

REPORT

ClarkDietz

Engineering Quality of Life®

Stormwater Management Plan



City of Glendale, WI

July, 2021

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EXECUTIVE SUMMARY

Current Stormwater Permit

For the City of Glendale, the Department first issued the WPDES Permit No. WI-061565-01 in March 2000, expiring December 31, 2005. This permit is also referred to as the North Shore Permit. The 7 North Shore Permittees affected by this proposed permit are: Village of Bayside, Village of Brown Deer, Village of Fox Point, City of Glendale, Village of River Hills, Village of Shorewood, Village of Whitefish Bay.

The Department renewed the North Shore Permit WPDES Permit No. WI-061565-02 on February 1, 2007 to expire on December 31, 2011. The Department renewed the WPDES Permit No. WI-061565-03 on June 12, 2013, expiring June 11, 2018.

New Stormwater Discharge Permit

In June 2021, Department has reissued WPDES Permit No. WI-061565-04 to continue the coverage of storm water discharges. The proposed permit requires an MS4 permittee to develop, implement, and maintain storm water management programs to reduce the discharge of pollutants from the MS4 to waters of the state.

The Glendale Stormwater Management Plan matches the structure of the permit to facilitate compliance activities and reporting requirements included in the permit. In addition, the permit includes requirements to meet TOTAL MAXIMUM DAILY LOAD (TMDL) requirements that were recently promulgated by the Department.

The production of this Stormwater Management Plan is in fact a requirement of the MS4 permit, which requires development of written storm water management program (SWMP) documents describing how the permittee will comply with the permit's requirements for each of the six minimum control measures, consistent with 40 CFR 122.34 (b).

Structure of the Stormwater Management Plan report

The Stormwater management plan includes the conditions required by s. NR 216.07, Wis. Adm. Code, which consists of the following six categories, or minimum control measures:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Pollutant Control
- Post-Construction Storm Water Management
- Pollution Prevention

In addition, the Stormwater Management Plan includes the following compliance elements:

- TMDL Pollutant Load Reduction Evaluation
- WLA Attainment Analysis

- Establishment of WLA Attainment Benchmarks
- Fecal Coliform Reduction Efforts

Current Compliance Status

Since the first Stormwater Discharge WPDES permits were promulgated in Wisconsin in 2000, Glendale has achieved compliance with all permit requirements. Each and every year of permit coverage in the last two decades, the City has provided the Department with an annual report of stormwater management activities and permit compliance.

And each annual report has been accepted by the Department as evidence of successful permit compliance. The following is a summary of the relevant activities that the City currently performs in compliance with its MS4 permit.

Compliance with the New Permit

With the new permit, there will be some modifications and, in some cases, additions to the operations currently underway in the city. In this sense, the recommendations contained in this Plan aim to build on existing practices and achieve a smooth transition from how City personnel operated under the previous permit to a slightly different framework under the current/new permit.

For each compliance element, we created standalone Standard Operating Procedure (SOP) manuals that contain all required compliance activities. We believe that each SOP will become a handy tool for not only compliance with the permit, but also a useful way to assemble the reports needed to be submitted to WDNR each year.

Total Maximum Daily Load and Waste Load Allocation

As with all communities along Milwaukee River, the pollutant load allocations assigned to Glendale mean that, in the coming years, Glendale will continue its practice of stormwater management when development occurs. In addition, Glendale will continue to exercise good housekeeping practices like street sweeping and catch basin cleaning to further reduce the amount of solids and phosphorus to the Milwaukee River.

Like many other communities, Glendale has a way to go to achieve the required pollutant load reductions. The only way to achieve these targets is to continue the City's current efforts and remain consistent in enforcing stormwater regulations.

Drainage Management Plan

The stormwater management identifies flood prone areas and drainage improvement intervention areas. In each identified area, further evaluation and ditch improvements will be scheduled in the coming years.

DEFINITIONS

Best Management Practices (BMP): Structural or non-structural measures, practices, techniques or devices employed to avoid or minimize sediment or pollutants carried in runoff to waters of the state; or manage the rate of volume of runoff.

Catch Basins: An inlet to a storm sewer constructed with a sediment sump on its outlet pipe to the downstream storm sewer.

Control Structure: The manmade structure that controls the water released from a stormwater facility to the outfall.

Curve Number: Also called the runoff curve number or CN, is an empirical parameter used in hydrology for predicting direct runoff or infiltration from rainfall excess, based on the area's hydrologic soil group, land use, treatment and hydrologic condition.

Design Storm: A hypothetical discrete rainstorm characterized by a specific duration, temporal distribution, rainfall intensity, return frequency, and total rainfall depth.

Detention Basin: An excavated area installed on, or adjacent to, tributaries of rivers, streams, lakes or bays to protect against flooding and, in some cases, downstream erosion by storing water for a limited period of time.

Discharge Volume: The quantity of runoff discharged from the land surface as the result of a rainfall event.

Drainage Basin: Any area of land where precipitation collects and drains off into a common outlet, such as into a river, lake, or other body of water.

Erosion: The detachment and movement of soil, sediment, or rock fragments by water, wind, ice or gravity.

Floodplain: The relatively flat lowland that borders a river, usually dry but subject to flooding.

Illicit Discharge: Any discharge to a municipal separate storm sewer system (MS4) that is not composed entirely of stormwater runoff, except discharges authorized by a WPDES permit or any other discharge not requiring a WPDES permit.

Impervious Surface: Any pavement or structural element that prevents rain, surface water runoff, or melting snow from infiltrating into the ground below, including, but not limited to, roofs and paved roads, driveways, and parking lots.

Infiltration: The process by which rainfall or surface runoff percolates or penetrates into the underlying soil.

Maximum Extent Practicable (MEP): A level of implementing BMPs to achieve a performance standard that takes into account the best available technology, cost-effectiveness, and other competing issues such as human safety and welfare, endangered and threatened resources, historic properties, and geographic features.

Municipal Separate Storm Sewer System (MS4): A conveyance or system of conveyances that is: owned by a state, city, town, village, or other public entity that discharges to waters of the U.S.; designed or used to collect or convey stormwater; not a combined sewer; and not part of a sewage treatment plant, or publicly owned treatment works (POTW).

New Development: A development that results from a conversion of a previous undeveloped land or agricultural land use.

Non-Storm Discharge: A discharge to the storm sewer system created by some process other than stormwater runoff.

Outfall: The location of where a drain, sewer, or stream discharges.

Peak Flow Discharge Rate: The maximum rate at which a unit of volume of stormwater is discharged.

Performance Standard: A measurable number or narrative indicating the minimum acceptable outcome for a practice or facility.

Pervious Surface: A surface that infiltrates rainfall during a large portion of the design rainfall event. Well-managed lawns, fields, and woodlands are examples of pervious surfaces.

Post-Construction Stormwater Discharge: Any stormwater discharged from a site following the completion of land disturbing construction activity and final site stabilization.

Post-Development Condition: The extent and distribution of land cover types, anticipated to occur under conditions of full development, that will influence stormwater runoff and infiltration.

Pre-Development Condition: The extent and distribution of land cover types present before the initiation of land disturbing activity.

Redevelopment: The area where a development replaces an older development.

Retention Basin: A permanent pool of standing water with vegetation around the perimeter that plays an important role in controlling stormwater runoff. Eventually empties into a receiving body of water.

Sheet Flow Runoff: An overland flow or downslope movement of water that forms a thin film and spreads across the soil surface.

Stormwater Management Plan: A document that identifies what actions will be taken to reduce stormwater quantity and pollutant loads within the municipality.

Stormwater Runoff: That portion of the precipitation fall during a rainfall event, or that portion of snow-melt, that runs off the surface of the land and into the natural or artificial conveyance or drainage network.

Structural Measure: Source area practices, conveyance measures, and end-of-pipe treatment that are designed to control stormwater runoff pollutant loads, discharge volumes, and peak flow discharge rates.

Sub-basin: An area where all the surface run-off flows through a series of rivers, lakes, or stream to a point in a water course.

Total Maximum Daily Load (TMDL): It is the calculations of the maximum amount of pollutants allowed to discharge per day in a waterbody to meet water body quality standards.

1 - INTRODUCTION

1.1 Regulatory and Permit Background

In 1978 the Wisconsin Legislature created the Nonpoint Source Water Pollution Abatement Program (nonpoint source program). The program goal is to reduce pollutants from urban and rural nonpoint sources to improve and protect the water quality of streams, lakes, wetlands, and groundwater.

In 1987, Congress amended the Clean Water Act, authorizing a national program of comprehensive storm water pollution control for Municipal Separate Storm Sewer Systems (MS4s), certain industries, and construction sites.

In 1993, Ch. 147, Wis. Stats., (now Ch. 283, Wis. Stats.) was amended to include storm water as a "point source" discharge and to require that the Department promulgate administrative rules for permitting the discharge of storm water.

Nonpoint sources include eroding agricultural lands, eroding stream banks and roadsides, runoff from livestock wastes, erosion from developing urban areas, and runoff from established urban areas. Pollutants from nonpoint sources are carried to the surface water or groundwater through the action of rainfall runoff or seepage, and snowmelt.

In December 2015, the United States Environmental Protection Agency (USEPA) promulgated the National Pollution Discharge Elimination System (NPDES) Electronic Reporting Rule (40 CFR Parts 9, 122, 123, 124, 127, 403, 501, and 503). This regulation requires the electronic reporting and sharing of NPDES program information. The USEPA identifies specific NPDES information, or data elements, that NPDES permitting authorities, such as the Department, are to electronically collect, manage, and share to the USEPA. The Department's electronic reporting system was built to collect these data elements.

In November 2016, the USEPA promulgated the MS4 General Permit Remand Rule (40 CFR Part 122). USEPA amended its regulations governing how small MS4s obtain coverage under NPDES general permits. In addition to establishing two alternative approaches to obtaining permit coverage, the rule clarifies that the permitting authority must establish the necessary "clear, specific, and measurable goals" for the MS4 to "reduce the discharge of pollutants from the MS4 to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act." Referred to as the "MS4 permit standard," both approaches ensure that the public participation requirements of the CWA are met. The Department is applying the Comprehensive Approach to issue this group permit. Under the Comprehensive Approach, all requirements are contained within the permit. For more information on the MS4 General Permit Remand Rule, use a standard Internet search engine and type in "EPA remand rule."

1.2 Glendale's Stormwater Discharge Permit

In Wisconsin, the Wisconsin Department of Natural Resources (WDNR, DNR, or Department) created Ch. NR 216, Wis. Adm. Code, for permitting storm water discharges from certain municipalities that own or operate MS4s, storm water discharges associated with industrial activity, and storm water discharges associated with land disturbing construction activity. Within this context, Glendale has been designated eligible and responsible to participate in the nonpoint source control effort through NR 216.

The Wisconsin Pollution Discharge Elimination System (WPDES) permits are issued by the Department with federal oversight from the United States Environmental Protection Agency (USEPA).

The Department is responsible for the issuance, reissuance, modification, and enforcement of all WPDES permits issued for discharges into the waters of the state, except discharges occurring in Indian Country which are regulated directly by the USEPA. No person may legally discharge to waters of the state without a WPDES permit issued under this authority.

This permit is issued under the statutory authority granted to the WDNR pursuant s. 283.33, Wis. Stats. (Storm water discharge permits) and implements applicable federal and state law relating to municipal separate storm sewer systems. The specific federal requirements for MS4 permits are found in U.S. Code § 1342 (p)(3)(b) and 40 CFR 122.26. The specific state requirements for MS4 permits are found in s. NR 216 Subchapter I, Wis. Adm. Code.

The current Wisconsin MS4 Permit conditions were developed to meet the MS4 permit standard; reduce pollutants to the maximum extent practicable, protect local water quality, and meet Clean Water Act Standards. This permit requires continued implementation of the six minimum control measure programs, development of a storm water management plan to achieve the reduction goals outlined in the Milwaukee River TMDL, and completion of special requirements specific to each MS4 which provide improvements in water quality. Permittees satisfy the MS4 permit standard through successful implementation of the storm water management programs and compliance with the WPDES permit.

This MS4 permit incorporates USEPA's clarification on permit requirements, specifically to address 40 CFR 122.34 (a), that "Terms and conditions (...) must be expressed in clear, specific, and measurable terms." To accomplish this, the permit terms that included caveat terms such as "if feasible" or "as necessary" are revised to provide more clarity on when a specific action is required.

For the City of Glendale, the Department first issued the WPDES Permit No. WI-061565-01 in March 2000, expiring December 31, 2005. This permit is also referred to as the North Shore Permit. The 7 North Shore Permittees affected by this proposed permit are: Village of Bayside, Village of Brown Deer, Village of Fox Point, City of Glendale, Village of River Hills, Village of Shorewood, Village of Whitefish Bay.

The Department renewed the North Shore Permit WPDES Permit No. WI-061565-02 on February 1, 2007 to expire on December 31, 2011.

The Department renewed the WPDES Permit No. WI-061565-03 on June 12, 2013. This permit officially expired on June 11, 2018, but because WDNR had not prepared a renewal, the permit stayed in effect until June 2021.

In June 2021, Department has reissued WPDES Permit No. WI-061565-04 to continue the coverage of storm water discharges. The proposed permit requires an MS4 permittee to develop, implement, and maintain storm water management programs to reduce the discharge of pollutants from the MS4 to waters of the state.

1.3 Glendale's Stormwater Management Plan Outline

First and foremost, the Glendale Stormwater Management Plan is a collection of information, analysis, and policy development document guiding the City's compliance with the proposed MS4 permit.

The Department considered the City's annual reports, previous storm water management plan documents, and the request for information provided by City officials when developing the permit conditions. Multiple meetings were held with Glendale and the rest of the North Shore Permittees

and partners to discuss permit conditions. Additionally, individual meetings were held with each permittee to discuss individual requirements. The following document provides an explanation for major permit requirements and summarizes changes from the previous permit.

The Glendale Stormwater Management Plan matches the structure of the permit to facilitate compliance activities and reporting requirements included in the permit. In addition, the permit includes requirements to meet TOTAL MAXIMUM DAILY LOAD (TMDL) requirements that were recently promulgated by the Department.

The production of this Stormwater Management Plan is in fact a requirement of the MS4 permit, which requires development of written storm water management program (SWMP) documents describing how the permittee will comply with the permit's requirements for each of the six minimum control measures, consistent with 40 CFR 122.34 (b).

As explained in the EPA Rule Remand, "the written SWMP provides [the Department] something concrete to review to understand how the MS4 will comply with permit requirements and implement its storm water management program."

The Plan also provides an opportunity for the Department to assess compliance with the permit requirements. The permittees are expected to develop written documents if they do not already exist and submit them to the Department. Existing and new SWMP documents describing the permittees approach to each minimum control measure must be submitted to the Department by June 1, 2023.

The Stormwater management plan includes the conditions required by s. NR 216.07, Wis. Adm. Code, which consists of the following six categories, or minimum control measures:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Pollutant Control
- Post-Construction Storm Water Management
- Pollution Prevention

In addition, the Stormwater Management Plan includes the following compliance elements:

- TMDL Pollutant Load Reduction Evaluation
- WLA Attainment Analysis
- Establishment of WLA Attainment Benchmarks
- Fecal Coliform Reduction Efforts

2 - GEOGRAPHICAL AND WATERSHED SETTING

The City of Glendale is located in Milwaukee County just north of the City of Milwaukee on either side of the Milwaukee River. Glendale is five miles north of the Milwaukee downtown and is part of the suburban development corridor that extends northerly through Milwaukee County and into adjacent Ozaukee County. The City is a combination of a medium density residential community, an industrial community, and a commercial center providing goods and services to several adjacent suburbs in northern Milwaukee County.

Glendale was incorporated in 1950 with a population of 3,150. Between 1950 and 1970 it grew rather steadily with a population of 9,537 in 1960, increasing to a population of 13,436 in 1970. Since 1970 the population of Glendale has remained fairly constant, with a population of about 13,000 in 2021.

2.1 Land Use – Land Cover

As an established North Shore community, there is very little land use conversion in the City. This is relevant because almost all land use or land cover transformations will change the runoff characteristics and therefore have an impact on stormwater management. In this sense, the City's current stormwater management needs are expected to remain fairly consistent over the next decade or so.

However, changes to land use are still possible, as in the case of the major changes occurring at Bayshore Mall. Other marginally-used lands are also being developed with high imperviousness (i.e., larger buildings and/or parking lots) as well. This process is expected to continue through this economic cycle with low interest rates and a favorable business climate encouraging redevelopment throughout the County, and certainly in the City of Glendale.

From a stormwater management perspective, this economic pressure is important in cases where the new land use leads to significantly higher impervious surfaces. We recommend that, when the impervious surface increases are anticipated, the land use study include consideration of existing storm drainage as a decision criterion.

For stormwater management planning purposes, we have not attempted to predict future modifications to the existing land use plan because (i) it is likely that future land use studies will include stormwater management (i.e., runoff management or reduction) as a component, and (ii) should the new land uses lead to increased imperviousness, it is likely that the runoff increase would be dealt with through stormwater management techniques.

