. WDNR Technical Standard 1003 - Infiltration Basin requires a pretreatment system to reduce the TSS load entering an infiltration basin by 60% for a residential land use and 80% for a commercial, industrial, or institutional land use. Typically, a wet detention pond or biofiltration device is used as the pretreatment system. The pretreatment system prevents the infiltration basin from failing and helps reduce the risk of groundwater contamination due to pollutants contained in stormwater. Not all stormwater runoff should be infiltrated due to concern for groundwater contamination.

In order for an infiltration basin to be feasible, the depth to groundwater typically needs to be 5 feet or more and the soil needs to be a loam, silt or sand. As shown in Figure 5, soils in the City are predominately clay (hydrologic soil group C and D). Sand and silt soils are found in limited locations in the City (hydrologic soil group A and B). As such, the feasibility of an infiltration basin is very limited within the City.

Finally, a significant amount of the water quality benefit is provided by the infiltration basin's pretreatment system. Typically, the pretreatment system is a wet detention pond or biofiltration device. From a water quality perspective, an infiltration basin is not cost effective after considering the pretreatment costs. As such, infiltration basin costs are not included in the analysis; rather pretreatment system costs are included in the analysis (i.e. wet detention ponds and biofiltration devices).

Hydrodynamic Separator Devices

Hydrodynamic separator devices are pre-manufactured underground devices which use cyclonic separation to provide pollutant reduction for stormwater. Hydrodynamic separator devices are typically placed in place of a storm sewer manhole within a storm sewer discharge pipe and are typically used to treat smaller (< 2 acre) drainage areas. Collected pollutants are typically removed with a vacuum truck. Examples of hydrodynamic separators include Vortechs®, CDS™, Aqua-Swirl®, and many other products. The costs to incorporate hydrodynamic separators into a street retrofit or reconstruction project are summarized in Table 5-10.

Table 5-10: Street Hydrodynamic Separator Devices (HSD)

Street Corridor Land Use	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)	
	TSS (%)	TP (%)	Retrofit	Reconstruct
Commercial Corridors	21%	18%	$5.5	$4.4
Industrial Corridors	23%	13%	$4.4	$3.5
Institutional Corridors	23%	20%	$4.3	$3.5
Residential Corridors	21%	17%	$7.4	$5.9
Open Space Corridors	21%	17%	$6.8	$5.4

The costs to incorporate hydrodynamic separators into a parking lot retrofit or reconstruction project are summarized in Table 5-11.

Table 5-11: Parking Lot Hydrodynamic Separator Devices (HSD)

Parking Lot Land Use	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)	
	TSS (%)	TP (%)	Retrofit	Reconstruct
Commercial Corridors	19%	16%	$15.5	$12.4
Industrial Corridors	20%	16%	$10.6	$8.4
Institutional Corridors	20%	15%	$18.7	$15.0
Residential Corridors	21%	15%	$26.3	$21.2
Open Space Corridors	31%	20%	$31.7	$25.3

Stormwater Filtration Devices

Stormwater Filtration devices are pre-manufactured underground stormwater treatment systems that use filters to reduce pollutants in stormwater. The filters are typically media filled cartridges which can be customized to target specific pollutants placed within a pre-cast or cast-in-place underground concrete structure and are typically used to treat smaller (< 2 acre) drainage areas. As clogging occurs within the filters, they can be cleaned underground and/or replaced when clogged. Examples of Stormwater Filtration include Stormfilter®, Perk Filter™, Aqua-Filter™, and many other products. The costs to incorporate stormwater filtration into a street retrofit project or a street reconstruction project are summarized in Table 5-12.

Table 5-12: Street Stormwater Filtration Devices

Street Corridor Land Use	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)	
	TSS (%)	TP (%)	Retrofit	Reconstruct
Commercial Corridors	38%	38%	$6.9	$6.0
Industrial Corridors	43%	26%	$5.3	$4.6
Institutional Corridors	42%	42%	$5.3	$4.6
Residential Corridors	39%	35%	$8.9	$7.7
Open Space Corridors	39%	35%	$8.4	$7.2

The costs to incorporate hydrodynamic separators into a parking lot retrofit or reconstruction project are summarized in Table 5-13.

Table 5-13: Parking Lot Stormwater Filtration Devices

Parking Lot Land Use	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)	
	TSS (%)	TP (%)	Retrofit	Reconstruct
Commercial Corridors	36%	34%	$26.5	$25.2
Industrial Corridors	39%	37%	$16.9	$16.0
Institutional Corridors	39%	35%	$29.8	$28.2
Residential Corridors	42%	34%	$41.0	$38.9
Open Space Corridors	61%	45%	$50.9	$48.2

Permeable Pavement

Permeable pavement is a pavement system which allows stormwater to drain through paved surfaces into the underlying soil or to an underground reservoir for treatment. In addition to pollutant reduction, permeable pavement is also used to reduce peak flow rates and stormwater runoff volumes for development sites. Permeable pavement includes but is not limited to: pervious concrete or asphalt, pervious pavers and open jointed blocks. WDNR allows for 100% TSS & TP credit for the volume of runoff that infiltrates into the native soil. Any runoff that discharges through an underdrain pipe receives a 55% TSS and 35% TP credit. The costs to incorporate a permeable pavement into a street retrofit project or a street reconstruction project are summarized in Table 5-14.

Table 5-14: Permeable Pavement

BMP Location	Pollutant Load Reduction		Avg. Annual TSS Cost ($/lb)			
	TSS (%)	TP (%)	Retrofit		Reconstruct	
			Sand	Clay	Sand	Clay
Permeable Pavement-Street	72%	65%	$14.0	$16.1	$10.1	$11.6
Permeable Pavement-Parking Lot	73%	54%	$47.0	$45.1	$32.4	$31.1

Wet Detention Ponds / Wetland Systems

Wet detention ponds and wetland systems are effective at removing sediment, nutrients, heavy metals, oxygen demanding compounds (BOD), hydrocarbons, and bacteria. Pollutant removal within a wet pond and wetland system is primarily due to gravity settling of particulate pollutants and sediment. Filtration, adsorption and microbial decomposition also remove pollutants, particularly within a wetland system. WDNR Technical Standard 1001 – Wet Detention Pond discusses design criteria for wet detention ponds.

Typically, a wet detention pond or wetland system must contain a minimum water depth of 5 feet within a portion of the permanent pool to minimize re-suspension of pollutants during a rainfall event. The WDNR requires that wet detention ponds and wetland systems be sized using the National Urban Runoff Project (NURP) particle size distribution. To achieve an 80% reduction in TSS, a wet detention pond or wetland system typically needs to remove the 3 to 5 micron sediment particle.

Existing dry detention ponds located in the City were evaluated to determine the feasibility of converting into wet detention ponds. Currently, WDNR does not allow water quality credit for dry detention ponds. Existing dry detention ponds located within the City are depicted in Figure 7 and summarized in Table 2-3. Generally, wet detention ponds are not recommended for small watersheds (less than 15 to 20 acres in clay soil). A wet detention pond located in a small watershed may develop stagnation problems and become a public nuisance. Public acceptance of stormwater BMPs is important to the success of the City's stormwater program.

In the 2002 version of the NR 151 rule, best management practices (BMPs) associated with post-construction sites containing new development may not be located in navigable waters to receive credit for meeting any performance standard in Chapter NR 151. This restriction has been retained in the revised rule. Also in the 2002 version of the rule, best management practices for existing development, re-development or in-fill development could receive water quality credit for wet detention ponds / wetland systems constructed within both perennial and intermittent streams if all applicable permits are received. As of January 1, 2011, NR 151.003 only allows water quality credit for newly constructed wet detention ponds / wetland systems constructed within intermittent streams for which all applicable permits are received.

A cost analysis was completed to determine the most cost-effective retrofits within the City. As part of the analysis, aerial photographs were used to identify potential undeveloped properties that could be used for a retrofit. The location of storm sewer pipes and the watershed size in relation to the undeveloped property was also considered. Table 5-15 summarizes the cost and water quality benefits of those wet detention ponds / wetland systems within the Fox River Sub-Watershed analyzed for the City (partial list of analyzed ponds). A detailed structural BMP cost analysis can be found in Appendix C and includes the full list of ponds and other BMP's analyzed. BMP Concept drawings for the facilities listed in Table 5-15 and are also provided in Appendix C

Table 5-15: Potential Wet Detention Ponds / Wetland Systems

Wet Detention Pond / Wetland System	Drainage Area (acres)	Pollutant Reduction		Capital Costs	Capital & O&M Costs Over 20 Years	Avg. Annual TSS Cost ($/lb)
		TSS (%)	TP (%)			
DOT Pond 4 - Alt 2	106	90%	66%	$15,000	$897,079	$1.39
Tayco Pond Expansion	836	69%	49%	$0	$928,031	$1.66
DOT Pond 4 - Alt 3	334	73%	54%	$1,953,600	$2,735,081	$2.20
Pleasants Park Pond	142	84%	62%	$800,300	$1,103,803	$2.54
DOT Pond 2 - Alt 2	62	92%	71%	$250,500	$632,146	$2.55
Hart Park Pond	59	83%	61%	$284,100	$431,566	$2.66
Jefferson Park Pond	79	85%	62%	$506,600	$685,616	$2.89
Sixth Street Pond	94	72%	52%	$916,000	$1,088,005	$3.14
Ninth Street Pond - Alt 2	40	79%	57%	$266,500	$397,607	$3.44
Smith Park Pond	90	83%	59%	$641,100	$808,431	$3.54
Ninth Street Pond - Alt 1	98	81%	60%	$934,300	$1,143,535	$3.67
DOT Pond 4 - Alt 1	33	95%	72%	$0	$882,079	$3.93
Racine Street Pond	26	83%	65%	$458,600	$583,864	$4.49
Shepard Park Pond	26	85%	60%	$380,400	$502,158	$4.63
Graphic Packaging Pond	55	76%	55%	$698,400	$910,116	$4.70
Lock Street Pond	45	80%	57%	$585,100	$713,870	$4.86
Third Street Pond	20	84%	64%	$427,000	$531,231	$5.92
Parkview Pond	44	82%	57%	$748,200	$890,992	$6.05
Midway Pond	200	72%	54%	$2,971,600	$3,523,319	$6.30
Abbey Pond	23	75%	55%	$586,500	$715,270	$8.19
DOT Pond 2 - Alt 1	5	96%	74%	$0	$381,646	$16.65

In addition to wet detention ponds, underground detention is another alternative to provide similar pollutant reduction, allowing for full build out of a proposed development site. The detention may be provided with a permanent pool of water in an underground piping system allowing for pavement above the stormwater device. The sediment accumulation is typically removed by vacuum truck or other method. The underground detention system is more expensive than wet detention ponds, but maximizes development area of sites. One

underground detention devices was investigated for the City. Table 5-16 summarizes the cost and water quality benefits for the proposed Center Street Underground Detention

Table 5-16: Underground Detention System

Underground Detention Pond	Drainage Area (acres)	Pollutant Reduction		Capital Costs	Capital & O&M Costs Over 20 Years	Avg. Annual TSS Cost ($/lb)
		TSS (%)	TP (%)			
Center Street Underground Detention	19	81%	62%	$2,462,700	$2,610,166	$33.43

Enhanced Settling (Alum Treatment)

In the future, the City may want to investigate the feasibility of adding polymers or flocculants such as Alum to wet detention ponds to enhance pollutant removal efficiencies. Polymer or flocculent additions will likely require installation of mechanical injection systems. The WDNR is currently discussing if Wisconsin will allow the use of polymers and flocculants in wet detention ponds. This TMDL pollutant analysis will likely require updating after WDNR guidance documents regarding the use of polymer and flocculants in ponds is completed. Table 5-17 summarizes the cost and water quality benefits of those wet detention ponds with Alum treatment analyzed for the City.

Table 5-17: Potential Wet Detention Ponds with Alum Treatment

Wet Detention Pond With Alum Treatment	Drainage Area (acres)	Pollutant Reduction		Capital Costs	Capital & O&M Costs Over 20 Years	Avg. Annual TSS Cost ($/lb)
		TSS (%)	TP (%)			
Tayco Pond Expansion with Alum	836	90%	85%	$298,002	$3,100,938	$2.16
DOT Pond 4 - Alt 3 with Alum	334	90%	85%	$2,229,312	$4,902,364	$3.13
Pleasants Park Pond with Alum	142	90%	85%	$937,925	$2,015,637	$4.26
Sixth Street Pond with Alum	94	90%	85%	$1,060,448	$2,061,871	$4.54
Jefferson Park Pond with Alum	79	90%	85%	$602,344	$1,219,911	$4.82
Smith Park Pond with Alum	90	90%	85%	$741,011	$1,377,371	$5.42
Midway Pond with Alum	200	90%	85%	$3,226,829	$5,504,382	$7.62

Mechanical / Biological Treatment Facilities

Mechanical / biological treatment facilities are not currently used in Wisconsin, with the exception of combined sewer systems that treat wastewater and stormwater. A mechanical / biological treatment facility would be difficult to implement for stormwater given the number of storm sewer outfalls located within the City. Significant storm sewer pumping would likely be

needed to convey stormwater from each outfall to a regional stormwater treatment facility, similar to a wastewater treatment facility. As a result, stormwater treatment facilities are not typically cost effective BMPs. A mechanical / biological treatment facility and associated pumping systems are estimated to have an average annual cost that is well above $20 per pound of TSS removed. In addition, diverting low flows from all storm sewer outfalls to a regional treatment facility may dry up existing wetlands and streams located near the City's current storm sewer outfalls.

Alternatives

The City is responsible for reducing phosphorus and sediment loads to satisfy the TMDL percent reductions listed in Table 4-3. Four alternatives were developed to satisfy the TMDL percent reductions. Each alternative identifies a combination of existing and proposed BMPs that satisfies the TMDL allocations for the City.

- Alternative 1 – As shown in Figure 16, Alternative 1 includes the existing wet ponds, existing biofilters, and proposed ponds including Tayco Pond Expansion (with Alum), DOT Pond 2-Alt 2, Jefferson Park Pond, DOT Pond 4-Alt 3 (with Alum), Ninth Street Pond-Alt2, Pleasants Park Pond (with Alum), Racine Street Pond, Sixth Street Pond (with Alum), Shepard Park Pond, and Smith Park Pond (with Alum). In addition, Alternative 1 includes high efficiency street sweeping twice per month with a parking control ordinance.

- Alternative 2 – As shown in Figure 17, Alternative 2 includes the existing wet ponds, existing biofilters, and proposed ponds including Tayco Pond Expansion (with Alum), DOT Pond 2-Alt 2, Jefferson Park Pond, DOT Pond 4-Alt 3 (with Alum), Ninth Street Pond-Alt2, Pleasants Park Pond (with Alum), Racine Street Pond, Sixth Street Pond, Shepard Park Pond, Smith Park Pond, and Lock Street Pond. In addition, Alternative 2 includes high efficiency street sweeping twice per month with a parking control ordinance.

- Alternative 3 – As shown in Figure 18, Alternative 3 includes the existing wet ponds, existing biofilters, and proposed ponds including Tayco Pond Expansion (with Alum), DOT Pond 2-Alt 2, Jefferson Park Pond, DOT Pond 4-Alt 2, Ninth Street Pond-Alt2, Pleasants Park Pond (with Alum), Racine Street Pond, Sixth Street Pond (with Alum), Shepard Park Pond, Smith Park Pond (with Alum), Graphic Packaging Pond, and Midway Pond (with Alum). In addition, Alternative 3 includes high efficiency street sweeping twice per month with a parking control ordinance.

- Alternative 4 – As shown in Figure 19, Alternative 4 includes the existing wet ponds, existing biofilters, and proposed ponds including Tayco Pond Expansion (with Alum), DOT Pond 2-Alt 2, Jefferson Park Pond, DOT Pond 4-Alt 2, Pleasants Park Pond (with Alum), Racine Street Pond, Sixth Street Pond (with Alum), Shepard Park Pond, Smith Park Pond (with Alum), Graphic Packaging Pond, and Midway Pond (with Alum). In addition, Alternative 4 includes high efficiency street sweeping once per week with a parking control ordinance.

Costs associated with the proposed street sweeping program and proposed structural BMPs are provided in Table 5-18. The capital costs provided in Table 5-18 are the estimated present value capital costs for the proposed structural BMPs. The capital costs include an allowance for construction, land acquisition, engineering, legal, and contingency costs.

Table 5-18: TMDL Alternatives Analysis

City MS4 Alternative	Proposed Street Sweeping*			Proposed Structural BMPs
	Type of Sweeper	Sweeping Frequency	Parking Control	Capital Costs
1	H.E.	Twice / month	Yes	$7.1 million
2	H.E.	Twice / month	Yes	$7.5 million
3	H.E.	Twice / month	Yes	$8.8 million
4	H.E.	Once / week	Yes	$8.6 million

* Street sweeping begins March 29 and ends November 25 of each year. High efficiency (H.E.). Mechanical (M).

Plan of Action

In the future, the City intends to develop a Plan of Action for achieving compliance with the TMDL waste load allocations. The Plan of Action will include a capital improvement plan for the next 20 plus years. Implementation will be dynamic over the next 20 years, but at least the Plan of Action provides a starting point as the City works toward TMDL compliance.

6.0 IMPLEMENTATION & RECOMMENDATIONS

Below are various recommendations for the City to consider when implementing the Stormwater Quality Management Plan and working toward MS4 Permit compliance.

Resource Management Plans

Several resource management plans were discussed in Section 1.0 of this Stormwater Quality Management Plan. It is recommended that the priorities and recommendations contained in these resource management plans be incorporated into this plan by reference.

Plan of Action

It is recommended that the City develop a Plan of Action for stormwater quality after completion of this report. It is recommended that pollutants of concern associated with the Lower Fox River Basin TDML be targeted during implementation. Pollutant loads and pollutant yields depicted in Figures I-4 through I-11 in Appendix A can be used to target specific drainage areas with heavier pollutant loads or yields. In addition, the pollutant load and BMP analysis contained in this report can be used to target specific source areas with a heavier load or BMPs with a more favorable cost.

Public Education & Public Involvement

Public education and public involvement are recommended during development and implementation of the Plan of Action. Potential stakeholders include the general public, elected officials, City Staff, developers, regulatory entities, individual property owners and other regulated entities. Although this stormwater quality management plan includes a cost versus benefit analysis, the plan does not take into consideration intangibles such as public sentiment, public opinion, land availability, etc.

Redevelopment Sites

It is recommended that the City evaluate public / private partnerships with landowners when developing and implementing its Plan of Action. As required by NR 151.12 and the City's Post-Construction Stormwater Management Ordinance, redevelopment sites with 1 acre or more of land disturbance are required to achieve a TSS reduction. Compliance with the TSS reduction is only required when a construction project occurs on the site. As such, these redevelopment sites do not have a specific timeline for achieving a TSS reduction. Nonetheless, when redevelopment occurs on commercial, industrial, institutional and multi-family residential parcels, stormwater quality improvements will be required. Public / private partnerships provide an opportunity to work together such that both the landowner and City benefit.

For example, redevelopment of a 20 acre shopping center may provide an opportunity to increase the site's TSS reduction to 80% or provide an opportunity to provide water quality

treatment for other nearby properties or streets. In some instances, cost sharing can be used as a financial incentive or the City cost share through of public / private partnership with the landowners. Typically, it is more cost effective to incorporate stormwater quality improvements into an already planned construction project as compared to retrofitting a BMP without considering other construction activities in the watershed.

Inter-Governmental Agreements

It is recommended that the City evaluate inter-governmental agreements when developing and implementing the Plan of Action. It may be more cost effective to work together with adjoining municipal jurisdictions, such as the Wisconsin Department of Transportation or Calumet & Winnebago County Highway Departments. Also, it may be beneficial to work together with adjoining cities, villages and townships to construct a mutually beneficial stormwater BMP, share equipment, restore a wetland, or improve water quality using other methods.

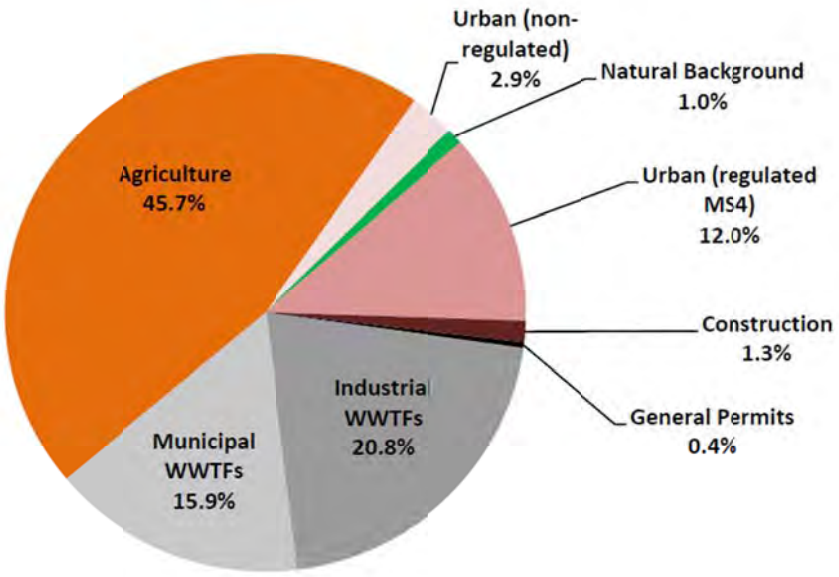
Water Quality Trading

It is recommended that the City evaluate the feasibility and cost effectiveness of water quality trading when developing and implementing its Plan of Action. The cost for achieving compliance with TMDL allocations is not uniform among dischargers and source areas. As such, compliance with TMDL allocations may be more cost-effectively achieved by trading with other dischargers. Water quality trading is allowed between wastewater treatment facilities, agricultural landowners, and other urban stormwater dischargers. In order to be eligible for water quality trading, specific criteria needs to be satisfied. The WDNR recently developed a water quality trading framework for Wisconsin. This framework has led to two additional guidance documents for trading implementation.

Watershed Adaptive Management

It is recommended that the City evaluate the feasibility and cost effectiveness of Watershed Adaptive Management when developing and implementing its Plan of Action. Adaptive management is a watershed approach that focuses on meeting water quality standards within a river, stream or lake in a more cost-effective manner. Watershed Adaptive Management needs to be initiated by a wastewater treatment facility owner, but would likely involve cooperation among other phosphorus dischargers including agricultural, urban stormwater, and wastewater dischargers. Exhibit 6-1 depicts the portion of phosphorus that is being generated by agriculture, urban stormwater and wastewater treatment facilities within the Lower Fox River Basin. Exhibit 6-1 was obtained from the Lower Fox River Basin TMDL Report.

Exhibit 6-1: Phosphorus Sources in Lower Fox River Basin



Municipal Leaf Collection Program

It is recommended that the City review and potentially revise their municipal leaf collection programs after the WDNR and United States Geological Survey (USGS) complete their scientific research. Currently, the WDNR and USGS are sampling and monitoring stormwater runoff in the City of Madison to determine the amount of phosphorus reduction associated with different municipal leaf collection techniques. The study results will help the City evaluate their municipal leaf collection programs. The study may indicate that the City is already using the best leaf collection technique for purposes of reducing phosphorus loads.

Stream, Shoreline & Channel Stabilization

It is recommended that the City undertake high priority stream, shoreline and channel stabilization projects to reduce the discharge of sediment and phosphorus pollutants associated with bed, bank or steep slope erosion. In addition to the water quality benefits, stabilization projects provide an opportunity to improve habitat, remove invasive species, and potentially restore wetland areas. Grant funding is available to assist with stabilization projects.

5-Year Capital Improvement Plan

It is recommended that the City develop a 5-year to 20-year capital improvement plan based on this stormwater quality management plan and the Plan of Action. We recommend that the capital improvement plan include ample time for public education, public input, BMP design, land acquisition, regulatory permits, grant applications, financing, and construction. The capital

improvement plan should also take into consideration other local capital improvement projects, such as street reconstruction projects, utility projects, and private development projects.

Financing Plan

It is recommended that the City develop a financing plan. The financing plan will allow the City to implement its Plan of Action and 5-year Capital Improvement Plan. Below is a discussion of various funding sources which may be available to the City. Depending on the project, funding options may be used individually or in combination.

- Debt / Bonds: General obligation and revenue bonds may be used to secure funding for stormwater projects. Property taxes and revenue fees are used for long-term debt payments.

- Special Assessments: Special assessments may be used to generate funds for a specific project. Property owners that benefit from the project pay the assessment fee. Typically, other funding sources are needed to pay for project costs until property owners pay the assessment.

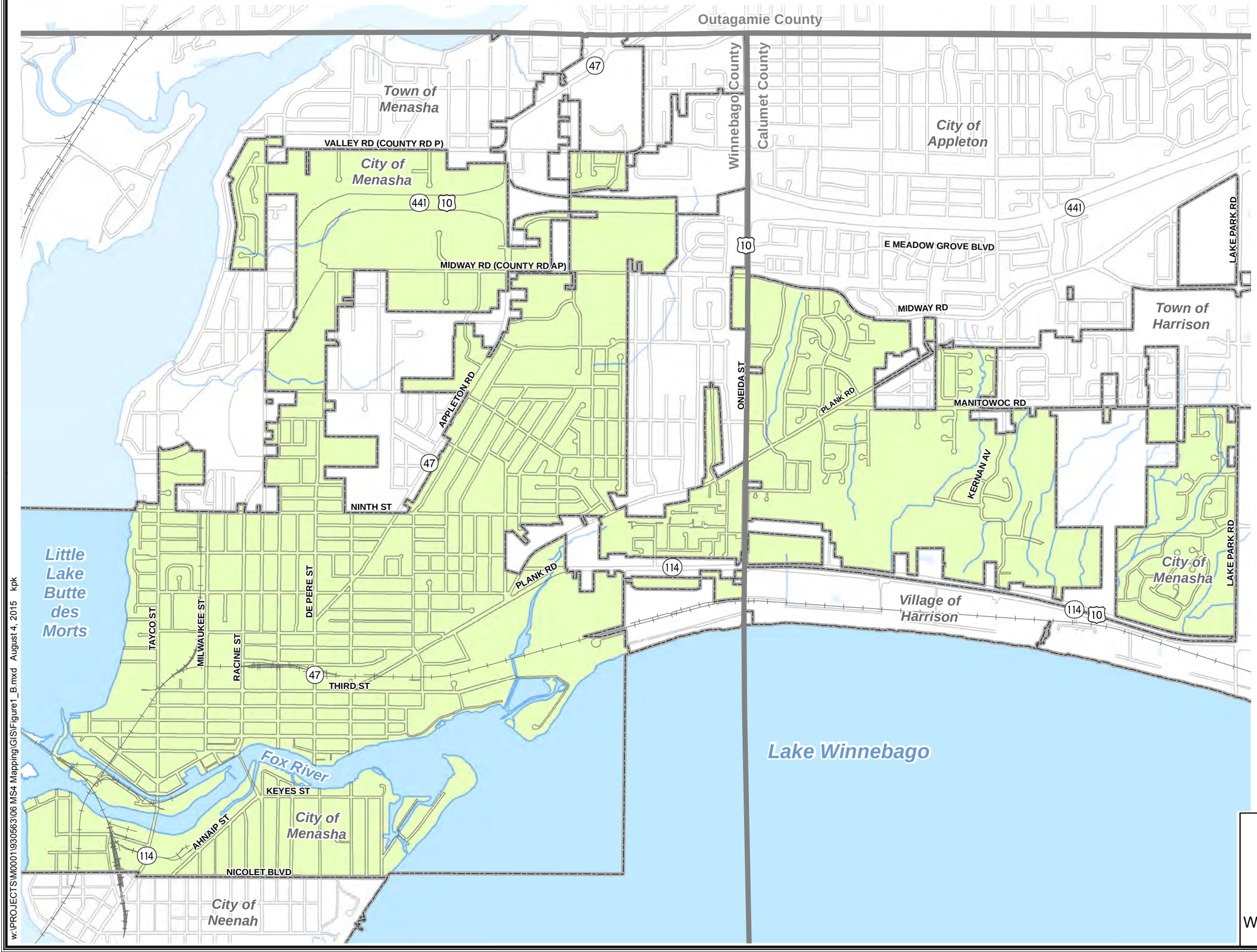
- Impact Fees: Impact fees may be charged to developers for stormwater projects that benefit the development. Impact fees are usually paid during initial stages of development. Typically, projects include regional stormwater facilities or improvements to deficient downstream infrastructure. Often, other funding sources are needed to pay for project costs until developers and property owners are required to pay the impact fee. Impact fees are recommended as needed to fund the municipal stormwater program.

- Tax Incremental Financing (TIF) District: TIF Districts may be used by Cities and Villages to fund stormwater projects that benefit property located within the District. Property value increases within the TIF District generate additional tax revenue that is used for long-term debt payments.

- Stormwater Utility: Stormwater utilities are similar to sanitary and water utilities. Stormwater utilities generate revenue for stormwater related projects by charging property owners an annual service fee. Annual service fees are based upon the amount of runoff generated by a specific property. Properties with more impervious area (i.e. roofs, parking lots, driveways, etc.) are charged a higher fee as compared to properties with less impervious area. All properties, including tax exempt properties, pay the service fee. Rate adjustments are recommended as needed to fund the municipal stormwater program.

- Grants / Loans: State and federal grant / loans are available for certain stormwater projects. Typically, only a certain percent of the total project cost is eligible for grant / loan money with remaining revenues to be generated by the applicant. Below are a few grant / loan programs which the City may or may not be familiar with. Grant applications are recommended.

- Urban Non-Point Source and Stormwater Construction Grant
- Targeted Runoff Management Construction Grant
- Great Lakes Basin Program
- Community Development Block Grant
- Clean Water Fund



Study Area

Other Mapped Features

- County Boundary
- Municipal Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Surface Water

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 1
STUDY AREA
STORMWATER
MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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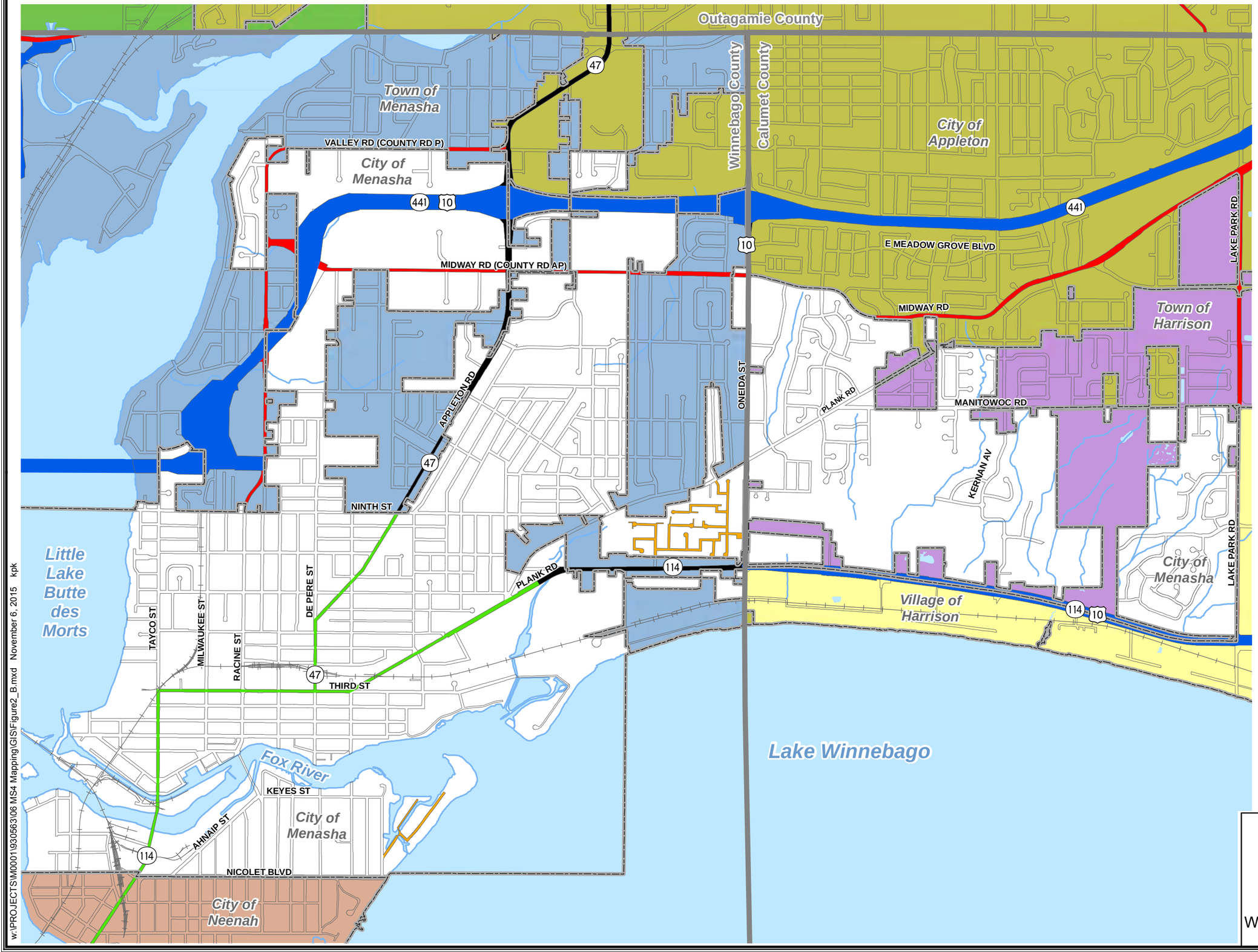

Municipal Jurisdiction
- City of Appleton
- Town of Grand Chute
- Town of Harrison
- Village of Harrison
- City of Menasha
- Town of Menasha
- City of Neenah

Highway Jurisdiction
- Connecting Highway
- County Trunk Highway
- State Freeway
- State Trunk Highway

Other Mapped Features
- County Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Private Road
- Surface Water

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 2
MS4 JURISDICTION
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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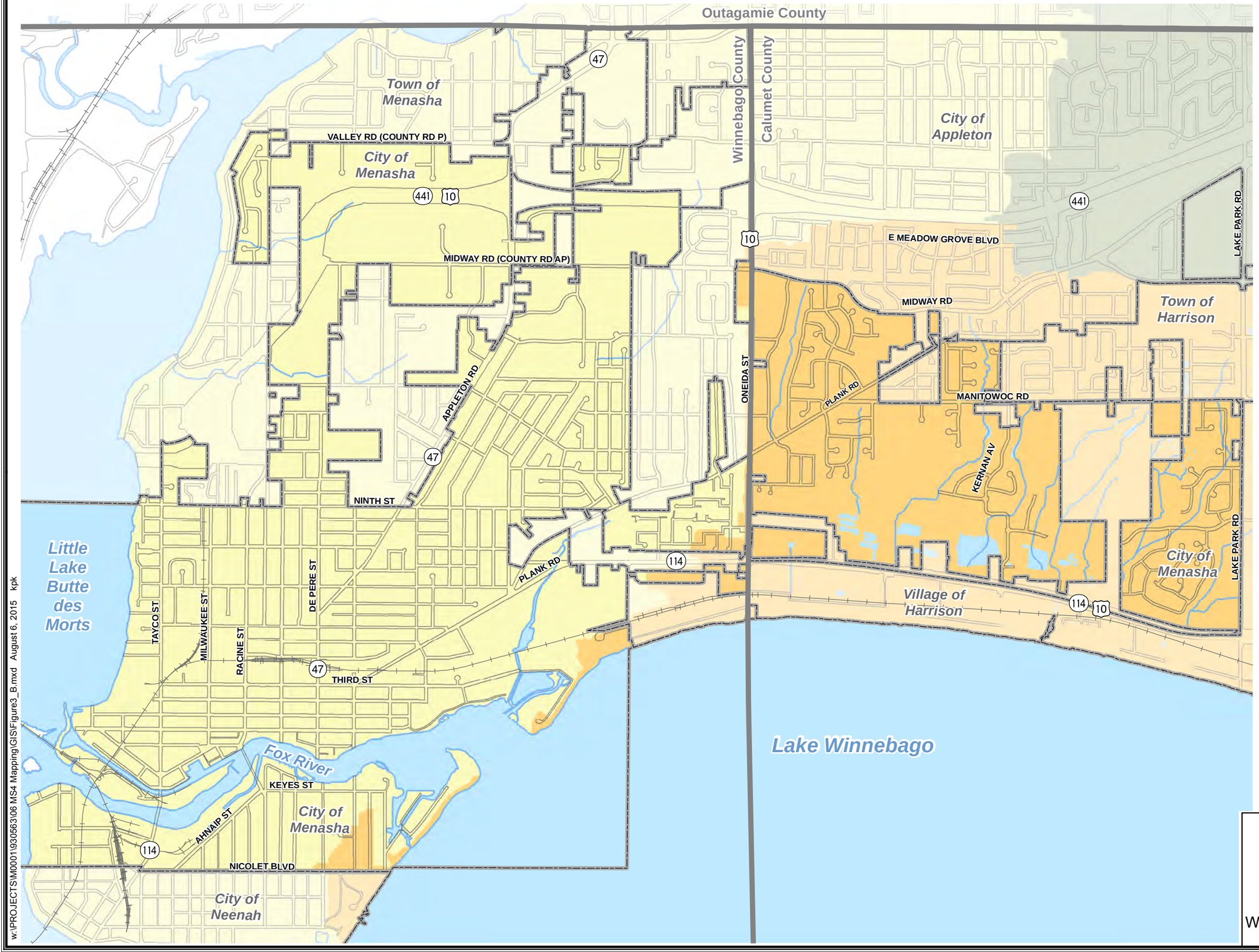

Menasha

Sub-Watersheds

- Fox River
- Garners Creek
- Lake Winnebago

Other Mapped Features

- County Boundary
- Municipal Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Surface Water

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 3
SUB-WATERSHEDS
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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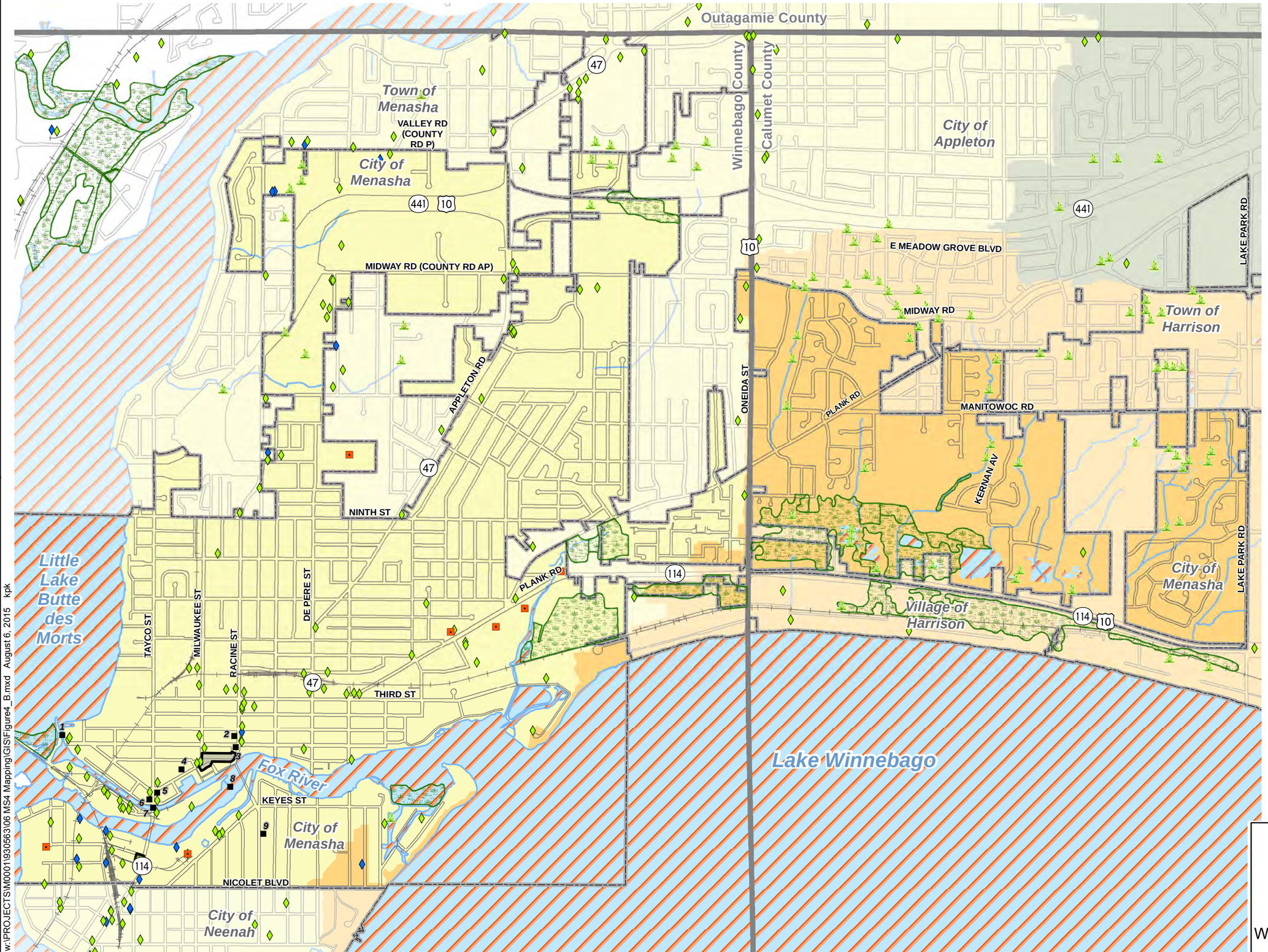