Consequently, the Stormwater Management practices outlined in this report assume that the existing land uses in the City will remain unchanged through the next two decades. Note that if this assumption cannot be sustained, the Stormwater Management Plan must be updated to reflect those changing land use patterns.

With a diverse existing and planned land use base, Glendale represents a microcosm of the metropolitan Milwaukee area. Quiet single family residential areas, hi-tech businesses, leading edge manufacturing companies, service and retail businesses, county parks, golf courses, interstate highways represent some of the more visible land uses in the City.

2.2 Soils

The soils in the City of Glendale have been surveyed by the United States Department of Agriculture (USDA) Soil Survey of Milwaukee and Waukesha County. Portions of the City are outside the detailed

study area and others which were included consist of three major soil associations. The Soil Survey lists these as: the Fox-Casco association, the Ozaukee-Morley-Mequon association, and the Kewaunee-Manawa association. We would expect very little of the native soils remaining as actual soil cover, though below the urban landscape, these soils persist.

- The Fox-Casco Soil is composed of well drained loams on stream terraces and along the Milwaukee River. The Fox series is well drained and includes variation from sandy loams to silty loams from 0-12 % slopes. The Casco series includes sandy loams and loams from 2-20% slopes.
- The Ozaukee-Morley-Mequon Soil includes well drained to somewhat poorly drained silty clays and silty clay loams, the Ozaukee and Morley soils occupy mostly ridges and slopes while the Mequon soils are associated with drainage ways. The Ozaukee silt loam composes the Ozaukee series and ranges from 2-20% slopes and is well to moderately well drained. The Morley silt loam composes the Morley series and ranges from 2-20% slopes and is well to moderately well drained. The Mequon silt loam, 1-3% slopes, composes the Mequon series and is somewhat poorly drained.
- The Kewaunee-Manawa Soil consists of well drained to somewhat poorly drained clays and silty clays. The Kewaunee series includes Kewaunee silt loam (2-6% slopes) and Kewaunee silty clay loam (2-6% slopes, eroded). Kewaunee silt loam and Kewaunee silty clay loam are both well drained soils of the uplands. The Manawa series consists solely of the Manawa silt loam (0-2% slopes). Manawa silt loam is a somewhat poorly drained soil in upland drainage ways and wetlands.

2.3 Precipitation and Climate

The annual precipitation in Southeastern Wisconsin is an average of 31 inches. The driest months are December, January, and February, with an average of 1.54 inches, 1.31 inches, and 0.95 inches of precipitation, respectively. These are also the months of greatest snow accumulation, when more than 30 inches or 68 percent of the average annual snowfall occurs. The wettest months are June, July, August, and September when more than 14 inches, or 47 percent of the average annual rainfall takes place. Most runoff occurs in March, April, and May when soil is either frozen or saturated.

2.4 Environmental Corridors

An Environmental Corridor is a linear natural resource feature on the landscape that has been identified as being significant by the Southeastern Wisconsin Regional Planning Commission in its Area Wide Water Quality Management Plan.

The primary environmental corridor in the City of Glendale is located along the Milwaukee River. This corridor runs north-south from one end of the City to the other and includes Kletzsch Park, portions of the Milwaukee River Parkway, Lincoln Park, and Estabrook Park.

Significant vegetation in the corridor includes mostly riparian species along the Milwaukee River: black willow, silver maple, box elder, green ash, cattails, sedges, riverbank grape, dogwoods, reed canary grass, honeysuckle, buckthorn, and some elms. Small mammals, deer, fish, song-birds, insects, amphibians, and waterfowl all rely on the wildlife habitat in the corridor. The presence of parks, passive and active, are evidence of the recreation value of the corridor.

Kletzsch Park contains the Kletzsch Park Woods, identified as a natural area of local significance by the Southeastern Wisconsin Regional Planning Commission Natural Areas Plan (Planning Report No. 42).

2.5 Groundwater

Deep underground, water is contained in one of four aquifers: sand and gravel, eastern dolomite (limestone), sandstone and dolomite, and crystalline bedrock. An aquifer is an underground rock or soil formation that stores and transmits water to lakes, streams, and wells. Aquifers in the Milwaukee River South Watershed are discussed in order of occurrence beneath the surface.

- **Sand and Gravel Aquifer:** The sand and gravel aquifer is comprised of surface material deposited from glacial ice that covered the watershed approximately 10,000 years ago. These deposits, which are generally 100 to 200 feet deep, are unconsolidated soil material with physical and chemical characteristics different from agricultural soils.

Groundwater in these deposits occurs and moves in the void spaces among the grains of sand and gravel. It is locally important as a source of groundwater for both public and private use where there are relatively thick saturated unconsolidated deposits. The potential for contamination is high because of the shallow depth to groundwater and permeability of the bedrock.

- **Eastern Dolomite Aquifer:** The eastern dolomite aquifer occurs beneath the sand and gravel formation. It was deposited approximately 400 million years ago and is 300 to 400 feet thick. It consists of both the Niagara dolomite formation and an underlying shale layer (Maquoketa shale). Dolomite is a brittle rock similar to limestone which contains groundwater in interconnected cracks. The Maquoketa shale formed from impermeable clays and prevents water from moving between the Niagara dolomite and the deeper aquifers. Most potable water used in the watershed comes from this formation. The potential for contamination is moderate.
- **Sandstone and Dolomite Aquifer:** The sandstone and dolomite aquifer occurs beneath the eastern dolomite formation in deposits between 425 and 600 million years old. It consists of sandstone and dolomite bedrock between 400 and 600 feet thick characterized by materials with variable water yielding properties. In eastern Wisconsin, most users of substantial quantities of water tap this deep aquifer to ensure adequate supplies are available. In areas where the Maquoketa shale underlies the dolomite aquifer, which is the case for most of the South Branch, the potential for contamination is low.
- **Crystalline Bedrock Aquifer:** The crystalline bedrock aquifer is located beneath the sandstone and dolomite aquifer in formations more than 600 million years old. This aquifer is not a primary source of water in the watershed. Most of the deposits are very dense crystalline rock that normally yield small amounts of water. Fractures in the crystalline structured rocks store water, but the quality and reliability of this water source and the extreme depth restrict its use.

2.6 Rivers and Streams in Glendale

In many ways, Glendale is the quintessential river community. The Milwaukee River bisects the City and defines the character of many of its neighborhoods, parks, and even golf courses. In this sense, the river is part of daily life in Glendale. It is, therefore, no surprise that the City is undertaking this Stormwater Management Plan with the express purpose of improving the water quality of the River.

Milwaukee River

Almost the entire City drains into the Milwaukee River and many public drainage facilities (i.e., storm sewer pipes, and drainage ditches) convey runoff to the River. In addition, there are a number of waterways, remnants of old streams, that help discharge surface waters to the Milwaukee River. Since the Milwaukee River itself is centrally located in the City, many storm sewer outfalls currently discharge directly to the river.

Crestwood Creek

To the southwest of the City, we have Crestwood Creek, which is a tributary to Lincoln Creek. Crestwood Creek drains most of the western side of Glendale, including the Johnson Controls property, as well as the industrial lands towards Bender Road and the Richard E Maslowski Recreation Complex, where the head waters of this 1.35 mile stream are located.

Brown Deer Creek

To the north, drainage systems discharge to Brown Deer Creek (through the Brown Deer Golf Course). This stream is a 2.2 mile waterway currently not considered impaired. It discharges to the Milwaukee River in River Hills, within the grounds of the Milwaukee Country Club golf course. Glendale's portion of Brown Deer Creek is mainly located on the Strattech property, where a large concrete lined channel exists. This channel is maintained by the City and connects to the more natural Brown Deer creek segment through the golf course north of Good Hope Road. The culvert under Good Hope Road is in the jurisdiction of Milwaukee County, and a replacement project is scheduled for 2022.

Bender Creek

In central Glendale, there is a relatively short 1.1 mile waterway generally referred to as Bender Creek. This waterway starts north of W Glen River Road by the railroad and winds south and east across Bender Road, between Alberta and Bittersweet lanes, and through the backyards east and south to Milwaukee River at Montclair Avenue between Appleblossom and Park Road.

2.7 Floodplain Regulations

As is the case with all rivers and streams, the Milwaukee River has an area of expected inundation called the floodplain, which is defined as area inundated by the direct overflow of rivers, streams, or other water body.

Accordingly, in Glendale, the flood insurance study and the related maps delineate the Milwaukee River floodplain. By convention, the 100-year flood has been established as the national standard for protection. This flooding event is the result of a flow condition that has a one percent probability of occurrence or exceedance during any given year. With certain exceptions, the 1 percent probability flood approximates, in terms of inundated land, the largest known floods that actually occurred in the region. The extent of this flood establishes the jurisdiction for floodplain regulations that are enforced through the City Zoning Ordinance.

It must be said that the 100-year flood in the Milwaukee River is not the direct result of a 100-year rainfall in Glendale. One can immediately appreciate that the Milwaukee River basin is several times larger than the City of Glendale and so it is easier to visualize that the precipitation and runoff occurring over this large basin would be the chief cause of any flooding of the Milwaukee River. In other words, any potential flooding conditions within the current Milwaukee River floodplain will not be addressed and will not be affected by the implementation of any of the stormwater management efforts described in this Stormwater Management Plan.

2.8 Drainage Infrastructure

Glendale's drainage infrastructure is a mix of storm sewers and roadside ditches, reflecting the diverse nature of our neighborhoods. Every major roadway in our City has adequately sized and located storm sewers and most of our quiet residential neighborhoods have roadside ditches along rural section streets.

The entire City enjoys storm sewer service, either in the form of storm sewers or roadside ditches, and in most cases, the available capacity and the overland drainage capabilities are sufficient to prevent serious flooding problems.

The digital storm sewer system map contains several pipe attributes like inverts, pipe diameters, and pipe lengths. The inverts that were not available on existing system maps were researched in the City files and added to the digital map when found. Loaded with this information, the storm sewer system map presents a complete picture of the existing pipe networks in Glendale. The pipe attribute information (i.e., pipe diameter, length, and invert elevations) on the map is sufficient for any future analysis or design effort that may be undertaken in the City. In other words, everything that is known about the storm sewer system resides in one easy to read and access map.

There are several stormwater detention and retention ponds, as well as small lakes in the City. Some ponds, like the Wiscona ¹ wetland stormwater treatment facility, are designed to treat runoff from existing developed areas, while others, like the Technology District or Silver Spring Drive ponds are designed to address the runoff treatment needs of planned development.

There are a number of other waterbodies in the City that are not specifically designed as stormwater management facilities. Despite this, waterbodies like Lake Glen or Brentwood Lake are connected to the storm sewer system and do provide retention and detention benefits. With their permanent water levels contribute to water quality downstream, while any storage capacity that is available above the outlet elevation reduces downstream peak flows and helps with capacity problems. The stormwater plan will attempt to quantify these benefits so that they can be maintained for the future benefit of residents.

The surface water courses in the City have largely been re-configured to fit the City's current drainage needs. Neither Crestwood Creek nor Brown Deer Park Creek have their original natural appearance and predominantly serve as conveyance facilities as part of the storm sewer system.

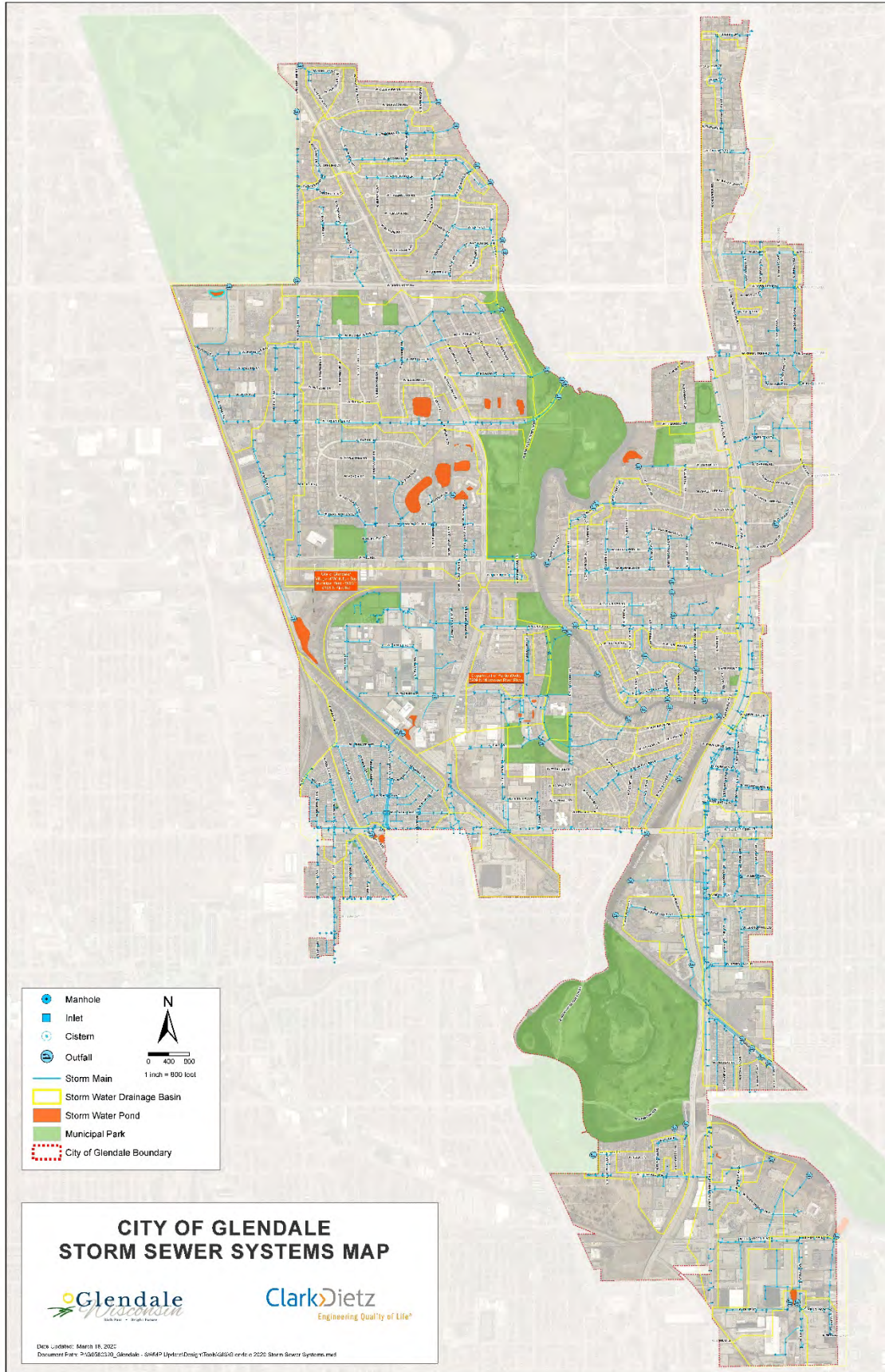
2.9 Urban Water Quality Conditions

With nearly fully developed conditions such as in Glendale, the amount of runoff generated has already increased significantly as compared to pre-development times. This is due to increased impervious surfaces, the disturbance of the native soils (which reduces infiltration), and the tendency to prevent flooding by quickly draining away stormwater in order to provide the maximum amount of developable land. Traditionally this has meant that drainage systems are designed and engineered to efficiently convey stormwater off the site downstream into a large watercourse such as the Milwaukee River. Typically curb and gutter along with extensive networks of storm sewers have been utilized to maximize the conveyance capacity of the system while minimizing the land area needed for stormwater.

This tendency has meant that natural drainage systems are usually completely replaced with structural systems and the natural drainage system in the City has long been replaced by a system of

¹ Wiscona is the name of a railroad yard located immediately west of the Oak Leaf Trail, where the new REM Community Center Trail joins Oak Leaf Trail. The stormwater pond is located adjacent to the area where Glendale dumps its fall leaf collection compost. The old abandoned iron bridges visible along the Oak Leaf trail are remnants of this rail yard. Back in 1911, Wiscona was the rail junction of several C&NW lines and the Milwaukee Road. Located on the north side of Milwaukee, this junction was built when the C&NW sold its Lake Front Depot and used the new Milwaukee Road Passenger Depot. This is the north side connector from the Milwaukee Road to the C&NW Lake Shore Division and route of the Flambeau.

pipes and channel and drainage-way improvements. With this system in place, the water quality treatment capacity of the natural environment would have been drastically reduced at the same time the pollutant loads would have been increasing. By engineering a drainage system for Glendale that includes the filtering capacity of the natural system, the water quality of the stormwater reaching the Milwaukee River will be significantly improved.



Urban areas produce a wide array of pollutants, some of which are unique to urban area runoff and some of which are also produced by agricultural land uses. Pollutants produced in common with agricultural land uses include sediment, nutrients, bacteria and other pathogens, and pesticides. Pollutants generated primarily in urban areas include a wide range of heavy metals such as lead, copper, zinc, cadmium, chromium, and a large number of toxic organic chemicals.

In addition, creation of urban areas causes extreme changes in the hydrology of streams. This occurs as runoff volume not only increases in magnitude but is produced in a shorter period of time creating large increases in peak stream discharge. In some areas, groundwater recharge is also significantly reduced as concrete and other impervious surfaces prevent rainwater and snowmelt from soaking into the ground. This reduces base flows needed to sustain fish and aquatic life during periods of low rainfall.

These urban impacts produce "flashy" streams which are thermally and chemically polluted, hydrologically unstable environments for fish and aquatic life. Streambank erosion is increased as the stream attempts to continually cut a channel in equilibrium with widely variable stream flows. Flooding problems that may result in personal and property damage are also created. Ultimately, such streams may be channelized and even lined with concrete to increase hydraulic capacity and reduce risk of damage. Such practices create, in effect, an open storm sewer which destroys the natural stream.

The delivery to surface waters of urban pollutants from established urban areas varies greatly depending on the type of urban land use, the stormwater conveyance system, and urban housekeeping practices. The pollutants include suspended sediment phosphorus, indicative of pollutants also produced in the agricultural areas, and two heavy metals, lead and zinc, which represent toxicants produced primarily in urban areas.

Generally, freeways, industrial areas, and commercial areas are the greatest generators of urban pollutants on a per acre basis. High density residential lands are also significant for some pollutants. Medium density residential areas are of much less importance for sediment and lead on a per acre basis, but continue to be significant as sources of pesticides, bacteria, and household or automotive maintenance products dumped into the storm sewer system. Low density residential areas are generally important only if housekeeping practices, including use of pesticides and fertilizers, are prevalent.

Glendale has banned the use of coal tar driveway sealants to prevent the harmful polycyclic aromatic hydrocarbons (PAHs) from washing off and reaching the Milwaukee River and its tributaries in the City.

These source areas vary in the types and amounts of pollutants available for transport by rainfall and runoff and vary in the extent to which pollutant-producing surfaces are hydrologically "connected" to the storm sewer system. These two factors are at the core of what makes urban land uses significant as pollution sources. For example, traffic density, a prime determinant in the production of lead, asbestos, cadmium, and street dirt is highest for street surfaces in commercial areas and freeways. Commercial areas and urban freeways are also highly connected to storm sewers and have little or no pollutant buffering. Lawn areas, important contributors of nutrients, pesticides, and sediment, are more prevalent in residential areas. Rooftops are important sources of zinc and asbestos, vary in the proportion of land they cover in each urban land use, and vary in the degree to which they are connected to the storm sewer system. Generally, connectedness is higher in commercial areas than residential areas.

Research shows that street sweeping removes some of the particulate pollutants from street and parking lot surfaces before rainfall and runoff can transport them to surface waters. An effective sweeping program would require weekly sweeping of heavily used street surfaces, with the alternating use of brush style and vacuum style sweepers to trap both small and larger size particles. Repeated sweeping of heavily used street surfaces in the early spring results in the greatest water quality benefit.

Sweeping during the fall is also important to reduce transport of leaf fragments to surface waters. Grassed swale conveyance, as opposed to curb and gutter drainage, also serves to reduce the proportion of urban pollutant loads that are delivered to surface waters, and in residential areas will lessen the need for intensified street sweeping.

Grassed swales reduce pollutants primarily through stormwater infiltration, and secondarily through pollutant filtration. Although grassed swales can be highly effective pollution reduction practices, it is assumed that existing swales in the watershed are minimally effective due to past construction techniques that have reduced their capability to infiltrate stormwater.

It is important to identify those land uses that are most important in contributing to the total urban pollutant load. Land uses gain significance based on a combination of factors, including the unit area rate of pollutant production for the land use and the total mass loading from a particular land use. In most sub-watersheds throughout the Milwaukee River South Watershed, commercial and industrial areas produce the most significant portion of the lead loading. These land uses also have significantly higher unit area lead loads than the other land uses.

When considering sources of sediment, medium and high-density residential areas take on greater significance across the watershed, competing more closely with commercial and industrial areas as important sources of the urban sediment loading.

It is important to note that urban renewal of established urban areas should be considered as new development for purposes of water quality control. Renovation of buildings and utilities can cause pollution from construction site erosion like new construction. In addition, even though urban renewal projects will not necessarily increase the amount of established urban surface, they do represent an opportunity to install stormwater quality controls that benefit the entire community.

3 - CURRENT STORMWATER PERMIT COMPLIANCE STATUS

Since the first Stormwater Discharge WPDES permits were promulgated in Wisconsin in 2000, Glendale has achieved compliance with all permit requirements. Each and every year of permit coverage in the last two decades, the City has provided the Department with an annual report of stormwater management activities and permit compliance.

And each annual report has been accepted by the Department as evidence of successful permit compliance. The following is a summary of the relevant activities that the City currently performs in compliance with its MS4 permit.

3.1 Current Education and Outreach Practices

Glendale has identified their targeted audiences as residents, riparian landowners, pet owners, and residential landscaping contractors. These audiences are the focus of this program.

Targeting these profiles will have a more significant impact to the Glendale environment than providing a random array of information that may not spark any interest. The City's Education and Outreach program include the following actions:

1. The City of Glendale allocates funding annually to the Respect our Waters Campaign, which is put on by SWWT Water (Southeastern Wisconsin Watersheds Trust) also known as Sweet Water. This non-governmental organization utilizes funding from the City to educate the community about stormwater related issues by attending events, airing TV commercials, and maintaining an interactive website. They provide education to a much larger audience than what City staff would be able to do on their own. Their website and outreach actions cover all the topics identified in the Group Permit Part II.A.1 a-j.

3.2 Current Public Participation and Involvement Practices

The following procedures are part of the City's Public Participation and Involvement Efforts:

1. The City of Glendale provides financial support to Sweet Water's, 'Respect Our Waters' educational campaign that is designed to assist the North Shore Group with meeting the Public Involvement and Participation permit requirements. The City's support and participation furthers the campaign's reach in educating the public about storm water issues through television advertisements, radio and news interviews, and a variety of community events.
2. The City distributes public notices for all public meetings through the City website, newsletters, and other media.

3.3 Current Illicit Discharge Detection and Elimination Practices

Glendale current illicit discharge detection and elimination program include the following compliance measures:

1. On-going dry weather outfall screenings are completed as part of the City's IDDE program. An evaluation of the stormwater conveyance network was completed. 17 outfall locations have been identified for screening. Following DNR Guidance Manual on IDDE Outfall Screenings, all of the outfalls qualify as a "major" outfall, or as a "priority" outfall.
2. The City televises 100,000 miles of sanitary sewer every 3 years, looking for defects in the pipe network that could potentially cause exfiltration of sewage into surrounding soils. Additionally, these pipes are cleaned out to prevent any backups from happening. When defects or poor pipe conditions are found, the segment is added to a list of sewers that need rehabilitation. The City contracts CIPP lining on an as needed basis.

3.4 Current Construction Site Pollution Prevention Practices

The City's current Construction Site Pollution Control program includes the following practices:

1. The City maintains and enforces their Chapter 15.2- Construction Site Erosion Control. The ordinance requires a permit from the City for any land disturbing activity affecting a surface area of 4,000 square feet or more; or excavation, filling, or grading of 400 cubic yards or more. Permits can be found on the City website here:
2. Typically, the City receives an average of 12 - 20 applications per year.
3. As permit applications are received either in person or by email, they are reviewed and approved by the Building Inspector. Permits are then given after all requirements of the application are met.
4. Inspections are performed by the Building Inspector for the life of the project.

3.5 Current Post-Construction Stormwater Management Practices

1. The City has an intake protocol for the review of development. The building inspection department and City Engineer review the project for compliance with City Ordinances and make recommendations to the City Council.
2. The City's ordinance for post-construction stormwater management standards are dictated by MMSD's Chapter 13 for stormwater quantity discharge and by DNR's NR151.121 for stormwater quality discharge.
3. The City maintains a record of all maintenance agreements for stormwater management facilities that have been installed in the City.

3.6 Current Pollution Prevention Practices

3.6.1 Winter Road Management

- The City mechanic staff calibrates all salt and brine applying machinery at the beginning of each season, following the manufacturer's guidelines for calibration. Each piece of equipment is calibrated before the snow removal season begins in order to ensure that the correct amount of material is used.
- The Director of Public Works, the Public Works Superintendent and the lead mechanic set the application rate of all equipment based on the snow event, the temperature and road conditions.
- Department of Public Works staff attends salt reduction workshops and works with other local municipalities to ensure that Best Management Practices are implemented.
- The City pre-wets with Calcium Chloride based on pavement temperatures using a mixture that contains 90% Brine and 10% Calcium Chloride.
- All salt is stored at the Public Works Yard in a covered building. The City is able to ensure that all material is stored away from storm drains that lead to surrounding waterways.
- Each year, the City of Glendale Department of Public Works budgets and purchases a new snow removal truck that replaces an older model. The City will continue this until all older model trucks are replaced with updated equipment that include brine applicator tanks and pavement temperature sensors.
- The City monitors pavement temperatures using a hand-held laser, as well as utilizing pavement temperature information through a subscription with the University of Wisconsin Milwaukee Meteorology Department.

- Roadways considered major collectors and arterials will be treated with salt, as necessary.
- Roadways considered secondary, will only be treated with salt in the intersections, along curves and hills, and mid-block, as necessary.
- The City regularly cleans and inspects all salt and brine applying equipment.
- At the end of the season, the City cleans and maintains the trucks, tanks, brine-making systems and pumps according to manufacturer specifications.
- Any material that remains at the end of the season is stored securely on an impervious surface in a securely covered building.

3.6.2 Nutrient Management

The City of Glendale's Turf Management Plan is implemented by a private contractor procured with a 3-year contract. Additionally, the City maintains on staff, at a minimum, one employee that is certified to apply pesticides or herbicides as needed throughout the season. The City follows specific guidelines when purchasing, storing and applying chemicals throughout the City MS4 area:

- Only a Certified Pesticide Applicator may apply pesticides or herbicides.
- Use proper Personal Protection Equipment (PPE) when handling and applying chemicals.
- All personnel handling, mixing and applying chemicals to be trained on the location and use of MSDS.
- Personnel applying chemicals are to read the MSDS for each product they use.
- Calibrate application equipment to ensure proper amount of product is applied.
- Follow manufacturer's recommendations for handling, mixing and applying chemicals.
- Mix only enough chemicals for immediate use.
- Purchase products only as needed and use before the end of the spraying season.
- Use caution when spraying product near a waterway or storm drain structure.
- Use a designated wash station to wash equipment.
- Do not apply products when the ground is frozen.
- Do not apply products when public is utilizing parks or green spaces.

3.6.3 Street Sweeping and Catch Basin Cleaning

- Street sweeping for the City of Glendale is completed by the Public Works Department. Once the winter weather is no longer present in the City, typically beginning in the month of March or April, the City will begin to perform street sweeping based on the direction the Director of Public Works. The City conducts street sweeping activities along 150 to 200 lane miles of City streets. During each street sweeping event, the Department conducts a complete sweeping of the entire City. Each event takes the City on average two (2) to three (3) weeks to complete.
- All street sweeping debris is collected and disposed of in a solid waste dumpster located at the City of Glendale Public Works Yard. The dumpster is disposed of by a third-party contractor as needed. The amount of debris that is collected is tracked based on the weight of the dumpster and the billing invoices from the disposal company. The City utilizes this information as part of the record keeping and reporting portion of this SOP.

- The City of Glendale Public Works Department maintains 1,613 catch basins (with sumps) and 1,147 inlets (without sumps) throughout the City MS4 Area. The City has created a City-wide Storm Sewer Catch Basin Cleaning and Inspection Plan. The plan has outlined a three (3) year cleaning and inspection cycle, utilizing a private contractor and city staff. Once the leaf season is complete, each catch basin (with sumps) is inspected and cleaned once every year; while each inlet (without sumps) is inspected and cleaned every three (3) years. Catch basins and inlets are cleaned utilizing a City owned vacuum truck, or by contractor owned equipment for the portion that is cleaned and inspected by a private contractor.

3.6.4 Management of Leaves and Grass Clippings

- The City of Glendale offers curbside leaf to its residents. Yard waste is collected by the City-wide waste management private contractor. The City informs its residents about this service through the City website, newsletter, and use of social media. Residents are instructed to not pile material near a storm sewer in order to prevent organic material from entering the storm sewer system.
- Leaf material is collected utilizing City equipment, including: a leaf vacuum unit, a pusher unit, and a yard waste truck. Each collection location is thoroughly cleaned at time of leaf collection to prevent any debris from entering the storm sewer system. When weather allows, the City completes a street sweeping event after leaf collection.
- The City of Glendale will pick up leave beginning early in October through November (contingent upon the weather) provided the following procedures are followed:
 - Leaves raked to the curb and gutter, and road areas should be collected by the City of Glendale Department of Public Works.
 - Leaves placed on City right of way for City pickup should be raked in long narrow piles that are within reach of the leaf vacuum tube.
 - Piles should not extend into traffic lanes, thereby creating traffic hazards.
 - Crews will not pick up leaves mixed with debris, logs, branches, rocks, plastic, metal or glass containers or any other type of refuse.
 - Leaves should not be placed on City cul-de-sacs, vacant land or City property except on the public right-of-way along the curb and gutter, and road shoulder areas.

3.7 Current Stormwater Quality Management Practices

The City has a stormwater management plan that addressed flooding and water quality. The existing stormwater management practices are implemented through Glendale's stormwater management ordinance, which requires all new development and redevelopment in the City to implement water quality improvement practices.

4 - NEW STORMWATER PERMIT REQUIREMENTS

4.1 Introduction

The City of Glendale, along with the Villages of Bayside, Brown Deer, Fox Point, Whitefish Bay, River Hills, and Shorewood, referred to as the North Shore Group, own and operate municipal separate storm sewer systems (MS4) that discharge to waters of the state.

The North Shore Group has been issued a permit to discharge under the Wisconsin Pollutant Discharge Elimination Systems (WPDES) in accordance with s. 283.33, Wis. Stats., and subch. I. of NR 216, Wis. Adm. Code. State and Federal regulations require that MS4 operators develop and implement a program to ensure that municipal operations are performed in ways that will reduce contamination of storm water discharges.

This Stormwater Management plan includes the conditions required by s. NR 216.07, Wis. Adm. Code, which consists of the following six categories, or minimum control measures:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Pollutant Control
- Post-Construction Storm Water Management
- Pollution Prevention

In addition, the Stormwater Management Plan includes the following compliance elements:

- TMDL Pollutant Load Reduction Evaluation
- WLA Attainment Analysis
- Establishment of WLA Attainment Benchmarks
- Fecal Coliform Reduction Efforts

Glendale has been in compliance with its MS4 permit since the permit's inception in 2000. The most recent iteration of the MS4 Permit has additional compliance elements that must be incorporated into the City's current compliance practices. The new/additional requirements are described below.

4.2 Public Education and Outreach

To comply with their MS4 permit, the City is required to implement a public education and outreach program to increase the awareness of storm water pollution impacts on waters of the state to encourage changes in public behavior to reduce such impacts. The intention is for the program to be implemented as a group (North Shore group co-permittees) but the City is not prohibited from implementing their own community program. The program may also incorporate cooperative efforts with other entities which are not regulated by the permit.

The previous permit required the North Shore Permittees as a group to increase awareness of how the combined actions of human behavior influence storm water pollution and its effects on the environment. The permittees were to identify target audiences, establish measurable goals, and

develop a mechanism for evaluating effectiveness. The specific education topics included items such as illicit discharge impacts, habitat degradation, yard waste management, proper BMP design and installation, and BMPs for snow and ice removal.

The North Shore Permittees, and other MS4s in the region, have combined resources to support Southeastern Wisconsin Watersheds Trust's Respect Our Waters campaign to provide broad education and outreach to the watershed. The reissued permit will build upon this foundation and broad education program and provide for more targeted education and outreach.

During permit development the permittees expressed interest continuing the group Education and Outreach program. Therefore, the requirements to address the nine broad education topics will remain a group condition and the permittees will need to track and report the education topics, target audiences, targeted pollutants, and delivery mechanism on the annual report.

4.2.1 Localized Education Requirement:

This permit requires focused, localized education by each MS4 permittee. The goal of the individual education program is to identify storm water education needs of the community and provide targeted education based on the identified needs.

The permit specifies 18 months (by November 30, 2022) for each permittee to identify and prioritize the specific storm water quality issues or pollutants of concern in the community. The permittees have flexibility to use a survey or other methods to learn what their MS4 education needs are.

4.2.2 Targeted Education Requirement:

Glendale will use the results of the evaluation and prioritization to select a topic for targeted education within their MS4. The permittees will have an additional 24 months (by November 30, 2024) to develop and provide the education material. The permittees will need to identify metrics which will be used to measure the effectiveness of their targeted education.

For example, if leaf collection and disposal methods are identified by residents as an education need, the permittee could assess quantity of leaf litter in roadways before and after education is provided. After completion of the targeted education, the permittees will have to submit a summary of the results with the next permit application along with plans for targeted education in the next permit term.

4.3 Public Participation and Involvement

The previous permit required permittees to notify the public of activities required by the permit and to encourage input from the public regarding these activities. The new permit contains a similar requirement but identifies more specific activities for public input.