Natural Resources
- WDNR Wetland Inventory (Less Than 2 Acres)
- WDNR Wetland Inventory (2 Acres and Greater)
- 303(d) Impaired Waters
- Rivers and Streams
- Surface Water

Sub-Watersheds
- Fox River
- Garners Creek
- Lake Winnebago

Other Mapped Features
- Historic Districts
- Historical Site ID
- Historical Waste Disposal Site
- Open DNR Remediation Site
- Closed DNR Remediation Site
- County Boundary
- Municipal Boundary
- Right-of-Way
- Railroad Centerline

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 4
NATURAL RESOURCES
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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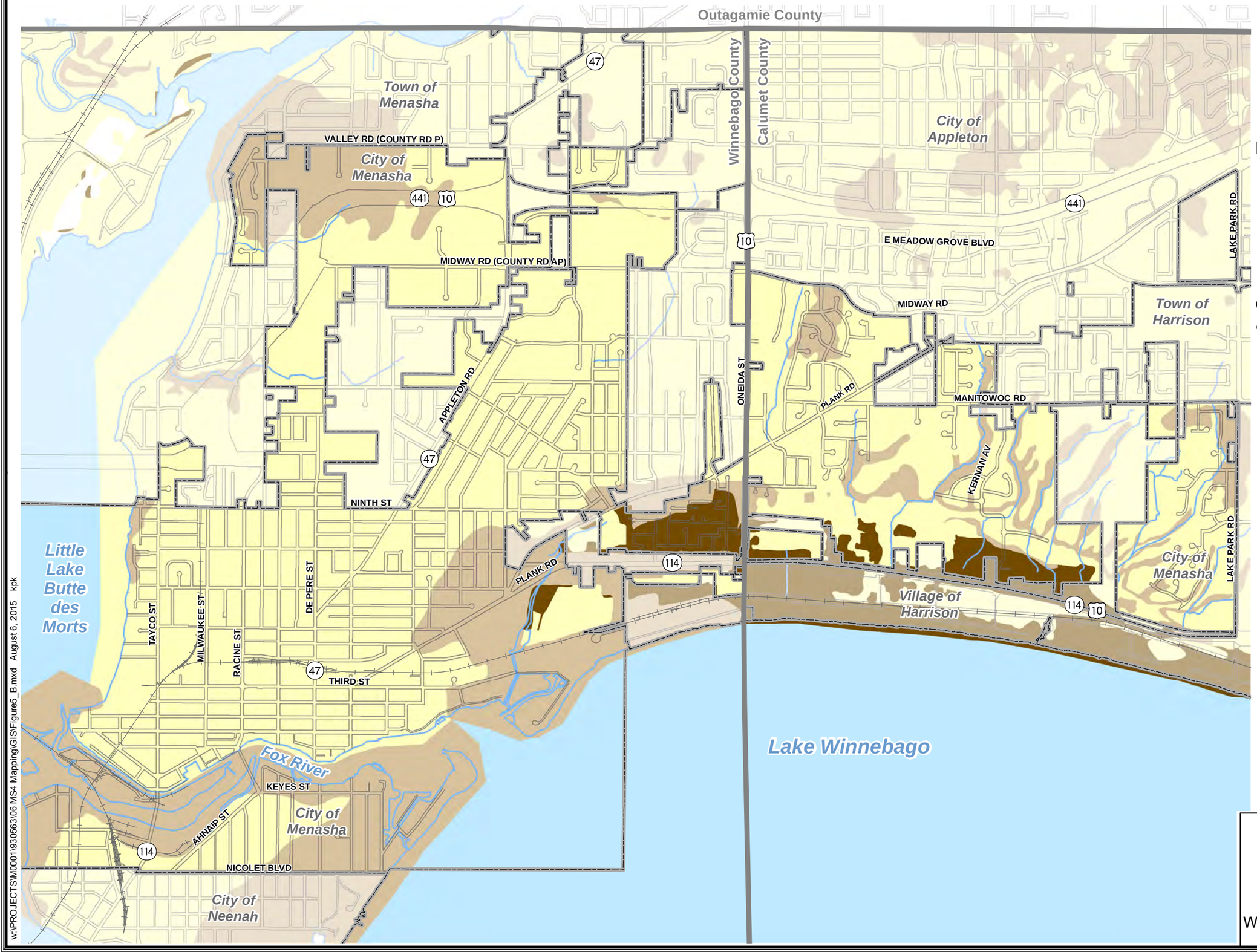

Menasha

Hydrologic Soil Group (HSG)

- HSG A
- HSG B (NA)
- HSG C
- HSG D

Other Mapped Features

- County Boundary
- Municipal Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Surface Water

Source: Calumet County, 2013-15; Winnebago County, 2013-14; USDA, October, 2014.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 5
SOILS
STORMWATER
MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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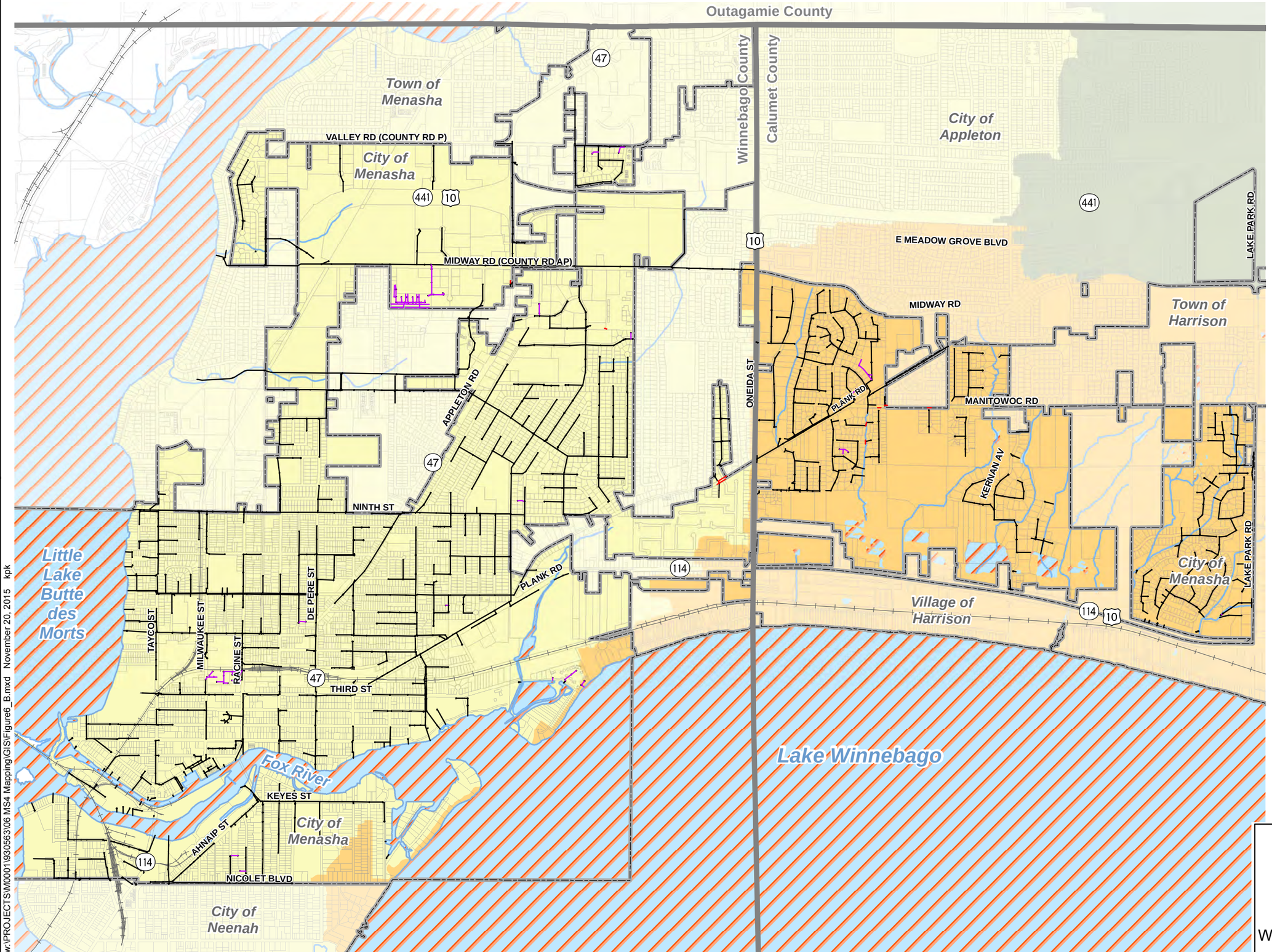

Menasha

MS4 Drainage System

- Storm Sewer System
- Private Storm Sewer
- Culvert

Sub-Watersheds

- Fox River
- Garners Creek
- Lake Winnebago

Other Mapped Features

- County Boundary
- Municipal Boundary
- Parcel Line
- Railroad Centerline
- Stream
- Surface Water
- 303(d) Impaired Waters

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 6
MS4 SYSTEM
STORMWATER
MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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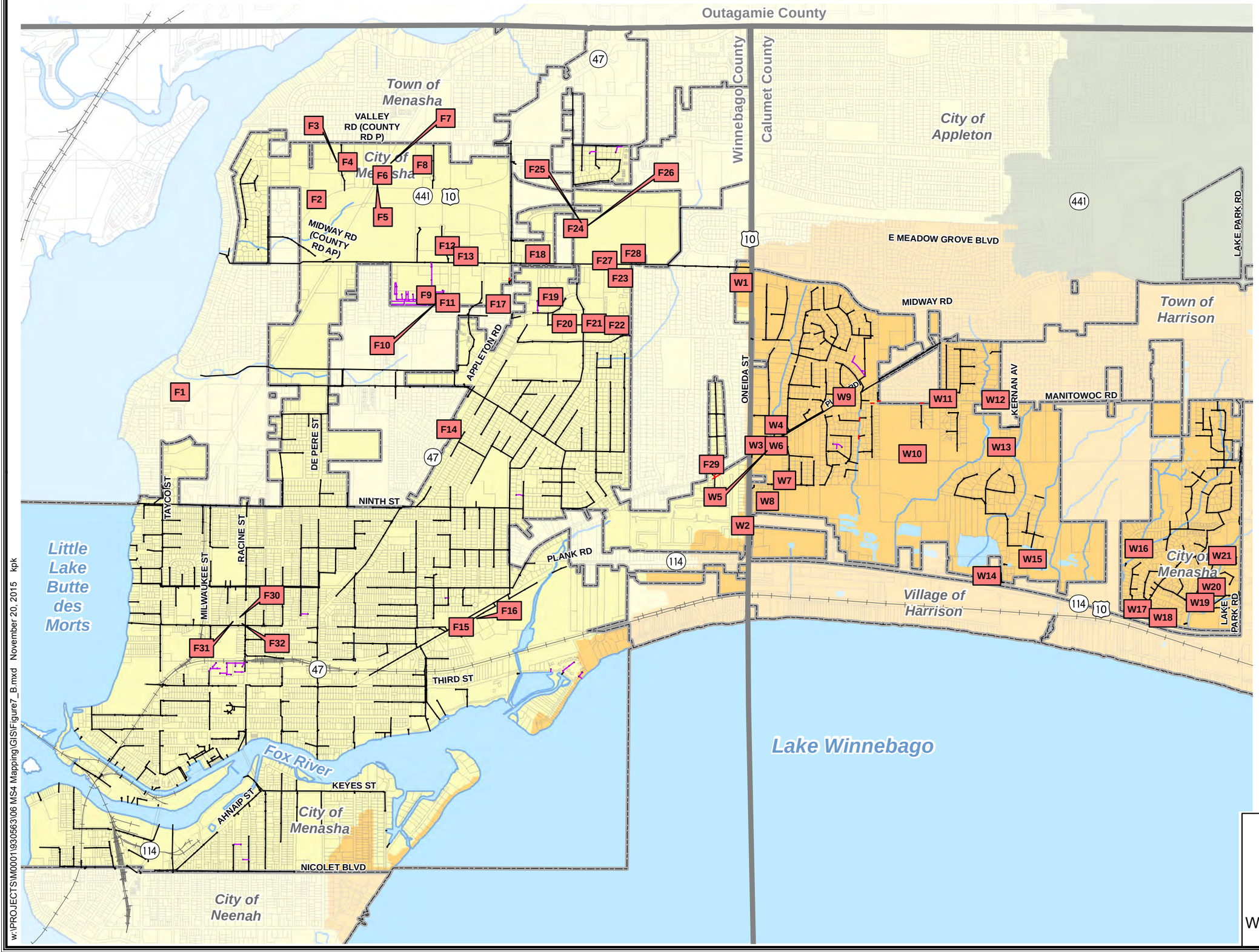

Menasha

MS4 Drainage System

- F1 Structural BMP ID
- Storm Sewer System
- Private Storm Sewer
- Culvert

Sub-Watersheds

- Fox River
- Garners Creek
- Lake Winnebago

Other Mapped Features

- County Boundary
- Municipal Boundary
- Parcel Line
- Railroad Centerline
- Stream
- Surface Water

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 7
STRUCTURAL BMPS
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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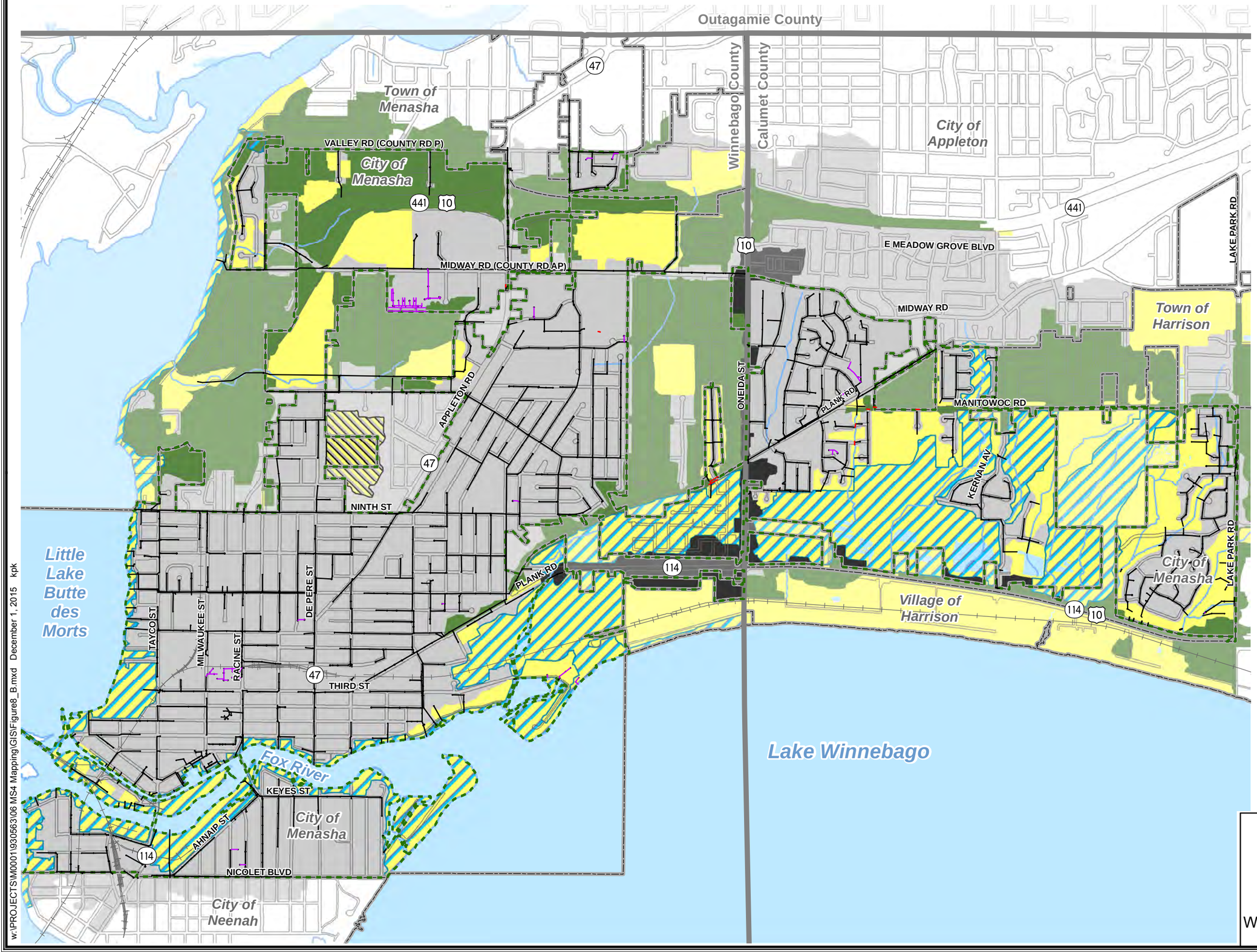

Menasha

Surface Drainage

- Curb Gutter
- No Controls
- Grass Swale

MS4 Drainage System

- Storm Sewer System
- Private Storm Sewer
- Culvert

Other Mapped Features

- Study Area Boundary
- County Boundary
- Municipal Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Surface Water
- Riparian Area
- MS4 'A' to 'B' Area
- Quarry

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 8
SURFACE DRAINAGE
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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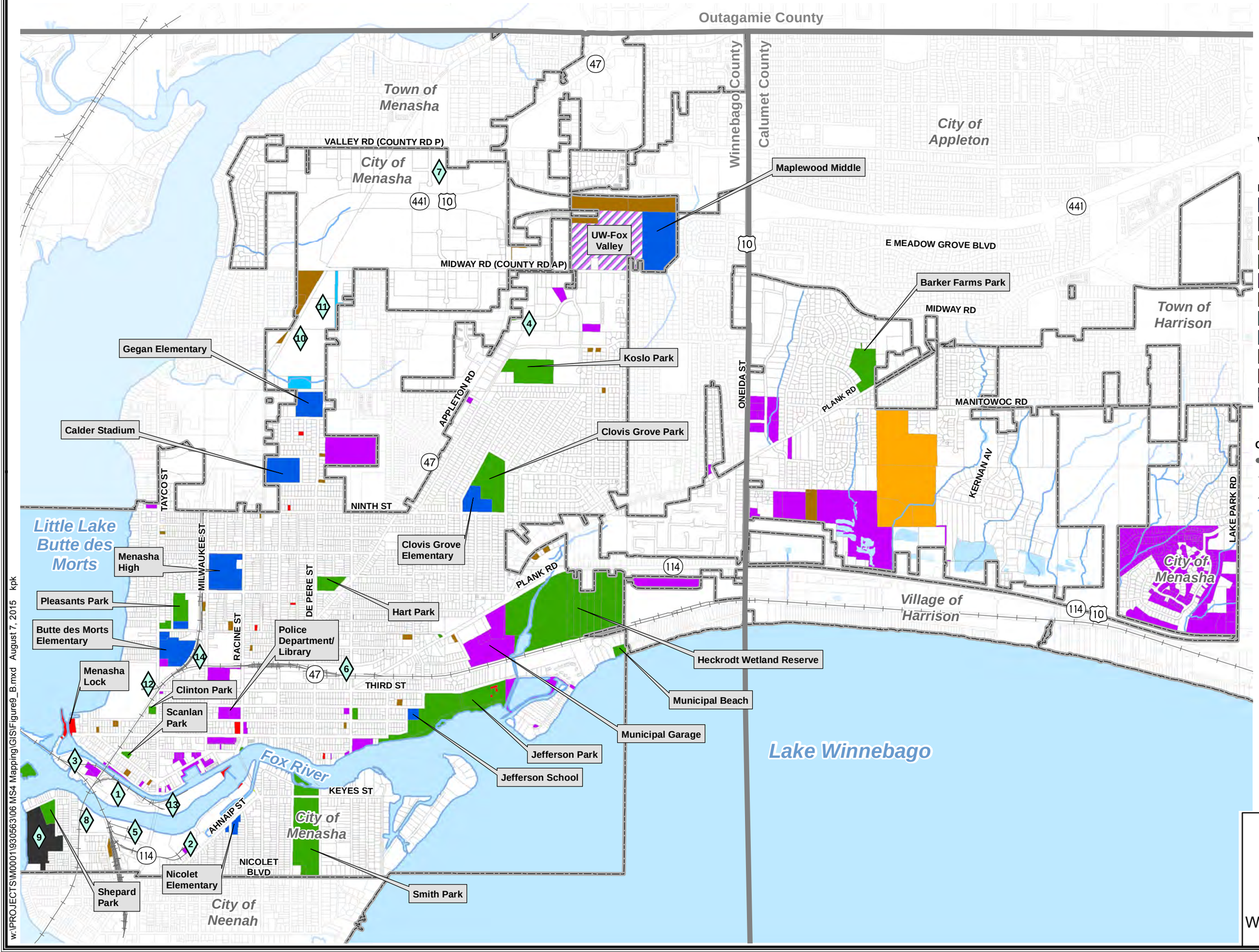

FIGURE 9
WPDES INDUSTRIAL PERMITS
STORMWATER
MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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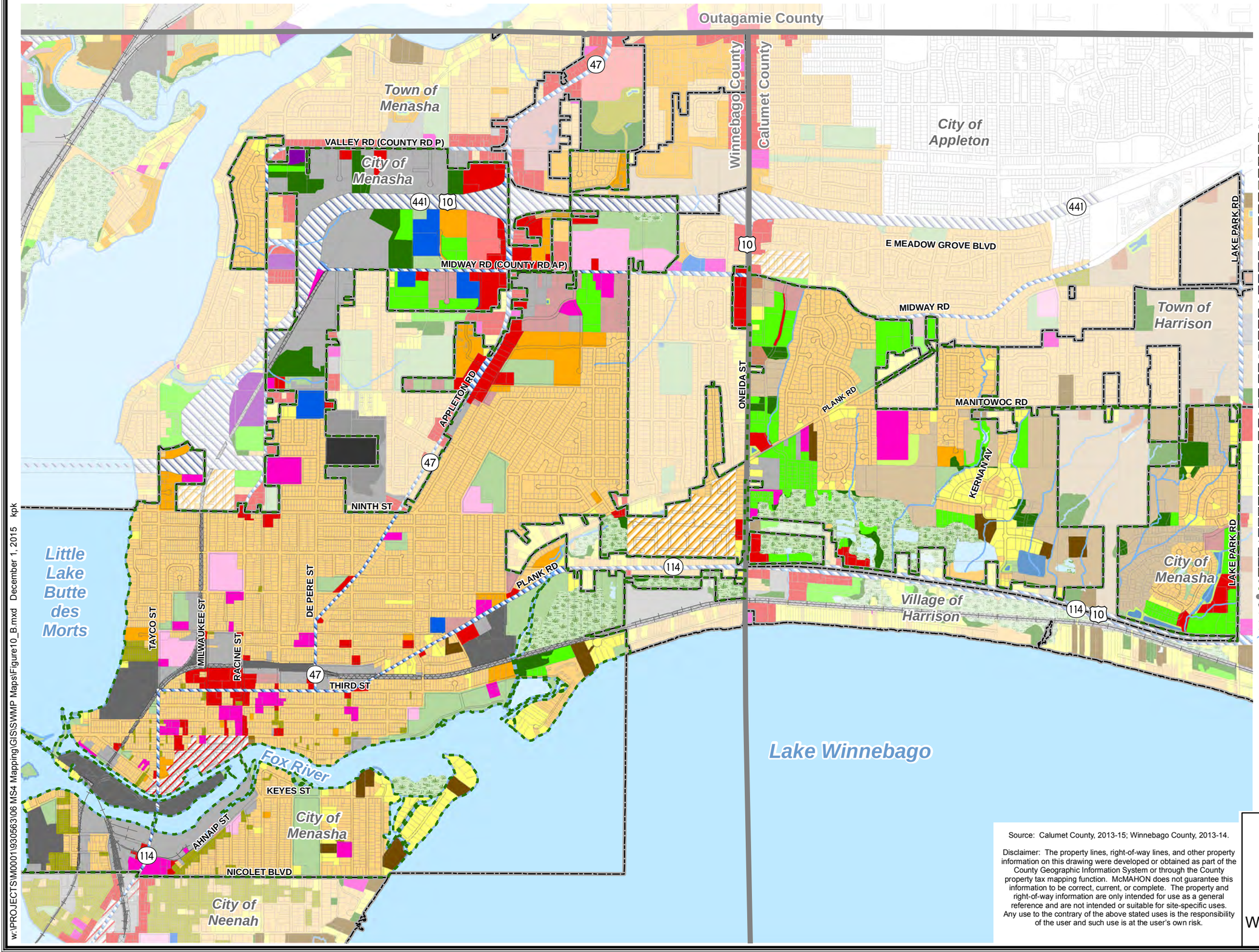

Menasha

SLAMM Standard Land Uses

Residential
- LDR - Low Density Single Family Residential (0.5 acre to 1.5 acre lots)
- MDR - Medium Density Single Family Residential (0.25 acre to 0.5 acre lots)
- MDRA - Medium Density Single Family Residential w/Alleys (0.25 acre to 0.5 acre lots)
- HDR - High Density Single Family Residential (0.125 acre lots or smaller)
- HDRA - High Density Single Family Residential w/Alleys (0.125 acre lots or smaller)
- MFR - Multi-Family Residential (3 or more families, 1-3 story height)
- HRR - High Rise Residential (1.5 acre to 5 acre lots, > 3 story)
- SUBR - Suburban Residential (1.5 acre to 5 acre lots)
- MOBR - Mobile Home or Trailer Park Residential

Institutional
- SCHOOL - Public or Private School
- UNIV - University, College, Technical School, etc.
- HOSP - Medical Facilities including Nursing Homes, Hospitals, etc.
- MISC - Miscellaneous Facilities (Churches, Institutional Property)

Commercial
- CDNTN - Downtown Commercial and Institutional Areas
- CSTRIP - Strip Commercial Areas (Courthouses, Police Stations, etc.)
- SHCNTR - Shopping Centers (parking lot is 2.5 times building area)
- OFFPRK - Office Parks (non-retail, multi-story, insurance, government)

Industrial
- LIGHTI - Light Industrial Areas (storage and distribution of goods for retail or sale)
- MEDI - Medium Industrial Areas (lumber, junk, or auto salvage yard, ag., co-op, oil tank farm, coal and salt storage, slaughter house)
- QUARRY - Aggregate Extraction and Excavation
- AIRPRT - Airport Facilities

Open Space
- CEM - Cemeteries, including grounds, roads, and buildings)
- PARK - Outdoor Recreational Areas (golf course, arboretums, botanical gardens, municipal playgrounds, and natural areas)
- RAIL - Railroad ROW (Excludes road ROW, storage yards)
- FRMSTD - Farmsteads, including limited houses, buildings, driveways and parking areas
- AGRIC - Agriculture fields
- GRASS - Undeveloped land that is vegetated (Excludes road ROW)
- GRASS_SWPOND - Vegetated land around a stormwater pond (Excludes road ROW)
- WOODS - Forested or Wooded Areas with Leaf Litter
- WETLND - DNR Wetland Inventory Map
- WATER - Waters of the State and Other Open Waters
- WATER_SWPOND - Open water associated with stormwater pond

Transportation
- FREE - Limited Access Highways and Interchanges, including vegetated ROW
- HWY - State or County Highway
- RURALRD - Rural Road

Other Mapped Features
- Study Area Boundary
- County Boundary
- Municipal Boundary
- Right-of-Way Lines
- Railroad Centerline
- Parcel Lines
- Streams

0 2,000 Feet

McMAHON ENGINEERS ARCHITECTS

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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FIGURE 10
2004 LAND USE
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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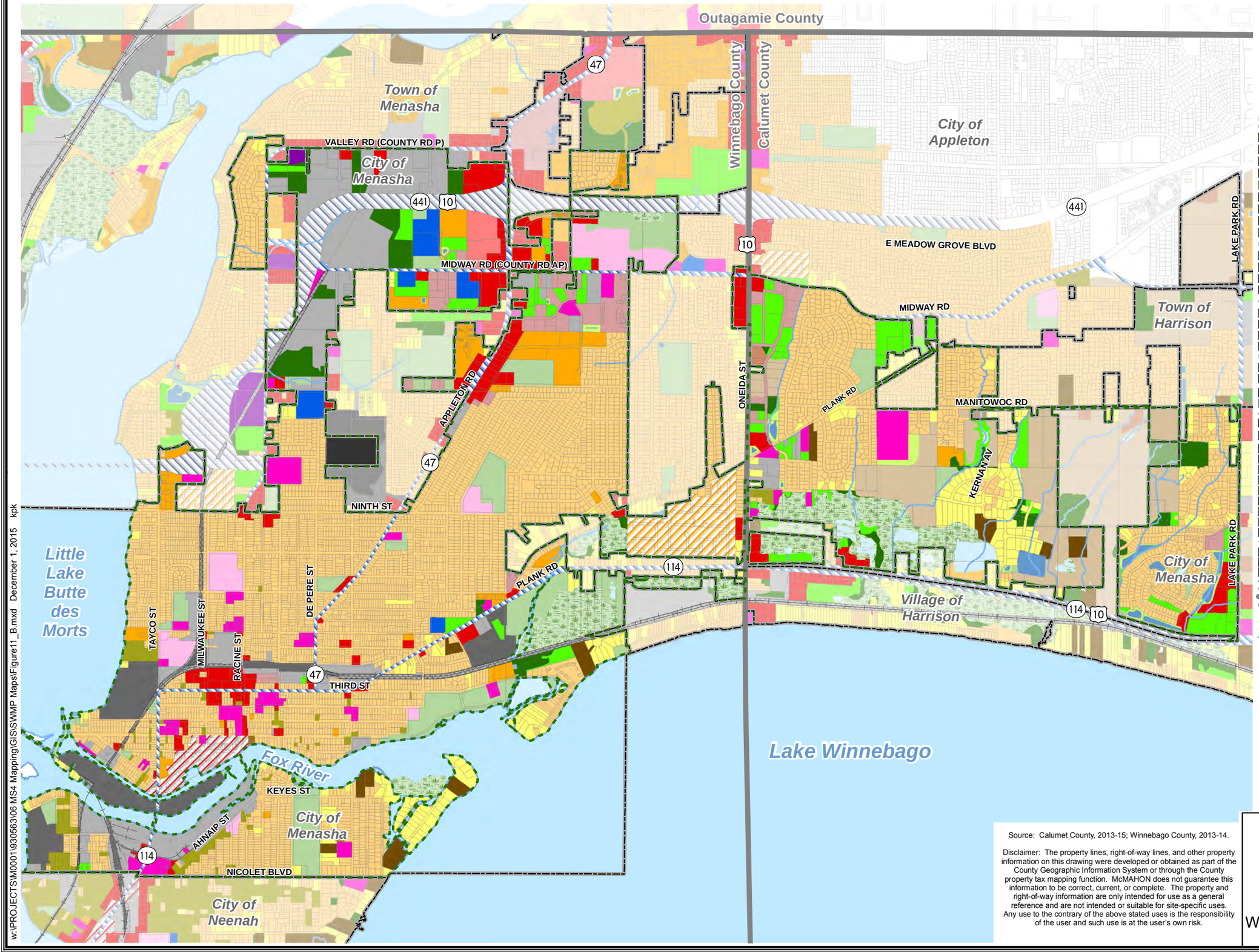

Menasha

SLAMM Standard Land Uses

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- MFR - Multi-Family Residential (3 or more families, 1-3 story height)
- HRR - High Rise Residential (1.5 acre to 5 acre lots, > 3 story)
- SUBR - Suburban Residential (1.5 acre to 5 acre lots)
- MOBR - Mobile Home or Trailer Park Residential

Institutional
- SCHOOL - Public or Private School
- UNIV - University, College, Technical School, etc.
- HOSP - Medical Facilities including Nursing Homes, Hospitals, etc.
- MISC - Miscellaneous Facilities (Churches, Institutional Property)

Commercial
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- CSTRIP - Strip Commercial Areas (Courthouses, Police Stations, etc.)
- SHCNTR - Shopping Centers (parking lot is 2.5 times building area)
- OFFPRK - Office Parks (non-retail, multi-story, insurance, government)

Industrial
- LIGHTI - Light Industrial Areas (storage and distribution of goods for retail or sale)
- MEDI - Medium Industrial Areas (lumber, junk, or auto salvage yard, ag., co-op, oil tank farm, coal and salt storage, slaughter house)
- QUARRY - Aggregate Extraction and Excavation
- AIRPRT - Airport Facilities

Open Space
- CEM - Cemeteries, including grounds, roads, and buildings)
- PARK - Outdoor Recreational Areas (golf course, arboretums, botanical gardens, municipal playgrounds, and natural areas)
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- WETLND - DNR Wetland Inventory Map
- WATER - Waters of the State and Other Open Waters
- WATER_SWPOND - Open water associated with stormwater pond

Transportation
- FREE - Limited Access Highways and Interchanges, including vegetated ROW
- HWY - State or County Highway
- RURALRD - Rural Road

Other Mapped Features
- Study Area Boundary
- County Boundary
- Municipal Boundary
- Right-of-Way Lines
- Railroad Centerline
- Parcel Lines
- Streams

0 2,000 Feet

McMAHON ENGINEERS ARCHITECTS

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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FIGURE 11
2014 LAND USE
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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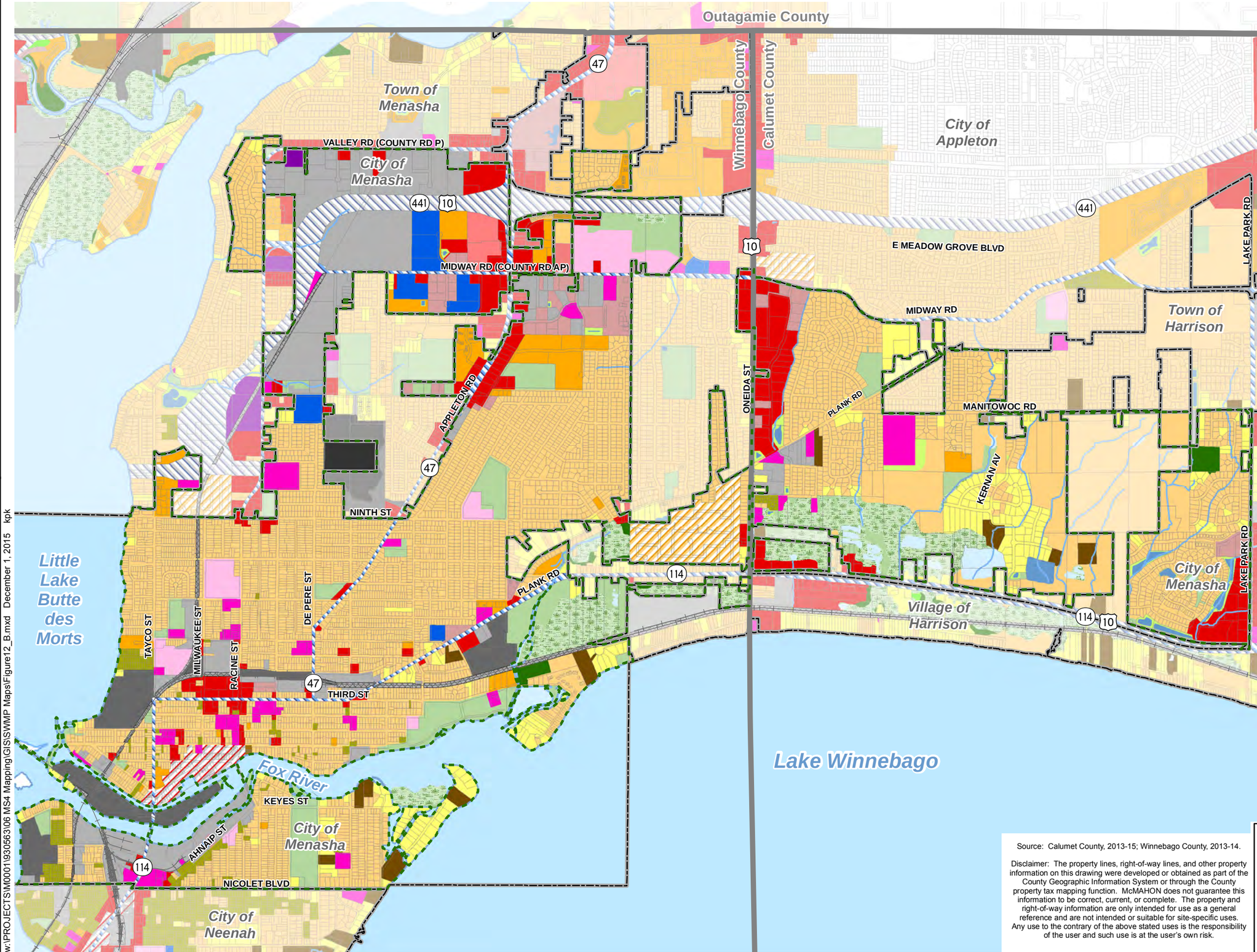

Menasha

SLAMM Standard Land Uses

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- UNIV - University, College, Technical School, etc.
- HOSP - Medical Facilities including Nursing Homes, Hospitals, etc.
- MISC - Miscellaneous Facilities (Churches, Institutional Property)

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- CSTRIP - Strip Commercial Areas (Courthouses, Police Stations, etc.)
- SHCNTR - Shopping Centers (parking lot is 2.5 times building area)
- OFFPRK - Office Parks (non-retail, multi-story, insurance, government)

Industrial
- LIGHTI - Light Industrial Areas (storage and distribution of goods for retail or sale)
- MEDI - Medium Industrial Areas (lumber, junk, or auto salvage yard, ag., co-op, oil tank farm, coal and salt storage, slaughter house)
- QUARRY - Aggregate Extraction and Excavation
- AIRPRT - Airport Facilities

Open Space
- CEM - Cemeteries, including grounds, roads, and buildings)
- PARK - Outdoor Recreational Areas (golf course, arboretums, botanical gardens, municipal playgrounds, and natural areas)
- RAIL - Railroad ROW (Excludes road ROW, storage yards)
- FRMSTD - Farmsteads, including limited houses, buildings, driveways and parking areas
- AGRIC - Agriculture fields
- GRASS - Undeveloped land that is vegetated (Excludes road ROW)
- GRASS_SWPOND - Vegetated land around a stormwater pond (Excludes road ROW)
- WOODS - Forested or Wooded Areas with Leaf Litter
- WETLND - DNR Wetland Inventory Map
- WATER - Waters of the State and Other Open Waters
- WATER_SWPOND - Open water associated with stormwater pond

Transportation
- FREE - Limited Access Highways and Interchanges, including vegetated ROW
- HWY - State or County Highway
- RURALRD - Rural Road

Other Mapped Features
- Study Area Boundary
- County Boundary
- Municipal Boundary
- Right-of-Way Lines
- Railroad Centerline
- Parcel Lines
- Streams

0 2,000 Feet

McMAHON ENGINEERS ARCHITECTS

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

Disclaimer: The property lines, right-of-way lines, and other property information on this drawing were developed or obtained as part of the County Geographic Information System or through the County property tax mapping function. McMAHON does not guarantee this information to be correct, current, or complete. The property and right-of-way information are only intended for use as a general reference and are not intended or suitable for site-specific uses. Any use to the contrary of the above stated uses is the responsibility of the user and such use is at the user's own risk.