The permittees must allow for public comment and consider comments on annual reports, storm water management plan revisions, adoption of storm water related ordinances, and development of benchmarks for TMDL pollutant reduction.

Lastly, to satisfy the eReporting Rule, the permittee needs to track and report the delivery mechanism and target participants for each activity.

4.3.1 Public Notification requirement

Compliance with the MS4 permit requires the City to implement a program to notify the public of activities required by the permit and to encourage input and participation from the public regarding these activities.

This program shall include measurable goals for public involvement and participation, from various interest groups such as river partnerships, and comply with applicable state and local public notice requirements. The measurable goals are defined and included in the Standard Operating Procedures for Public Involvement and Participation, Appendix 2.

4.4 Illicit Discharge Detection and Elimination

The City of Glendale storm drainage system discharges to the Milwaukee River and Lake Michigan. In addition to stormwater runoff, the storm drainage system connected to each of these outfalls has the potential to carry other discharges introduced to the stormwater drainage system such as sanitary sewage, waste oil, and other substances that may harm downstream water quality. The term “illicit discharge” is generally used to refer to any discharge to a storm drainage system that is not composed entirely of stormwater, except those discharges allowed by an ordinance or permit.

In recognition of the potentially harmful impacts of illicit discharges, WNDR has identified development of an Illicit Discharge Detection and Elimination (IDDE) program as a condition of the City’s Stormwater Discharge Permit.

Both the existing and reissued permit require MS4s to have an ordinance or regulatory provision which prohibits non-storm water discharges into the MS4 system or waters of the state. The ordinance coupled with inspection and enforcement authority are necessary for the MS4 to prevent illicit discharges or improper disposal. As these are existing requirements, the Department expects MS4s to already be enforcing the ordinance or regulatory mechanism.

Section II. D. 4 of the new permit requires development of an enforcement response plan that documents how the MS4 will enforce its illicit discharge ordinance. The enforcement response plan is intended to provide clarity and consistency in enforcement actions the MS4 will complete once an illicit discharge is identified. The enforcement response to all identified illicit discharges may not be the same, consider illegal dumping verses cross connections, so the permittee may identify specific actions for all illicit discharges or identify actions for certain types of discharges. The enforcement response plan must also identify the person responsible for responding to illicit discharge reports.

Field screening remains an effective way to identify illicit discharges or which storm water pipes may have illicit connections. Similar to the previous permit, the permittee needs to identify pollutant parameter action levels used during outfall screening. Based upon the sampling result for a specific pollutant, the permittee may need to take additional action. For example, the concentration of ammonia detected at the outfall may require the permittee to collect a sample for lab analysis and complete a sewer shed investigation to find the source. Other times only follow up monitoring is needed.

The permittee has the flexibility to determine the action levels and corresponding response steps provided the pollutants and specified parameter action levels are identified in the written IDDE field screening procedures or similar document. The Department has developed guidance to assist with developing parameter action levels, and permittees are encouraged to adapt their IDDE programs based upon the results of screening and characteristics of the sewer sheds. The IDDE field screening procedures or similar document shall also explain when a certified lab sample needs to be collected, as these are more accurate and hold greater weight during enforcement.

4.4.1 Outfall Prioritization

Prioritization of outfalls to screen is an effective practice to identify illicit discharges and eliminate the pollutant loads. Similar to the previous permit, this permit calls for identifying priority outfalls.

Permittees may consider factors such as pipe age, condition, material, number of overlapping sanitary service, or other factors when developing their prioritization scheme.

An example prioritization scheme is the Human Illicit Discharge Potential (HIDP) analysis developed by the Menomonee permittees. The HIDP analysis is used to identify outfalls having a high likelihood of illicit discharge based upon multiple variables. The analysis looks at all MS4 outfalls, not just major outfalls.

The North Shore permittees can use a similar prioritization or develop their own methods. Once the prioritization analysis is complete, the permittee should select 1/5 of the major outfalls and priority outfalls to screen each year. Any major outfall showing evidence of illicit discharges or exceeding a parameter action level, needs to be monitored at least once per year.

4.4.2 Outfall Screening

Outfall screening consists of visual observation, field analysis, documentation, and potentially lab analysis. Each permittee is required to develop its own screening procedures. The procedures should include the information the permittee collects, a description of the decision-making process for further investigation and follow up, and documentation of results.

Typically, if flowing water is observed at the outfall, a field analysis should be conducted to determine the source of the flow and the appropriate parameter action levels followed. If general observations and screening indicate the presence of illicit discharge, and the source cannot be readily identified, the permittee should collect a water sample for lab analysis. The water sample should then be analyzed for parameters to aid in determining the source of illicit discharge. Documentation of field screening activities shall be kept for at least 5 years. A summary of the results must be submitted with the annual report. This can be a spreadsheet summarizing the sample results for each outfall. The permit includes a provision for alternative field analysis procedures that can be implemented upon approval by the department.

4.4.3 Illicit Discharge Investigation

The final requirement of the IDDE program is investigation and elimination procedures for responding to known or suspected illicit discharges. Where enforcement response procedures outline how the ordinance is enforced once an illicit contributor is identified, the investigation and elimination procedures outline the actions the permittee will take to respond when illicit discharges are suspected or identified through screening, notification, complaints, or other sources.

Each permittee should have procedures for immediately investigating portions of the MS4 suspected to contain illicit discharge based upon field screening, complaints, visual observation or other relevant information. These procedures shall identify the person responsible, the response time, investigation techniques to employ, and equipment necessary. Each permittee must also have a plan for responding to spills which discharge into or out of the storm sewer, including prevention and containment.

The current permit changes the response time for eliminating illicit discharges or connections. The previous permit required the removal of the discharge or connection within 3 days to the maximum extent practicable and required follow up screening if the source was indeterminant but did not specify a timeframe for resolution outside of the 3-day period.

The permittee must take appropriate actions to eliminate the illicit discharge within 30 days. For public sources, this can mean begin taking steps to stop the illicit discharge. For private sources, this can mean beginning to use the enforcement response procedures (written notice, NON, etc.). Within

the 30-day time period, an initial assessment of feasibility to remove the discharge should be made. If the illicit discharge cannot be removed in 30 days, the permittee must contact the Department. If after initial assessment, the permittee determines it will take longer than 30 days to remove the illicit connection, the permittee must submit an illicit discharge elimination plan within 45 days which identifies the actions and timeframe the permittee will follow to remove the illicit discharge.

For example, if a sanitary sewer is leaking into a storm sewer under a major roadway, significant resources and time may be needed to plan and complete the repair. The permittee will be expected to follow the submitted elimination plan and remove the illicit connection as soon as practicable.

The IDDE investigation and elimination procedures should also include specific notification procedures. Permittees must immediately notify the Department in the case of a spill or release of hazardous substance. The permittees are also required to contact the Department within 24 hours of identifying an illicit discharge. Advance notification of dye testing is also required because dyes are often confused with illicit dumping. Finally, the permittee should contact adjacent MS4s if it identifies an illicit discharge which flows from or into the adjacent permittee's storm sewer.

Each permittee must also maintain a system for documenting illicit discharge activities including complaints, referrals, and investigation activities. Records shall be kept for at least 5 years.

4.4.4 Staff Training on Illicit Discharge Detection

This permit also requires training for those staff responsible for implementing the illicit discharge program at least once during the permit term. This can include police and fire staff, if they are responsible for responding after hours. They may not need to be trained in investigation and clean up, but should understand what an illicit discharge is, and who to report findings to.

4.5 Construction Site Pollution Control

Pollution from construction sites, construction materials and specifically erosion of exposed dirt poses a threat to the natural waterways of the City. Construction sites within the City are required to incorporate erosion control measures whenever there is land disturbance on a property.

This permit continues the requirement to implement a construction site pollutant control program to reduce the discharge of sediment from construction sites. The requirements are similar to the last permit and the changes are intended to add clarity to the permit. The permittees are expected to have a construction site ordinance in place which requires construction plans which meet the performance standards in s. NR 151, Wis. Adm Code, allows for inspection and enforcement to ensure compliance with performance standards, and requires site operators to properly manage waste materials on construction sites.

The requirement for the MS4 to notify landowners of other potentially required permits has been removed because it is the landowner's responsibility to obtain all applicable permits, and the municipality does not always know what are the latest DNR wetland and waterway permitting requirements that could apply to a site.

New requirements in this permit include written plan review procedures, specific construction site inspection frequencies, and written enforcement procedures. The permittees also need to include in the construction program documents how they will respond to information submitted from the public, including complaints.

4.5.1 Written Erosion Control Plan and Permit Procedures

The permittee's plan review procedures should identify the steps construction site operators will follow to obtain a construction permit and the procedures the plan review staff (MS4 permittee) will follow to review and issue construction site permits. The procedures should also describe how the permittee will consider water quality impacts through its plan review process as required in s. NR 216.07 (4) (b). Wis. Adm. Code. The considerations can be in the form of a checklist or specific BMPs for certain site conditions but must describe a consistent process or evaluation that is applied to all sites within the permittee's jurisdiction. For example, the permittee may require certain BMPs on high slope or large sites or additional barriers if the site is adjacent to wetlands or other waterbodies. The permittees may also require identification of portable toilets on construction sites and require them to be on impervious surfaces and in locations of low traffic to limit bacteria runoff.

4.5.2 Erosion Control Inspection Frequency

Each Permittee is required to develop a construction site inspection procedure which consider multiple factors affecting the potential water quality impact. These factors include, site size, slope, soil type, nature of construction, proximity to receiving water, receiving water quality (exceptional, outstanding, impaired, etc.) and previous site operator compliance issues. The EPA Permit Improvement Guidance gives recommended inspection frequencies based upon certain site factors. The sites with higher chance of impacting the receiving water should receive the most inspection attention. Permittees are also required to keep record of all inspections and follow up for 5 years.

All sites with one or more acres of disturbance:

- New projects shall be inspected within the first two weeks of commencement of land disturbing activity.
- All active sites shall be inspected at least once every 45 days.
- All inactive sites shall be inspected at least once every 60 days.

Follow up Inspections:

- Follow up inspections are required within 7 days of any sediment discharge or inadequate control measure, unless corrections were made and observed by the inspector during initial inspection or corrections were verified via photographs submitted to the inspector.

Final Inspection:

- Confirm that all graded areas have reached final stabilization and that all temporary control measures are removed, and permanent storm water management BMPs are installed as designed.

4.5.3 Erosion Control Enforcement Plan Requirement

The new requirement of the construction program is for permittees to develop an enforcement response plan or similar document. The enforcement response plan should describe how and when the permittee will use the enforcement provisions in their local ordinance to ensure the discharge of sediment and pollutants is controlled accordingly. For example, a permittee may elect to issue a stop work order after an initial inspection and follow up inspection 7 days later, to a site which has not installed erosion and sediment control practices but has begun mass site grading.

4.6 Post-Construction Stormwater Management

To comply with the MS4 Permit the City is required to continue to implement and enforce a program that establishes measurable goals and controls the quantity and quality of discharges from areas of new development and redevelopment, after construction is completed.

The post-construction program is intended to control the quality of storm water discharges from the MS4 after construction is complete. The discharges should be controlled for the life of the site or until redevelopment takes place. This permit continues the requirement for permittees to have an ordinance or regulatory mechanism that applies to sites of specific size and requires post-construction standards equal to or more restrictive than Ch. NR 151, Wis. Adm. Code, and Department technical standards. The ordinance shall also require permit a storm water management plan for the site, permit application and associated fees, long term maintenance for post-construction BMPs, and provide the MS4 with inspection and enforcement authority.

4.6.1 Written Procedures for Stormwater Plan Reviews

Similar to the construction site program, the permit requires written procedures the permittee will employ for reviewing plans for sites which require post-construction BMPs. The procedures should describe the permittee's review process and items the permittee reviews to consider water quality impacts. These may include wellhead protection barriers near drinking water sources or additional controls for developments in TMDL areas. The procedures should also describe how permittees review requests for regional storm water controls if proposed by the site developer.

4.6.2 Creating a Tracking System for Stormwater Permits

New to this permit is the requirement for the permittees to develop and maintain a system for tracking all post-construction BMPs. Tracking post-construction BMPs is critical for documenting TMDL progress as well as ensuring BMPs are functioning as designed and meeting the performance standards. The tracking system must include an inventory of all BMPs the permittee uses for credit towards pollutant reduction goals. In order for the MS4 to take credit for a private BMP, there must be a maintenance agreement in place or the MS4 needs to have authority to maintain or require maintenance of the private BMPs. The tracking system should also include the procedures the permittee will follow to ensure long-term maintenance is completed to maintain BMP function. A long-term inspection of each BMP is also required at least once per permit term, and the permittee needs to maintain a system for tracking these inspections. The final piece of the post-construction tracking system is a description of when and how the permittees will use their enforcement authority in the post-construction ordinance to address compliance issue. For example, if the permittees ordinance provides authority to make repairs and bill the property owner, the enforcement response procedures should describe when this authority will be used and steps the permittee will undergo to complete the repairs.

4.6.3 Removing Barriers to Green Infrastructure

The last new requirement of the post-construction program is for permittees to remove barriers to green infrastructure (GI) from their ordinances. Removal of these GI barriers is essential for adoption of innovative storm water management techniques and provides developers and landowners with more alternatives to meet the post-construction performance standards. The permittees should review zoning, site development, storm water management, public works (parking, streets, etc.), landscaping and other ordinances to identify barriers to GI practices and update the ordinances by May 31, 2023. An ordinance audit tool titled "Tackling Barriers to Green Infrastructure: An Audit of Municipal Codes and Ordinances" was developed by Wisconsin Sea Grant in partnership with 1000 Friends of Wisconsin, Orion Planning and Design, and Milwaukee Metropolitan Sewerage District.

The permittees are encouraged to use this tool or similar methods when reviewing their ordinances to identify GI Barriers. Clean Wisconsin, on behalf of MMSD, completed a review of each municipality's ordinances within its service area and developed recommendation based upon the methodology above. Lastly, if permittees are made aware of barriers in their codes and ordinances after May 31, 2023, they are required to modify the ordinance within 18 Months.

4.6.4 Existing BMP Maintenance Requirement

The maintenance requirements for municipality-owned or -operated BMPs has also been moved to the post-construction section because this activity fits within the BMP maintenance and tracking requirements.

The permittees are expected to maintain all BMPs used to achieve their existing control level in accordance with s. 281.16 (2) am (3), Wis. Stats. Maintenance and continued operation of BMPs is necessary to prevent backsliding.

4.7 Pollution Prevention

Permittee shall continue to implement and enforce a pollution prevention program that establishes measurable goals to prevent or reduce the discharge of pollutants in storm water runoff. In this context, "measurable goals" will be met by implementing the pollution prevention activities as described in the following sections.

Glendale will demonstrate (i.e., provide a measure) that it is meeting its goals by documenting its pollution prevention activities as outlined in this report.

The pollution prevention activities consist of multiple programs and training which are employed to reduce municipal sources of pollution. These include winter road management, nutrient management, street sweeping and catch basin cleaning, management of leaves and grass clipping, good housekeeping at municipal properties, and employee training. Each of the program is described in more detail below.

4.7.1 Winter Road Management – Salt Use Management

This permit continues the requirement for municipalities to not apply road salt or deicers in quantities larger than required to maintain public safety. To reduce overapplication of salt and deicers, this permit requires permittees to develop and implement a salt application strategy, salt reduction strategy, or similar document which describes the conditions, equipment and strategy which will be followed during deicing events. The Wisconsin Department of Transportation (WisDOT) Highway Maintenance Manual -Chapter 6, contains guidelines on winter maintenance including application of road salt and other deicers. This document can be used to assist with development of the permittees salt reduction strategy. The permit also requires training on the permittee's salt reduction strategy for municipal staff involved in deicing operations every other year.

The permit requires annual calibration for salt application machinery. The permittee's winter road management program should describe how calibration is completed for each piece of equipment. Factory calibration is not considered acceptable for annual calibration as new machinery has been shown to significantly over apply salt based on factor settings. Calibration is also key for properly using the quantity of deicers used for reporting on the annual report.

4.7.2 Nutrient Management – Fertilizer Use Management

Nutrient management plans are required for fertilizer application on all municipally controlled properties (parks, athletic fields, golf courses, lawns, etc.) with five acres of pervious area. This includes soil samples for each individual property.

4.7.3 Street Sweeping and Catch Basin Cleaning

Street sweeping and catch basin cleaning activities are an effective way to remove large sediment particles that would otherwise be washed away during precipitation events. This permit requires the permittees to track the number of lane miles swept, number of catch basins cleaned, and the weight in tons of material collected annually. If permittees use street sweeping or catch basin cleaning as part of their efforts to meet a performance standard or TMDL reduction goal, the sweeping and cleaning frequencies must be consistent with those identified in the pollutant loading analysis.

Collected material is considered solid waste and must be disposed of in an appropriate manner. If the permittee dewateres the material prior to disposal, BMPs should be employed to prevent contamination with storm water runoff to surface or ground water. All material should be disposed of in a landfill unless the permittee has an approved beneficial reuse exemption from the DNR Solid Waste Program. Currently, none of the North Shore permittees have an approved beneficial reuse for street sweeping and catch basin material.

4.7.4 Management of Leaves

Collection of leaves is an effective measure for reducing nutrient input from urban storm water runoff. While many BMPs are designed to settle out solid materials, leaf matter leaches dissolved phosphorus, which is not captured by traditional settling devices. Collection of leaves before precipitation is essential for reducing dissolved phosphorus contributions from the MS4.

This permit requires permittees to provide a description of their leaf collection program including the methodology and equipment used for collection, the frequency and timing of collection, and instructions for residents and landowners on where to locate leaves for collection. Consistent with the previous permit, the permittee must identify where leaves are disposed of and track the quantity of leaves collected on an annual basis.

A new requirement for the leaf collection program during this permit term is for the permittee to identify BMPs it will employ to the leaf management program to reduce nutrient loading. The permittees should evaluate their current leaf collection strategies and look for opportunities to improve collection practices with the goal of reducing the amount of time leaves are on streets. The overall leaf management strategy should consider the source of leaves, transport (curb and gutter vs. swale), and fate (infiltration practice vs. pond vs. direct discharge). Recent leaf management research shows the phosphorus loading is tied to the quantity of leaves on the streets and the frequency of removing leaves from the street is more important than the method of removing the leaves. Permittees are encouraged to pilot new leaf management techniques as part of the iterative process and identify collection practices best fitting the needs of their residents, street characteristics, and resources while reducing nutrients in runoff.

4.7.5 Storm Water Pollution Prevention Planning – Public Works Yard Management

This permit continues the requirement for municipal garages, storage areas, and other public works related facilities to have storm water pollution prevention plans (SWPPP) for each site under the permittee's control. These sites would normally be covered by an industrial storm water permit, but to minimize the duplication of permits, the requirements for these sites are contained in the MS4 permit. The requirements for each SWPPP are outlined in s. NR 216.27 (3), Wis. Adm. Code, excluding the pollutant monitoring requirements. These include a map of the site, potential sources of pollution, description of housekeeping activities, and description of BMPs to reduce the runoff of pollutants from the site.

If the permittee operates at a site without a SWPPP, one must be developed within 8 months of permit issuance, or by December 31, 2021. New SWPPPs must be submitted to the Department for review.

Quarterly visual inspections should be conducted at each site, and inspections documented. Additionally, an annual inspection should be completed for each site. Any deficiencies found during the inspections should be corrected and the SWPPP updated. Updated SWPPPs should be submitted with the annual report any time revisions are made.

4.7.6 City Staff Education and Training

Like the previous permit, the permittees are also required to provide training to municipal staff involved in pollution prevention activities. One training event must be held during the permit term to cover each pollution prevention topic, except Winter Road Management which education must occur every other year.

4.7.7 Annual Report Submittal

The permit requires that the City submit its annual reports and other permit compliance documents electronically through the Department's electronic reporting system.

4.8 Storm Water Quality Management

The storm water quality management conditions are continued from the previous permit, except for the REMOVAL of the requirement to develop a plan to achieve a 20 percent TSS reduction from the pre-2004 urbanized area.

This requirement was removed because the permittees in the region have collectively achieved a 23.6% reduction and the Milwaukee River TMDL sets much higher reduction goals for TSS. Instead, the quantitative water quality goals have been established through the approval of the Milwaukee River TMDL.

4.8.1 SPECIAL CONDITIONS: TMDL Pollutant Load Reduction Evaluation for TSS and TP

The first step in the TMDL planning process is identifying which reaches the MS4 discharges to and the associated reduction goal.

The permit requires updates to the MS4 map identifying the specific TMDL reach boundaries, structural BMPs and associated drainage areas, and excluded areas. For any excluded areas, the MS4 should specify why the area will not be included in the load reduction evaluation.

Pollutant Load Calculations:

Once the individual TMDL subwatersheds and drainage areas are identified, the permittee is required to estimate the pollutant loading from each watershed with and without controls. The difference between the with controls and without controls pollutant loading is the load reduction. The calculated load reductions can then be compared to the reach goal to determine how much additional control is needed for each reach.

Pollutant Load Reduction Calculations:

The permittee can utilize WinSLAMM software to develop load reduction estimates, even though the permittees are not required to use this program.

Through this plan, Glendale has developed its pollutant load reduction calculations using WinSLAMM. This analysis can be easily updated based upon changes to the individual

watershed. Rather than updating the whole analysis, it will be more cost effective to update one model or subset of models. This will be a useful approach for evaluating progress in future permit terms.

Pollutant Removal Efficiency of BMPs

Lastly for each BMP, the permittee needs to compile a tabular summary documenting the pollutant removal efficiency of the BMP, area treated, and a maintenance agreement for any privately-owned BMP. Any privately-owned BMP without a maintenance agreement should not be included in the pollutant load reduction evaluation.

The Table below lists the permittees’ TMDL reachsheds and their current known TSS and TP reductions. The blank cells indicate where information is not available at the time of permit.

Permittee	Reachshed	TP Reduction	TSS Reduction	Source
City of Glendale	MI-27	n.a.	21.8%	2016 Glendale MS4 Annual Report
	MI-30	n.a.	21.8%	
	MI-31	n.a.	21.8%	
	MI-32	n.a.	21.8%	

4.8.2 SPECIAL CONDITIONS: Establishment of WLA Benchmarks for TSS and TP

Where the TMDL pollutant reduction evaluation shows TMDL WLAs not met for TSS or TP, the permittee must develop pollutant load reduction benchmarks for those parameters and submit them with the permit application package.

The benchmarks should reflect structural controls implemented as part of the permittee’s storm water management program as well as any additional reductions expected to result from BMPs proposed to be completed during the next permit term. Nonstructural controls can be included where effectiveness information is available.

The Department expects the TMDL benchmarks to be permit cycle (5-year basis) targets used to assess progress towards meeting the final WLA goal. The permittee should continue to iteratively manage its storm water programs to reduce pollutants and identify the TMDL benchmarks accordingly.

4.8.3 SPECIAL CONDITIONS: Fecal Coliform Reduction Efforts

The third TMDL pollutant with WLAs from the Milwaukee River TMDL is fecal coliform. While the TMDL allocations in the Milwaukee River Basin TMDL are expressed only in terms of fecal coliform, both fecal coliform and E. coli have been listed as sources of recreational use impairments that the TMDL was completed to address.

Unlike TSS and TP, fecal coliform WLAs are based on a load reduction curve rather than a mass reduction. For permittees, this means that depending upon the moisture conditions, the allowable loading of fecal coliforms changes. Currently, fecal coliform loads greatly exceed the water quality standard under all flow conditions, so efforts are needed across the board.

Parameter Action level Development

The first new requirement in this permit to address fecal coliform is for the permittees to develop a parameter action level to use during illicit discharge screening by June 1, 2022.

This parameter action level shall set a level for bacteria indicator in the sample, that if exceeded, requires specific follow up action or investigation. The permittee has the flexibility to select which bacteria indicator it wishes to use and the associated action benchmark. It is expected the permittee will adjust its action benchmark as more data on dry flow conditions are collected.

While the TMDL WLAs are specified in fecal coliform, which is used as an indicator of enteric pathogens,² the specific indicator selected for illicit discharge is not as important as the action level. This is because the goal of this requirement is to identify illicit cross connections or discharges rather than monitor the level of instream fecal coliform. It is expected that an illicit connection will result in a strong positive result for the selected indicator. The permittee shall provide explanation for why it chooses a specific indicator and include how the tests will be completed.

Fecal Coliform Source Inventory

Permittees are also required to complete a Fecal Coliform Source Inventory by May 31, 2024. For this effort, the permittees will need to identify and locate on a map, other potential sources of fecal coliform entering the MS4. The permit provides a list of potential sources, but this list is not considered inclusive of all sources within the permitted MS4 area.

It is likely that the fecal coliform source inventory will be performed by a consultant team on behalf of the City. The inventory will consist of investigating the storm sewer outfalls for presence of fecal coliform. If found, this will be an indication of cross contamination between sanitary sewers and storm sewers. Such cross contamination is the result of leaky sanitary sewers that can introduce human waste into nearby storm sewers.

Fecal Coliform Source Prioritization

Once the fecal coliform source inventory is complete, the permittee will need to prioritize the sources and identify BMPs to be employed to remove the sources in a Source Elimination Plan. The Plan shall explain the rationale for the prioritization system and provide a cost estimate of the BMPs that will be employed. Lastly, the permittee must develop a schedule for addressing the sources which includes specific actions or benchmarks the permittee will complete during the next permit term. This Source Elimination plan is due with the permit application on November 30, 2025.

Southeastern Wisconsin Watersheds Trust developed a Bacteria White Paper³ which outlines an example approach to addressing bacterial pollution in storm water. Permittees are encouraged to review this paper as they develop their strategy to address Fecal Coliform.

² Final Report: Total Maximum Daily Loads for Total Phosphorus, Total Suspended Solids, and Fecal Coliform Milwaukee River Basin, Wisconsin. Approved by USEPA on March 9, 2018.

³ The Bacteria White Paper can be found at this link: <https://www.swwtwater.org/bacteria-white-paper>.

4.8.4 SPECIAL CONDITIONS: Individual Benchmarks

The individual benchmarks specify the permittee specific actions which will be completed during the next permit term. These requirements were proposed by the individual MS4s.

Where the individually specified goal is a requirement elsewhere in the permit, it is not repeated in this section. These benchmarks should be completed by the end of the permit term unless otherwise specified. The following activities are specifically included in the permit:

- 1. Install three Green Infrastructure or Stormwater Quality projects during the permit period.*
- 2. Develop a DPW yard SWPPP by December 31, 2021.*
- 3. Improve salt storage facility during the permit period.*

5 - CITY OF GLENDALE MS4 PERMIT COMPLIANCE STRATEGY

As outlined in the previous chapter, Glendale has a track record of successful compliance with its Stormwater Permit since its implementation. With the new permit, there will be some modifications and, in some cases, additions to the operations currently underway in the city. In this sense, the recommendations contained in this Plan aim to build on existing practices and achieve a smooth transition from how City personnel operated under the previous permit to a slightly different framework under the current/new permit.

For each compliance element, we created standalone Standard Operating Procedure (SOP) manuals that contain all required compliance activities. We believe that each SOP will become a handy tool for not only compliance with the permit, but also a useful way to assemble the reports needed to be submitted to WDNR each year.

5.1 Recommended Education and Outreach Practices

To comply with the MS4 Permit, the City shall maintain a written document that can be referenced by staff for tracking procedures of the Education and Outreach efforts as outlined in Part II.A.

Additions to the current City practices consist of:

1. Providing additional pamphlets or brochures that address topics pertinent to the target audiences and keep track annually of how many pamphlets were handed out from City Hall. Brochures can be obtained from the Southeast Wisconsin Watershed Trust. An even more targeted approach should include audience surveys after each year of outreach to find out if the provided information was helpful or not. These surveys will provide feedback to restructure the program after each year.
2. Create a stormwater education section on the City website with links to Respect Our Waters (ROW) and SWWT website information. Targeted audiences will have a better chance of following up on information if there is redundant information provided from different media.
3. Work directly with ROW on very specific and direct topics, focusing on one target audience for a specific duration of time. This would allow the City to measure and report on the results from that time period.
4. A recommended Standard Operating Procedure (SOP) document has been provided in *Appendix 1*.

5.2 Recommended Public Participation and Involvement Practices

To comply with the MS4 Permit, the City shall maintain a written document that can be referenced by staff for tracking procedures of the Public Involvement and Participation efforts as outlined in Part II.B.

Additions to the current City practices consist of:

1. Providing annual updates at a City Council meeting to summarize the MS4 annual reports submitted to the DNR. During this meeting the City will provide an opportunity for public comment and questions relating to the City's storm water program.
2. Continue to post the MS4 Annual Reports to the City website.
3. A recommended Standard Operation Procedure (SOP) document has been provided in *Appendix 2*.

5.3 Recommended IDDE Practices

To comply with the MS4 Permit, the City shall maintain a written document that can be referenced by staff for tracking procedures of the Illicit Discharge Detection and Elimination Program efforts as outlined in Part III.A.

Additions to the current City practices consist of:

1. Create specific ordinance language that directly addresses illicit discharge. Language at a minimum should “prohibit the discharge, spill or dumping of non-storm water substances or material into waters of the state or the MS4s.”
2. Include information on the City website for homeowners to report illicit discharges.
3. A recommended Standard Operation Procedure (SOP) document has been provided in *Appendix 3*.

5.4 Recommended Construction Site Pollution Prevention Practices

To comply with the MS4 Permit, the City shall maintain a written document that can be referenced by staff for tracking procedures of the Construction Site Pollution Control Program as outlined in Part III.B.

Additions to the current City practices consist of:

1. Recording and tracking individual inspections of construction sites
2. A recommended Standard Operation Procedure (SOP) document has been provided in *Appendix 4*.

5.5 Recommended Post Construction Stormwater Management Practices

Additional practices the City should incorporate in the Post-Construction Stormwater Management Program consist of:

1. Maintain a record of all maintenance agreements for stormwater management facilities that have been installed in the City.
2. Collect and record annual inspection reports from the landowners that hold maintenance agreements with the City to verify compliance with the maintenance activities listed in the agreements.
3. Implement a maintenance and inspection program of municipally and privately owned stormwater best management practices (BMPs). This includes routine and non-routine inspection and maintenance of City and privately owned BMPs, including Detention Basins, Swales, and Bioretention Basins.
4. Train applicable City personnel on inspection procedures, as well as where the document can be found.
5. A draft Standard Operation Procedure (SOP) document has been provided in *Appendix 5*.

5.6 Recommended Pollution Prevention Practices

To comply with the current MS4 Permit, the City shall maintain a written document that can be referenced by staff for tracking procedures of the Pollution Prevention Program efforts as outlined in Part III.D.

A draft Standard Operation Procedure (SOP) document has been provided in *Appendix 6*.

5.7 Recommended Stormwater Quality Management Practices

The City of Glendale has met its goal of 20 percent reduction of total Suspended Solids discharge to the Milwaukee River during the previous permit period. This was accomplished through the pollution prevention programs as well as the implementation of post construction stormwater management regulations.

No further action is required.

5.8 Stormwater Pollution Prevention Plan (SWPPP) for the DPW Yard

The Department of Public Works updated its SWPPP for the DPW facility in November of 2020.

A draft SWPPP document has been provided in *Appendix 7*.

5.9 TMDL Pollutant Load Evaluation

Glendale has performed the TMDL Pollutant Load evaluation as part of this Stormwater Management planning effort.

A summary of this evaluation is presented in this report.

5.10 WLA Attainment Benchmarks

Waste Load Allocation for Glendale is currently lower than the City's pollutant reduction system can provide. In other words, additional pollutant reduction practices are needed for compliance with the WLA contained in the TMDL study.

Glendale has performed the TMDL WLA Attainment Analysis as part of this Stormwater Management planning effort. TMDL WLA reduction in Glendale will occur through the on-going construction of stormwater best management practices during development as well as limited number of City owned stormwater projects that will be predominantly funded through various green infrastructure funding sources.

A summary of this WLA attainment evaluation is presented later in this report. WLA Attainment plan is due to the Department by May 2024.

5.11 Fecal Coliform Reduction

Fecal Coliform reduction elements in the MS4 Permit seek to identify and eliminate sewage contamination in storm sewers. In many municipal systems, trace amounts of human waste is found to travel between the sanitary sewer system and the storm sewer system, mainly at each leaking sanitary lateral or sanitary sewer pipe that may be in the vicinity of a storm drain or pipe.

Glendale will propose that the fecal coliform reduction requirement be conducted using E. Coli as the indicator bacteria. Similar to e coli limits in wastewater effluent analysis, Glendale will propose that the actionable limits for E Coli in the selected outfalls is 125 #/100 ml. monitored and tested between the months of May and September.

This will be proposed to the Department within the permit period, and testing for E Coli will be included in the Illicit Discharge monitoring program.

Should the IDDE program and testing identify sewage contamination in any of the stormwater outfalls, the City will propose to conduct a detailed tracing study to identify and eliminate these contamination sources from the drainage system.

The commitment to do so will be included in the City's Fecal Coliform Reduction Plan to be submitted to the Department by May 2024.

5.12 Individual Benchmarks for Glendale

Glendale has accepted three individual benchmarks as part of the MS4 Permit renewal process as described in section 4.8.4 at the end of the previous chapter.

Where the individually specified goal is a requirement elsewhere in the permit, it is not repeated in this section. These benchmarks should be completed by the end of the permit term unless otherwise specified. The following activities are specifically included in the permit:

1. Install three Green Infrastructure or Stormwater Quality projects during the permit period.
 - *The first of these is the 2021 Green Alley project. Other similar projects will be implemented in coming years.*
2. Develop a DPW yard SWPPP by December 31, 2021.
 - *The DPW Yard SWPPP is complete and available as part of this Report.*
3. Improve salt storage facility during the permit period.
 - *DPW is working for a better salt storage facility as part of its vision to improve the usability and efficiency of the entire DPW Yard.*
 - *We expect that improvements to this facility will be possible in 2023 or 2024.*

6 - TOTAL MAXIMUM DAILY LOAD (TMDL) EVALUATION

The Stormwater Management Plan update will focus on water quality and compliance with the Milwaukee River TMDL. Updating the sediment loading model computes the reduction of pollutants from City maintained water quality practices.