FIGURE 12
FUTURE LAND USE
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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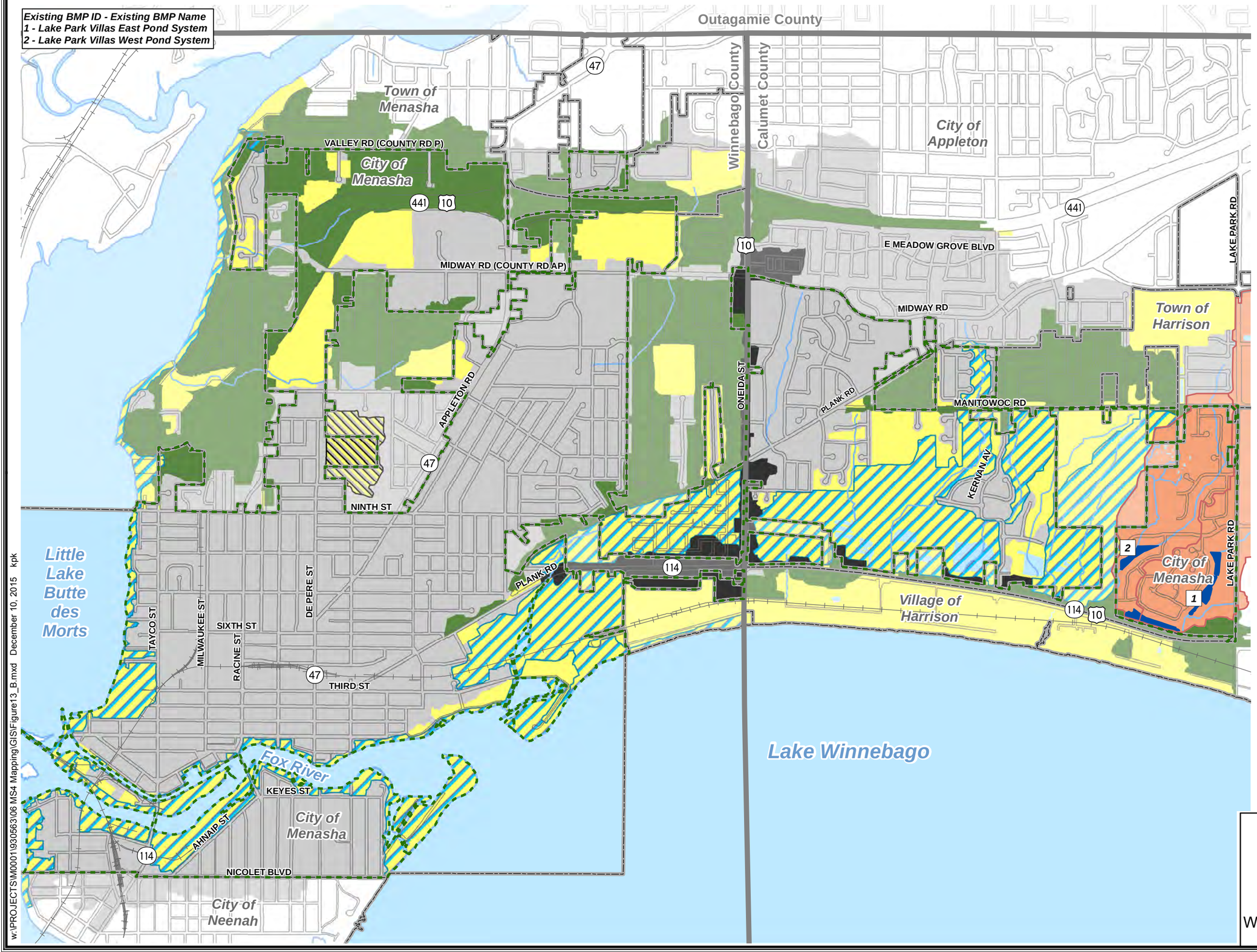

Structural BMPs
- Existing BMP Watershed
- Wet Pond Location

Surface Drainage
- Curb Gutter (ME Sweeper, Once per Month, NPC)
- No Controls
- Grass Swale

Other Mapped Features
- Study Area Boundary
- County Boundary
- Municipal Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Surface Water
- Riparian Area
- MS4 'A' to 'B' Area
- Quarry
- BMP ID

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 13
2004 BMPs
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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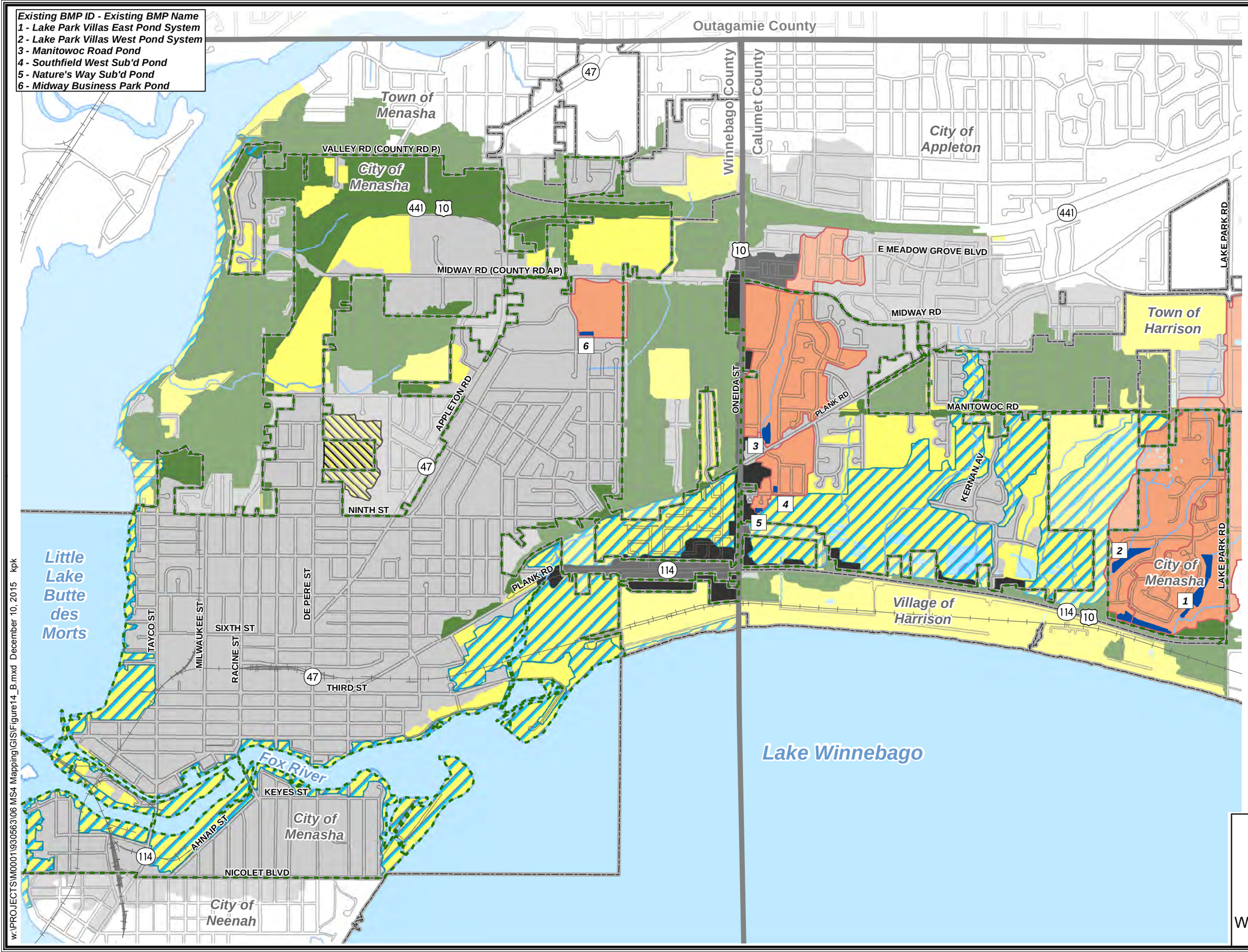

FIGURE 14
2008 BMPs
STORMWATER
MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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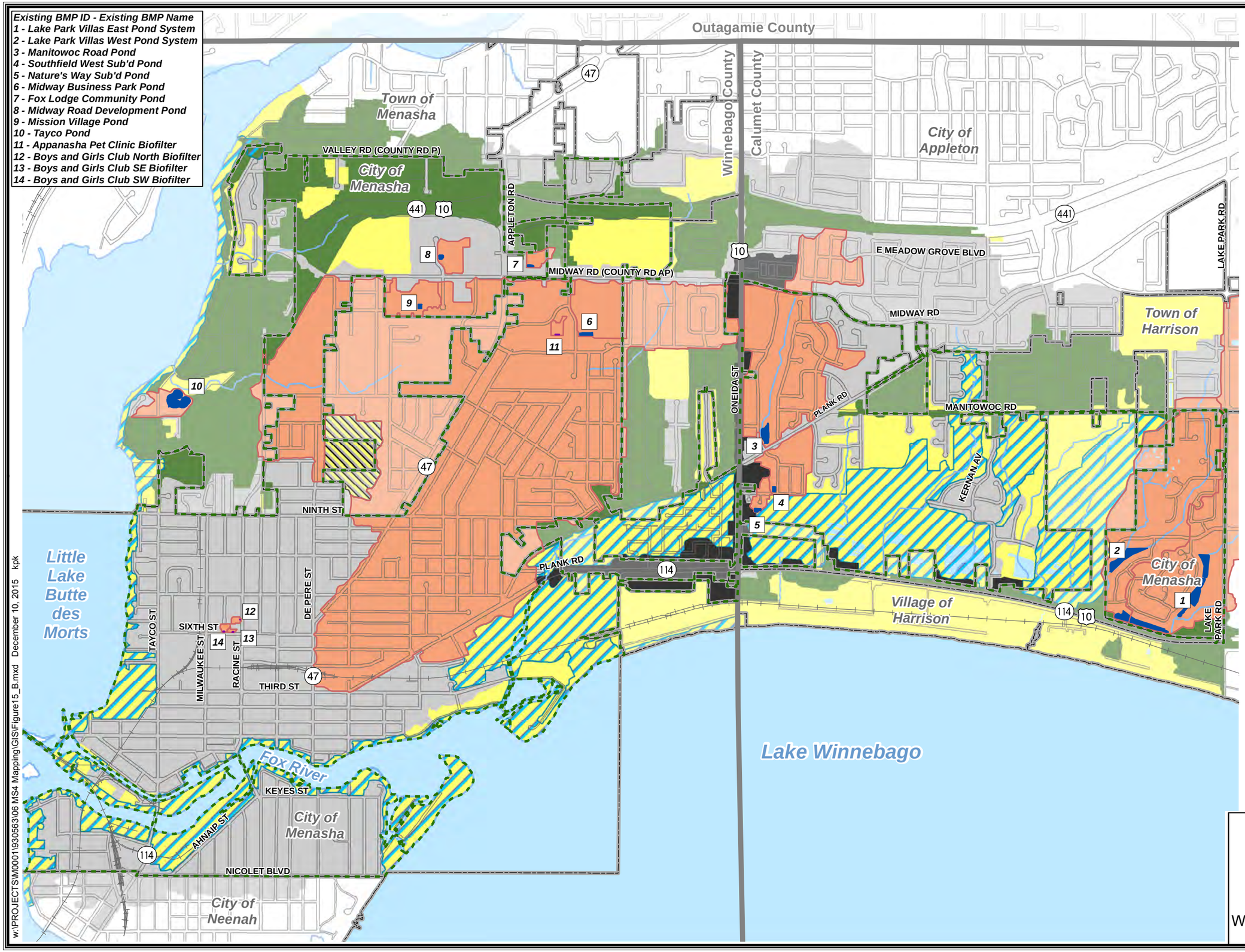

FIGURE 15
2014 BMPs
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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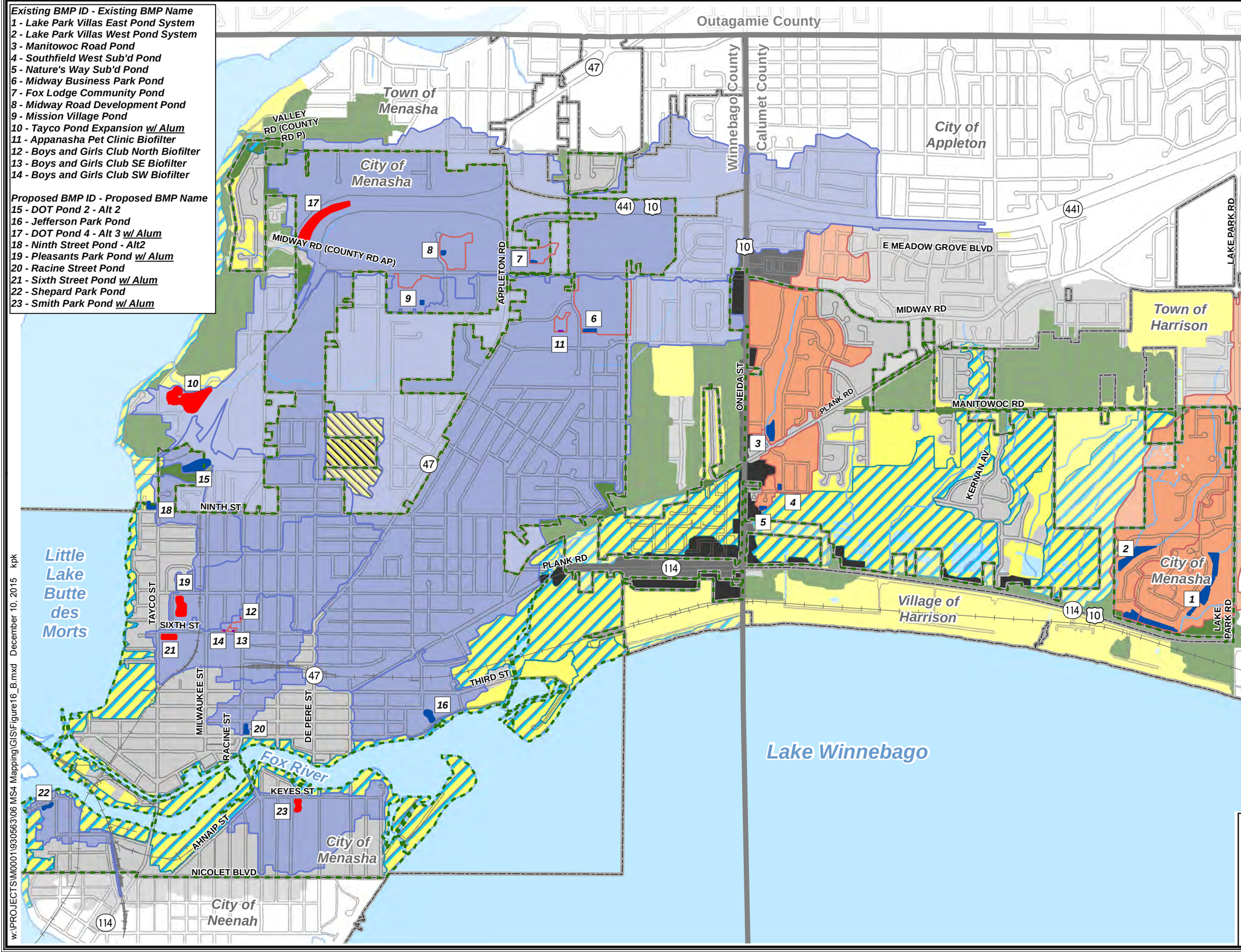
Existing BMP ID - Existing BMP Name
1 - Lake Park Villas East Pond System
2 - Lake Park Villas West Pond System
3 - Manitowoc Road Pond
4 - Southfield West Sub'd Pond
5 - Nature's Way Sub'd Pond
6 - Midway Business Park Pond
7 - Fox Lodge Community Pond
8 - Midway Road Development Pond
9 - Mission Village Pond
10 - Tayco Pond Expansion w/ Alum
11 - Appanasha Pet Clinic Biofilter
12 - Boys and Girls Club North Biofilter
13 - Boys and Girls Club SE Biofilter
14 - Boys and Girls Club SW Biofilter

Proposed BMP ID - Proposed BMP Name
15 - DOT Pond 2 - Alt 2
16 - Jefferson Park Pond
17 - DOT Pond 4 - Alt 3 w/ Alum
18 - Ninth Street Pond - Alt2
19 - Pleasants Park Pond w/ Alum
20 - Racine Street Pond
21 - Sixth Street Pond w/ Alum
22 - Shepard Park Pond
23 - Smith Park Pond w/ Alum



Structural BMPs
- Existing BMP Watershed
- Proposed BMP Watershed
- Wet Pond Location
- Biofilter/Proprietary Device Location
- Wet Pond Location w/ Alum Treatment

Surface Drainage
- Curb Gutter (HE Sweeper, Twice per Month, WPC)
- No Controls
- Grass Swale

Other Mapped Features
- Study Area Boundary
- County Boundary
- Municipal Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Surface Water
- Riparian Area
- MS4 'A' to 'B' Area
- Quarry
- BMP ID

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 16
ALTERNATIVE 1
TMDL ANALYSIS
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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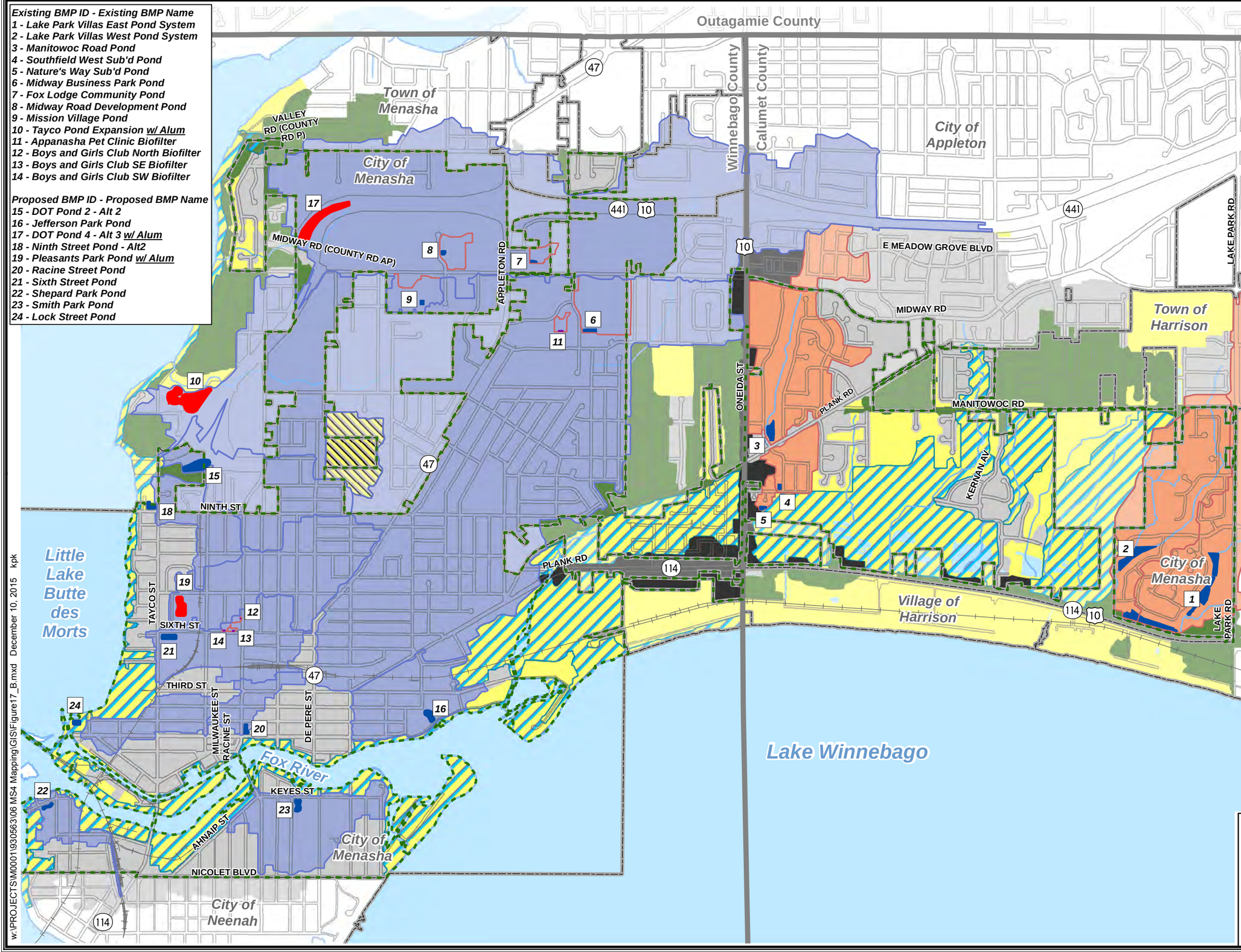
Existing BMP ID - Existing BMP Name
1 - Lake Park Villas East Pond System
2 - Lake Park Villas West Pond System
3 - Manitowoc Road Pond
4 - Southfield West Sub'd Pond
5 - Nature's Way Sub'd Pond
6 - Midway Business Park Pond
7 - Fox Lodge Community Pond
8 - Midway Road Development Pond
9 - Mission Village Pond
10 - Tayco Pond Expansion w/ Alum
11 - Appanasha Pet Clinic Biofilter
12 - Boys and Girls Club North Biofilter
13 - Boys and Girls Club SE Biofilter
14 - Boys and Girls Club SW Biofilter

Proposed BMP ID - Proposed BMP Name
15 - DOT Pond 2 - Alt 2
16 - Jefferson Park Pond
17 - DOT Pond 4 - Alt 3 w/ Alum
18 - Ninth Street Pond - Alt2
19 - Pleasants Park Pond w/ Alum
20 - Racine Street Pond
21 - Sixth Street Pond
22 - Shepard Park Pond
23 - Smith Park Pond
24 - Lock Street Pond



Structural BMPs
- Existing BMP Watershed
- Proposed BMP Watershed
- Wet Pond Location
- Biofilter/Proprietary Device Location
- Wet Pond Location w/ Alum Treatment

Surface Drainage
- Curb Gutter (HE Sweeper, Twice per Month, WPC)
- No Controls
- Grass Swale

Other Mapped Features
- Study Area Boundary
- County Boundary
- Municipal Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Surface Water
- Riparian Area
- MS4 'A' to 'B' Area
- Quarry
- BMP ID

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 17
ALTERNATIVE 2
TMDL ANALYSIS
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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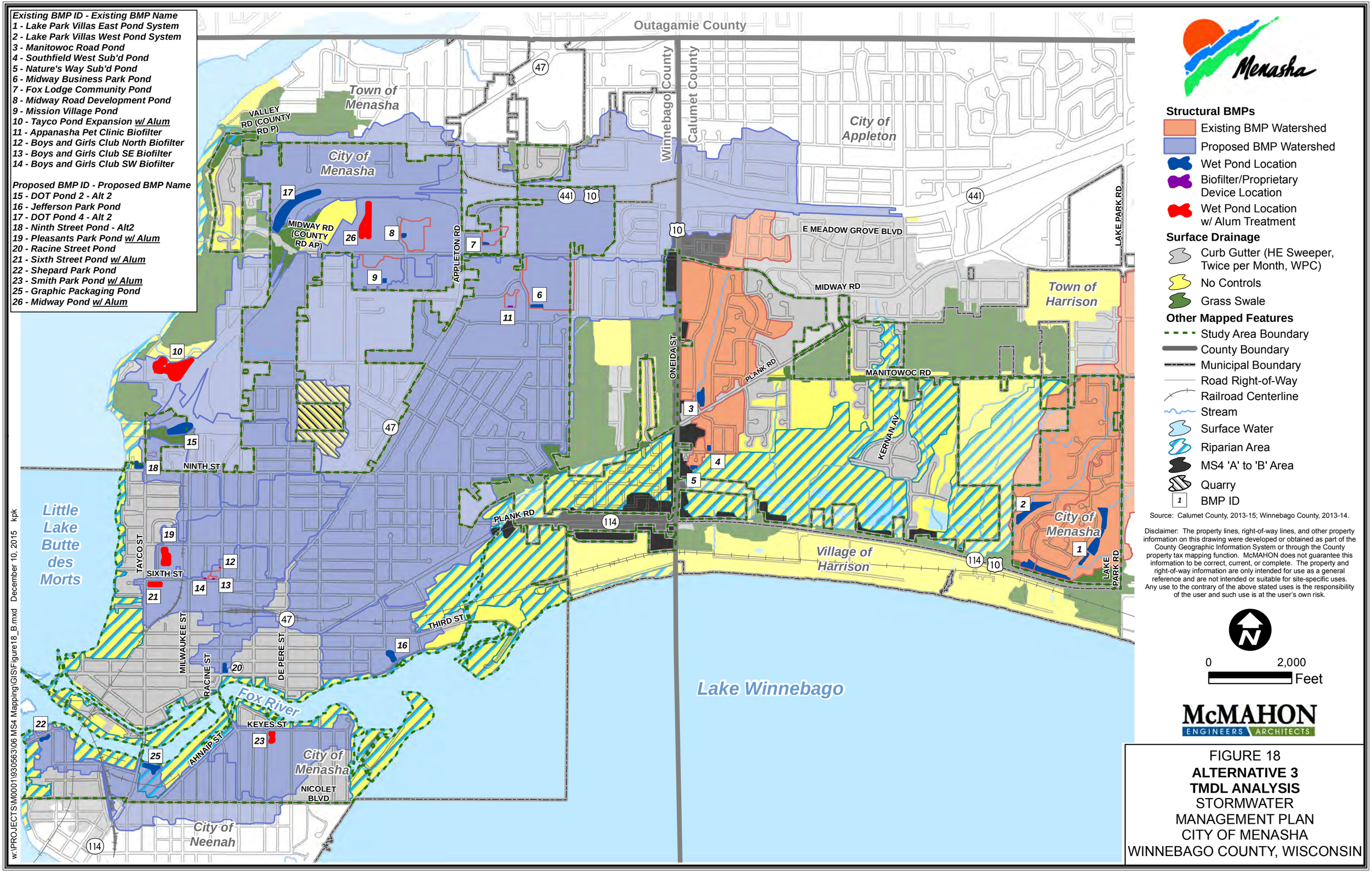
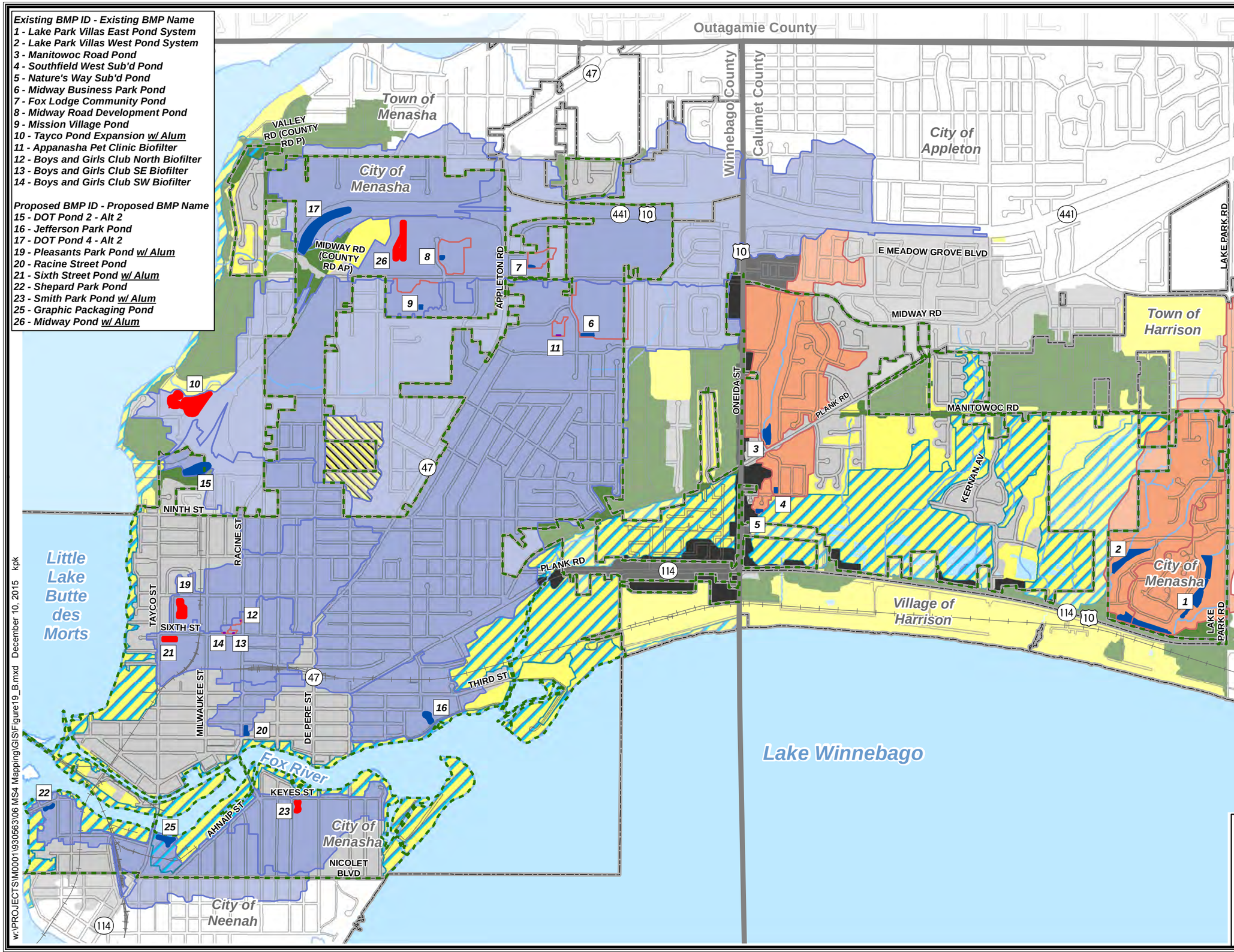


FIGURE 18
ALTERNATIVE 3
TMDL ANALYSIS
STORMWATER
MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

Existing BMP ID - Existing BMP Name
1 - Lake Park Villas East Pond System
2 - Lake Park Villas West Pond System
3 - Manitowoc Road Pond
4 - Southfield West Sub'd Pond
5 - Nature's Way Sub'd Pond
6 - Midway Business Park Pond
7 - Fox Lodge Community Pond
8 - Midway Road Development Pond
9 - Mission Village Pond
10 - Tayco Pond Expansion w/ Alum
11 - Appanasha Pet Clinic Biofilter
12 - Boys and Girls Club North Biofilter
13 - Boys and Girls Club SE Biofilter
14 - Boys and Girls Club SW Biofilter

Proposed BMP ID - Proposed BMP Name
15 - DOT Pond 2 - Alt 2
16 - Jefferson Park Pond
17 - DOT Pond 4 - Alt 2
19 - Pleasants Park Pond w/ Alum
20 - Racine Street Pond
21 - Sixth Street Pond w/ Alum
22 - Shepard Park Pond
23 - Smith Park Pond w/ Alum
25 - Graphic Packaging Pond
26 - Midway Pond w/ Alum



Structural BMPs
- Existing BMP Watershed
- Proposed BMP Watershed
- Wet Pond Location
- Biofilter/Proprietary Device Location
- Wet Pond Location w/ Alum Treatment

Surface Drainage
- Curb Gutter (HE Sweeper, Once per Week, WPC)
- No Controls
- Grass Swale

Other Mapped Features
- Study Area Boundary
- County Boundary
- Municipal Boundary
- Road Right-of-Way
- Railroad Centerline
- Stream
- Surface Water
- Riparian Area
- MS4 'A' to 'B' Area
- Quarry
- BMP ID

Source: Calumet County, 2013-15; Winnebago County, 2013-14.

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McMAHON ENGINEERS ARCHITECTS

FIGURE 19
ALTERNATIVE 4
TMDL ANALYSIS
STORMWATER MANAGEMENT PLAN
CITY OF MENASHA
WINNEBAGO COUNTY, WISCONSIN

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McMAHON ENGINEERS ARCHITECTS