The water quality modeling is done with the Wisconsin DNR approved and recommended software: WinSLAMM (Windows based “Source Loading and Management Model”) for modeling compliance with TSS removal rates for stormwater management. The findings in this report have been modeled with WinSLAMM Version 10.0.3 based on guidance from the Wisconsin DNR TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance #3800-2014-04 dated October 28, 2014

This program utilizes various inputs to approximately calculate pollutant loading and pollutant reductions in both large-scale areas such as entire municipal areas and small-scale areas on single parcels.

WinSLAMM’s History Webpage states: *“WinSLAMM calculates mass balances for both particulate and dissolved pollutants and runoff flow volumes for different development characteristics and rainfalls. It was designed to give relatively simple answers (pollutant mass discharges and control measure effects for a very large variety of potential conditions).”* Meteorological information, land use and ground cover information, soil characteristics, outfall control practices, particle sizes, and pollutant types are some examples of inputs to WinSLAMM that can help predict sediment loading and runoff volumes on an annual basis.

6.1 Pollution Generation Estimates

WinSLAMM is used to estimate the annual nonpoint source pollution generated from the drainage areas within Glendale. The calculations consider the land cover parameters and, from previous studies of similar land covers, estimate the amount of sediment and phosphorus (i.e., plant material) that could be accumulating and washing off during the course of the year.

To visualize nonpoint source pollution accumulation with time, consider the progressively darkening color of roadside snowbanks in winter. Now consider that the same amount of accumulation occurs throughout the year and that rainfall throughout the year carries that debris to our rivers and streams.

6.1.1 Rainfall Data

WinSLAMM utilizes a parameter file with rainfall data that can include many years or decades of rainfall information for specific metropolitan areas around Wisconsin and other states. For Glendale, the rainfall parameter file recommended for MS4 water quality modeling is the Milwaukee five-year rainfall starting in 1966. The winter seasons of the precipitation data has been removed as snow and ice cannot be accommodated by WinSLAMM. The Milwaukee rainfall is not modeled between December 6th to March 28th.

6.1.2 Runoff Coefficient File

This contains the parameters specific to different land uses and relates runoff volumes with different rainfall events on these areas.

6.1.3 Particulate Solid Concentration File

These parameters allowing the WinSLAMM model to determine the weight of particulate solids loadings from different source area types such as residential areas or freeways.

6.1.4 Pollutant Probability Distribution File

This file describes the pollutant loadings that come from different land use types.

6.1.5 Watershed Boundaries

Watershed boundaries for each Milwaukee River Basin reach were delineated based on the 2018 1-foot topographic contours available from Milwaukee County Land Information GIS (Geographic Information Systems) data and analyzing the stormwater conveyance network.

Four drainage areas along the Milwaukee River have been delineated by the WDNR TMDL report. These four drainage areas have distinct land cover characteristics and may include lands from other municipal jurisdictions as well. In this report, we only include the portions of these four drainage areas that are within the municipal boundaries of Glendale.

Each drainage area is named after a “reach” of the Milwaukee River. TMDL reports focus on individual river reaches to achieve pollutant reduction targets in each of those reaches. Therefore, we must individually identify pollutant sources in each drainage area to each reach, and then seek to reduce those pollutant loads within that reach.

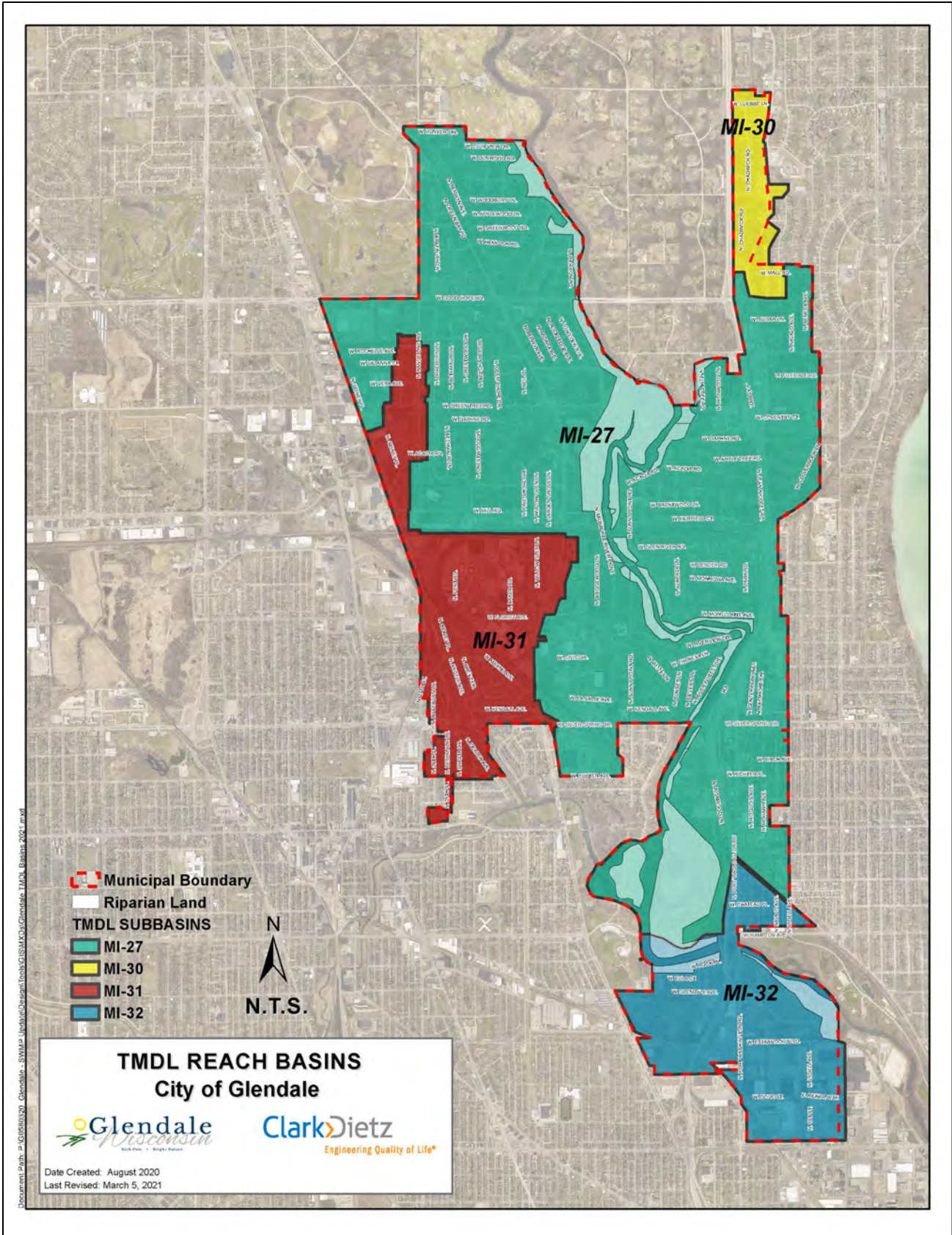
Other communities or jurisdictions that have lands in the same reach have the same pollutant reduction targets.

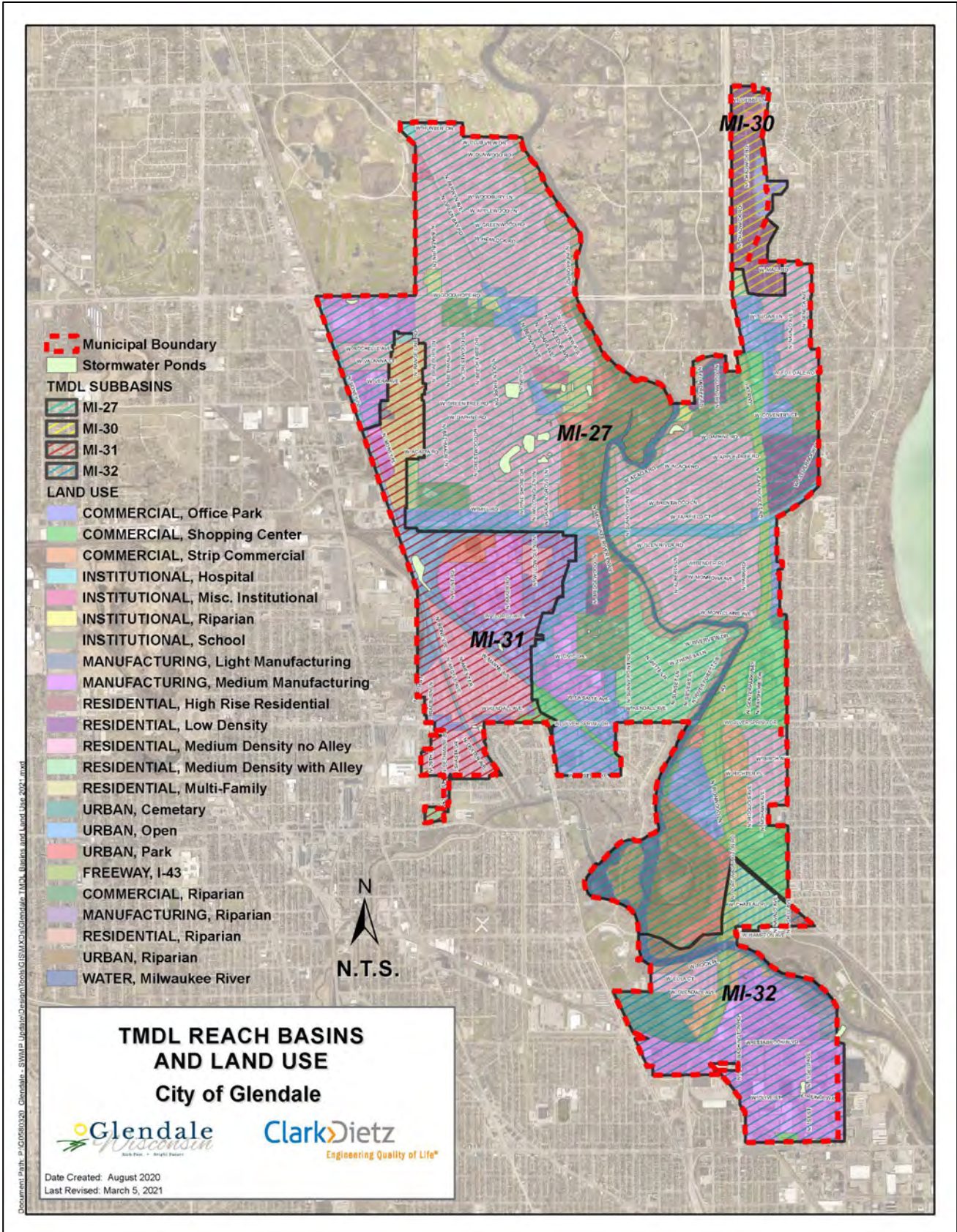
6.1.6 Riparian Areas

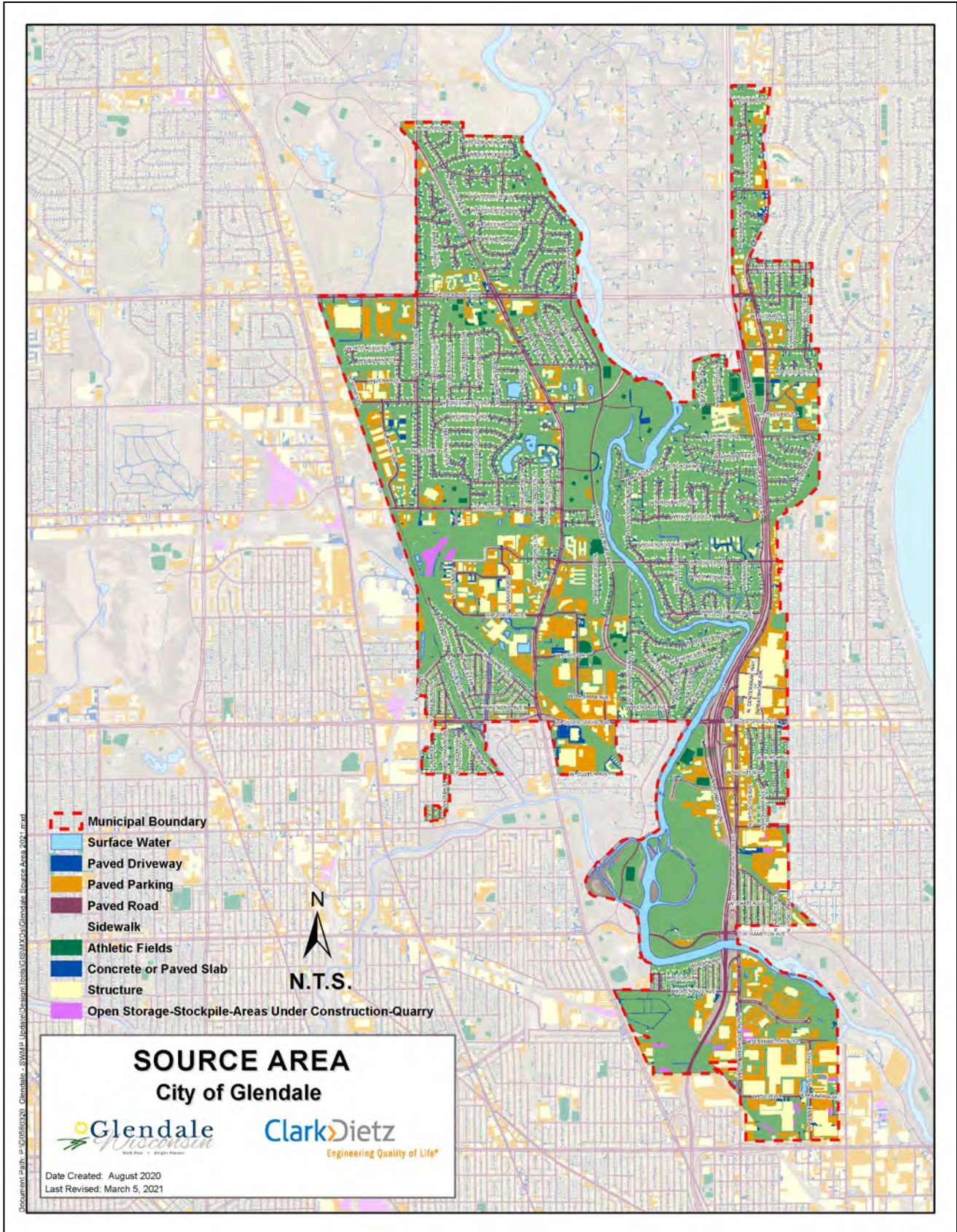
Riparian areas are adjacent to waters of the state that are not serviced by the City’s conveyance system, so these areas are excluded for calculation. The TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance (2014) Part 3 – Modeling provides that areas that never pass through a permittee’s MS4 such as riparian areas are optional to include in WinSLAMM Modeling.

6.1.7 Land Use and Source Area Data

With the help of GIS planimetric data, parcels in Glendale were assigned a Land Use attribute based on the most recent land use information from the City’s GIS Zoning Map as well as visual inspection. These characteristics were associated with an appropriate WinSLAMM Standard Land Use to be included in the Model.







LAND USE IN EACH REACH DRAINAGE AREA

MI-27 LAND USE BREAK DOWN			MI-31 LAND USE BREAK DOWN		
Total:	2222.00	acre	Total:	518.40	acre
Commercial:	434.55	acre	Commercial:	96.79	acre
Office Park	272.15	acre	Office park	90.76	acre
Shopping Center	130.07	acre	Shopping center	6.02	acre
Strip Mall	32.33	acre	Institutional:	2.82	acre
Institutional:	156.14	acre	Misc	2.82	acre
Hospital	3.06	acre	Manufacturing:	89.88	acre
Misc	13.05	acre	Light	8.38	acre
Schools	140.03	acre	Medium	81.49	acre
Manufacturing:	126.04	acre	Residential:	232.81	acre
Medium	126.04	acre	Medium Density w/ Alley	3.50	acre
Residential:	1351.25	acre	Medium Density w/out Alley	156.60	acre
Low Density	85.04	acre	Multi-family	72.71	acre
Medium Density w/ Alley	121.57	acre	Urban :	96.11	acre
Medium Density w/out Alley	1099.17	acre	Open	81.31	acre
Multi-Family	45.47	acre	Parks	14.81	acre
Urban :	154.03	acre			
Open Space	50.71	acre	MI-32 LAND USE BREAK DOWN		
Parks	100.30	acre	Total:	393.98	acre
Cemetaries	3.02	acre	Commercial:	21.29	acre
Riparian Area:	309.52	acre	Shopping Center	2.50	acre
			Strip	18.79	acre
MI-30 LAND USE BREAK DOWN			Manufacturing:	268.09	acre
Total:	114.64	acre	Meduim	268.09	acre
Commercial:	17.22	acre	Residential:	62.07	acre
Office Park	17.22	acre	High Rise	3.89	acre
Residential:	91.36	acre	Medium density w/ alley	32.31	acre
Low Density	91.36	acre	Meduim density w/o alley	25.87	acre
Institutional	6.06	acre	Other:	42.54	acre
Misc	6.06	acre	Cemetary	41.80	acre
			Park	0.73	acre
			Riparian:	40.15	acre

6.2 Pollution Reduction Estimates

Glendale’s waste load allocation (WLA) requires that stormwater management best practices are implemented so that the discharge of pollutants into the Milwaukee River is less than the pollution that normal life creates in our City.

The City of Glendale implements several different types of best management practices for controlling and reducing stormwater pollution, most of which can be modeled in WinSLAMM and accepted by DNR. Many of the detention areas created during development of lands in the city contribute to the pollution reduction within each of our drainage areas.

- Non-structural practices include street sweeping, catch basin cleaning, and leaf collection.

- Structural practices include grassed swales, porous pavement, bioretention, underground detention cisterns, and wet ponds.

Current stormwater management elements that help **reduce** the NO CONTROLS pollution generated within the drainage areas in Glendale are included in calculations as follows:

6.2.1 Street Sweeping

The City owns a 2012 Elgin vacuum assisted street sweeper and completes a full sweep of the City every 2-3 weeks. Street parking controls are enforced, and typical daytime parking is light.

6.2.2 Catch Basin Cleaning

The City has a formal catch basin vacuuming program. The City of Glendale Public Works Department maintains 1,613 catch basins (with sumps) and 1,147 inlets (without sumps) throughout the City MS4 Area. The City has created a City Wide Storm Sewer Catch Basin Cleaning and Inspection Plan.

The plan has outlined a three (3) year cleaning and inspection cycle, utilizing a private contractor and city staff. Once the leaf season is complete, each catch basin (with sumps) is inspected and cleaned once every year; while each inlet (without sumps) is inspected and cleaned every three (3) years. Catch basins and inlets are cleaned utilizing a City owned vacuum truck, or by contractor owned equipment for the portion that is cleaned and inspected by a private contractor.

All street sweeping debris is collected and disposed of in a solid waste dumpster located at the City of Glendale Public Works Yard. The dumpster is disposed of by a third-party contractor as needed. The amount of debris that is collected is tracked based on the weight of the dumpster and the billing invoices from the disposal company.

6.2.3 Leaf Collection

The City of Glendale offers curbside leaf to its residents. Yard waste is collected by the City wide waste management private contractor. The City informs its residents about this service through the City website, newsletter, and use of social media. Residents are instructed to not pile material near a storm sewer in order to prevent organic material from entering the storm sewer system.

Leaf material is collected utilizing City equipment, including: a leaf vacuum unit, a pusher unit, and a yard waste truck. Each collection location is thoroughly cleaned at time of leaf collection to prevent any debris from entering the storm sewer system. When weather allows, the city completes a street sweeping event after leaf collection.

The City of Glendale will pick up leaves beginning early in October through November (contingent upon the weather) provided the following procedures are followed:

1. Leaves raked to the curb and gutter, and road shoulder areas will be collected by the City of Glendale Department of Public Works.
2. Leaves placed on City rights-of-way for City pickup should be raked in long narrow piles that are within reach of the leaf vacuum tube.
3. Piles should not extend into traffic lanes, thereby creating traffic hazards.
4. Crews will not pick up leaves mixed with debris, logs, branches, rocks, plastic, metal or glass containers or any other type of refuse.

6.2.4 Grassed Swales

Fully a third of Glendale has roadside ditch drainage. The average swale geometry was assumed to have 3:1 side slopes with a 2-foot bottom width. For each reach area the total swale lengths were calculated from doubling the roadway lengths where curb was not observed.

A typical grass height was determined to be 6 inches with a swale retardance factor “C” for Bermuda Grass/Blue Grass at a 6” height. The typical swale longitudinal slope was determined to be very minimal throughout the City at 1%

The swale dynamic infiltration rate input has a significant effect on the grassed swale efficiency. The infiltration rate determination was made using the DNR Technical Standard, No. 1002– Site Evaluation for Stormwater Infiltration. There are three methods for determining the static infiltration rate outlined in Step C.3. Infiltration Rate Determination of the Technical Standard, No. 1002. The first method utilizes soil test pits to determine the soil type and infiltration rates are determined based on Table 2. The second method utilizes tested infiltration rates with in-field devices. The third method that was used for this report based the soil type off of the NRCS Web Soils Map as discussed in section 3.2 and determined the dynamic infiltration rate the same way as method one with the design rates from Table 2.

The swale dynamic infiltration rate of 0.067in/hr. was determined by comparing the silt loam soil type within the City to DNR Technical Standard, No. 1002 – Site Evaluation for Stormwater Infiltration. The swale modeling guidance mentioned in Chapter 3.1 states “Prior to entering an infiltration rate in the model, the design infiltration rate from Table 2, must be reduced by 50%.”

6.2.5 Detention Ponds

The City owns and maintains a number of stormwater detention ponds that benefit water quality. Each of these ponds have been included in the models, taking credit for the sediment and phosphorous reduction properties.

The City owned detention ponds are as follows:

- Wiscona Pond
- Silver Spring/Crestwood Ponds
- Tech District Ponds

6.2.6 Green Infrastructure

The City owns and maintains a number of bioretention facilities classified as green infrastructure. The most recent of these facilities are located at City Hall and Bender Road, across the street from the REM Community Center.

6.2.7 Private BMPs

It has come to our team’s attention that the many stormwater facilities constructed in the City have not been properly recorded with binding maintenance agreements recorded at the County Register of Deeds. Therefore, the City is unable to take pollution reduction credits for these facilities at this time.

Significant stormwater facilities that will add to Glendale’s WLA efforts are:

1. Bayshore pervious pavement
2. Hobbs Pond

3. REM Recreational Complex stormwater facilities
4. Infinity North Shore
5. Heartis Village
6. Bender Rd Apartments
7. Aldi
8. Amato Chrysler
9. Heiser Ford
10. Napleton Lexus

The City is currently cataloguing maintenance agreements for the above list and potentially others and will soon update the pollutant reduction estimates based on these structural best management practices in the city.

It is expected that the inclusion of these facilities in the pollutant reduction calculations will bring the City closer to its WLA.

6.3 WinSLAMM Calculation of Generated Pollution

A WinSLAMM Model was created for each TMDL reach area in the City. The results of the run model are shown below.

Existing Modeled Reduction from No - Controls							
Reach	Area (acres)	TP Yield (lbs/year)	TSS Yield (lbs/year)	Average TP (lbs/year) MODELED Reduction	Average TP Percent MODELED Reduction	Average TSS (lbs/year) MODELED Reduction	Average TSS Percent MODELED Reduction
MI-27	2,222	1951	621,000	492	25%	184,400	29.7%
MI-30	115	89.5	24,557	17.72	20%	6,988	28.5%
MI-31	518	440.4	153,950	82	19%	39,023	25.3%
MI-32	394	336.4	165,583	81	24%	57,874	35.0%

The table above describes how Glendale’s current stormwater efforts help reduce pollution discharges to the Milwaukee River. We note that these efforts are/were in full compliance with Glendale’s previous MS4 permit.

We see that phosphorus generated in the City is reduced by an average of 25 percent and total solids (sediment, dirt, and grit) are reduced by an average of 28 percent before being discharged to the Milwaukee River.

Previous targets for reduction were 20 percent in each category and Glendale met those goals throughout the life of the permit, since 1999.

6.4 Comparison with Milwaukee River Basin TMDL Requirements

Pollution reduction targets are more stringent under the new permit. The City is part of the MI-27,30,31 and 32 Milwaukee River TMDL Reach Basin. The Total Maximum Daily Loads for Total

Phosphorous, Total Suspended Solids, and Fecal Coliform – Final Report (DNR TMDL Report) contains specific loading reduction requirements for the City is summarized below.

Required % Reduction of MS4 TP and TSS- FINAL From Baseline				Required % Reduction from No - Controls	
Reach	Area (acres)	Average TP Percent Reduction	Average TSS Percent Reduction	Average TP Percent Reduction	Average TSS Percent Reduction
MI-27	2737	48%	66%	54%	73%
MI-30	121	73%	57%	76%	66%
MI-31	430	84%	64%	86%	71%
MI-32	492	14%	48%	24%	58%
Note: Percent reduction is calculated as the average of the monthly percent load reductions from baseline.					

The required reductions are presented in the DNR TMDL Report as a percentage from a baseline condition. The baseline condition is considered by the DNR to be a 20% reduction of TSS from a no-controls condition. TP baseline condition is considered a 11.3% reduction from a no-controls condition.

These percentages reflect the stormwater quality regulations in s. NR 151.13 and set the starting point for the TMDL allocations. TMDLs are required, at a minimum, to one day meet regulatory requirements.

The reductions from baseline are given as a percentage above and beyond the regulatory requirement. The WinSLAMM Modeling results are given as reductions from a no-controls condition. The conversion between no-controls and baseline reductions is presented in the Wisconsin DNR - TMDL Guidance for MS4 Permits and shown below:

- No Controls Reduction of TSS = $20 + (0.8 * \% \text{ Baseline Reduction of TSS})$
- No Controls Reduction of TP = $11.3 + (0.887 * \% \text{ Baseline Reduction of TP})$

TMDL Pollution Reduction – Waste Load Allocation						
Reach	No Controls TP lbs/yr	No Controls TSS lbs/yr	Baseline TP bs/yr	Baseline TSS bs/yr	TP Allocation lbs/yr	TSS Allocation lbs/yr
MI-27	1,951	621,000	1,726	496,800	897	168,912
MI-30	89	24,557	78	19,645	21	8,447
MI-31	440	153,950	390	136,553	62	49,159
MI-32	336	165,583	298	132,466	256	68,882

The Glendale WLA for total phosphorus and total suspended solids is shown in the table above.

6.5 Summary of Results

The modeling results are consistent throughout each reach area with TSS reductions within 10% of each other and the TP reductions within 6% which would be as expected. The City’s basins contain equally diverse land use areas contributing to the sediment loading.

The modeled reductions show that the TMDL requirements are not being met by the current City treatment practices.

The gap between Glendale's current pollution reduction performance and the prescribed WLA represents the compliance effort to be performed in the coming years. As a whole, the effort to bridge this gap will be called WLA Attainment Plan, due for submittal to DNR by May 2024.

The summary of the WLA attainment gap is as follows.

TMDL Pollution Reduction – Waste Load Allocation Attainment Gap						
Reach	Current TP Discharge bs/yr	Current TSS Discharge bs/yr	TP Allocation lbs/yr	TSS Allocation lbs/yr	TP WLA Gap lbs/yr	TSS WLA Gap lbs/yr
MI-27	1,459	436,600	897	168,912	562	267,688
MI-30	72	17,569	21	8,447	51	9,122
MI-31	358	114,927	62	49,159	296	65,768
MI-32	255	107,709	256	68,882	0	38,827

The comparison between the current TP and TSS discharges to the Milwaukee River from the four reaches shows that significant future water pollution reduction efforts will be needed. However, we also note that several BMP and pollution reduction facilities in the City are yet to be included in the pollution reduction calculations.

The WLA attainment gaps indicated above will be the stormwater target for the City for the years to come. We recommend that the attainment plan extends into the second permit renewal and that the City go about its attainment effort in a steady and methodical manner.

7 - WLA ATTAINMENT PLAN

This chapter discusses opportunities for the City to close the pollutant reduction gap between the current and the required TMDL reductions. Both nonstructural and structural alternatives are presented. Structural alternatives considered for water quality improvements were chosen to blend into the urban surroundings and build upon the City's proactive approach to analyzing all capital improvement projects for the inclusion of stormwater management structural controls.

7.1 Consider/Evaluate Increasing Street Cleaning Frequency

TSS reduction currently achieved by the street cleaning practices achieve 15% of the annual load within the TMDL area. Utilizing the vacuum-assisted sweeper for a more intensive schedule during the non-winter months can increase the annual load reductions.

Realized reductions from either bi-weekly or weekly cleaning frequencies are shown below. The increase in Total Phosphorous reduction is also shown.

<u>Frequency</u>	<u>Annual TSS Reduction</u>	<u>TP Reduction Increase from Current Practices</u>
Monthly Street Cleaning	15%	+ 0%
Bi-Weekly Street Cleaning	22%	+ 4%
Weekly Street Cleaning	28%	+ 7%

Increased frequency of street sweeping would require either contracted services, or the purchase of the Village's own vacuum-assisted sweeper with increased knowledgeable staff to perform the required actions.

7.2 Catch Basin Cleaning

It is worth noting that increases to the frequency of catch basin cleaning does not appear to have any significant impact on improved pollution reduction performance. Therefore, we recommend that the current catch basin cleaning plan is maintained.

7.3 Maintenance Agreement Compliance

As previously discussed, Glendale has a huge potential to realize additional TSS reductions from private developments. A partial list was provided in the previous chapter. Glendale must follow up with existing stormwater facility installation to secure maintenance agreements.

This will allow these practices to be added to the WinSLAMM Model and overall pollutant reduction.

1. Verify maintenance agreements have been recorded with past land developments, and follow-up to obtain them if records are not found.
2. Collect and record annual inspection reports from the landowners that hold maintenance agreements with the City to verify compliance with the maintenance activities listed in the agreements.

7.4 Regenerative Stormwater Conveyance at Outfall Locations

A regenerative stormwater conveyance system (RSC) is a series of stepped rock weirs that create riffle pools that treat quantity and quality of stormwater runoff. RSCs are effective at reducing

pollutants from otherwise untreated point outfalls before the stormwater reaches the ultimate downstream water body or installed to manage the first flush from surface runoff.

Several of Glendale’s stormwater outfalls are along the Milwaukee River, set into the steep banks. This system is ideal for steep slopes where other practices would not be feasible.

Typically, a three-cell system with established vegetation and stone storage promoting infiltration will yield 70% TSS reductions and 20% TP reductions.

7.5 Structural Stormwater Facilities

Many engineered systems can be effectively used to increase Glendale’s pollution reduction performance and get the City closer to its WLA attainment. Many of these systems have already been used in the City, and their continued application will be an important element in MS4 TMDL compliance.

The expected pollution reduction benefits each structural stormwater management practice is presented in the following table. We note that these benefits accrue to the City regardless of ownership, as long as properly recorded maintenance agreements are enforced.

It is recommended that the City target a pollution reduction improvement of 5 percent per year for the next 10 years. The reduction ranges indicated in the table below show the types of activities to be included in the City’s annual infrastructure plan.

MMSD Green Solutions Approved - Green Infrastructure Pollutant Reduction Strategies	Description	REDUCTION POTENTIAL	TSS REDUCTION EFF.	TP REDUCTION EFF.	Notes
Green Alleys/Streets/Parking Lots/Sidewalks	Permeable/Porous Pavements	High	65%	35%	Assumed 24" Stone storage with underdrain
Terrace Bioswales/ Bioretention	Biofiltration	High	80%	35%	Requires filtering through an engineered soil and discharge via an underdrain.
Stormwater Trees (Tree Pits)/Bioretention	Perhaps to replace Ash trees? Tree Pits	High	80%	35%	Possible to use current tree locations and existing trees. < \$1000 to remove and put back 6" diameter tree
Green Roofs	Municipal buildings	Low	-	-	No WinSLAMM Modeling. Not recognized by DNR as a pollutant reduction strategy
Constructed Wetlands	Depressional areas with slow release	High	80%	67%	Similar to Wiscona
Native Landscaping	Well rooted plants trap and filter pollutants	Low	30%	21%	Depends if designed as filter strip or grassed swale
Rain Gardens with Engineered Soil	Soils help infiltrate and treat pollutants	High/Average	60%	60%	Micro scale, runoff areas less than 4000SF, Max 300 SF footprint
Infiltration Basins	infiltrating soils help pollutant reduction	High	100%	100%	No underdrain, require good infiltrating soils
Cisterns	Capture runoff, slow release for pollutant settling	Average	80%	67%	Depends on size and flow
Regenerative Stormwater Conveyance	Stone plunge pools with sand/mulch filter layer below	High	70%	20%	Depends on size and flow, good for channelized stormsewer outfalls

7.6 Funding Options

7.6.1 Glendale's Stormwater Utility

Recognizing the need for an alternative revenue source, Glendale established a stormwater utility and became only the second metropolitan municipality to clearly identify stormwater management as a distinct service to its residents.

7.6.2 MMSD Green Solutions Program Funding

The MMSD Green Solutions funding is provided annually to municipalities. More information is found at the below website:

<https://www.freshcoastguardians.com/take-action/municipal>

The program overview as stated from the website reads,

“To assist the municipalities served by the Milwaukee Metropolitan Sewerage District (District) with Total Maximum Daily Load (TMDL) compliance and to improve municipal stormwater management that may affect the District’s system, the District’s 2015-2024 Capital Budget includes a project, Green Solutions (GS), that will serve as a funding mechanism to the municipalities for Commission-approved types of green infrastructure and combined sewer separation.”

7.6.3 Wisconsin DNR Grant Funding

Targeted Runoff Management Program

The DNR TRM Grant is given to municipalities with a 70% cost share for BMP’s to help meet TMDL’s.