CITY OF MENASHA
PROPOSED STRUCTURAL BMPS
WATER QUALITY RESULTS & COST ANALYSIS

			Total Suspended Solids (TSS)							Total Phosphorus (TP)						Biofilter Capital / O&M Costs				Pond Capital / O&M Costs				Alum Treatment Capital / O&M Costs						TSS Cost Analysis & Ranking			TSS Cost Analysis & Ranking		
BMP Catchment ID	Catchment ID's treated by BMP	BMP Name	Area (acres)	Before Drainage System (lbs)	After Existing Drainage System & Outfall Controls (lbs)	PBMP TSS Removal %	After Proposed Outfall Controls (lbs)	Total Load Reduction (lbs)	Net Gain* (lbs)	Before Drainage System (lbs)	After Existing Drainage System & Outfall Controls (lbs)	PBMP TP Removal %	After Proposed Outfall Controls (lbs)	Total Load Reduction (lbs)	Net Gain* (lbs)	Estimated Capital Costs	Average Annual O&M Costs For 2014	Average Annual O&M Costs Over 20 Years	Capital & Average Annual O&M Costs Over 20 Years	Estimated Capital Costs	Average Annual O&M Costs For 2014	Average Annual O&M Costs Over 20 Years	Capital & Average Annual O&M Costs Over 20 Years	Estimated Capital Costs	Average Annual O&M Costs For 2014	Total Average Annual O&M Costs Over 20 Years	Capital & Total Average Annual O&M Costs Over 20 Years	Total Estimated Capital Costs	Capital & Total Average Annual O&M Costs Over 20 Years	Average Annual TSS Net Gain Over 20 Years For City (lbs)	Average Annual Total Cost For City ($/lbs)	TSS Ranking	Average Annual TP Net Gain Over 20 Years For City (lbs)	Average Annual Total Cost For City ($/lbs)	TP Ranking
P-BMP-F9d3	P-BMP-F9d3	Miron Pond-Obtain M.A.[1]	20.00	8,225	8,225	52.0%	3,948	4,277	4,277	12.6	12.6	32.0%	8.6	4.0	4.0	$0	$0	$0	$0	$5,000	$1,540	$45,861	$50,861	$0	$0	$0	$0	$5,000	$50,861	85,536	$0.59	1	81	$630	3
P-BMP-F9b3	P-BMP-F9b3	UW Fox-Valley Pond	10.19	2,433	2,433	80.0%	487	1,946	1,946	8.9	8.9	60.0%	3.5	5.3	5.3	$0	$0	$0	$0	$5,000	$1,400	$41,692	$46,692	$0	$0	$0	$0	$5,000	$46,692	38,925	$1.20	2	106	$439	1
P-BMP-F9e6 (Alt 2)	P-BMP-F9d3, F9e1, F9e2, F9e5, F9e6, F9f1, F9f2	DOT Pond 4 - Alt 2	105.90	36,646	36,044	89.8%	3,727	32,919	32,317	65.6	64.9	66.2%	22.2	43.4	42.7	$0	$0	$0	$0	$15,000	$29,622	$882,079	$897,079	$0	$0	$0	$0	$15,000	$897,079	646,333	$1.39	3	855	$1,050	10
E-BMP-F8d7	E-BMP-F8c1-4, F8d1-3, F8d5, F8d7; P-BMP-F8e4	Tayco Pond Expansion	835.58	204,053	92,078	68.6%	64,052	140,001	28,026	656.6	399.3	49.5%	331.8	324.8	67.5	$0	$0	$0	$0	$0	$31,165	$928,031	$928,031	$0	$0	$0	$0	$0	$928,031	560,517	$1.66	4	1,351	$687	5
E-BMP-W3h1	E-BMP-W3h1	Manitowoc Road Pond - Outlet Modification	117.38	23,779	5,690	80.4%	-4,668	19,111	1,022	84.19	34.6	62.5%	31.6	52.6	3.0	$0	$0	$0	$0	$5,000	$1,120	$33,354	$38,354	$0	$0	$0	$0	$5,000	$38,354	20,450	$1.88	5	61	$631	4
E-BMP-F8d7	E-BMP-F8c1-4, F8d1-3, F8d5, F8d7; P-BMP-F8e4	Tayco Pond Expansion with Alum Treatment	835.58	204,053	92,078	90.0%	20,405	183,648	71,673	656.6	399.3	85.0%	98	558	301	$0	$0	$0	$0	$0	$31,165	$928,031	$928,031	$298,002	$62,963	$1,874,904	$2,172,906	$298,002	$3,100,938	1,433,457	$2.16	6	6,017.1	$515	2
P-BMP-F9e6 (Alt 3)	E-BMP-F9b5, F9c2, F9c4; P-BMP-F9b1-4, F9b6, F9c5, F9c8, F9d3, F9e1-2, F9e5, F9e6, F9f1, F9f2	DOT Pond 4 - Alt 3	333.76	92,961	87,535	72.8%	25,313	67,648	62,222	221.0	207.4	53.8%	102.0	119.0	105.4	$0	$0	$0	$0	$1,953,600	$26,243	$781,481	$2,735,081	$0	$0	$0	$0	$1,953,600	$2,735,081	1,244,442	$2.20	7	2,108	$1,298	16
P-BMP-F6f3	P-BMP-F6f1, F6f3	Pleasants Park Pond	142.20	32,424	26,883	84.1%	5,152	27,272	21,731	116.0	103.7	61.7%	44.4	71.6	59.3	$0	$0	$0	$0	$800,300	$10,192	$303,503	$1,103,803	$0	$0	$0	$0	$800,300	$1,103,803	434,613	$2.54	8	1,186	$931	7
P-BMP-F7c2 (Alt 2)	P-BMP-F7a1, F7c2	DOT Pond 2 - Alt 2	62.08	16,498	13,655	92.4%	1,259	15,240	12,397	53.4	47.4	70.8%	15.6	37.8	31.8	$0	$0	$0	$0	$250,500	$12,816	$381,646	$632,146	$0	$0	$0	$0	$250,500	$632,146	247,930	$2.55	9	637	$993	8
P-BMP-F6f1	P-BMP-F6f1	Hart Park Pond	58.57	12,671	10,209	83.5%	2,096	10,576	8,113	47.8	42.2	60.7%	18.8	29.0	23.4	$0	$0	$0	$0	$284,100	$4,952	$147,466	$431,566	$0	$0	$0	$0	$284,100	$431,566	162,256	$2.66	10	467	$923	6
P-BMP-F4h	P-BMP-F4h	Jefferson Park Pond	79.22	17,300	14,385	85.4%	2,534	14,766	11,851	63.7	57.3	62.0%	24.2	39.5	33.1	$0	$0	$0	$0	$506,600	$6,012	$179,016	$685,616	$0	$0	$0	$0	$506,600	$685,616	237,017	$2.89	11	663	$1,035	9
P-BMP-F9e6 (Alt 3)	E-BMP-F9b5, F9c2, F9c4; P-BMP-F9b1-4, F9b6,	DOT Pond 4 - Alt 3 with Alum Treatment	333.76	92,961	87,535	90.0%	9,296	83,665	78,239	221.0	208.5	85.0%	33	188	175	$0	$0	$0	$0	$1,953,600	$26,243	$781,481	$2,735,081	$275,712	$63,522	$1,891,571	$2,167,283	$2,229,312	$4,902,364	1,564,786	$3.13	12	3,507.4	$1,398	18
P-BMP-F6b6	E-BMP-F6b1-3; P-BMP-F6b6	Sixth Street Pond	94.15	29,118	25,628	71.5%	8,287	20,831	17,342	78.1	72.2	51.8%	37.7	40.4	34.5	$0	$0	$0	$0	$916,000	$5,776	$172,005	$1,088,005	$0	$0	$0	$0	$916,000	$1,088,005	346,832	$3.14	13	689	$1,579	19
P-BMP-F9e1	P-BMP-F9e1	Mini-Max West Pond-Obtain M.A.[1]	2.05	881	881	80.0%	176	705	705	1.3	1.3	60.0%	0.5	0.8	0.8	$0	$0	$0	$0	$5,000	$1,400	$41,692	$46,692	$0	$0	$0	$0	$5,000	$46,692	14,101	$3.31	14	16	$2,956	32
P-BMP-F7a2 (Alt 2)	P-BMP-F7a2	Ninth Street Pond - Alt 2	40.47	8,982	7,687	78.9%	1,900	7,082	5,787	32.6	29.8	56.5%	14.2	18.5	15.6	$0	$0	$0	$0	$266,500	$4,403	$131,107	$397,607	$0	$0	$0	$0	$266,500	$397,607	115,736	$3.44	15	311	$1,277	15
P-BMP-F2g3	P-BMP-F2f, F2g3	Smith Park Pond	90.16	17,349	14,438	82.6%	3,019	14,330	11,419	66.3	60.0	59.3%	27.0	39.3	33.0	$0	$0	$0	$0	$641,100	$5,619	$167,331	$808,431	$0	$0	$0	$0	$641,100	$808,431	228,378	$3.54	16	661	$1,224	13
P-BMP-F9e2	P-BMP-F9e2	Mini-Max East Pond-Obtain M.A.[1]	2.02	867	867	80.0%	173	694	694	1.3	1.3	60.0%	0.5	0.8	0.8	$0	$0	$0	$0	$5,000	$1,540	$45,861	$50,861	$0	$0	$0	$0	$5,000	$50,861	13,878	$3.66	17	16	$3,271	34
P-BMP-F7a2 (Alt 1)	P-BMP- F7a1, F7a2	Ninth Street Pond - Alt 1	98.03	24,221	20,147	81.2%	4,556	19,665	15,591	82.6	73.8	60.4%	32.7	49.9	41.1	$0	$0	$0	$0	$934,300	$7,026	$209,235	$1,143,535	$0	$0	$0	$0	$934,300	$1,143,535	311,827	$3.67	18	822	$1,391	17
P-BMP-F9e5 (Alt 1)	P-BMP-F9e6	DOT Pond 4 - Alt 1	33.07	12,172	11,844	95.0%	609	11,564	11,235	22.9	22.5	71.6%	6.5	16.4	16.0	$0	$0	$0	$0	$0	$29,622	$882,079	$882,079	$0	$0	$0	$0	$0	$882,079	224,708	$3.93	19	320	$2,753	29
P-BMP-F6f3	P-BMP-F6f1, F6f3	Pleasants Park Pond with Alum Treatment	142.20	32,424	26,883	90.0%	3,242	29,182	23,640	116.0	112.8	85.0%	17	99	95	$0	$0	$0	$0	$800,300	$10,192	$303,503	$1,103,803	$137,625	$25,999	$774,209	$911,834	$937,925	$2,015,637	472,808	$4.26	20	1,908.6	$1,056	11
P-BMP-F3w1	P-BMP-F3w1	Racine Street Pond	26.17	9,723	8,110	83.4%	1,612	8,111	6,498	24.2	21.6	64.8%	8.5	15.7	13.1	$0	$0	$0	$0	$458,600	$4,207	$125,264	$583,864	$0	$0	$0	$0	$458,600	$583,864	129,963	$4.49	21	262	$2,229	23
P-BMP-F6b6	E-BMP-F6b1-3; P-BMP-F6b6	Sixth Street Pond with Alum Treatment	94.15	29,118	25,628	90.0%	2,912	26,206	22,717	78.1	76.4	85.0%	12	66	65	$0	$0	$0	$0	$916,000	$5,776	$172,005	$1,088,005	$144,448	$27,853	$829,418	$973,866	$1,060,448	$2,061,871	454,334	$4.54	22	1,294.5	$1,593	20
P-BMP-F1f	P-BMP-F1f	Shepard Park Pond	26.06	7,620	6,603	84.5%	1,178	6,442	5,425	21.7	19.7	60.2%	8.6	13.1	11.0	$0	$0	$0	$0	$380,400	$4,089	$121,758	$502,158	$0	$0	$0	$0	$380,400	$502,158	108,505	$4.63	23	221	$2,277	24
P-BMP-F1n4	P-BMP-F1n4	Graphic Packaging Pond	55.01	16,364	13,600	76.0%	3,922	12,442	9,678	49.2	44.1	54.7%	22.3	26.9	21.8	$0	$0	$0	$0	$698,400	$7,110	$211,716	$910,116	$0	$0	$0	$0	$698,400	$910,116	193,556	$4.70	24	436	$2,087	22
P-BMP-F4h	P-BMP-F4h	Jefferson Park Pond with Alum Treatment	79.22	17,300	14,385	90.0%	1,730	15,570	12,655	63.7	62.0	85.0%	10	54	52	$0	$0	$0	$0	$506,200	$6,012	$179,016	$685,216	$96,144	$14,727	$438,551	$534,695	$602,344	$1,219,911	253,106	$4.82	25	1,048.7	$1,163	12
P-BMP-F5b2	P-BMP-F5b2	Lock Street Pond	45.38	12,346	9,815	80.0%	2,469	9,877	7,345	41.0	36.1	57.1%	17.6	23.4	18.5	$0	$0	$0	$0	$585,100	$4,324	$128,770	$713,870	$0	$0	$0	$0	$585,100	$713,870	146,906	$4.86	26	369	$1,934	21
P-BMP-W3h8	P-BMP-W3h8	The Shoppes at Waverly Pond-Obtain M.A.[1]	1.36	460	460	80.0%	92	368	368	1.11	1.1	60.0%	0.4	0.7	0.7	$0	$0	$0	$0	$5,000	$1,120	$33,354	$38,354	$0	$0	$0	$0	$5,000	$38,354	7,361	$5.21	27	13	$2,880	31
P-BMP-F2g3	P-BMP-F2f, F2g3	Smith Park Pond with Alum Treatment	90.16	17,349	14,438	90.0%	1,735	15,614	12,703	66.3	64.7	85.0%	10	56	55	$0	$0	$0	$0	$641,100	$5,619	$167,331	$808,431	$99,911	$15,751	$469,030	$568,940	$741,011	$1,377,371	254,054	$5.42	28	1,094.6	$1,258	14
P-BMP-F5c1	P-BMP-F5c1	Third Street Pond	20.11	6,714	5,559	84.0%	1,075	5,639	4,484	19.3	17.8	64.0%	6.9	12.3	10.9	$0	$0	$0	$0	$427,000	$3,500	$104,231	$531,231	$0	$0	$0	$0	$427,000	$531,231	89,682	$5.92	29	218	$2,439	25
E-BMP-F8c2	E-BMP-F8c2	Watters Plumbing Pond-Obtain M.A.[1]	2.17	710	323	80.0%	142	568	181	1.4	0.9	60.0%	0.6	0.9	0.3	$0	$0	$0	$0	$5,000	$560	$16,677	$21,677	$0	$0	$0	$0	$5,000	$21,677	3,630	$5.97	30	6	$3,567	35
P-BMP-F4c1	P-BMP-F4c1-2	Parkview Pond	43.85	12,256	9,524	82.4%	2,156	10,100	7,368	40.2	35.6	56.9%	17.3	22.9	18.2	$0	$0	$0	$0	$748,200	$4,795	$142,792	$890,992	$0	$0	$0	$0	$748,200	$890,992	147,361	$6.05	31	365	$2,443	26
P-BMP-W3h4	P-BMP-W3h4	Stone Toad Pond-Obtain M.A.[1]	2.74	770	770	80.0%	154	616	616	1.99	2.0	60.0%	0.8	1.2	1.2	$0	$0	$0	$0	$5,000	$2,380	$70,877	$75,877	$0	$0	$0	$0	$5,000	$75,877	12,317	$6.16	32	24	$3,174	33
P-BMP-F9c5	E-BMP-F9b5, F9c2, F9c4; P-BMP-F9b1-4, F9b6,	Midway Pond	200.50	45,472	40,649	72.1%	12,700	32,772	27,948	138.1	125.2	53.8%	63.9	74.2	61.3	$0	$0	$0	$0	$2,971,600	$18,528	$551,719	$3,523,319	$0	$0	$0	$0	$2,971,600	$3,523,319	558,968	$6.30	33	1,226	$2,873	30
E-BMP-F8d2	E-BMP-F8d2	Multi-Storage Biofilters-Obtain M.A.1	3.29	1,168	532	80.0%	234	934	299	2.7	1.6	0.0%	2.7	0.0	-1.0	5,000.0	$1,314	$39,116	$39,116	$0	$0	$0	$0	$0	$0	$0	$0	$5,000	$39,116	5,971	$6.55	34	-21	-$1,893	45
P-BMP-W5d5	P-BMP-W5d5	Woodland Hills Pond-Obtain M.A.[1]	54.94	8,763	6,948	90.0%	876	7,887	6,072	35.04	30.9	65.0%	12.3	22.8	18.6	$0	$0	$0	$0	$5,000	$30,623	$911,886	$916,886	$0	$0	$0	$0	$5,000	$916,886	121,442	$7.55	35	372	$2,465	27
P-BMP-F9c5	E-BMP-F9b5, F9c2, F9c4; P-BMP-F9b1-4, F9b6, F9c5	Midway Pond with Alum Treatment	200.50	45,472	40,649	90.0%	4,547	40,925	36,102	138.1	125.8	85.0%	21	117	105	$0	$0	$0	$0	$2,971,600	$18,528	$551,719	$3,523,319	$255,229	$57,957	$1,725,834	$1,981,063	$3,226,829	$5,504,382	722,030	$7.62	36	2,102.3	$2,618	28
P-BMP-F1b	P-BMP-F1b	Abbey Pond	22.60	6,842	6,059	75.2%	1,694	5,148	4,365	18.3	16.7	54.7%	8.3	10.0	8.4	$0	$0	$0	$0	$586,500	$4,324	$128,770	$715,270	$0	$0	$0	$0	$586,500	$715,270	87,310	$8.19	37	169	$4,241	39
P-BMP-F4c2	P-BMP-F4c2	Depere Street Pond	9.61	3,414	2,577	86.5%	460	2,955	2,117	9.8	8.7	59.3%	4.0	5.8	4.7	$0	$0	$0	$0	$272,000	$3,579	$106,568	$378,568	$0	$0	$0	$0	$272,000	$378,568	42,347	$8.94	38	93	$4,050	37
P-BMP-F9b4	P-BMP-F9b4	UW Fox-Valley West Biofilter	0.69	170	139	80.0%	34	136	105	0.6	0.5	0.0%	0.6	0.0	-0.1	$5,000	$473	$14,090	$19,090	$0	$0	$0	$0	$0	$0	$0	$0	$5,000	$19,090	2,109	$9.05	39	-2	-$10,592	46
P-BMP-F9f1	P-BMP-F9f1	Miron Storage Yard Pond	2.98	439	439	75.9%	106	333	333	1.2	1.2	64.0%	0.4	0.8	0.8	$0	$0	$0	$0	$5,000	$1,960	$58,369	$63,369	$0	$0	$0	$0	$5,000	$63,369	6,669	$9.50	40	15	$4,114	38
E-BMP-W3j1	E-BMP-W3j1	Southfield West Subdivision Pond - Outlet Modification	27.49	5,837	1,944	70.2%	1,742	4,095	201	19.65	10.2	50.4%	9.7	9.9	0.5	$0	$0	$0	$0	$5,000	$1,120	$33,354	$38,354	$0	$0	$0	$0	$5,000	$38,354	4,028	$9.52	41	10	$3,827	36
P-BMP-F9b1	P-BMP-F9b1	UW Fox-Valley East Biofilters	0.93	216	216	80.0%	43	173	173	0.8	0.8	0.0%	0.8	0.0	0.0	$5,000	$1,029	$30,650	$35,650	$0	$0	$0	$0	$0	$0	$0	$0	$5,000	$35,650	3,453	$10.33	42	0	$0	44
P-BMP-F7c2 (Alt 1)	P-BMP-F7c2	DOT Pond 2 - Alt 1	4.52	1,259	1,195	96.1%	49	1,211	1,146	3.4	3.3	74.0%	0.9	2.5	2.4	$0	$0	$0	$0	$0	$12,816	$381,646	$381,646	$0	$0	$0	$0	$0	$381,646	22,915	$16.65	43	49	$7,829	40
P-BMP-F3r	P-BMP-F3r	Center Street Underground Detention	19.23	6,644	5,166	81.0%	1,262	5,382	3,904	18.8	16.6	62.1%	7.1	11.7	9.4	$0	$0	$0	$0	$2,462,700	$4,952	$147,466	$2,610,166	$0	$0	$0	$0	$2,462,700	$2,610,166	78,087	$33.43	44	188	$13,856	42
E-BMP-F8d1	E-BMP-F8d1	Piggly Wiggly Pond-Obtain M.A.1	0.96	295	134	80.0%	59	236	75	0.8	0.5	60.0%	0.3	0.5	0.2	$0	$0	$0	$0	$5,000	$1,680	$50,031	$55,031	$0	$0	$0	$0	$5,000	$55,031	1,508	$36.50	45	3	$17,191	43
P-BMP-W5b4	P-BMP-W5b4	Woodland Trails Condos Pond-Obtain M.A.[1]	2.23	108	108	80.0%	22	86	86	0.43	0.4	60.0%	0.2	0.3	0.3	$0	$0	$0	$0	$5,000	$2,100	$62,538	$67,538	$0	$0	$0	$0	$5,000	$67,538	1,723	$39.19	46	5	$13,062	41

*Based on Existing BMP's (if applicable) and proposed street sweeping program

[1]Existing private BMP with no maintenance agreement. Estimated capital cost is for obtaining such an agreement. Pollutant reductions listed are approximate due to lack of necessary information to model in WinSLAMM.

- Fox River Sub-Watershed
- Lake Winnebago Sub-Watershed

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POTENTIAL STORMWATER BMP RETROFIT

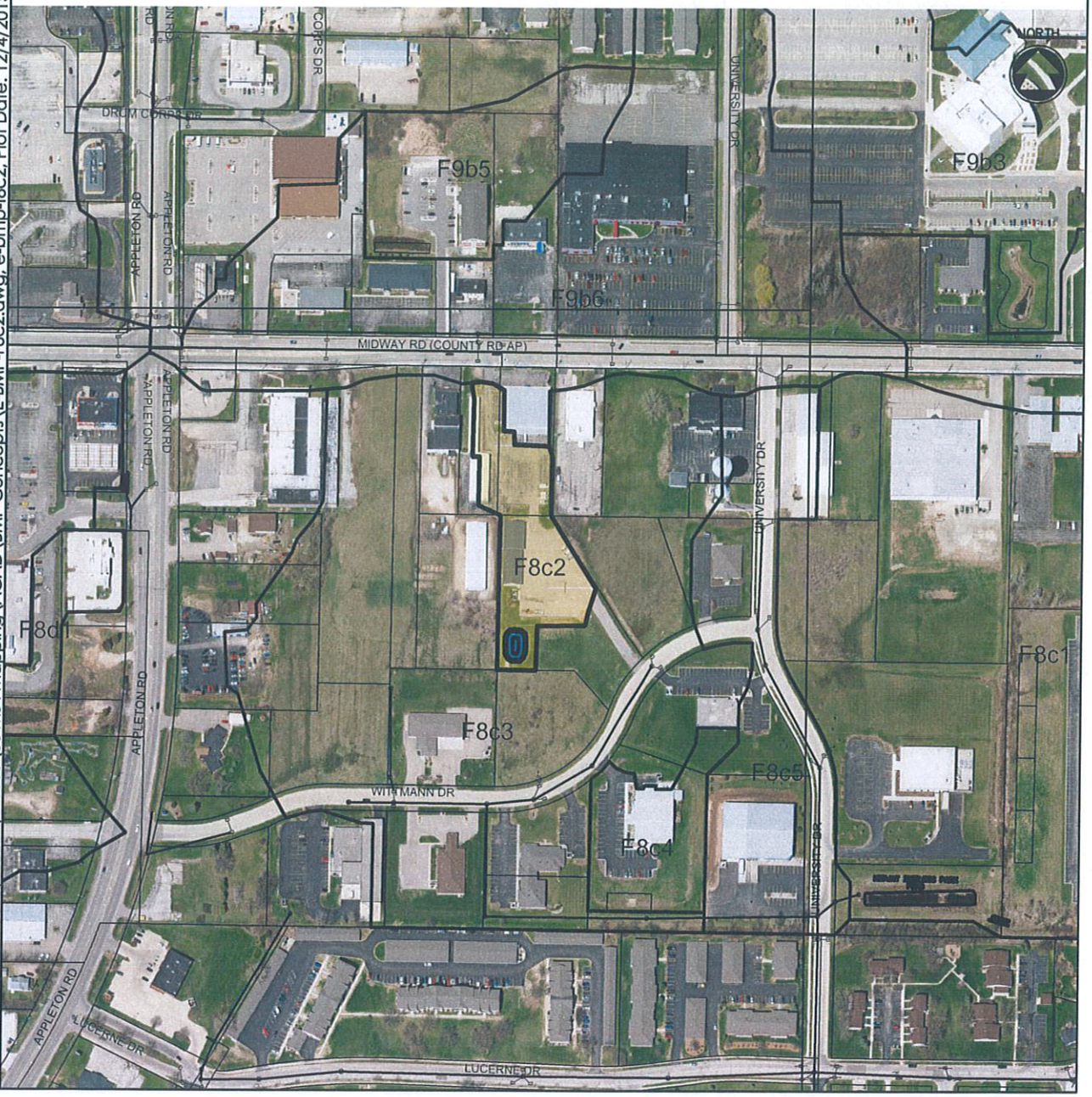
BMP CATCHMENT ID: E-BMP-F8c2

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: WATTERS PLUMBING POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F8c2	Total Drainage Area: 2.2 acres
Imperviousness (Future): 71.9%	Runoff Curve Number (Future): 93	Water Quality Volume (Future): 0.19 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):

Infrastructure modifications or flow diversions required for retrofit:

Site access for future BMP maintenance:

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.05 acre permanent pool	N/A	$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.

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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: E-BMP-F8d1

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: PIGGLY WIGGLY POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F8d1	Total Drainage Area: 1.9 acres
Imperviousness (Future): 76.1%	Runoff Curve Number (Future): 94	Water Quality Volume (Future): 0.18 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):

Infrastructure modifications or flow diversions required for retrofit:

Site access for future BMP maintenance:

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.12 acre permanent pool	N/A	$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.

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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: E-BMP-F8d2

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: MULTI-STORAGE BIOFILTERS	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F8d2	Total Drainage Area: 3.3 acres
Imperviousness (Future): 90.4%	Runoff Curve Number (Future): 96	Water Quality Volume (Future): 0.36 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Bioretention

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):

Infrastructure modifications or flow diversions required for retrofit:

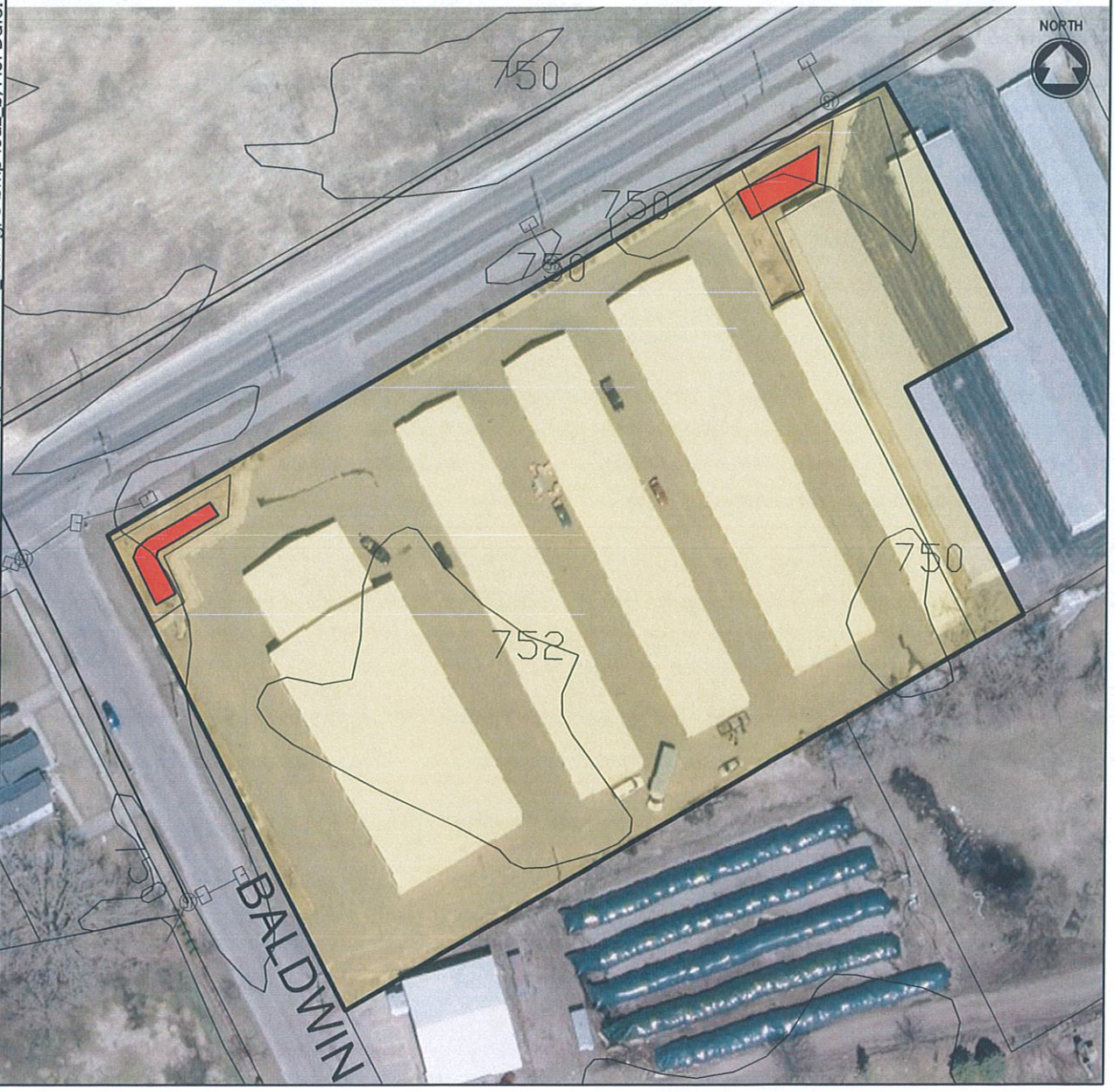
Site access for future BMP maintenance:

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost: $5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: E-BMP-F8d7

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: TAYCO POND EXPANSION	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F8b1-2, F8c1-5, F8d1-7, F8e1-4	Total Drainage Area: 1,295.6 acres
Imperviousness (Future): 46.1%	Runoff Curve Number (Future): 88	Water Quality Volume (Future): 75.29 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge through existing outlet structure & storm sewer. DOT will be modifying the outlet structure as part of expansion.

Infrastructure modifications or flow diversions required for retrofit:
DOT to expand pond and install storm sewer to divert flows from 441 corridor into pond.

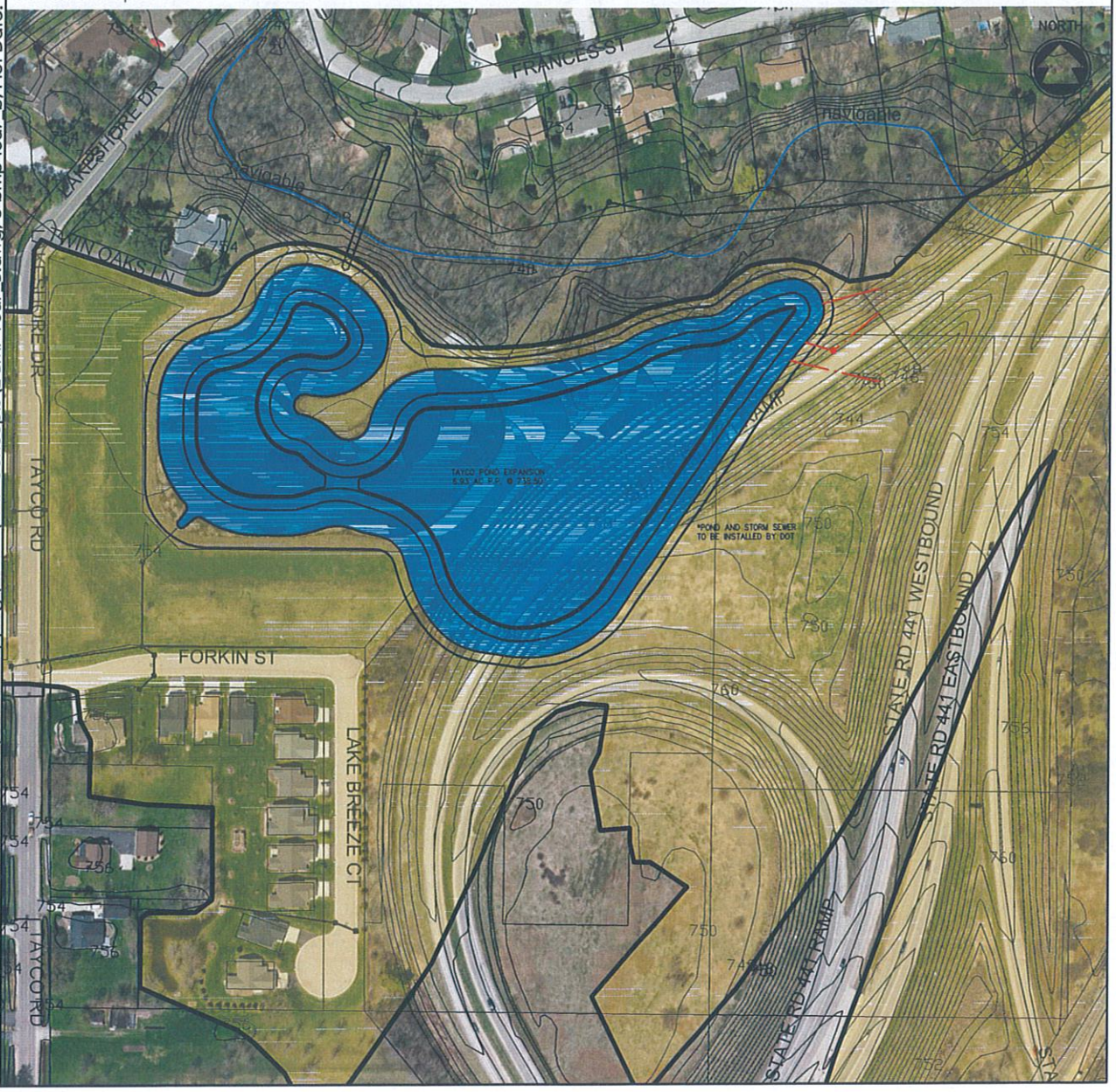
Site access for future BMP maintenance:
Good. Access from Twin Oaks Ln.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
6.93 acre permanent pool	0 (DOT donating land)	$0*

Sketch of Proposed BMP Retrofit:

*DOT will be constructing pond expansion & storm sewer as part of "441" project. City & Town to own & maintain pond.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: E-BMP-W3h1

McM PROJECT NO: M0001-930563

SITE INFORMATION:

Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: MANITOWOC ROAD POND - OUTLET MODIFICATION	Initials: PTK

DRAINAGE AREA:

Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: W3h1	Total Drainage Area: 162.8 acres
Imperviousness (Future): 54.6%	Runoff Curve Number (Future): 89	Water Quality Volume (Future): 11.02 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into storm sewer that drains southwest along Manitowoc Rd.

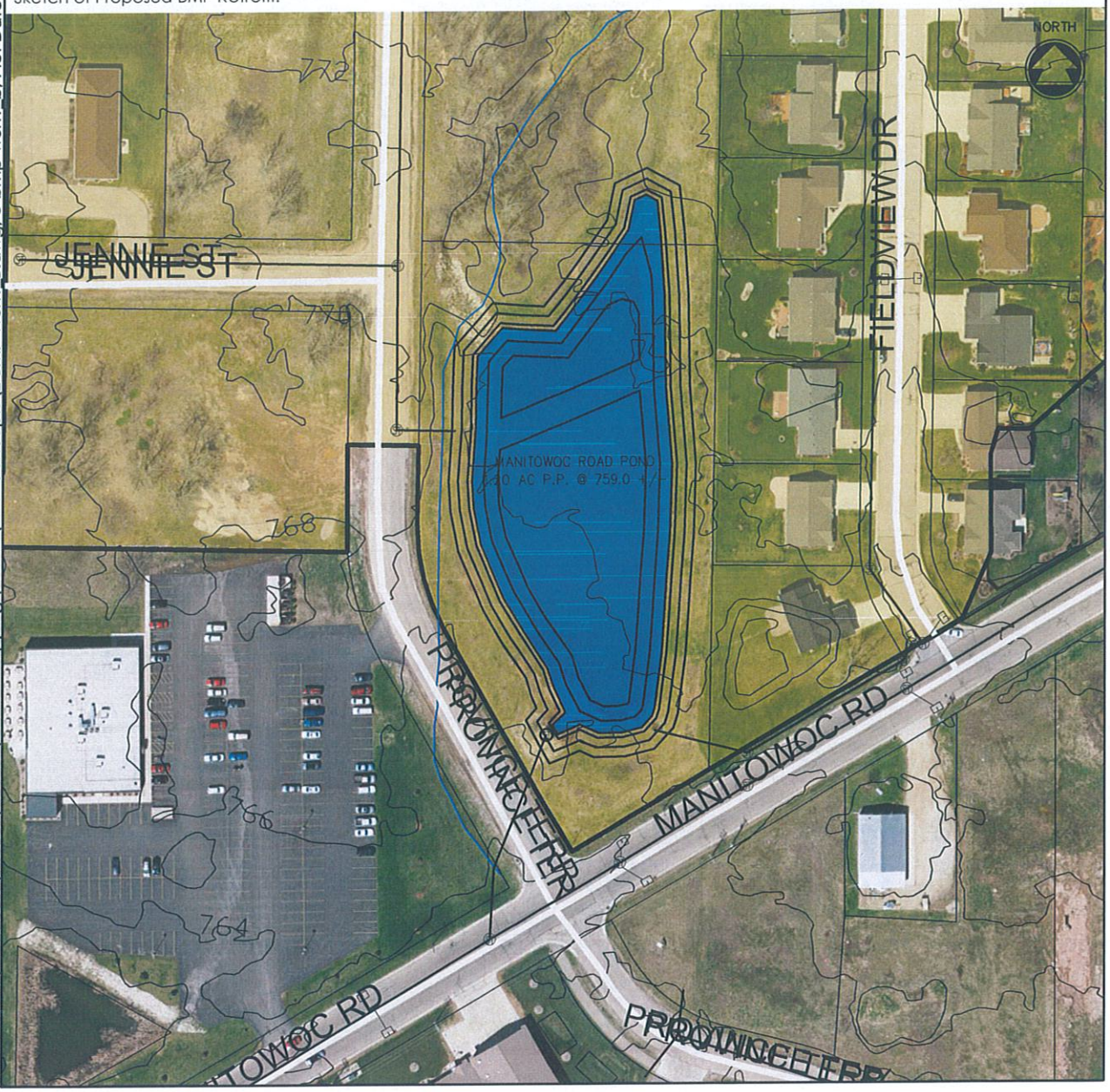
Infrastructure modifications or flow diversions required for retrofit:
Modify the outlet structure to increase water quality performance.

Site access for future BMP maintenance:
Good. Access from Manitowoc Rd and Province Terrace.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
H&H analysis should be completed to determine if modified outlet structure impacts the upstream storm sewer system

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
1.20 acre permanent pool	N/A (City currently owns)	$5,000

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: E-BMP-W3j1

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: SOUTHFIELD WEST SUBDIVISION POND-OUTLET MODIFICATION	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: W3j1	Total Drainage Area: 27.5 acres
Imperviousness (Future): 47.7%	Runoff Curve Number (Future): 89	Water Quality Volume (Future): 1.65 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into storm sewer that drains east under Nature's Way.

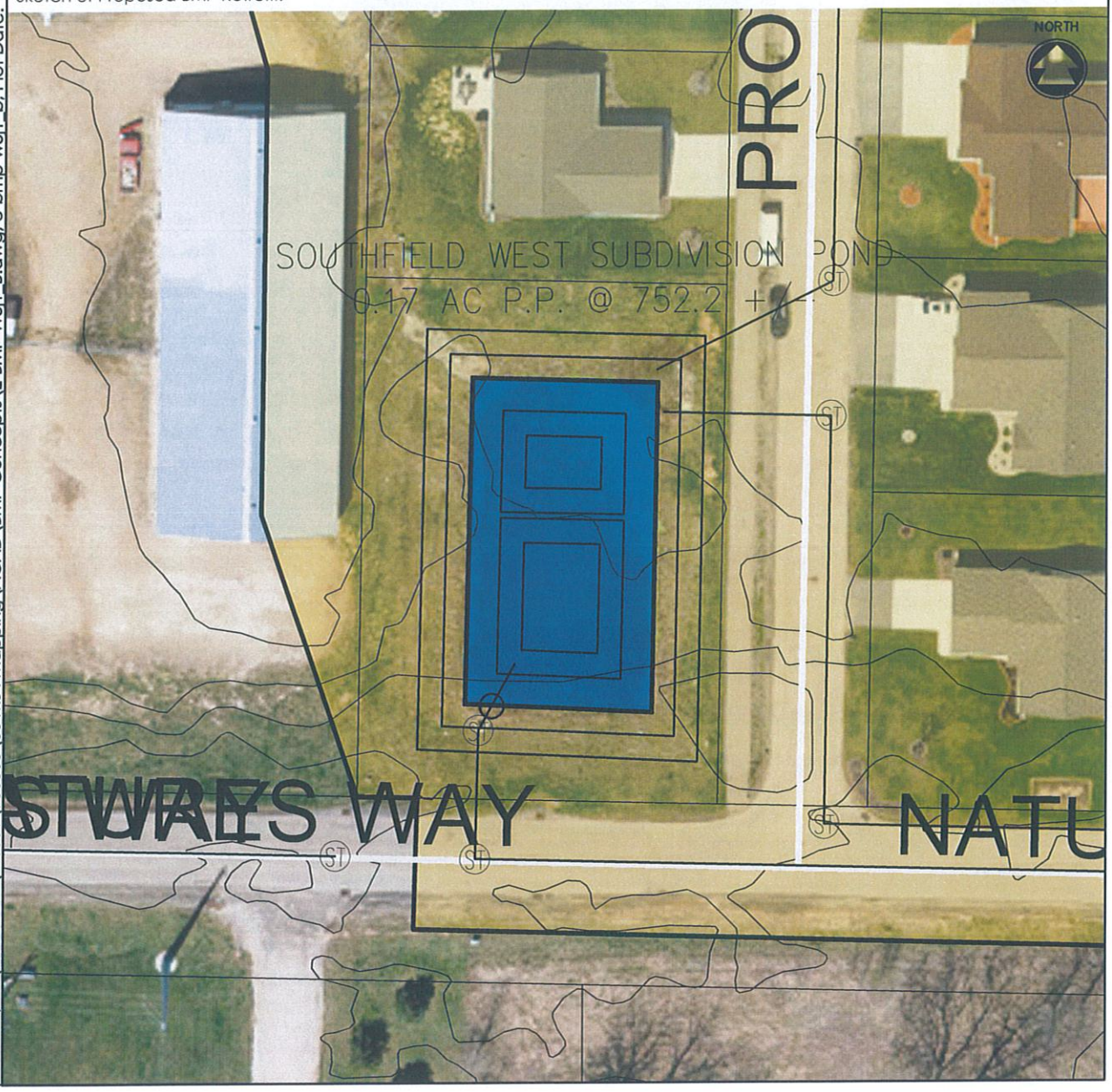
Infrastructure modifications or flow diversions required for retrofit:
Modify the outlet structure to increase water quality performance.

Site access for future BMP maintenance:
Good. Access from Nature's Way and Province Terrace.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
H&H analysis should be conducted to determine if modifying outlet structure would impact upstream storm sewer performance.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.17 acre permanent pool	N/A (City currently owns)	$5,000

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

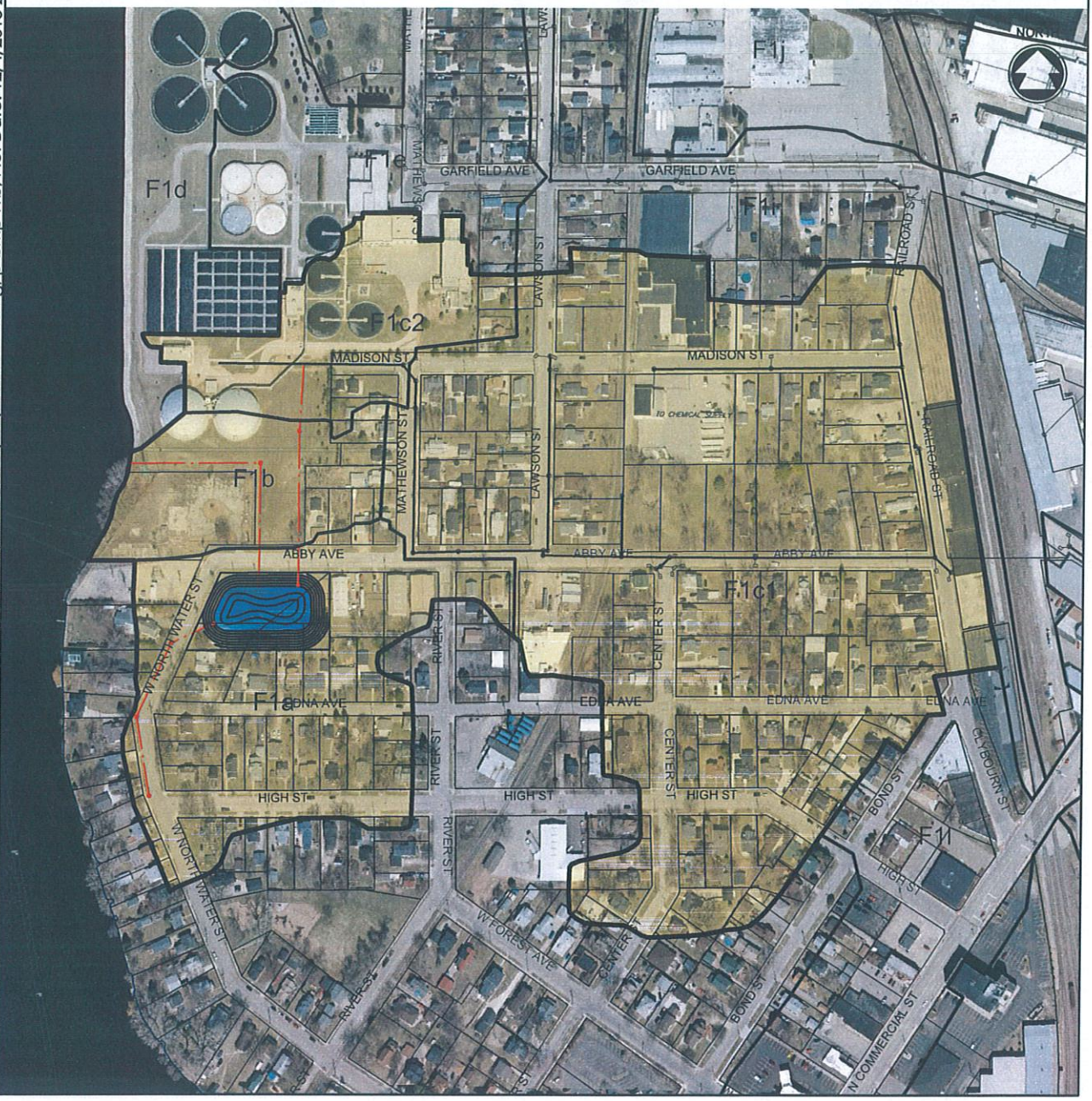
BMP CATCHMENT ID: P-BMP-F1b

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: ABBEY POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F1a, F1b, F1c1-2	Total Drainage Area: 49.1acres
Imperviousness (Future): 57.7%	Runoff Curve Number (Future): 90	Water Quality Volume (Future): 3.49 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft): 2.7 +/-	Remediation:	☒ Yes ☐ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in): >80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture: Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge through new storm sewer that will discharge to the Fox River.

Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Madison St will need to be conveyed to the pond via new storm sewer.

Site access for future BMP maintenance:
Good. Access either from Abby Ave or W. North Water St

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Closed remediation site. Potential for asbestos in houses to be demolished.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.46 acre permanent pool	1.12 acres	$586,500*

Sketch of Proposed BMP Retrofit:

*Possible cost share with C. Neenah

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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F1f

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: SHEPARD PARK POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F1e, F1f, F1h, F1i	Total Drainage Area: 26.6 acres
Imperviousness (Future): 48.4%	Runoff Curve Number (Future): 87	Water Quality Volume (Future): 1.61 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.5+/-	Remediation:	☒ Yes ☐ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☒ Yes ☐ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge through new storm sewer that will discharge to the Fox River.

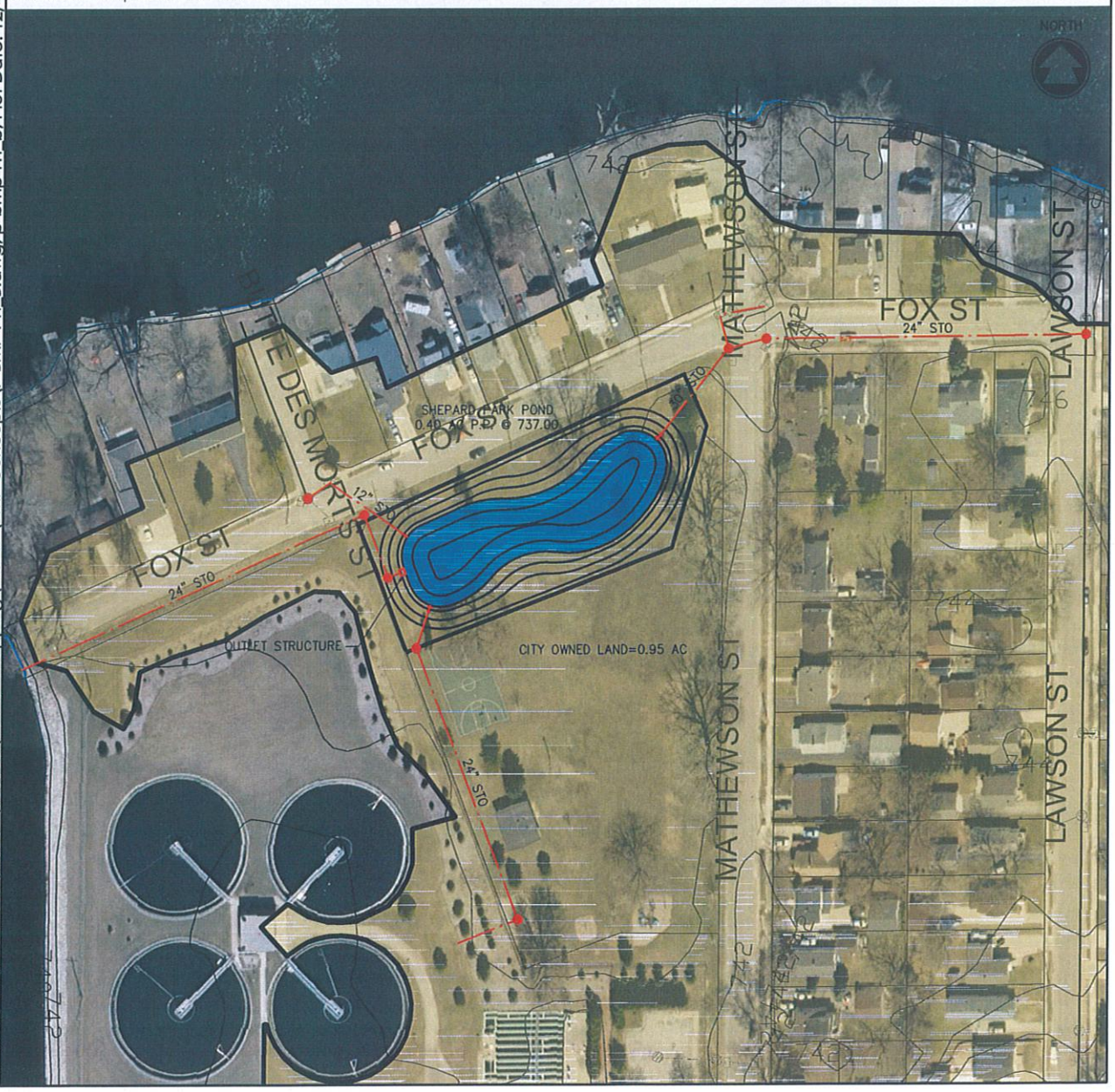
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Lawson St, Mathewson St and Fox St will need to be conveyed to the pond via new storm sewer.

Site access for future BMP maintenance:
Good. Access from Fox Street or park

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Close to closed remediation & historical waste site. Water main lowering anticipated.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.40 acre permanent pool	0.95 (City currently owns)	$380,400

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

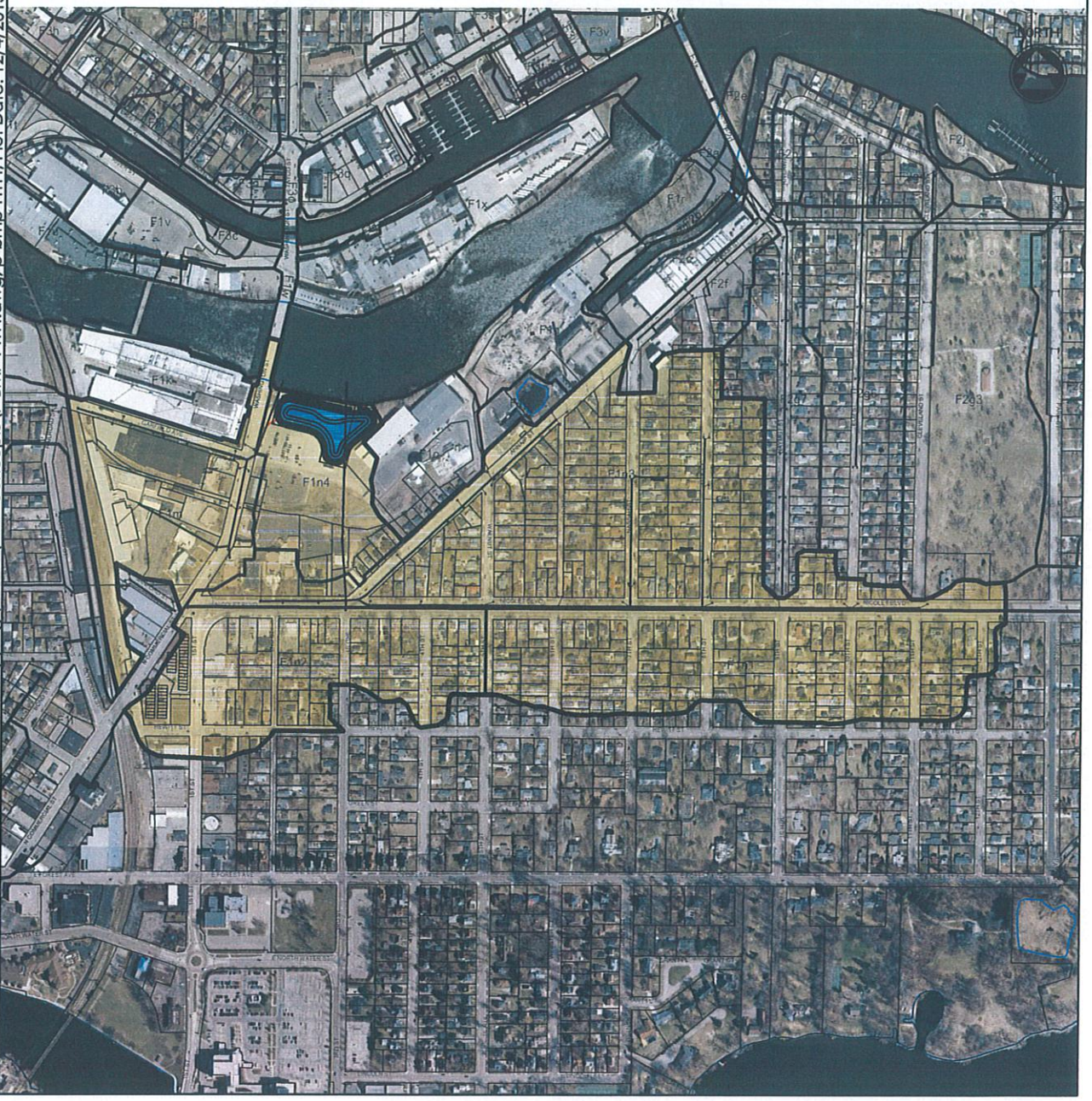
BMP CATCHMENT ID: P-BMP-F1n4

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: GRAPHIC PACKAGING POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F1n1-4, F1m	Total Drainage Area: 26.6 acres
Imperviousness (Future): 54.2%	Runoff Curve Number (Future): 89	Water Quality Volume (Future): 7.39 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.5+/-	Remediation:	☒ Yes ☐ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☒ Yes ☐ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge through new storm sewer that will discharge to the Fox River.

Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Washington St and Ahnaip St will need to be conveyed to the pond via new storm sewer.

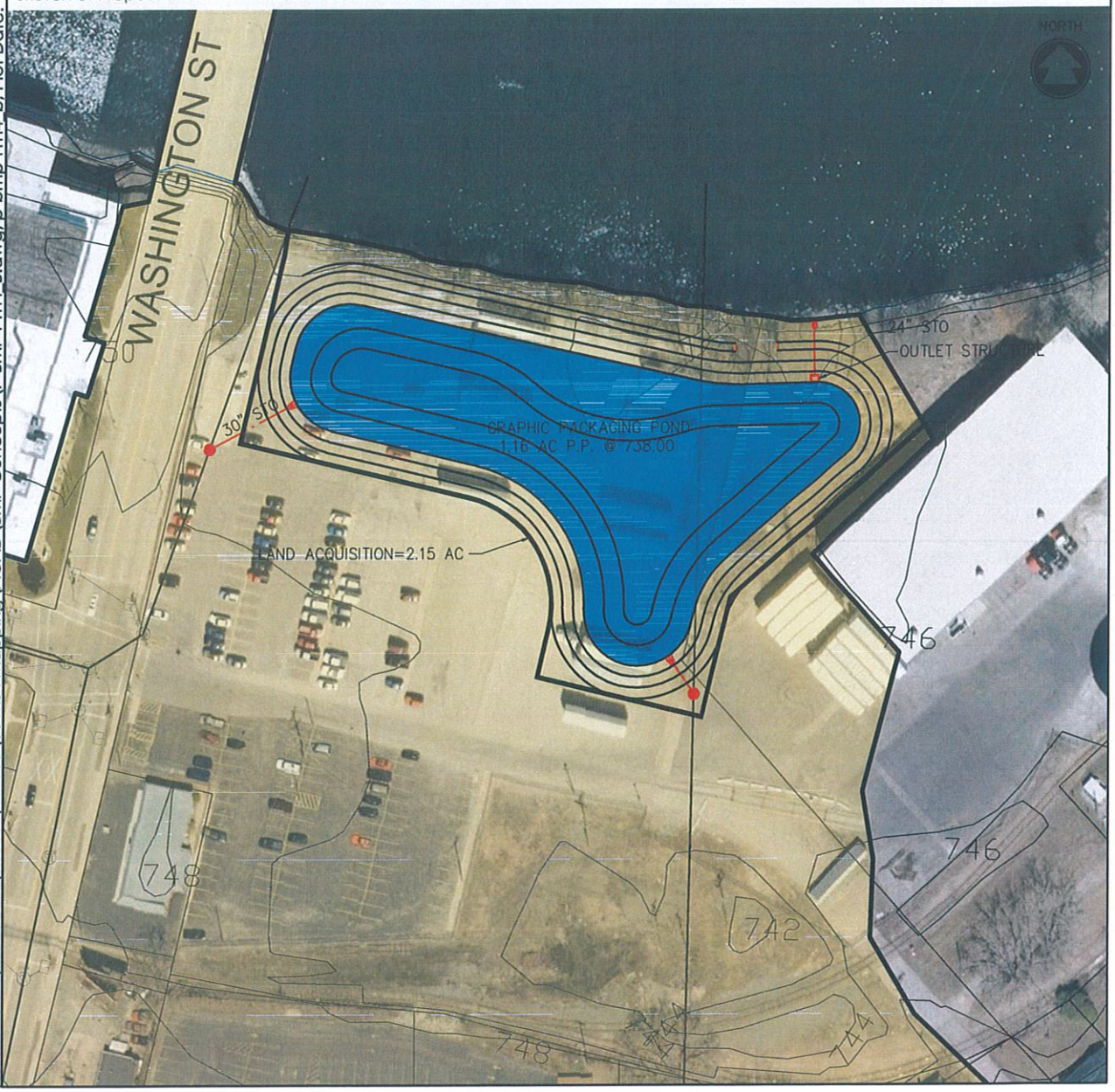
Site access for future BMP maintenance:
Good. Access from Washington Street. Ingress/Egress easement anticipated through parking lot

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Close to open remediation & historical waste site. Possible bedrock and blasting required. Overhead electric lines (ATC?)

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
1.16 acre permanent pool	2.15	$698,400*

Sketch of Proposed BMP Retrofit:

*Possible cost share with C. Neenah



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F2g3

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: SMITH PARK POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F2g1-3, F2g6-7, F2f	Total Drainage Area: 90.2 acres
Imperviousness (Future): 31.1%	Runoff Curve Number (Future): 83	Water Quality Volume (Future): 3.72 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge to the existing storm sewer that drains west along Keyes St.

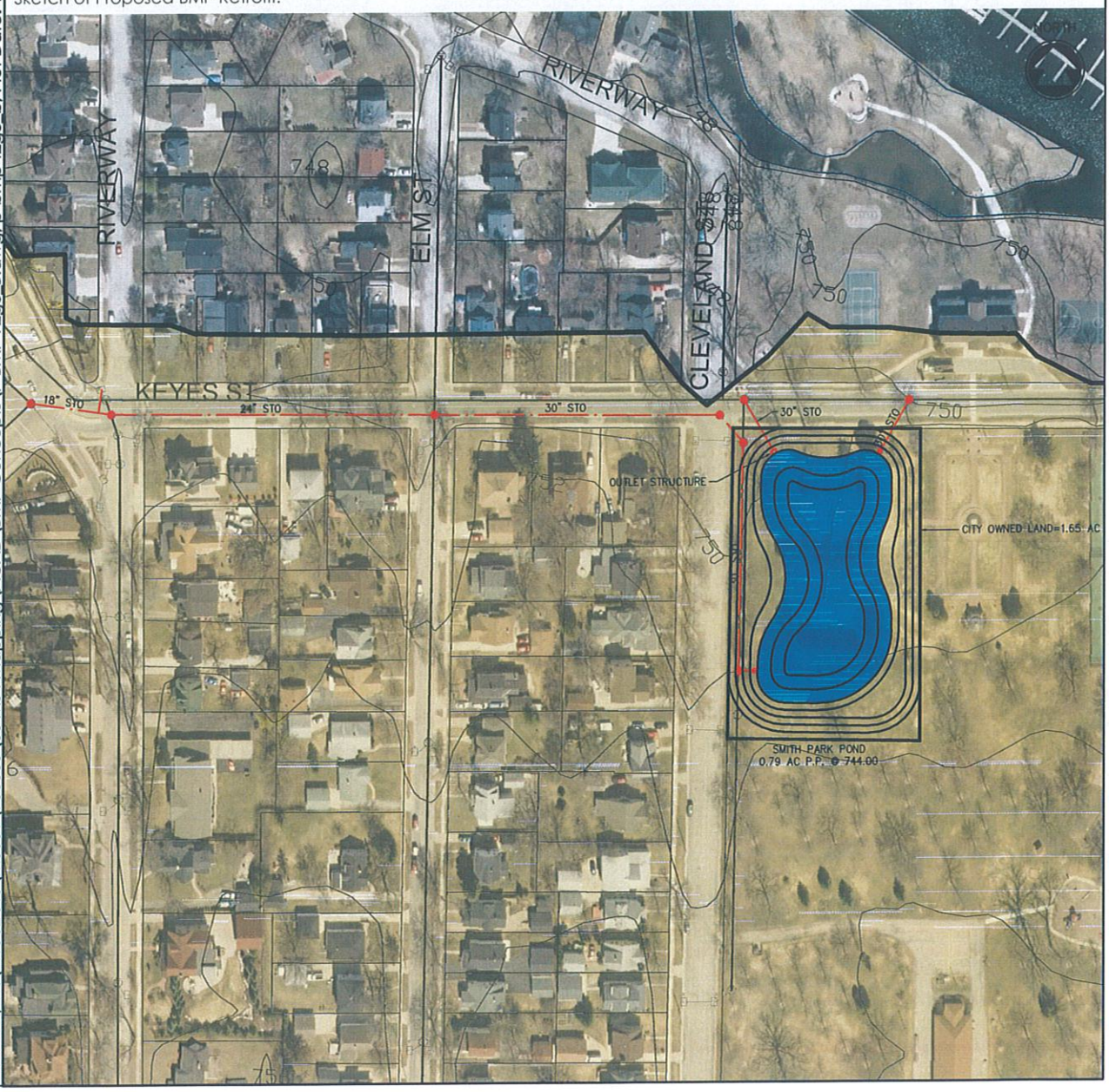
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer to be installed along Keyes St to as shown to drain watershed to pond.

Site access for future BMP maintenance:
Good. Access from Keyes St or Cleveland St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Private utilities within park? Possible sanitary sewer conflicts?

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.79 acre permanent pool	1.65 (City currently owns)	$641,100

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F3r

McM PROJECT NO: M0001-930563

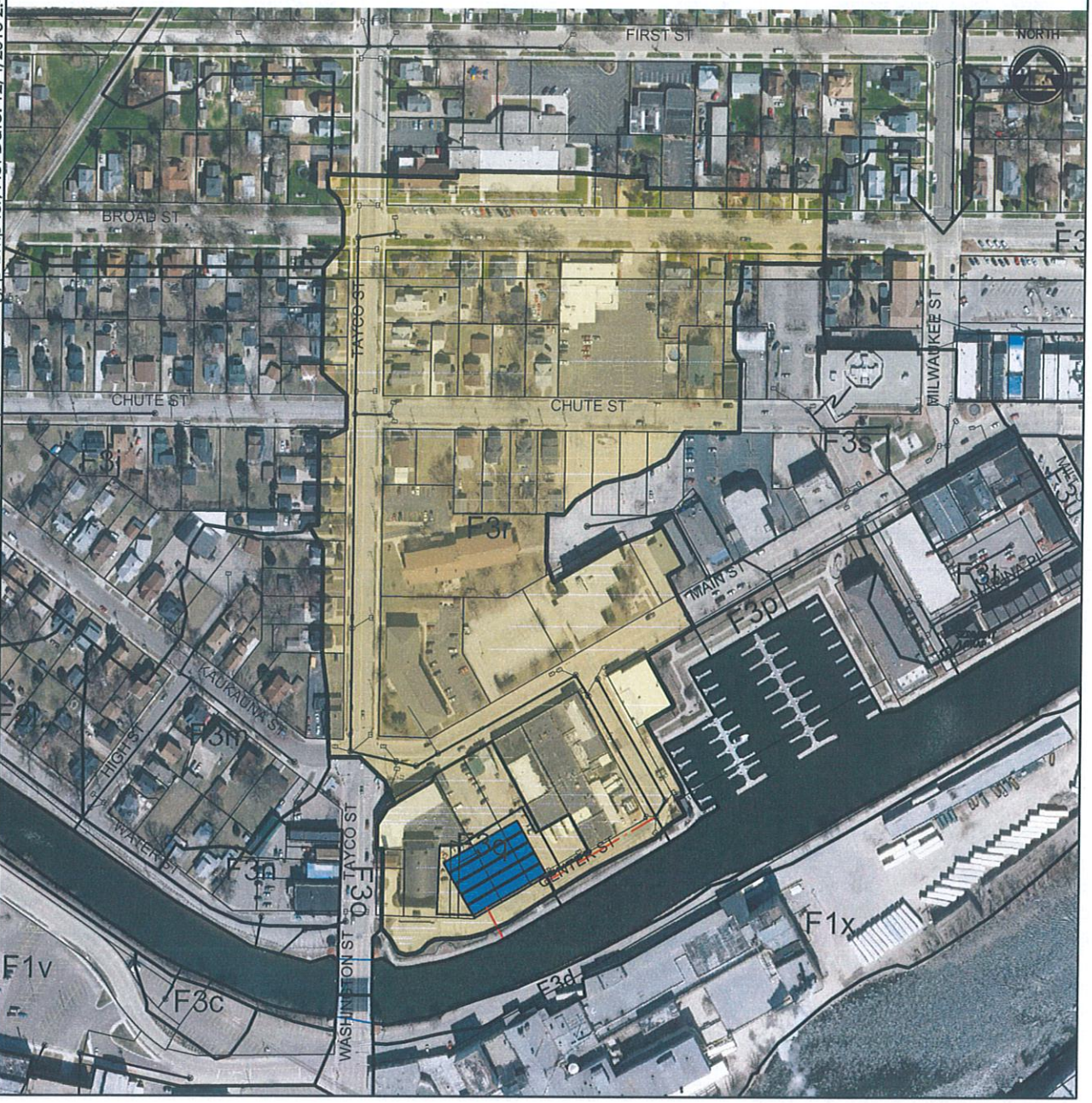
SITE INFORMATION:

Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: CENTER STREET UNDERGROUND DETENTION	Initials: PTK

DRAINAGE AREA:

Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F3r, F3q	Total Drainage Area: 19.2 acres
Imperviousness (Future): 70.3%	Runoff Curve Number (Future): 93	Water Quality Volume (Future): 1.64 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Underground Detention

Initial BMP Screening

Groundwater Depth (ft): 2.7 +/-	Remediation:	☒ Yes ☐ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in): >80	Historical:	☒ Yes ☐ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture: Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge through new storm sewer that will discharge to the Fox River.

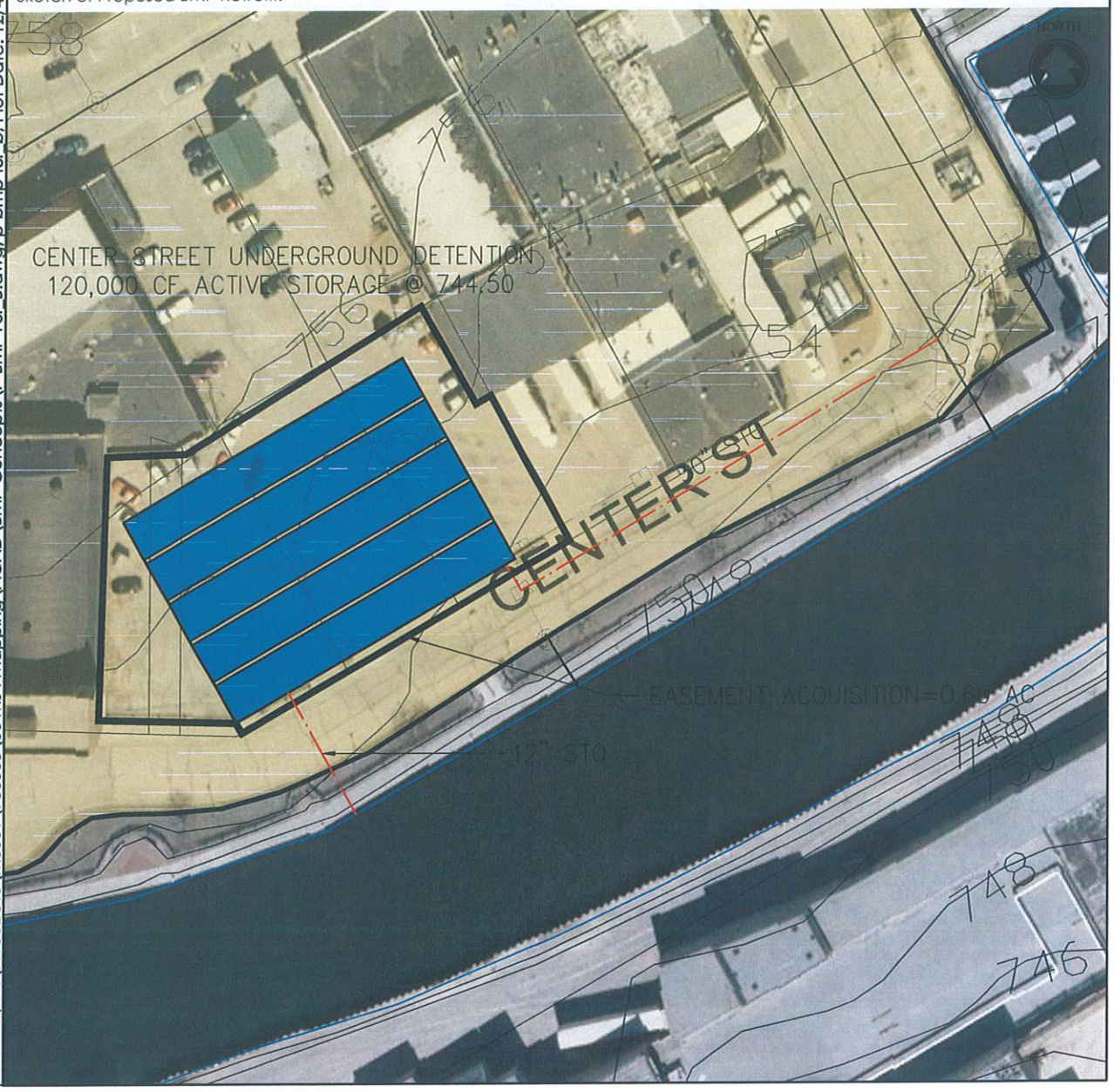
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Center St and will need to be conveyed to the underground detention device via new storm sewer.

Site access for future BMP maintenance:
Good. Access from Center Street.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Close to closed remediation & historical site. Possible santiary conflicts on Center St. Relocation of overhead electric lines.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
120,000 CF of active storage	0.60	$2,462,700

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

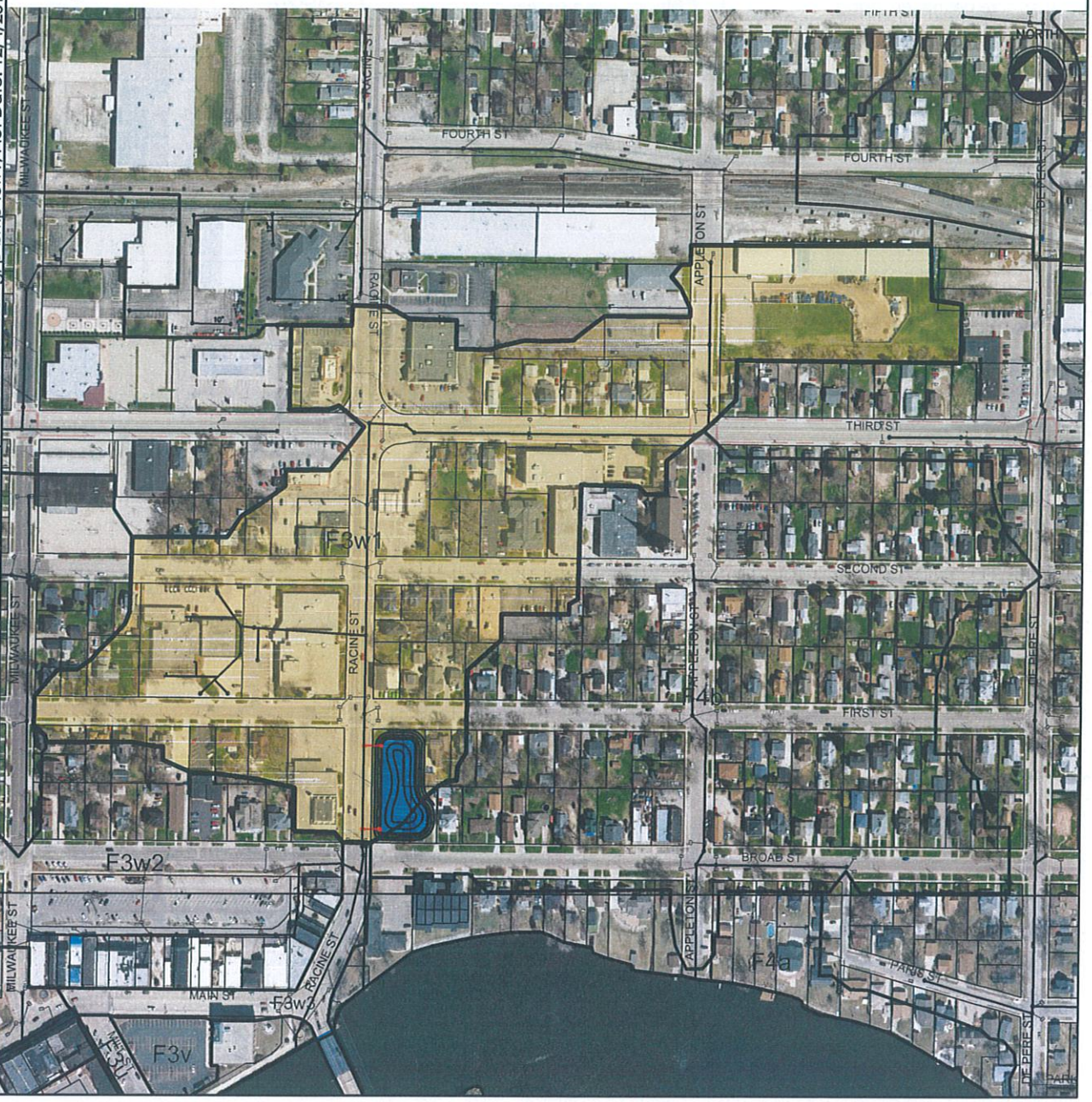
BMP CATCHMENT ID: P-BMP-F3w1

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: RACINE STREET POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F3w1	Total Drainage Area: 26.2 acres
Imperviousness (Future): 65.9%	Runoff Curve Number (Future): 92	Water Quality Volume (Future): 2.10 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Underground Detention

Initial BMP Screening

Groundwater Depth (ft):	2.7 +/-	Remediation:	☒ Yes ☐ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge to existing storm sewer within Racine Street that drains south.

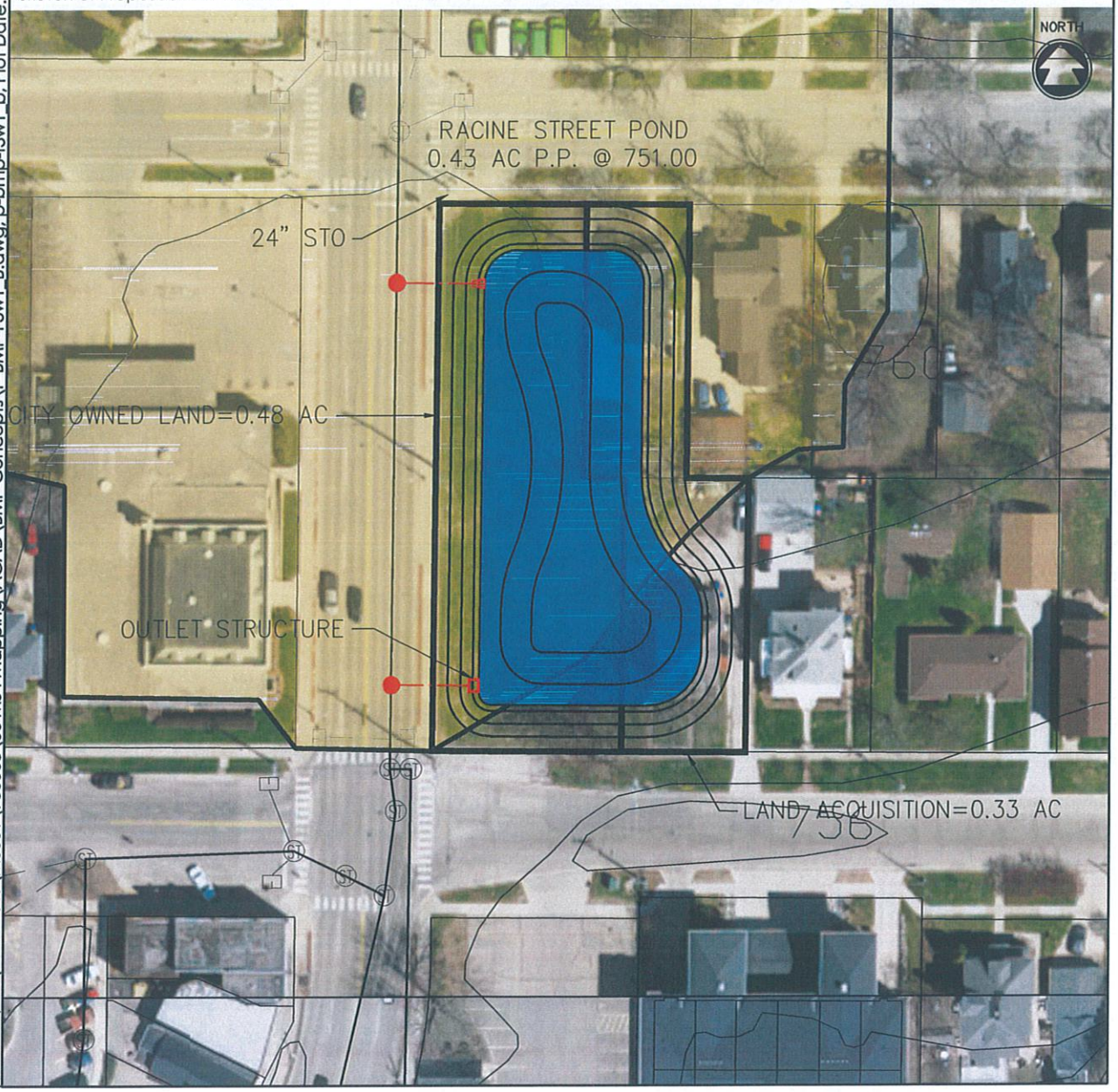
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Racine Street will be diverted into the pond.

Site access for future BMP maintenance:
Good. Access from Racine or Broad Street.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Open & closed remediation sites. May require asbestos removal of houses to be demolished.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.43 acre permanent pool	0.81	$458,600

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F4c1

McM PROJECT NO: M0001-930563

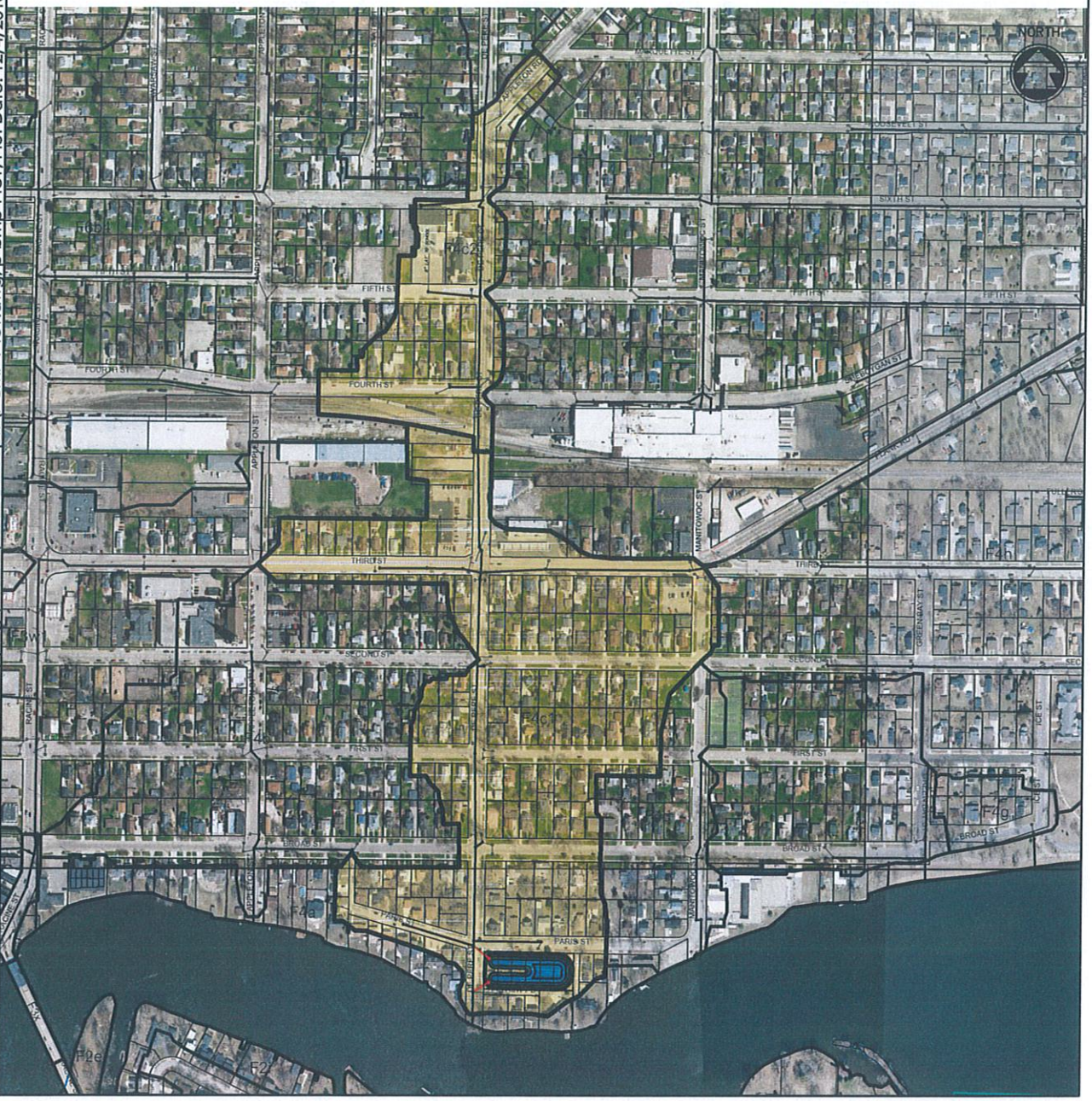
SITE INFORMATION:

Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: PARKVIEW POND	Initials: PTK

DRAINAGE AREA:

Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F4c1-2	Total Drainage Area: 43.9 acres
Imperviousness (Future): 49.6%	Runoff Curve Number (Future): 89	Water Quality Volume (Future): 2.72 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	0.5+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge to the existing storm sewer that drains south along Depere St

Infrastructure modifications or flow diversions required for retrofit:
Storm sewer along Depere St to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Paris St or Depere St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Houses to be demolished may contain asbestos? Shallow depths to groundwater anticipated.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.58 acre permanent pool	0.96	$748,200

Sketch of Proposed BMP Retrofit:

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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F4c2

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: DEPERE STREET POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F4c2	Total Drainage Area: 9.6 acres
Imperviousness (Future): 59.2%	Runoff Curve Number (Future): 91	Water Quality Volume (Future): 0.70acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	0.5+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge to the existing storm sewer that drains south along Depere St

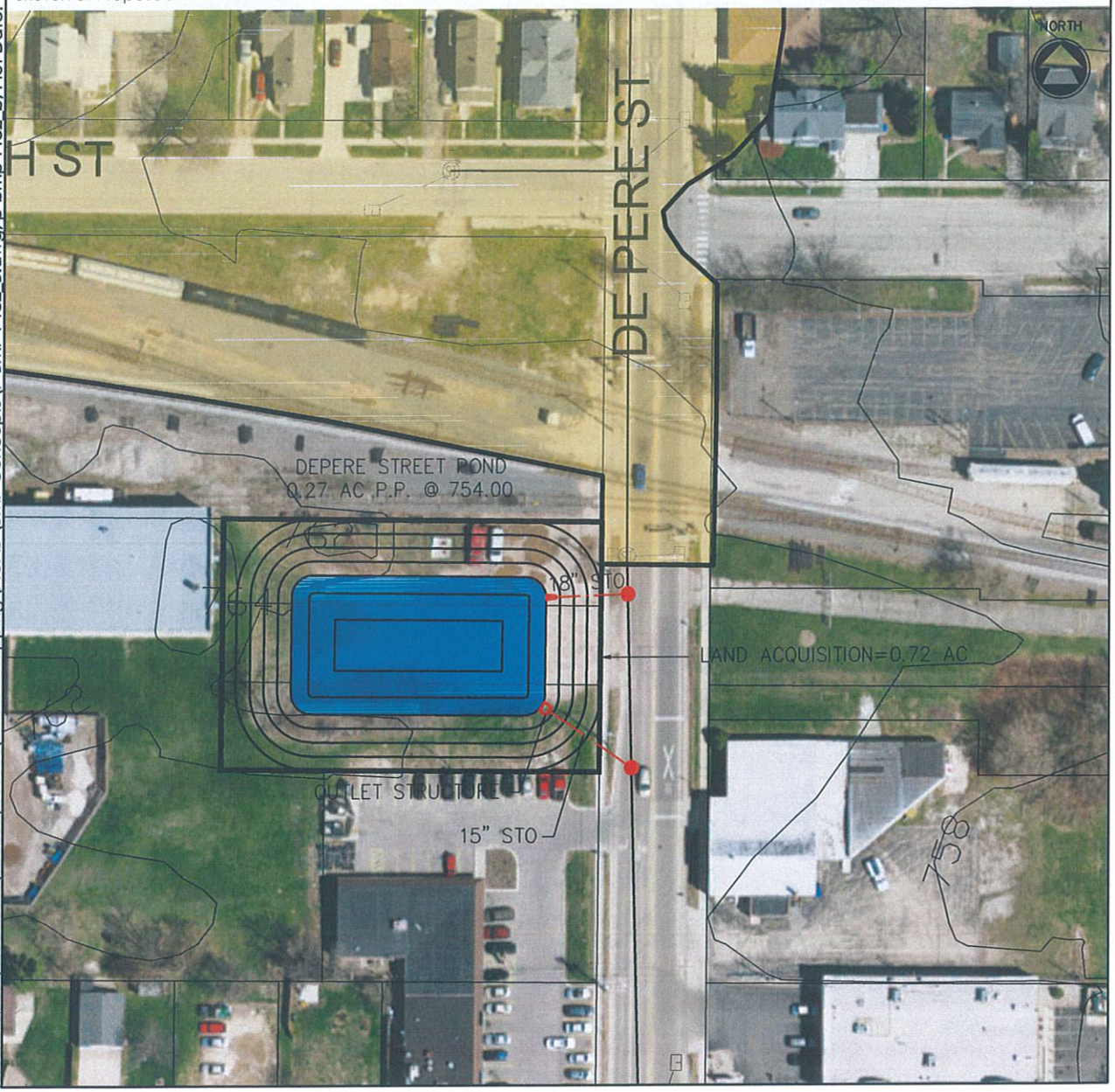
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer along Depere St to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Depere St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Close to closed remediation site. Shallow depths to groundwater anticipated.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.27 acre permanent pool	0.72	$272,000

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F4h

McM PROJECT NO: M0001-930563

SITE INFORMATION:

Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: JEFFERSON PARK POND	Initials: PTK

DRAINAGE AREA:

Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F4e, F4f, F4g, F4h, F4i, F4j	Total Drainage Area: 79.2 acres
Imperviousness (Future): 32.4%	Runoff Curve Number (Future): 85	Water Quality Volume (Future): 3.38 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	0.5+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☒ Yes ☐ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge to the existing storm sewer that drains southeast into Fox River

Infrastructure modifications or flow diversions required for retrofit:
Several storm sewer interceptors will be required to convey flows from the watershed into the pond.

Site access for future BMP maintenance:
Good. Access from Kargus Dr or Konemac St parking lot.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Relocate or abandon existing sanitary sewer within pond area. Shallow depths to groundwater anticipated.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.89 acre permanent pool	1.48 (City currently owns)	$506,600

Sketch of Proposed BMP Retrofit:

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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F5b2

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: LOCK STREET POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F5b1-2	Total Drainage Area: 45.4 acres
Imperviousness (Future): 43.9%	Runoff Curve Number (Future): 88	Water Quality Volume (Future): 2.52 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge via new storm sewer into Fox River.

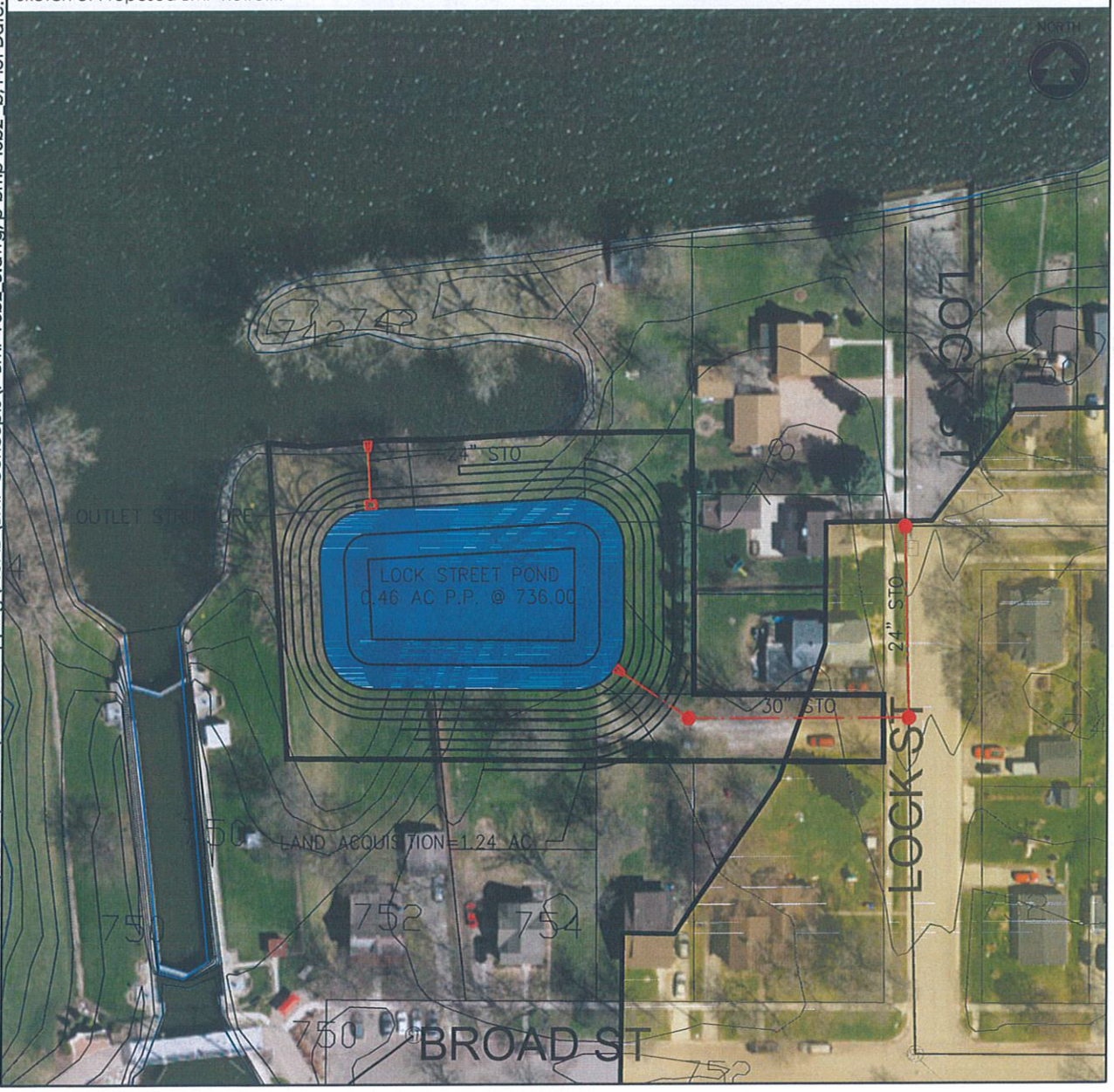
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer to be installed from Lock St as depicted.

Site access for future BMP maintenance:
Good. Access from Lock St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Close to closed remediation site.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.46 acre permanent pool	1.24	$585,100

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F5c1

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: THIRD STREET POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F5c1	Total Drainage Area: 20.1 acres
Imperviousness (Future): 67.3%	Runoff Curve Number (Future): 92	Water Quality Volume (Future): 1.65 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Third St.

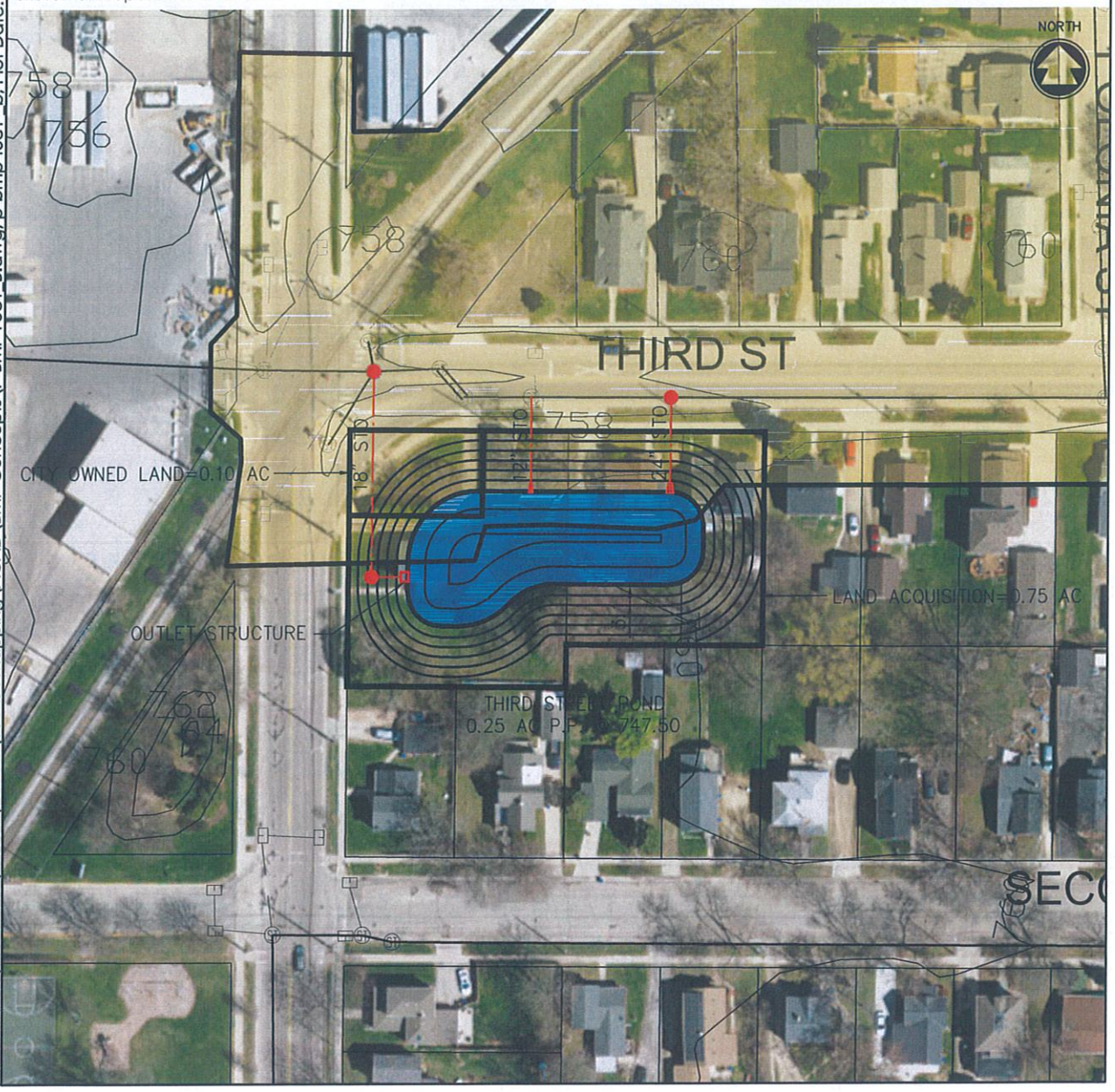
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Third St to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Third St or Tayco St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Potential for asbestos in houses to be demolished. Possible railroad permits for storm sewer work?

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.25 acre permanent pool	0.85 (City currently owns 0.10 ac)	$427,000

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

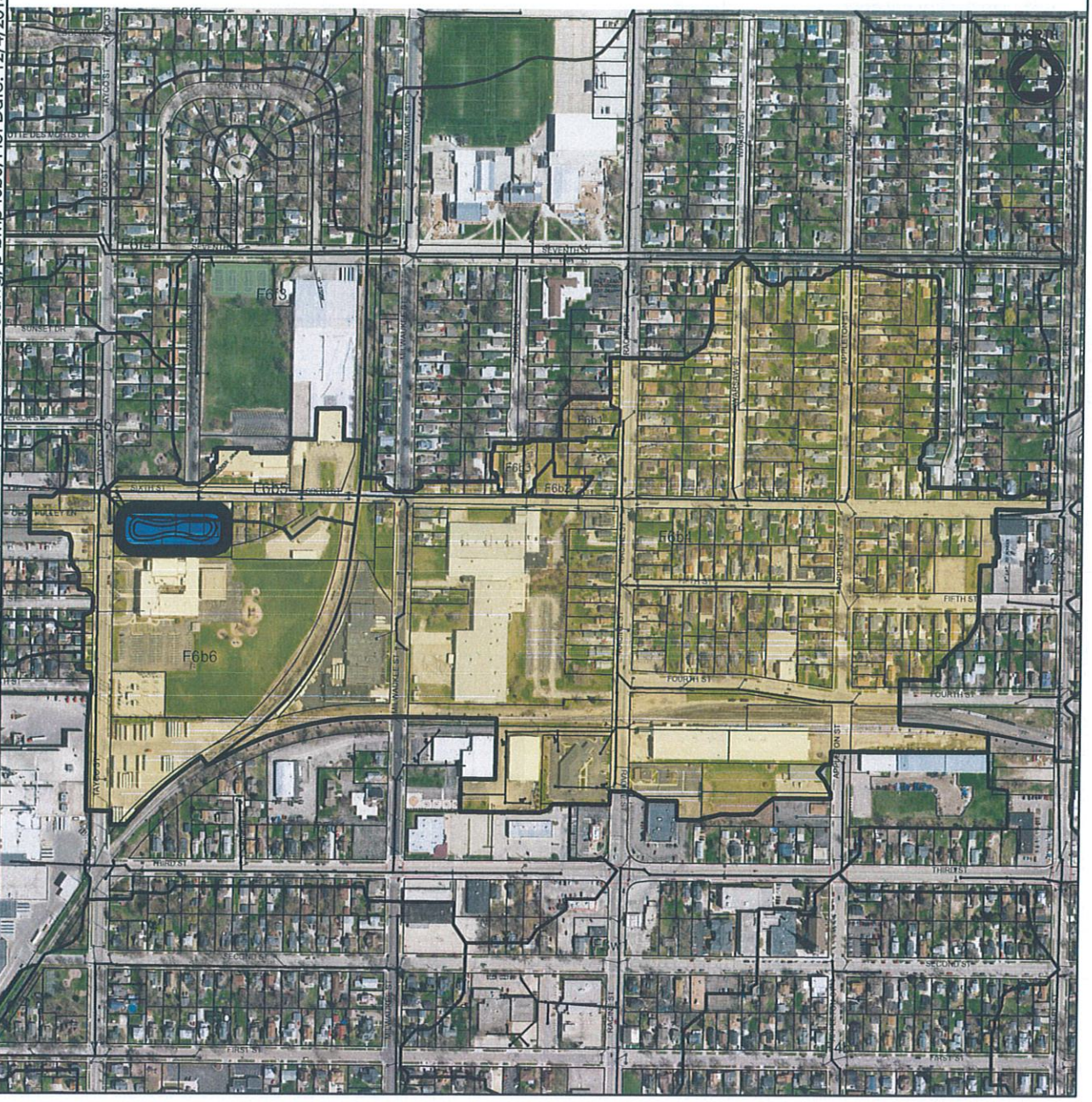
BMP CATCHMENT ID: P-BMP-F6b6

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: SIXTH STREET POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F6b1-6	Total Drainage Area: 94.1 acres
Imperviousness (Future): 55.2%	Runoff Curve Number (Future): 90	Water Quality Volume (Future): 6.44 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains north along Tayco St.

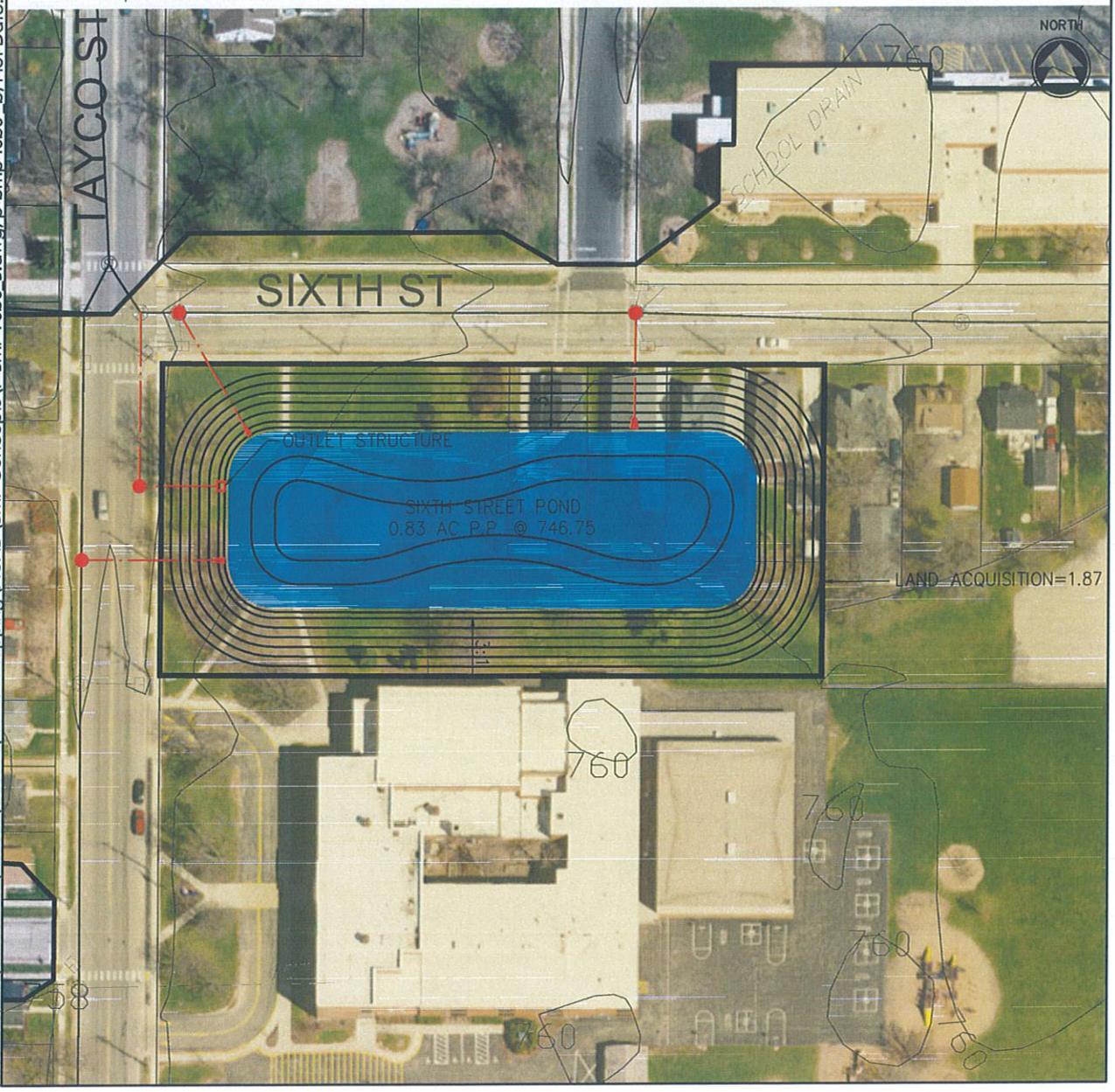
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Sixth St & Tayco St to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Sixth St or Tayco St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Potential for asbestos in houses to be demolished. Possible sanitary sewer conflicts along Sixth Street.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.83 acre permanent pool	1.87	$916,000

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F6f1

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: HART PARK POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F6f1	Total Drainage Area: 58.6 acres
Imperviousness (Future): 36.6%	Runoff Curve Number (Future): 87	Water Quality Volume (Future): 2.77 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Seventh St.

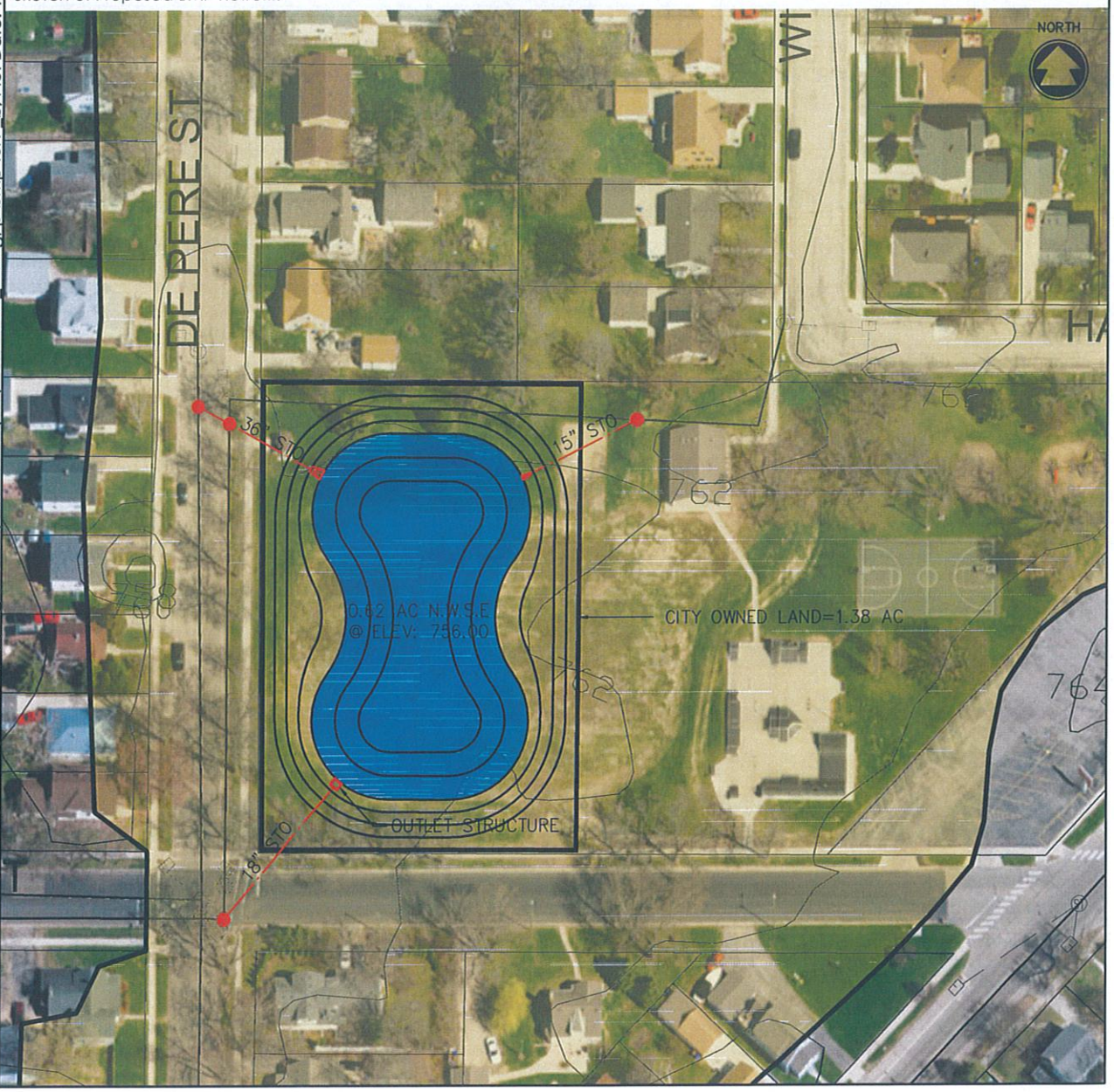
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Depere St to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Depere St or Seventh St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible utility conflicts in Depere St or Seventh St.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.62 acre permanent pool	1.38 (City currently owns)	$284,100

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

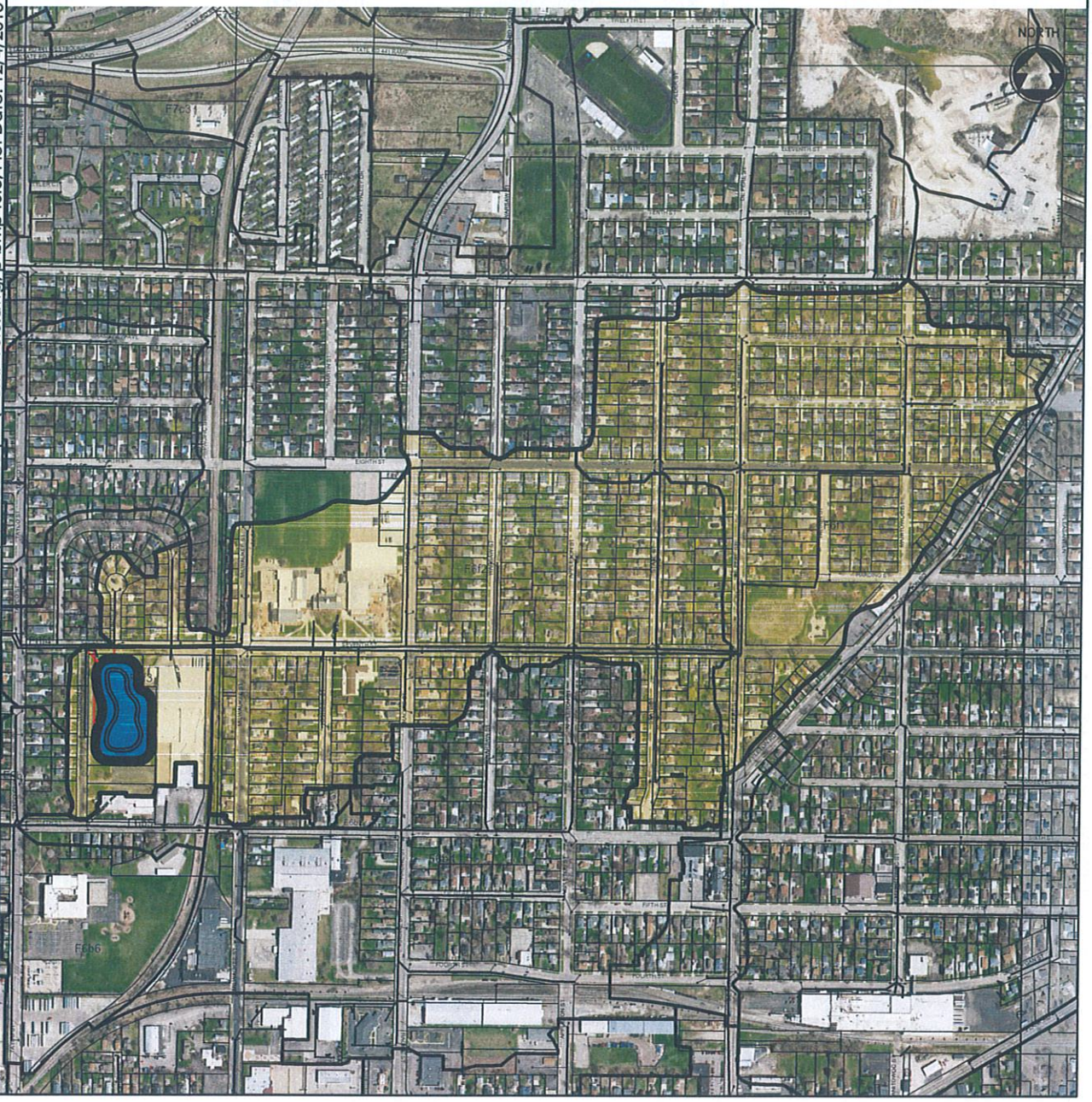
BMP CATCHMENT ID: P-BMP-F6f3

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: PLEASANTS PARK POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F6f1-3	Total Drainage Area: 142.2 acres
Imperviousness (Future): 39.3%	Runoff Curve Number (Future): 87	Water Quality Volume (Future): 7.18 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential	☐ Yes	☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:		☐ Yes	☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:		☐ Yes	☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Seventh St.

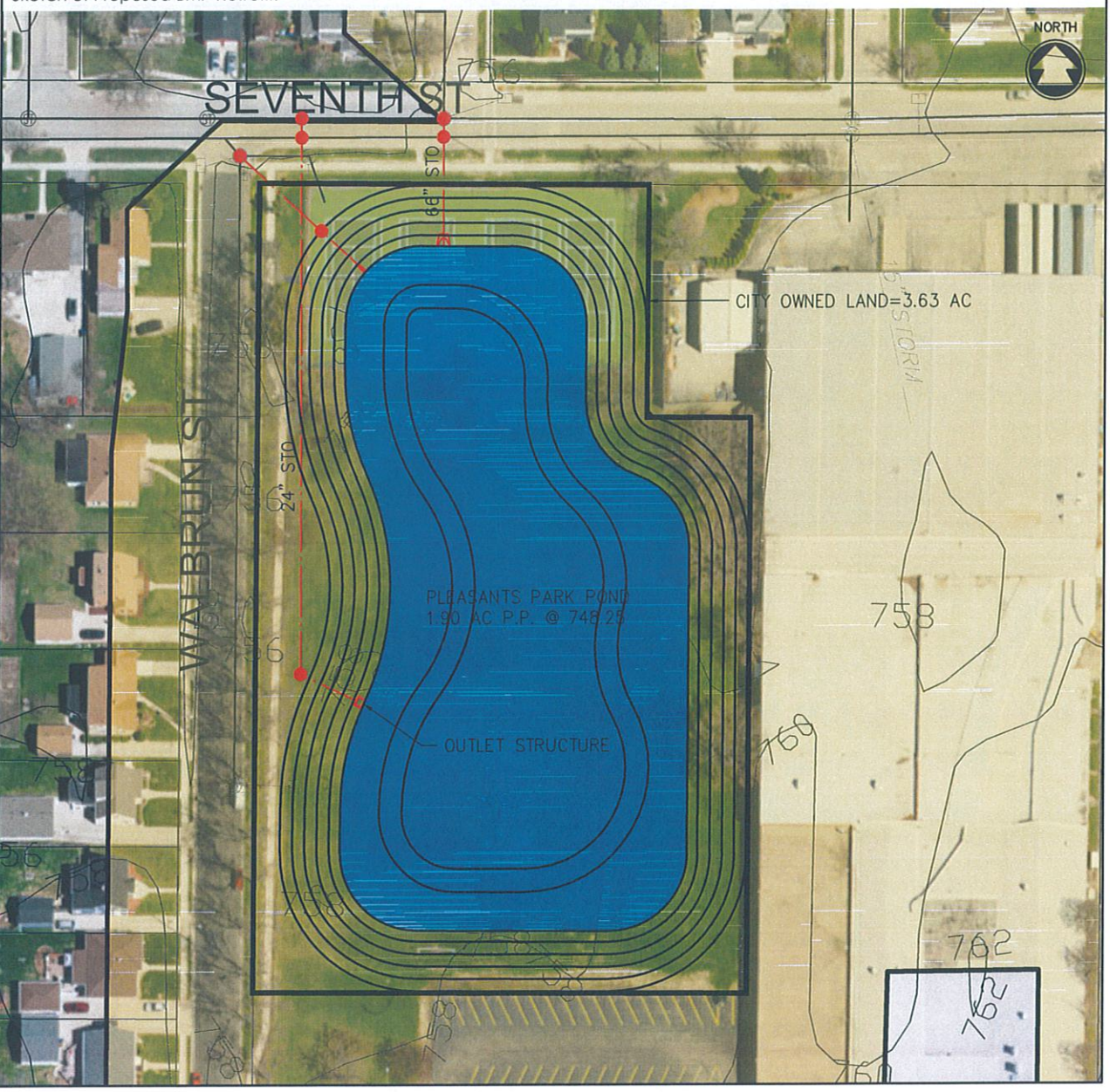
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Seventh St & Walbrun St to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Walbrun St or Seventh St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible utility conflicts on Seventh St.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
1.90 acre permanent pool	3.63 (City currently owns)	$800,300

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F7a2 (Alt 1)

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: NINTH STREET POND (ALT 1)	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F7a1-2	Total Drainage Area: 115.7 acres
Imperviousness (Future): 44.3%	Runoff Curve Number (Future): 88	Water Quality Volume (Future): 6.49 acre-feet

Drainage Area / Site Location Map:

pkleman, W:\PROJECTS\M0001\930563\06 MS4 Mapping\ACAD\BMP Concepts\P-BMP-F7a2 (Alt 1).dwg, p-bmp-f7a2 (alt 1), Plot Date: 12/4/2015 2:59 PM, xrefs: (x-win_cal contours,

PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential	☐ Yes	☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:		☐ Yes	☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:		☐ Yes	☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Ninth St.

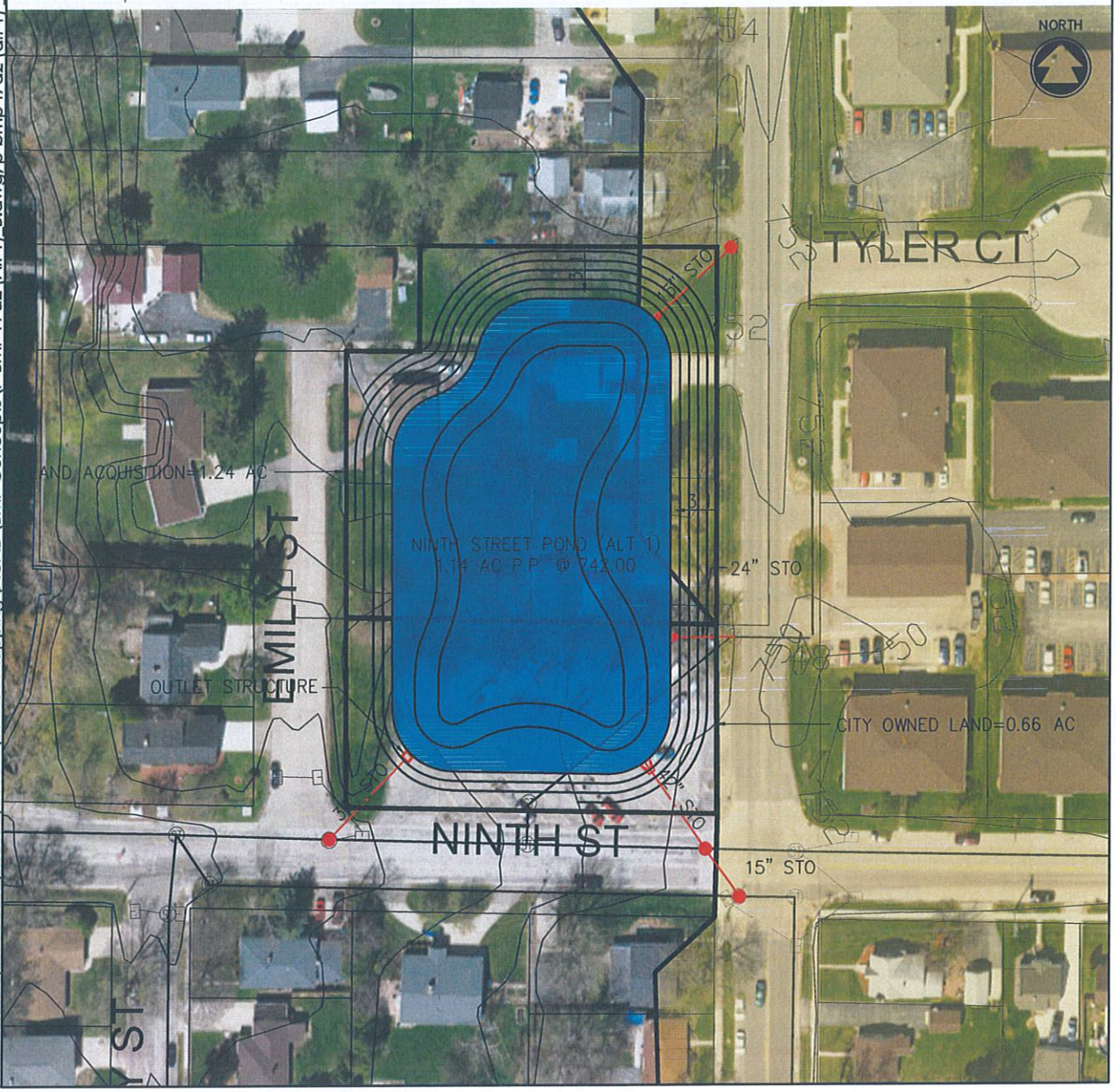
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Ninth St & Tayco St to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Ninth St or Tayco St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible asbestos in houses to be demolished.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
1.14 acre permanent pool	1.90 (City currently owns 0.66 ac)	$934,300

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F7a2 (Alt 2)

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: NINTH STREET POND (ALT 2)	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F7a2	Total Drainage Area: 52.0 acres
Imperviousness (Future): 41.6%	Runoff Curve Number (Future): 88	Water Quality Volume (Future): 2.76 acre-feet

Drainage Area / Site Location Map: NOTE: POND WATERSHED DEPICTED IS BASED ON DOT POND 2 (ALT 2) BEING CONSTRUCTED.

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Ninth St.

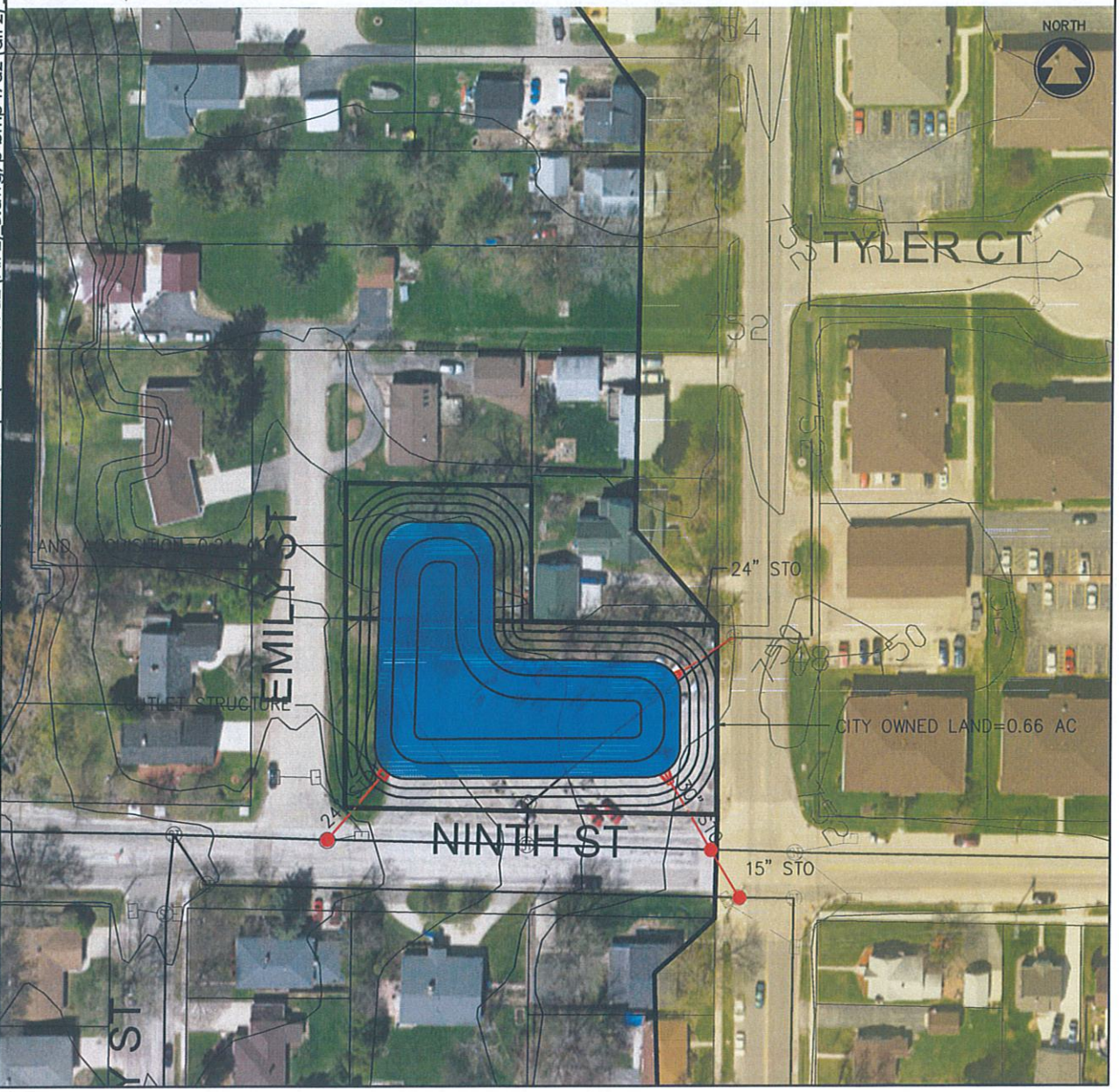
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Ninth St & Tayco St to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Ninth St or Tayco St.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible utility conflicts along Ninth St.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.48 acre permanent pool	0.90 (City currently owns 0.66 ac)	$266,500

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F7c2 (Alt 1)

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: DOT POND 2 (ALT 1)	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F7c1-2	Total Drainage Area: 55.5 acres
Imperviousness (Future): 57.7%	Runoff Curve Number (Future): 90	Water Quality Volume (Future): 3.95 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential	☐ Yes	☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:		☐ Yes	☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:		☐ Yes	☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into storm sewer that will drain west (to be installed by DOT)

Infrastructure modifications or flow diversions required for retrofit:
DOT to build pond and storm sewer as part of the "441" project.

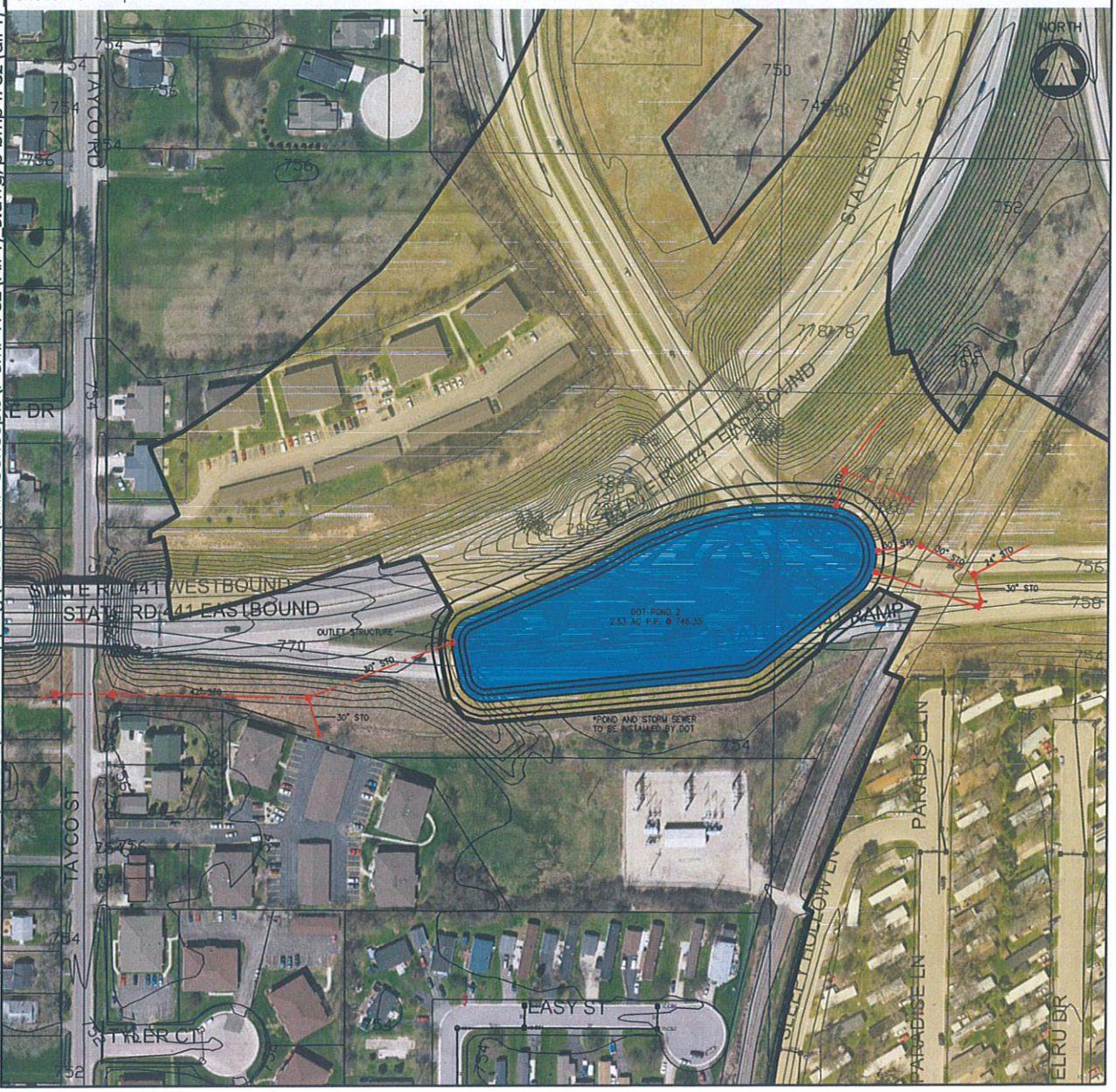
Site access for future BMP maintenance:
N/A

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
N/A

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
2.53 acre permanent pool	N/A	$0*

Sketch of Proposed BMP Retrofit:

*Assumes DOT builds pond as part of "441" project with no cost sharing & City being responsible for future O&M.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F7c2 (Alt 2)

McM PROJECT NO: M0001-930563

SITE INFORMATION:

Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: DOT POND 2 (ALT 2)	Initials: PTK

DRAINAGE AREA:

Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F7a1, F7c1-2	Total Drainage Area: 119.1 acres
Imperviousness (Future): 51.8%	Runoff Curve Number (Future): 89	Water Quality Volume (Future): 7.68 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☒ Potential	☐ Yes	☐ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:		☐ Yes	☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:		☐ Yes	☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into storm sewer to be installed by DOT.

Infrastructure modifications or flow diversions required for retrofit:
Storm sewer to be installed to divert flows from Ninth St north into the DOT ditch. New culvert under RR to convey flows into pond.

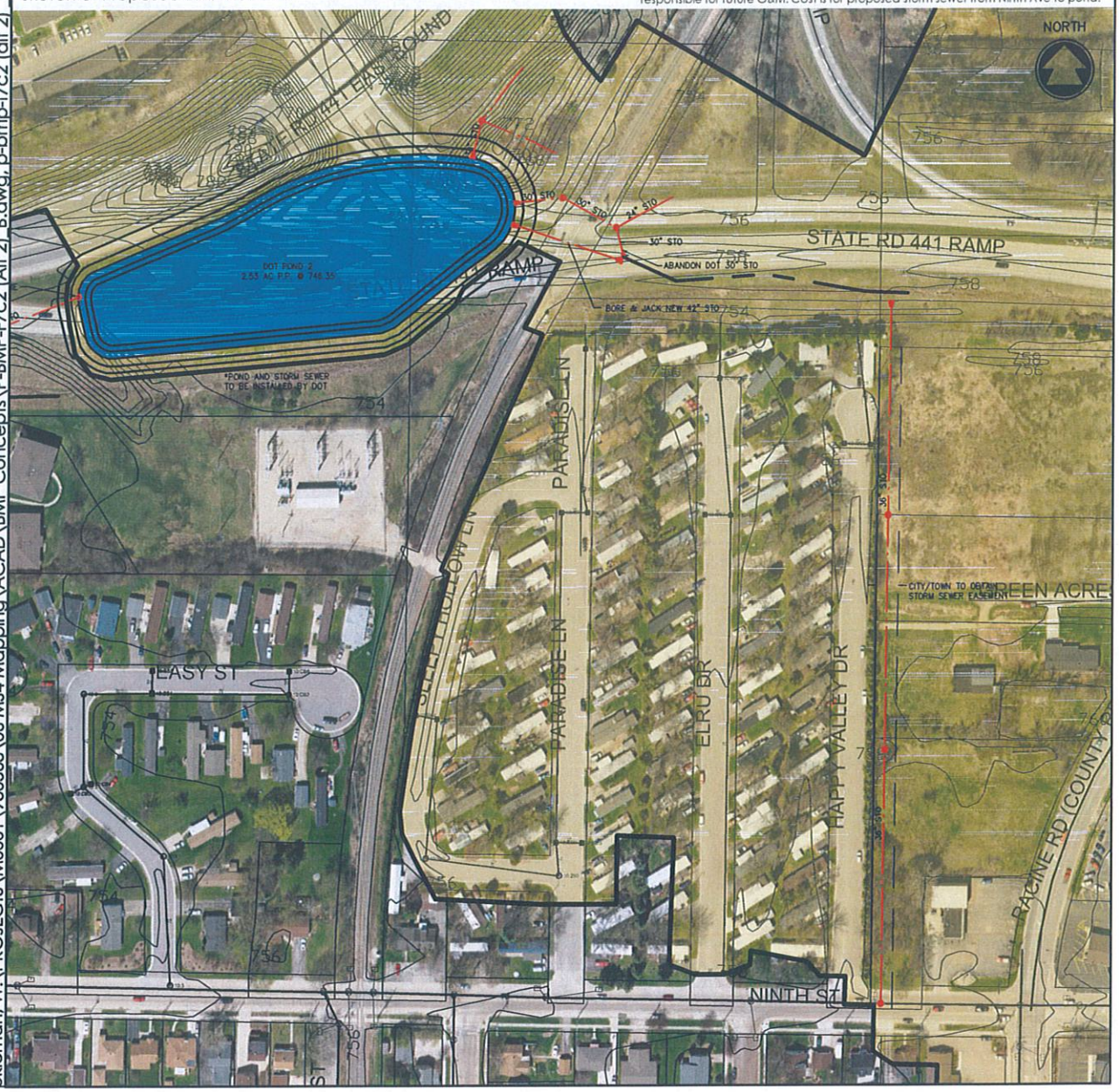
Site access for future BMP maintenance:
Good. Access from future Racine St ramp.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible wetland impacts in DOT ditch. Railroad permits for boring new storm sewer under tracks to pond.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
2.53 acre permanent pool	N/A	$250,500*

Sketch of Proposed BMP Retrofit:

*Assumes DOT builds pond as part of "441" project with no cost sharing & City being responsible for future O&M. Cost is for proposed storm sewer from Ninth Ave to pond.



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POTENTIAL STORMWATER BMP RETROFIT

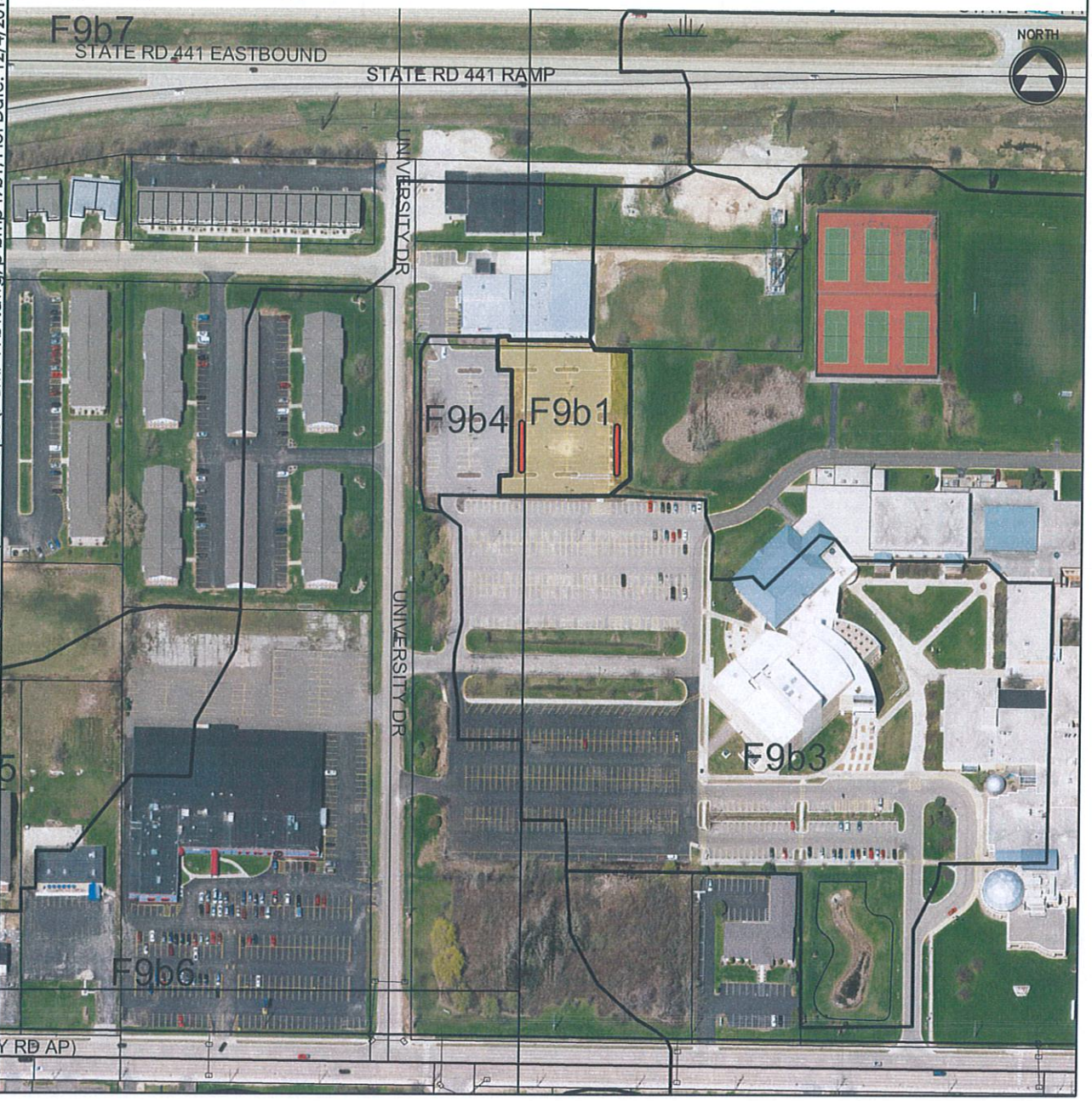
BMP CATCHMENT ID: P-BMP-F9b1

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: UW FOX-VALLEY EAST BIOFILTERS	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9b1	Total Drainage Area: 0.93 acres
Imperviousness (Future): 55.8%	Runoff Curve Number (Future): 90	Water Quality Volume (Future): 0.06 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Bioretention

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):

Infrastructure modifications or flow diversions required for retrofit:

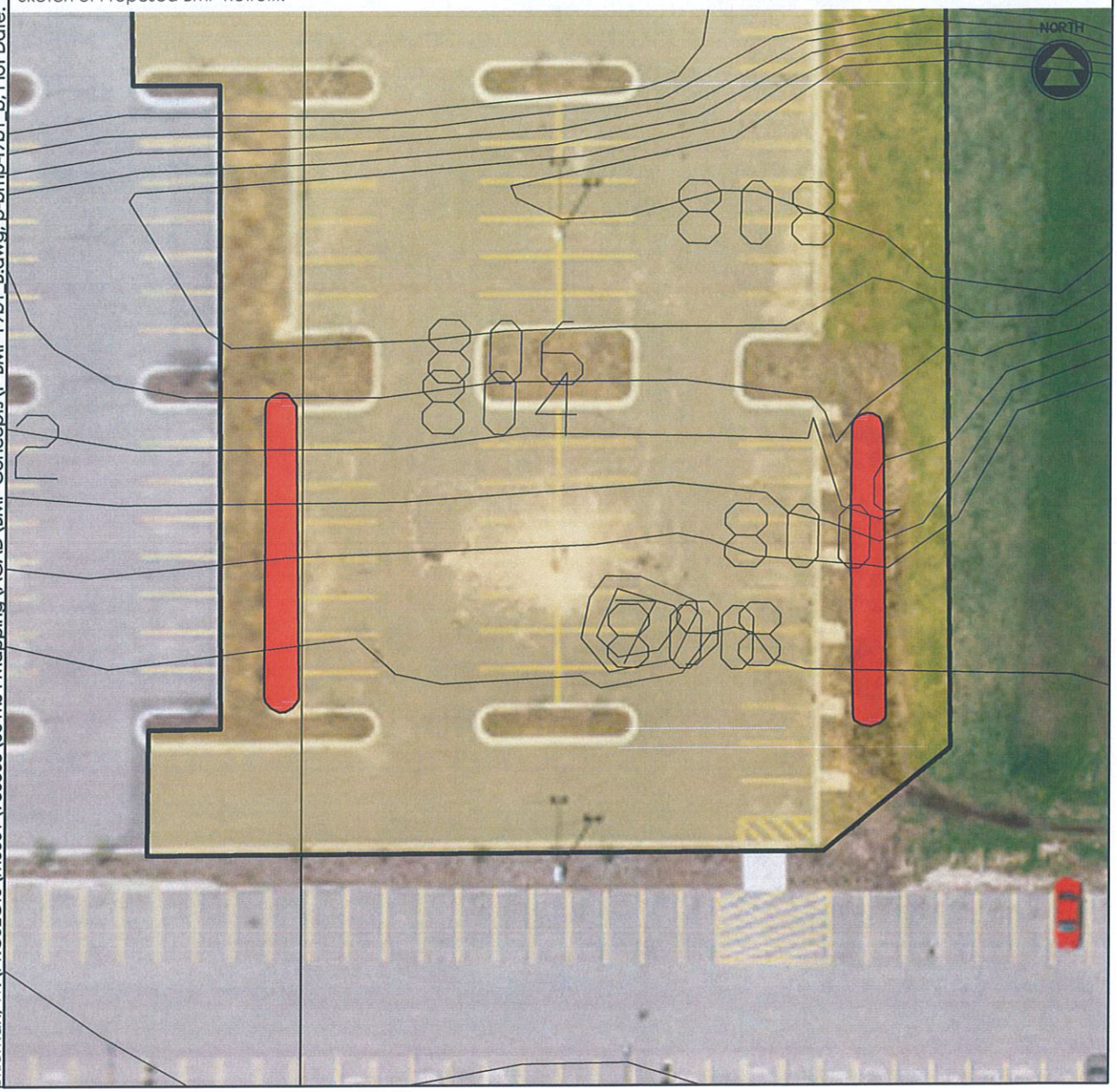
Site access for future BMP maintenance:
Good. Access from University Dr.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost: $5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to create a maintenance agreement for City.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F9b3

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: UW FOX-VALLEY POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9b3	Total Drainage Area: 10.2 acres
Imperviousness (Future): 57.9%	Runoff Curve Number (Future): 90	Water Quality Volume (Future): 0.73 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond is assumed to discharge to the existing storm sewer that drains west along Midway Rd.

Infrastructure modifications or flow diversions required for retrofit:

Site access for future BMP maintenance:
Good. Access from Midway Rd or UW Fox Valley's property.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Plans available for pond? Ensure pond is in accordance with 1001 code.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.10 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain a maintenance agreement for City.

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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F9b4

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: UW FOX-VALLEY WEST BIOFILTER	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9b4	Total Drainage Area: 0.69 acres
Imperviousness (Future): 59.4%	Runoff Curve Number (Future): 91	Water Quality Volume (Future): 0.05 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Bioretention

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):

Infrastructure modifications or flow diversions required for retrofit:

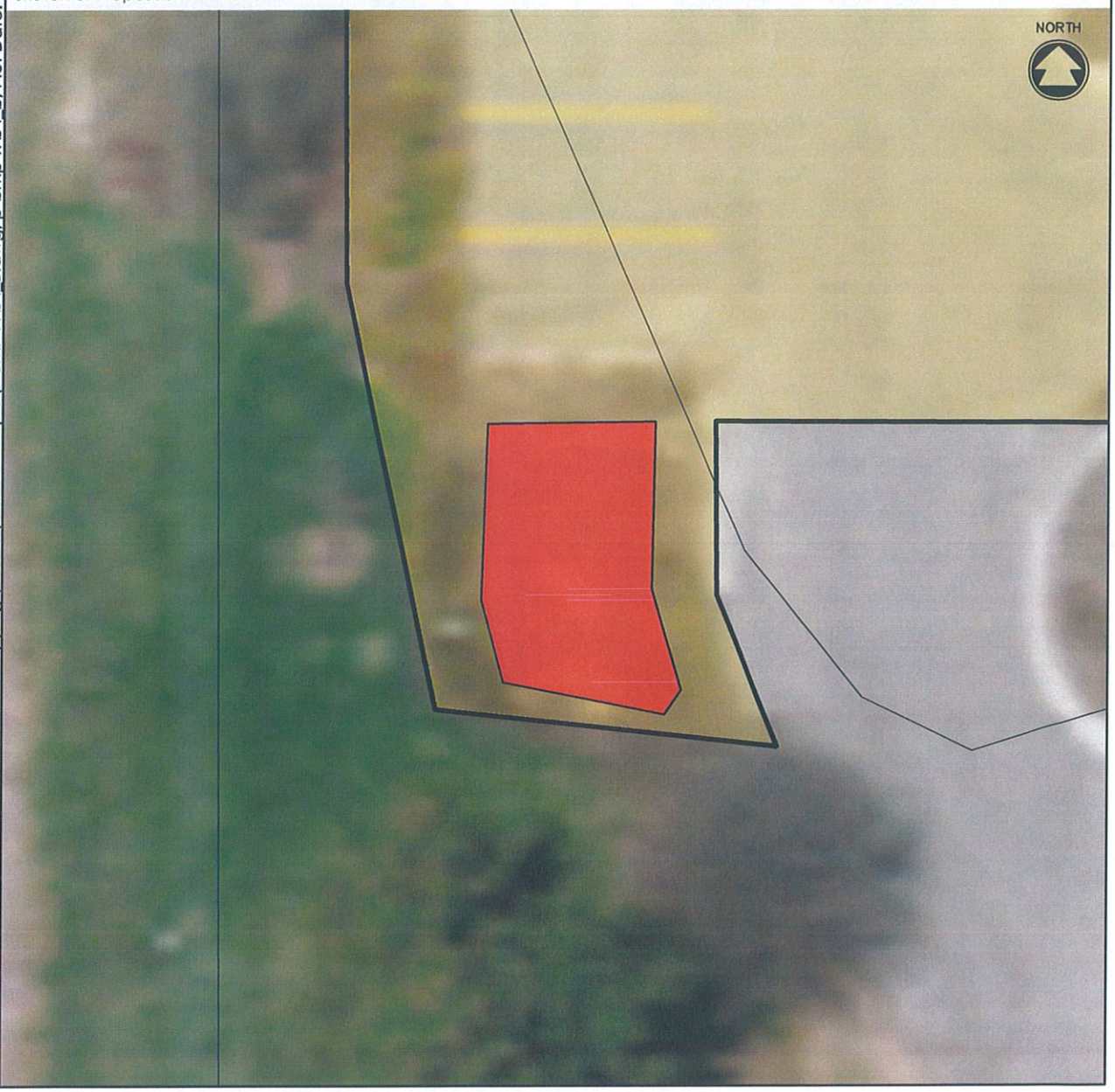
Site access for future BMP maintenance:
Good. Access from University Dr.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost: $5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain a maintenance agreement for City.



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POTENTIAL STORMWATER BMP RETROFIT

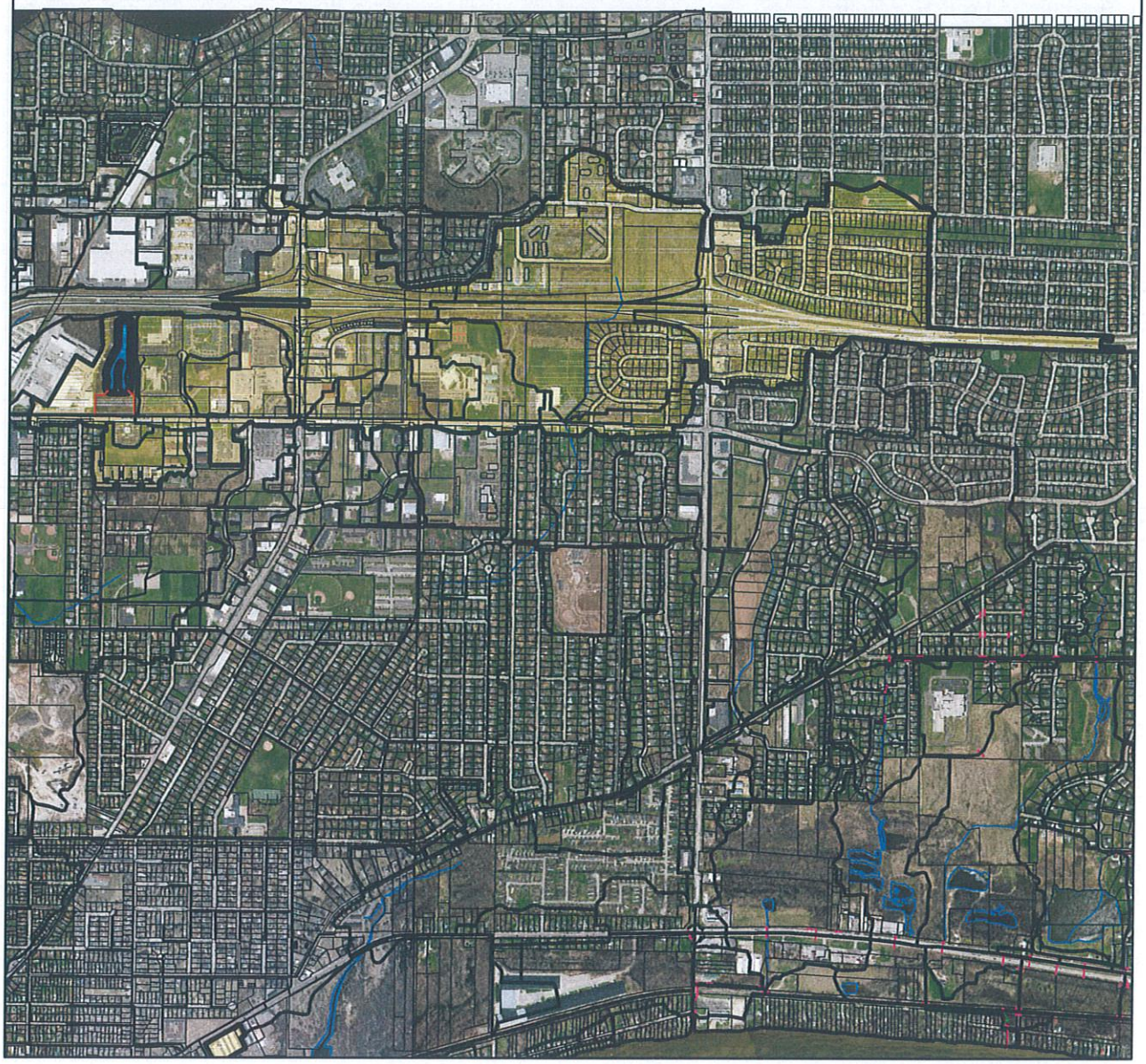
BMP CATCHMENT ID: P-BMP-F9c5

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: MIDWAY POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9a1-3, F9b1-7, F9c1-5	Total Drainage Area: 598.0 acres
Imperviousness (Future): 58.0%	Runoff Curve Number (Future): 90	Water Quality Volume (Future): 42.15 acre-feet

Drainage Area / Site Location Map:



PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	0.5+/-	Remediation:	☐ Yes ☒ No	Wetland:	☒ Potential ☐ Yes ☐ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Midway Rd.

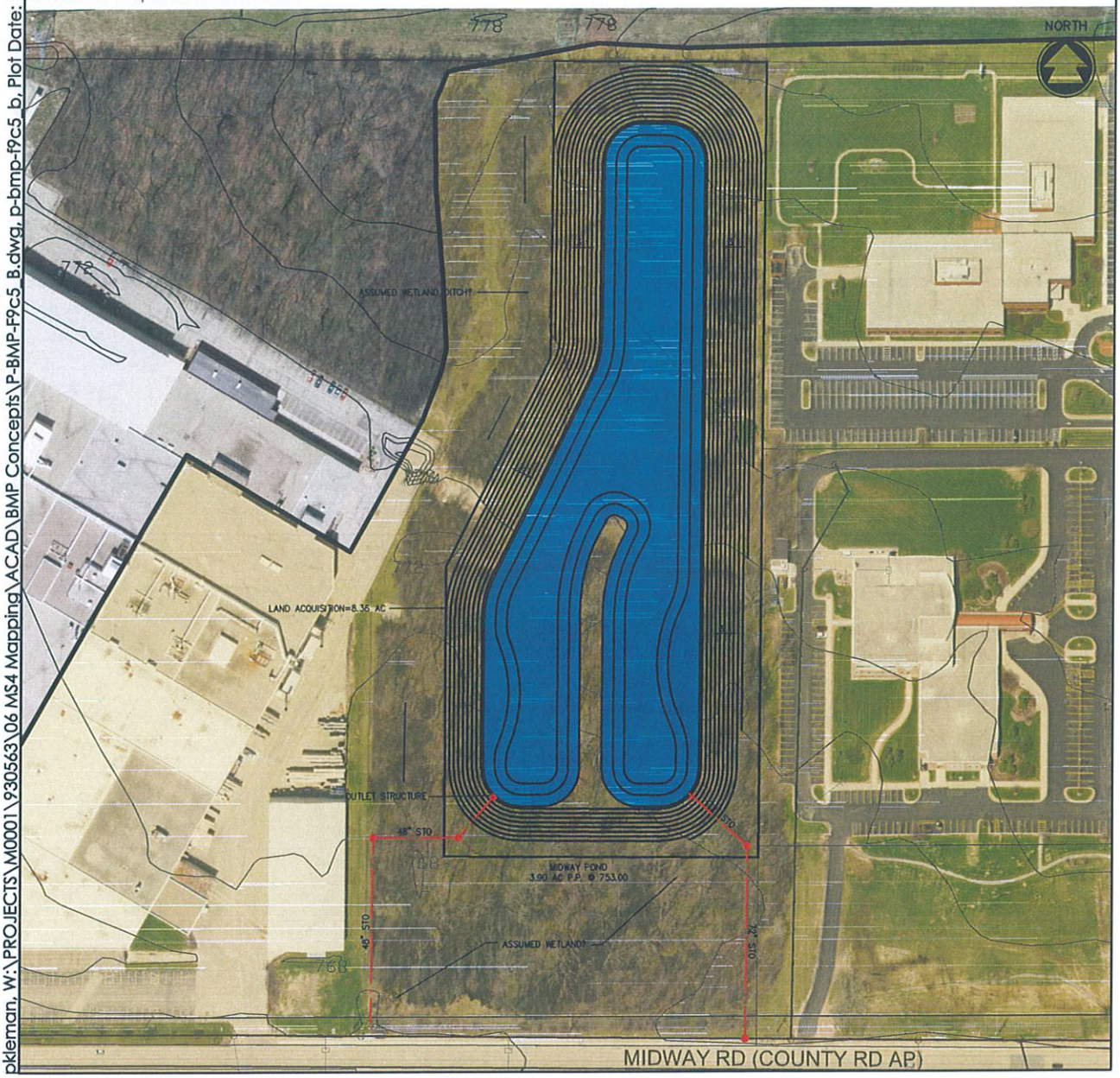
Infrastructure modifications or flow diversions required for retrofit:
Storm sewer from Midway Road to be diverted into pond.

Site access for future BMP maintenance:
Good. Access from Midway Rd.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible wetlands within wooded area. Verify depths of Midway Road storm sewer interceptor.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
3.90 acre permanent pool	8.36	$2,971,600

Sketch of Proposed BMP Retrofit:



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F9d3

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: MIRON POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9d3	Total Drainage Area: 58.5 acres
Imperviousness (Future): 68.4%	Runoff Curve Number (Future): 92	Water Quality Volume (Future): 4.87 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	0.5+/-	Remediation:	☐ Yes ☒ No	Wetland:	☒ Potential ☐ Yes ☐ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond discharges into the DOT ditch.

Infrastructure modifications or flow diversions required for retrofit:

Site access for future BMP maintenance:
Good. Access from Bud Drive through Miron's property.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Plan set for pond available? Verify pond satisfies technical standard 1001.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.11 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.

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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F9e1

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: MINI-MAX WEST POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9e1	Total Drainage Area: 2.1 acres
Imperviousness (Future): 79.5%	Runoff Curve Number (Future): 93	Water Quality Volume (Future): 0.20 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into storm sewer that drains south under Bud Dr.

Infrastructure modifications or flow diversions required for retrofit:

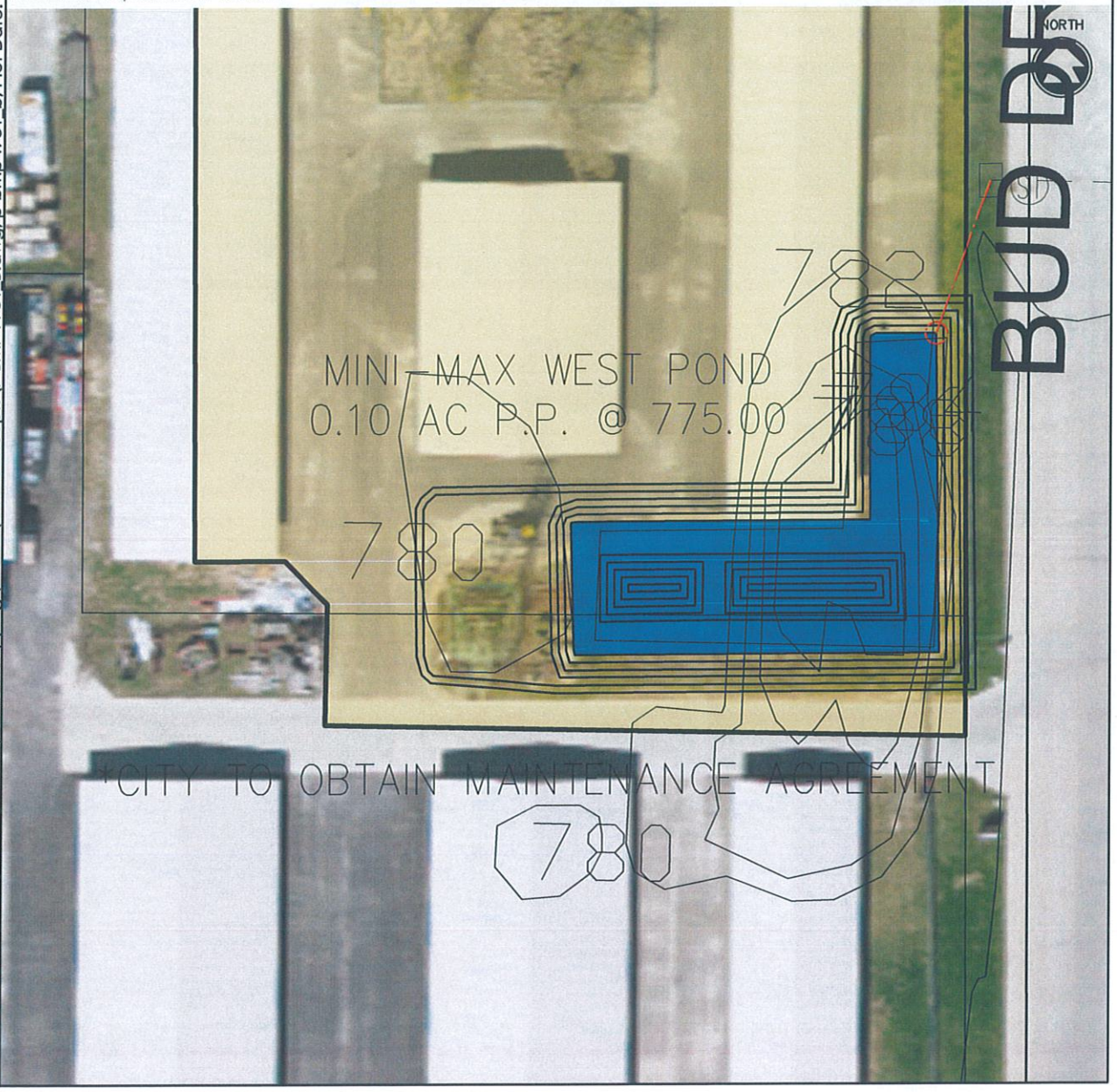
Site access for future BMP maintenance:
Good. Access from Bud Dr.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.10 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F9e2

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: MINI-MAX EAST POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9e2	Total Drainage Area: 2.0 acres
Imperviousness (Future): 79.5%	Runoff Curve Number (Future): 93	Water Quality Volume (Future): 0.19 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into storm sewer that drains south under Bud Dr.

Infrastructure modifications or flow diversions required for retrofit:

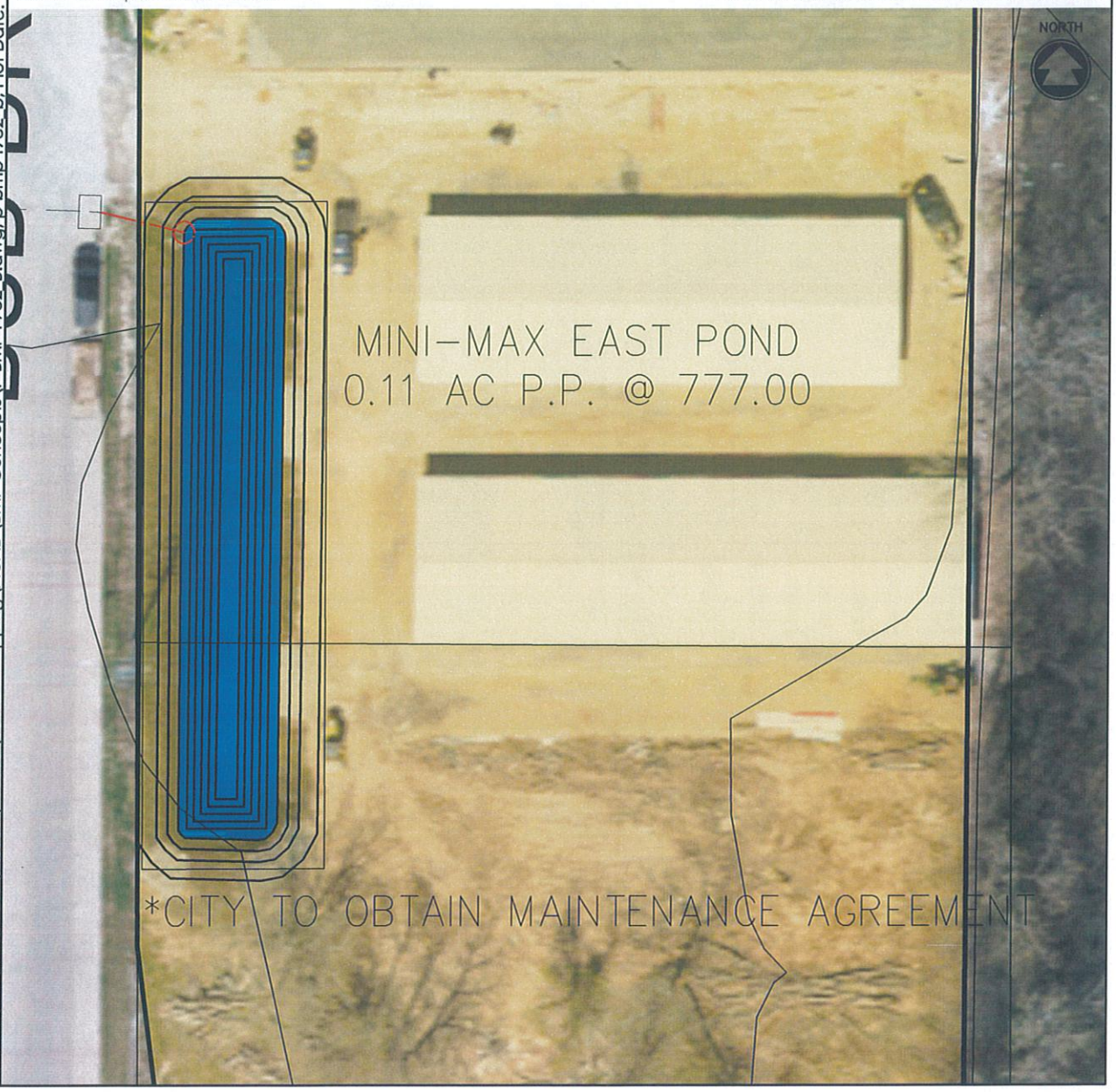
Site access for future BMP maintenance:
Good. Access from Bud Dr.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.11 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F9e6 (Alt 1)

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: DOT POND 4 (ALT 1)	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9e6	Total Drainage Area: 71.2 acres
Imperviousness (Future): 68.0%	Runoff Curve Number (Future): 91	Water Quality Volume (Future): 5.89 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	0.5+/-	Remediation:	☐ Yes ☒ No	Wetland:	☒ Potential ☐ Yes ☐ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Midway Rd.

Infrastructure modifications or flow diversions required for retrofit:
DOT to construct pond and install storm sewer as part of the "441" project.

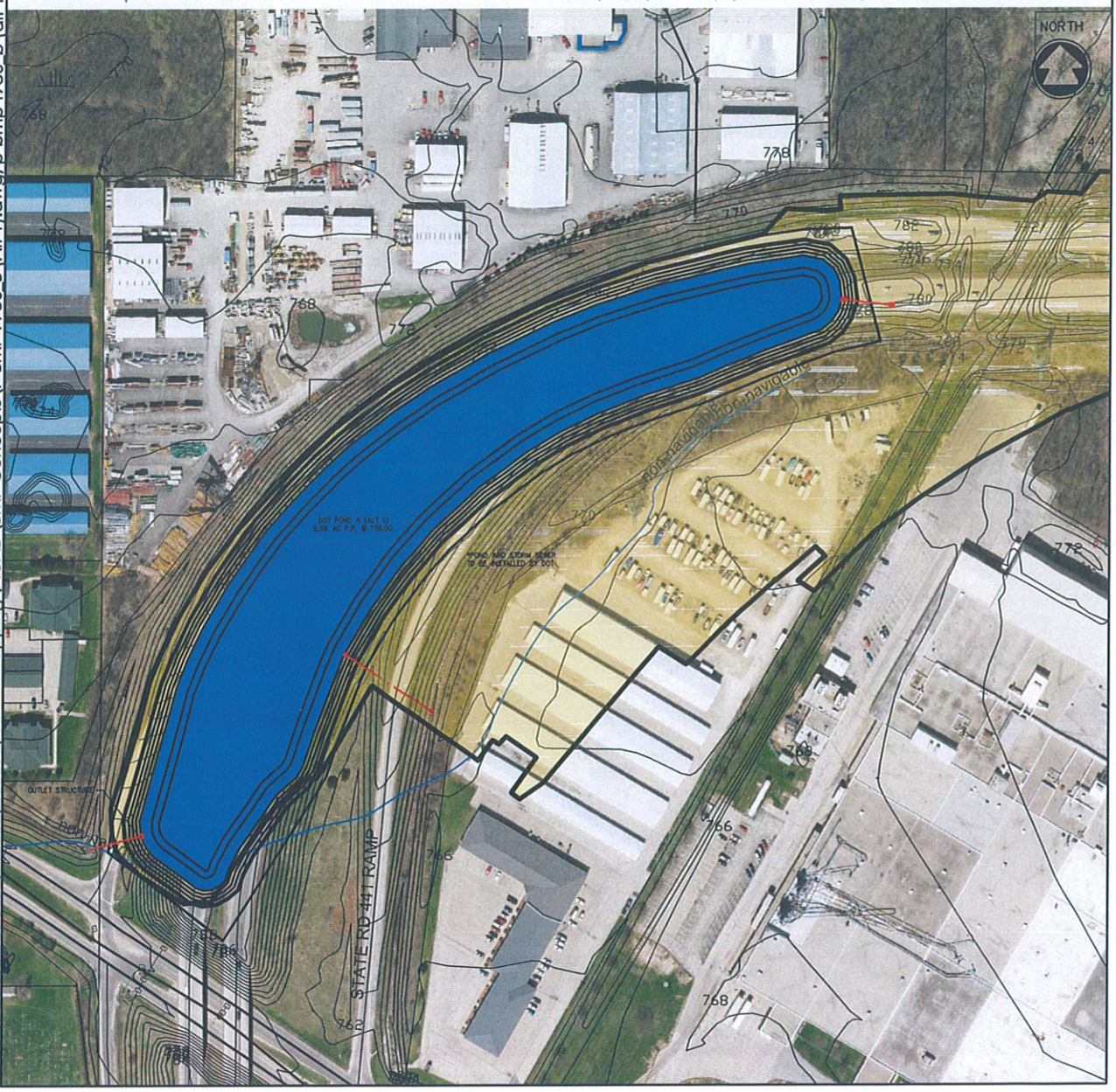
Site access for future BMP maintenance:
Fair. Assume access from Midway Rd.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible wetlands within DOT right-of-way.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
6.56 acre permanent pool	N/A	$0*

Sketch of Proposed BMP Retrofit:

*Assumes DOT builds pond as part of "441" project with no cost sharing & City being responsible for future O&M.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F9e6 (Alt 2)

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: DOT POND 4 (ALT 2)	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9d1-3, F9e1-6, F9f1-2	Total Drainage Area: 189.1 acres
Imperviousness (Future): 70.6%	Runoff Curve Number (Future): 92	Water Quality Volume (Future): 16.20 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	0.5+/-	Remediation:	☐ Yes ☒ No	Wetland:	☒ Potential ☐ Yes ☐ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Midway Rd.

Infrastructure modifications or flow diversions required for retrofit:
DOT to construct pond & install storm sewer as part of the "441" project. City only to install 24" storm at southwest corner of pond

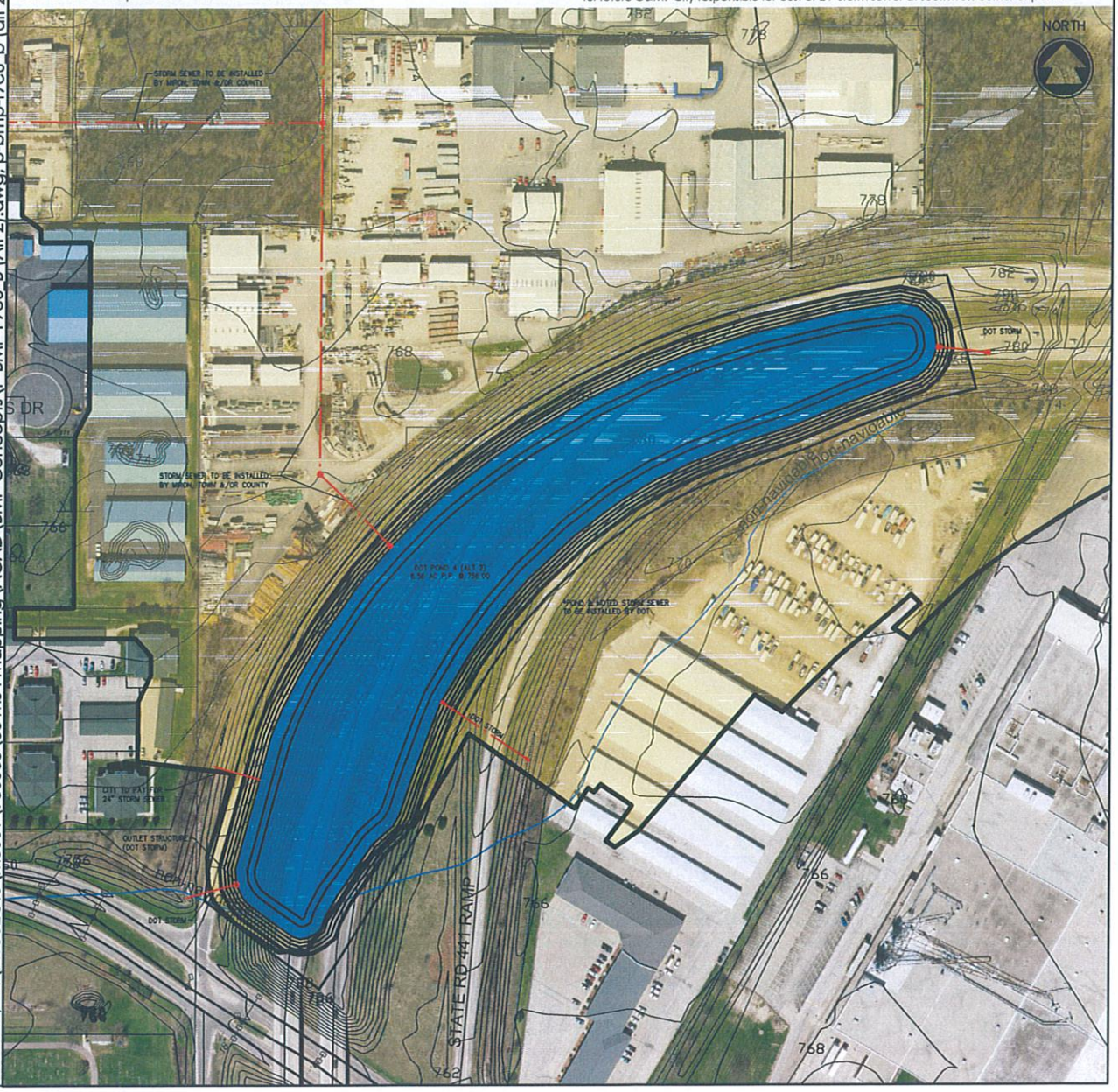
Site access for future BMP maintenance:
Fair. Assume access from Midway Rd.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible wetlands within DOT right-of-way.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
6.56 acre permanent pool	N/A	$15,000*

Sketch of Proposed BMP Retrofit:

*Assumes DOT builds pond as part of "441" project with no cost sharing & City being responsible for future O&M. City responsible for cost of 24" storm sewer at southwest corner of pond.



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POTENTIAL STORMWATER BMP RETROFIT

BMP ID: P-BMP-F9e6 (Alt 3)

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: DOT POND 4 (ALT 3)	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9a1-3, F9b1-7, F9c1-8, F9d1-3, F9e1-6, F9f1-2	Total Drainage Area: 811.2 acres
Imperviousness (Future): 61.6%	Runoff Curve Number (Future): 91	Water Quality Volume (Future): 61.36 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	0.5+/-	Remediation:	☐ Yes ☒ No	Wetland:	☒ Potential ☐ Yes ☐ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into existing storm sewer that drains west along Olde Midway Rd.

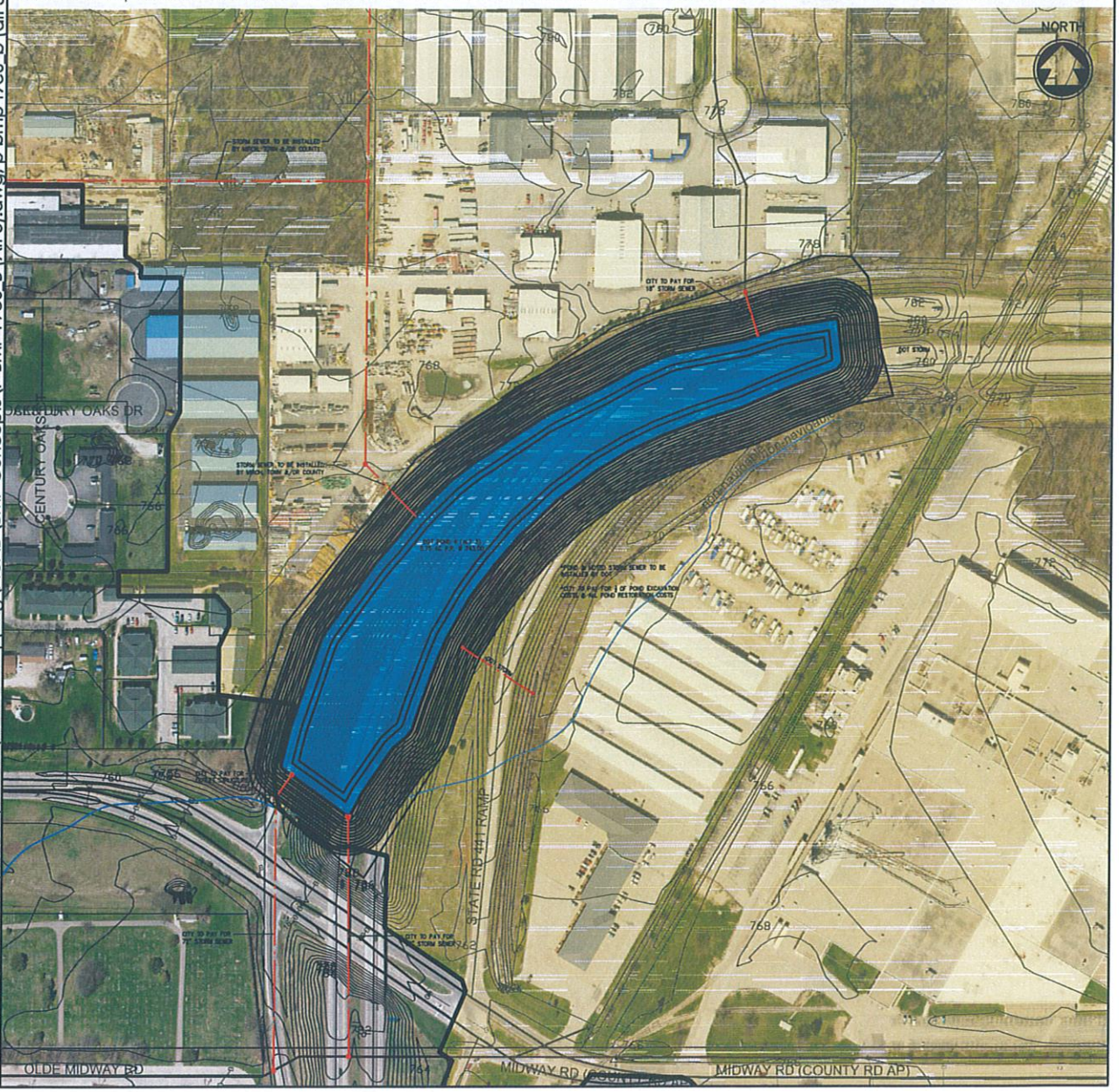
Infrastructure modifications or flow diversions required for retrofit:
DOT to construct pond and install storm sewer as part of the "441" project. City to install storm sewer as depicted.

Site access for future BMP maintenance:
Fair. Assume access from Midway Rd.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):
Possible wetlands within DOT right-of-way. Possible utility conflicts on Midway Road or as part of "441" project.

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
5.75 acre permanent pool	N/A	$1,953,600*

Sketch of Proposed BMP Retrofit: *Assumes DOT builds pond & City pays for half excavation costs. City cost also includes installing the 18", 54" and 72" storm sewer as depicted.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-F9f1

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: MIRON STORAGE YARD POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: F9f1	Total Drainage Area: 3.0 acres
Imperviousness (Future): 79.5%	Runoff Curve Number (Future): 94	Water Quality Volume (Future): 0.29 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge ditch along east side of Cty Rd P.

Infrastructure modifications or flow diversions required for retrofit:

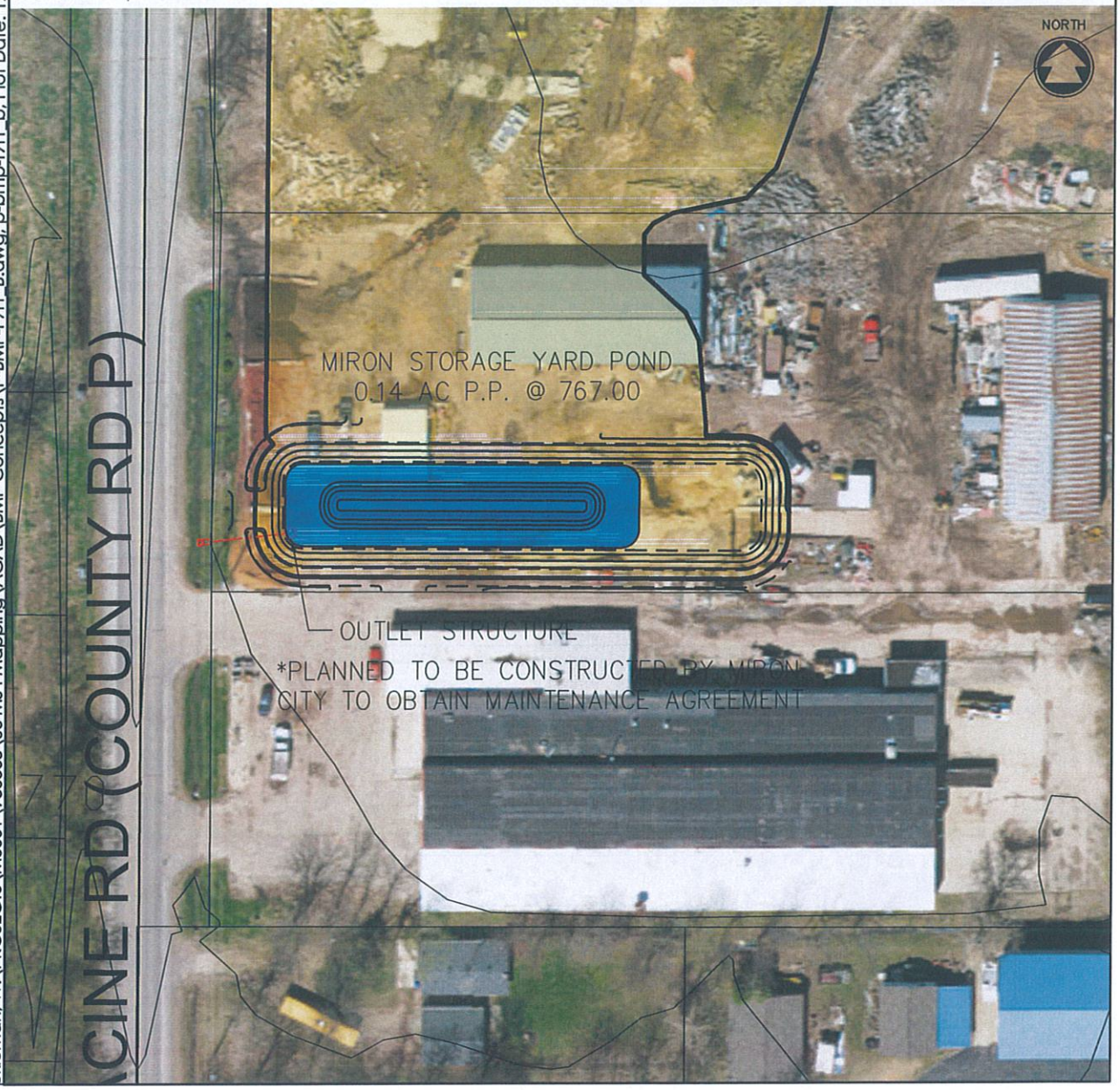
Site access for future BMP maintenance:
Good. Access from Cty Rd P.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.10 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-W3h4

McM PROJECT NO: M0001-930563

SITE INFORMATION:

Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: STONE TOAD POND	Initials: PTK

DRAINAGE AREA:

Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: W3h4	Total Drainage Area: 2.7 acres
Imperviousness (Future): 79.9%	Runoff Curve Number (Future): 94	Water Quality Volume (Future): 0.26 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into storm sewer that drains south along Oneida St.

Infrastructure modifications or flow diversions required for retrofit:

Site access for future BMP maintenance:
Good. Access from Manitowoc Rd.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.17 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.

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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-W3h8

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: THE SHOPPES AT WAVERLY POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: W3h8	Total Drainage Area: 1.4 acres
Imperviousness (Future): 92.1%	Runoff Curve Number (Future): 95	Water Quality Volume (Future): 0.15 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond is assumed to discharge east into the Oneida St storm sewer system that drains south.

Infrastructure modifications or flow diversions required for retrofit:

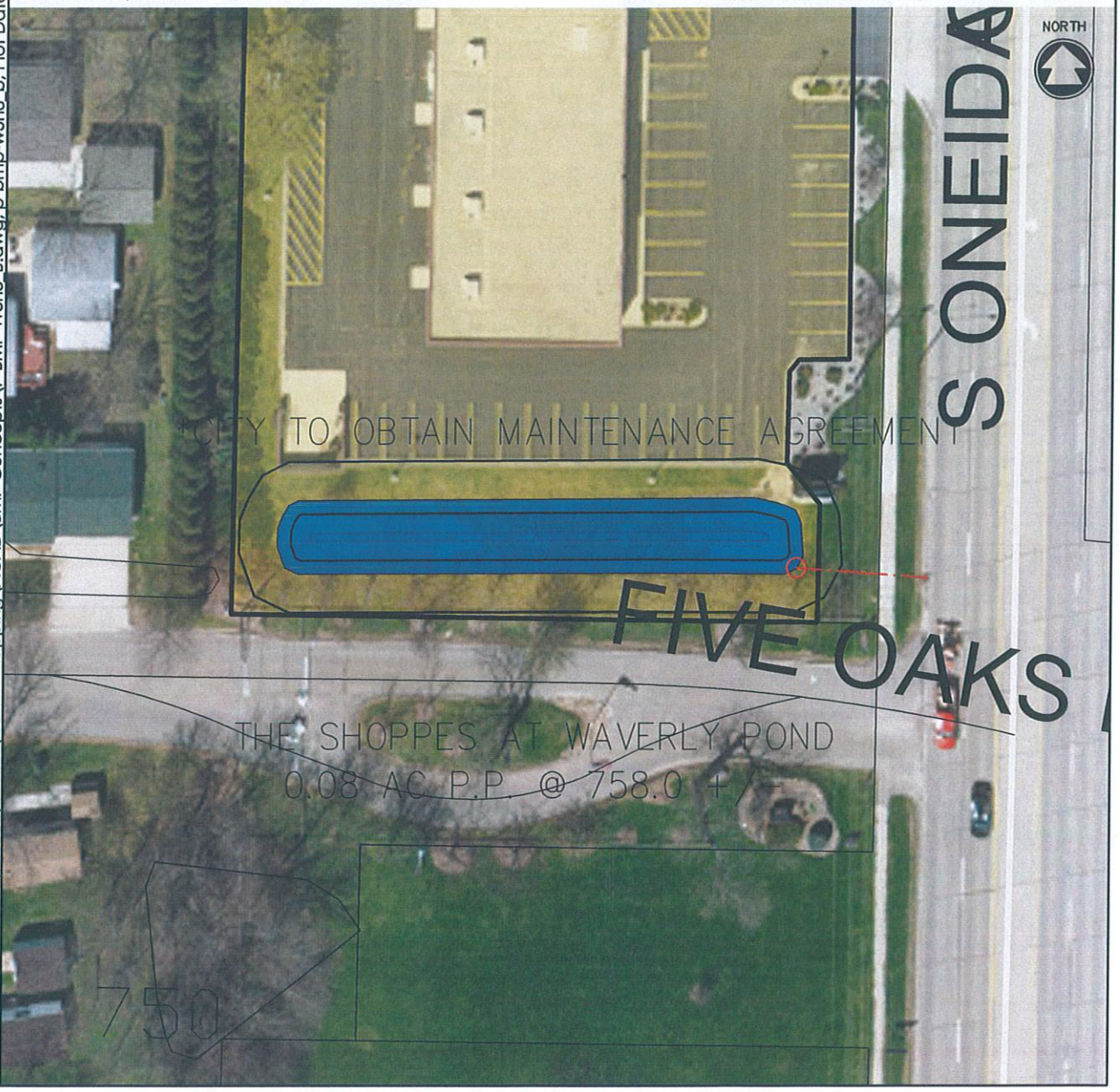
Site access for future BMP maintenance:
Good. Access from Oneida St and 5 Oaks Dr.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.08 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.



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POTENTIAL STORMWATER BMP RETROFIT

BMP CATCHMENT ID: P-BMP-W5b4

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: WOODLAND TRAILS CONDOS POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: W5b4	Total Drainage Area: 2.4 acres
Imperviousness (Future): 37.8%	Runoff Curve Number (Future): 61	Water Quality Volume (Future): 0.12 acre-feet

Drainage Area / Site Location Map:

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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into ditch that drains east along STH 114.

Infrastructure modifications or flow diversions required for retrofit:

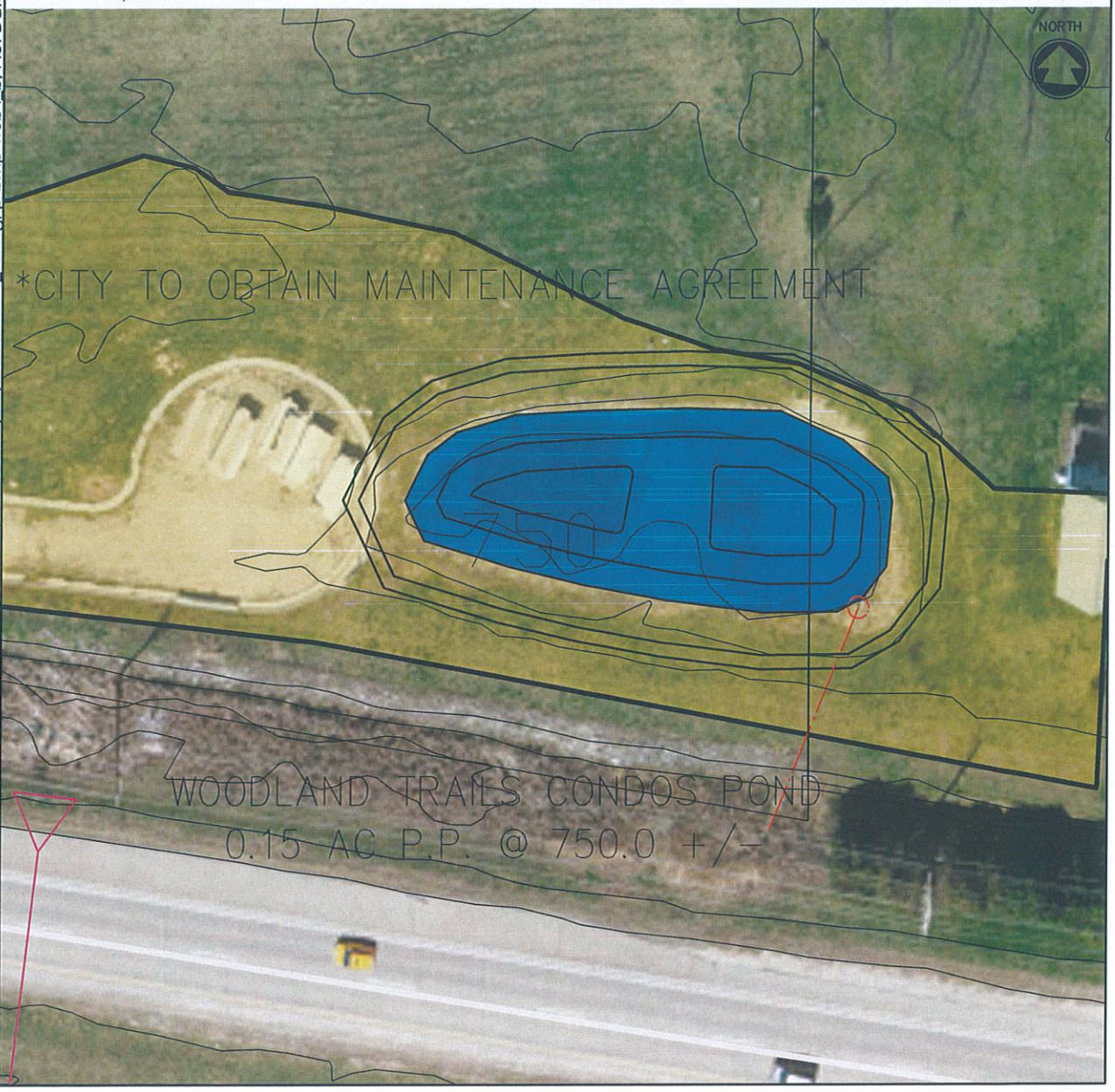
Site access for future BMP maintenance:
Good. Access from STH 114.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
0.15 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.



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POTENTIAL STORMWATER BMP RETROFIT

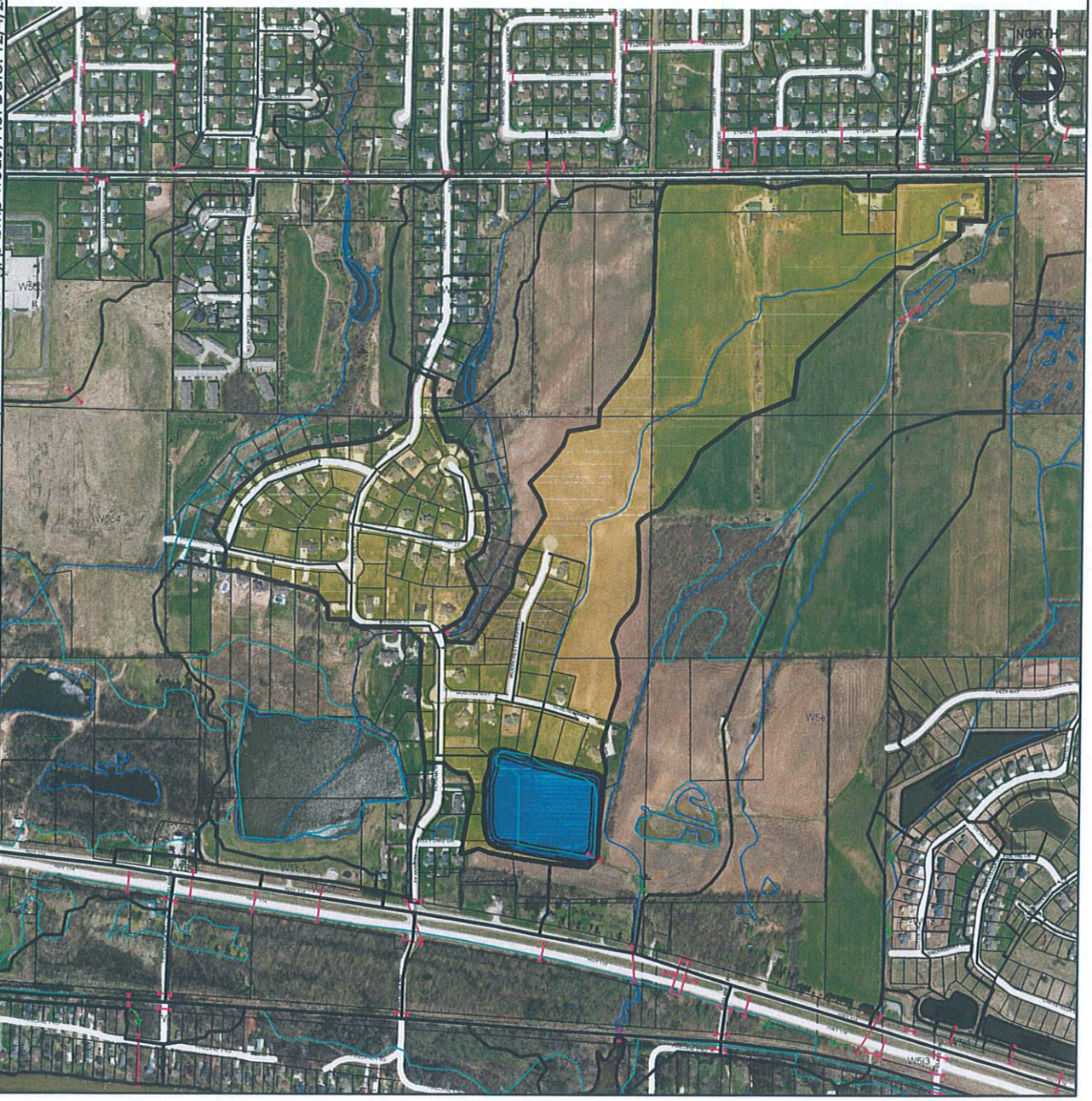
BMP CATCHMENT ID: P-BMP-W5d5

McM PROJECT NO: M0001-930563

SITE INFORMATION:	
Municipality: CITY OF MENASHA	Date: SEPT 2015
Proposed BMP Name: WOODLAND HILLS POND	Initials: PTK

DRAINAGE AREA:		
Sub-watershed ID: FOX RIVER	Tributary Drainage Area IDs: W5d5	Total Drainage Area: 109.8 acres
Imperviousness (Future): 34.6%	Runoff Curve Number (Future): 85	Water Quality Volume (Future): 4.96 acre-feet

Drainage Area / Site Location Map:



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PROPOSED BMP RETROFIT:

Type of proposed BMP retrofit (e.g. wet pond, bioretention, proprietary device, etc.):
Wet Detention Pond

Initial BMP Screening

Groundwater Depth (ft):	2.7+/-	Remediation:	☐ Yes ☒ No	Wetland:	☐ Potential ☐ Yes ☒ No
Bedrock Depth (in):	>80	Historical:	☐ Yes ☒ No	Public Well < 400 ft:	☐ Yes ☒ No
USDA Soil Texture:	Silty Clay Loam	100-Year Floodplain:	☐ Yes ☒ No	Private Well < 100 ft:	☐ Yes ☒ No

BMP Outfall (storm sewer, stream, wetland, groundwater, etc.):
Pond to discharge into ditch that drains south to CTH 114 ditch.

Infrastructure modifications or flow diversions required for retrofit:
Pond may need to be dredged to satisfy WDNR Technical Standard 1001.

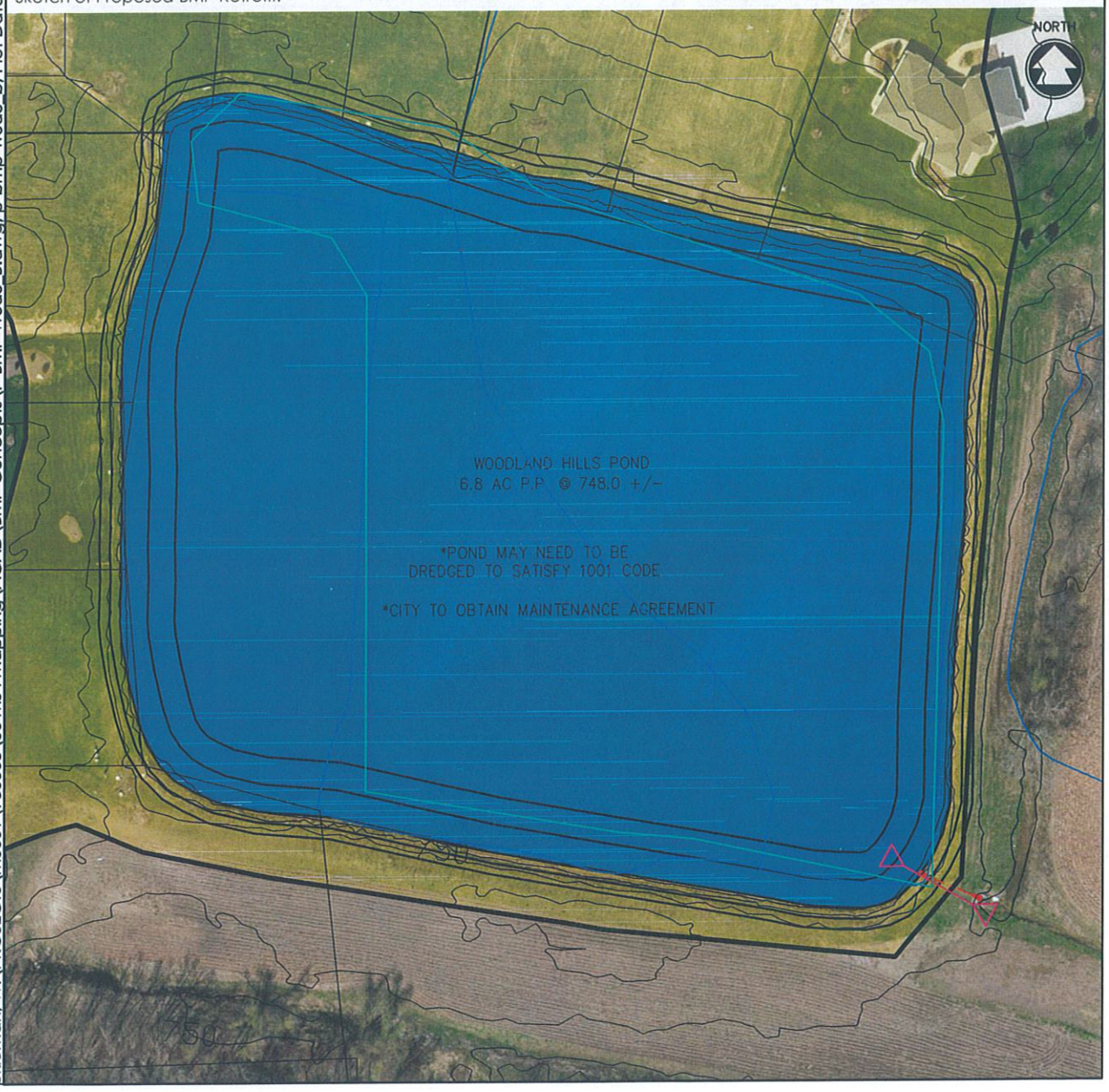
Site access for future BMP maintenance:
Good. Access from Kelly Lake Dr.

Site constraints that require further investigation (e.g. utility conflicts, wetlands, groundwater, etc.):

Approx. Size of BMP Retrofit:	Approx. Land Required (ac):	Estimated Cost:
6.80 acre permanent pool		$5,000*

Sketch of Proposed BMP Retrofit:

*Cost associated with fees to obtain maintenance agreement for City.



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