Website: <https://dnr.wisconsin.gov/aid/TargetedRunoff.html>

Urban Non-point Source Construction Grant Program

Additional grant funding that is most geared towards TMDL compliance projects in Urban areas is the grant opportunity provide every odd year, (2021, 2023, 2025, etc.). The DNR ranks the grant applications and provides 50% cost share for a total reimbursement that cannot exceed \$150,000 for construction and engineering, plus an additional \$50,000 for land acquisition.

Website: <https://dnr.wisconsin.gov/aid/UrbanNonpoint.html>

7.6.4 Fund for Lake Michigan

Each year until 2035 the Fund for Lake Michigan provides \$4 million for projects that support and promotes their mission:

“The mission of the Fund for Lake Michigan is to improve the health of Lake Michigan, its shoreline and river systems, for the benefit of the people and communities that depend on it for water, recreation and commerce.”

8 – DRAINAGE MANAGEMENT

Apart from stormwater permit compliance matters, the Stormwater Management Update also provides a summary status report on drainage issues that were first identified in early 2005. Many improvements have occurred in the intervening years, and we are presenting a status report that will guide future drainage improvements in Glendale.

Overall, as previous hydraulic and hydrologic analysis shows, the storm sewer system has the proper capacity to handle a 1.5 to 2.0 inch rainfall event, which is the appropriate level of service commonly found in municipal environments. However, since the pipe system cannot handle storms larger than the 1.5 to 2.0 inch rainfall, overland drainage routes are critical in preventing flood damage. Glendale has a few of these land-locked areas lacking in overland drainage to relieve flood risks.

8.1 Flood Prone Areas

8.1.1 FLOOD PRONE AREA NO. 1

Location: “Lake Glen”. A partially water-filled former gravel pit just north of Green Tree Road between Neil Place and Glen Shore Drive.

This man-made depression was included “as is” in a residential subdivision, and homes were constructed on lots platted around its perimeter. The normal water surface, regulated primarily by sub-surface ground water levels, is below any existing or proposed storm sewer discharge system.

The existing storm sewer system in Green Tree Road which drains to the east and outlets in the Milwaukee River, can be utilized as an emergency overflow only when the peak flows in this sewer are gone and there is capacity available. A flap gate in a structure over a lake overflow sewer to the Green Tree system allows water to leave the lake only when the Green Tree system can accept it.

At the time of development, the owners were informed that should undesired excess flows accumulate in the Lake, they can be discharged only by pumping and then only to the existing road ditches in Neil Place and Edward Lane. A pipe overflow was installed at that time from the water's edge to a manhole structure in Neil Place approximately at the northeast corner of the Lake. High water levels in the Lake would then be transferred to this accessible manhole located in public right-of-way, and could be pumped therefrom.

The master sewer design for the area provides for an ultimate extension of storm sewers south in Glen Shore Dr. and east in Edward Lane from their present connection point in W. Bernard Lane. These existing and proposed sewers have provided for the pond area in their design, but do not contain any excess capacity for major flood-generated flows.

Therefore, the pumping rate to be utilized cannot exceed that to which the sewer system can accept. All monitoring and pumping activities are to be performed by the owners of “Lake Glen” themselves. There is no City facility other than the two listed above to which overflows from the Lake could be economically discharged. Even then, the discharge rates must be strictly regulated.

Recommendations: Extend storm sewer south in Glen Shore Drive, east in Edward Lane, and south in Neil Place to where the north overflow from Lake Glen discharges to the pump access manhole.

8.1.2 FLOOD PRONE AREA NO. 2

Location: N. Sunny Point Lane and part of N. Sunny Point Road north of the Railroad embankment.

All of N. Sunny Point Lane lies in the floodway of the Milwaukee River. Any stormwater improvements would only function during lesser storm events when the water level in the river would permit free discharge. In part of this area is a dike or berm along its eastern border which limits the extent of flooding. A recent subdivision was developed just east of this berm (River Park Meadows). The building sites were filled above the flood protection elevation, the grade of N. Sunny Point Road adjacent on the east was raised, and storm sewer was provided. Most of this new sewer drains southwesterly through the subdivision to the river. A flap gate was provided in a storm sewer structure, which would close in periods of high water in the river. Obviously, any further runoff that would occur after the gate was closed would have to be stored in the sewer pipes and on the land itself until the river level dropped and the gate opened.

W. Acacia Road at the north end of Sunny Point Road is technically out of the flood plain. However, it also contains an additional storm sewer, which could be subjected to backwater flooding from the river. It is not known if there is a flap gate on the outfall, but this could benefit the service area during high water conditions at the river.

Recommendations: When any lots are developed east of Sunny Point Road and Cedar Ridge is extended, additional storm sewer segments will be needed. Carefully consider floodplain zoning regulations for any proposed activity along the road. Install a flap gate on the Acacia Road storm sewer outlet headwall. Maintain gates at least yearly.

8.1.3 FLOOD PRONE AREA NO. 3

Location: Lower Clovernook Ravine between Acacia Road and Brentwood Court and east of Elm Tree Road

Other than the June 21, 1997 flood, we have no knowledge of excessive flooding in this heavily wooded ravine area. It no longer receives drainage from east of Port Washington Road, therefore all runoff collected would only originate from the backs of the residential lots adjacent thereto.

This area enters a storm sewer system just north of Fairfield Court and discharges again to a culvert located under the railroad embankment approximately at Bittersweet Lane extended. See flood prone area No. 4 below.

Recommendation: Inspect and clean channel in wooded ravine throughout its length. Improve entrance conditions to storm sewer. Verify that the west bank of ditch high enough to control back yard flooding of lots facing Elm Tree Road. Access to the ravine may have to be from Jean Nicolet Road to perform this work.

8.1.4 FLOOD PRONE AREA NO. 4

Location: Bender Creek from Bender Road southeasterly to the Milwaukee River

South of the railroad tracks this drainage system continues in an open channel which is inadequate to handle any major storm flows. The channel then enters into a large storm sewer in W. Bender Road, proceeds west and discharges in the so-called Bender Creek.

This length of open channel can benefit from a regular (5 year) program of maintenance, primarily cleaning and removal of forest debris. The first maintenance has been performed in 2019 and significant improvements in flow have been realized.

Continued regular debris and woody material removal at a 5-year cycle is strongly recommended. This area is worthy of keeping a watch on, but would be considered less critical than previous years.

Recommendations: Improve the open channel in the drainage easement from railroad to Bender Road, re-grade and landscape former deep open channel (remove paved invert). Clean Bender Creek flow bed south of Bender, remove debris and sediment. Inspect integrity of large culvert structure crossing Montclair Avenue.

8.1.5 FLOOD PRONE AREA NO. 5

Location: Most of this older area of the City lies in the flood plain of the Milwaukee River, north of Silver Spring Drive and east of Milwaukee River Parkway.

Developed long before floodplains and floodways were established, much of the area consists of filled low lands. Very few storm sewers exist in the area and all are of questionable capacity under current standard design criteria.

Flood prone properties in this area have been the target of acquisition and removal of residential buildings to create publicly owned green space. This is the most efficient way to protect property damage due to flooding in the Milwaukee River floodplain.

Recommendation: Examine capacity of existing old storm sewers and augment with extensions in all streets. Add flap gates on each river outlet. Re-grade and curb all streets to facilitate on-site street runoff storage during major storm event when river level is high. Project will likely require more than one construction season to implement due to the amount of cost to be incurred in this relatively large area.

8.1.6 FLOOD PRONE AREA NO. 6

LOCATION: Crestwood subdivisions north of Silver Spring Drive and tributary to a north branch of Lincoln Creek.

Flooding in this area can only be attributed to the inadequacy of the existing waterway known as "Crestwood Creek." All local storm sewers are capable of handling the flows for which they were designed, as per MMSD requirements.

The Silver Spring reconstruction project originally included a system of interceptor storm sewers on each side of the main creek channel to collect and separate local drainage from the creek flows. This intercepted drainage was to be routed through the stormwater detention ponds constructed as a part of the project. The ponds are designed to eliminate backups from the Creek into the local Crestwood sewers, unless the backup originates from Lincoln Creek and its north branch.

There are five (5) box culverts along Crestwood Creek between Silver Spring Drive and Marne Avenue. All have been designed for the 25 year storm event – 2.0 to 2.5 inch rain. All necessary storm sewers in the local streets south of Wingate Avenue are currently in place.

However, Crestwood Addition, from Wingate to the northwest has no storm sewers and the flat grades and clogged ditches and culverts have long been a source of local flooding and citizen complaint.

Recommendation: The following are the recommended activities to alleviate flood risks along Crestwood Creek:

- Routine cleaning of the City of Milwaukee's grate on the downstream end of the Silver Spring culvert.

- Removal or replacement of the grate on the downstream end of the Silver Spring Drive culvert to reduce potential blockage from debris.
- Removal of accumulated rocks downstream of the Silver Spring Drive culvert.

8.2 City-wide Ditch Improvement Program

Fully a third of Glendale has roadside ditch drainage. We estimate that there are 26 miles of roadway with ditch drainage in Glendale, resulting in a total ditch length of 275,500 feet. A considerable amount, given that we generally view our City with a more suburban/urban complexion.

A number of street segments have been identified for drainage and roadway improvements over the last several years. Even though recent capital investment priorities have shifted to the elimination of watermain breaks in Glendale, drainage and roadway improvements still demands our attention.

However, while past improvement needs have focused on curb and gutter installation, present improvement philosophy is to preserve the more suburban look of Glendale's neighborhoods. Enclosing ditches and building curb and gutter is no longer part of our day-to-day infrastructure outlook.

Instead, the drainage management plan divides the City into 8 units and tries to schedule a regular rotation of maintenance and drainage review. As part of this review, we would recommend addressing two areas per year so that improvements can be implemented quickly.

Once implemented, we believe that there will be a long-term benefit to residents, and we would not expect additional improvement needs to arise in many years to come. In this sense, ditch and culvert improvements in these 8 units will fully and quasi-permanently address any issues that may be present.

In addition, these ditch improvement projects will also remove/replace a number of ineffective driveway culverts that are not replaced by property owners but continue to impeded ditch flows and therefore reduce the effectiveness of our drainage system as a whole. Properly set driveway culverts, and properly sloped ditches improve the overall quality and presentation of our neighborhoods and add to the quality of life we expect from our city.

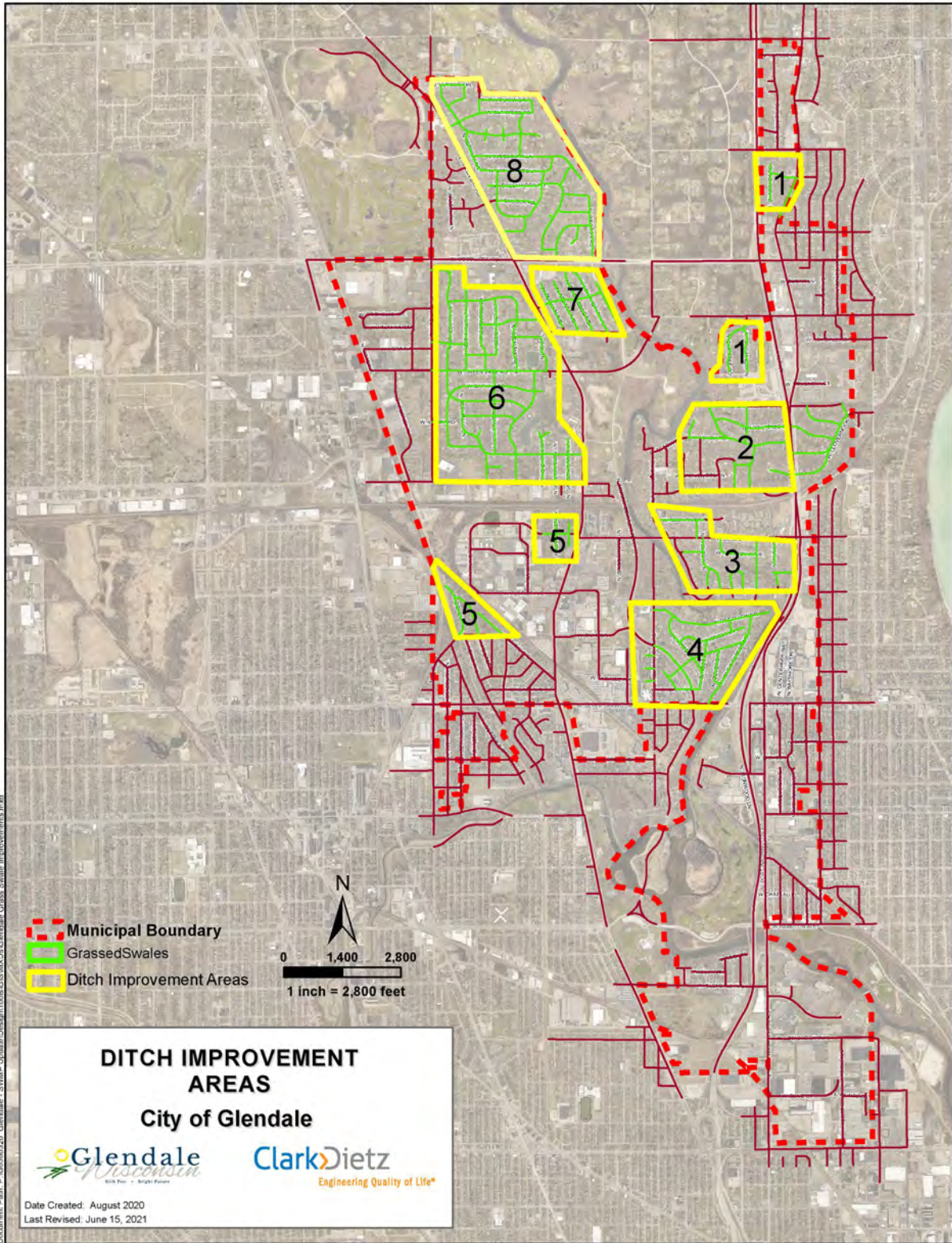
The 8 units are numbered in a counterclockwise direction, and the unit numbers do not reflect priorities which will be presented in the following discussion.

8.2.1 Unit 1: Isolated Northeast Neighborhoods – LOW PRIORITY

The two neighborhoods in Unit 1 consist of the Elm Tree/Ironwood just south of Green Tree Rd and Chadwick/Bayfield Avenue. There has been recent drainage and ditch erosion issues reported at

Elm Tree, and in general we know that the ditches in this neighborhood are overgrown and squeezed out by property encroachments. A review of these ditches with respect to the full width of the right of way is warranted. Ditch improvements will be needed, and vegetation and other debris clearing are also needed.

Chadwick/Bayfield area have very flat ditches, but these are generally in good shape, especially judging by the alignment of the driveway culverts.



8.2.2 Unit 2: Lower Clovernook – HIGH PRIORITY

This unit is the entire Historic Clovernook subdivision which has a mixture of flat, undefined ditches, as well as deep and lined ditches. Culvert conditions vary greatly, with some that are large and properly set, while others crushed and bulging out of driveways.

All things considered, the entire Clovernook needs a thorough drainage ditch review. The result of this review will undoubtedly result in the identification of ditching and culvert improvements in many streets, predominantly the east-west aligned roadways that vary greatly in slope and ditch capacity.

To west of Clovernook, we have to account for the effects of the Milwaukee River floodplain. This matter was covered previously under Flood Prone Area No. 2.

Unit 2 improvements will likely be similar to the Mt. Royal ditch project in scope and extent. We would expect that this work would result in significant improvements in ditch appearance, driveway culvert condition, as well as longevity of streets.

8.2.3 Unit 3: Bender's Subdivision – Glendale Garden – MEDIUM PRIORITY

This area is essentially bound by Bender Rd. to the north, the Milwaukee River to the west and south, and the Interstate to the east. A lot of this Unit is covered in whether the Milwaukee River floodplain or the floodway itself. The Unit also has a well-defined drainage channel through the backs of the lots, generally called Bender Creek.

Montclair Avenue is curbed. However, all the other streets in this unit have undefined ditches, some with no culverts or buried structures. Those streets not curbed should be reviewed for drainage and if at all possible, limited ditching should be provided.

The almost complete lack of any elevation change is the main challenge in improving drainage in this Unit. While we expect that defined ditches are difficult to find in this area, it is also difficult to create the slopes needed to drain the streets to the river.

Nevertheless, we recommend that a topographic review be conducted and the possibility of creating some semblance of positive drainage to the river be explored. We anticipate that any improvements in this Unit will be limited in scope (because of the physical/topographical conditions). This presents an opportunity to combine the study and the improvement design with other Units.

8.2.4 Unit 4: Riverview – River Forest – Parkway – MEDIUM PRIORITY

Unit 4 is almost entirely included in the Milwaukee River floodplain and as such, ditch improvements will be limited to more common rains rather than flood protection during river flooding events. However, a review of these ditches should be performed as many streets suffer from flat to non-existent ditches and sporadic culvert effectiveness.

The anticipated results of a drainage review and potential improvements is identical to our view of Unit 3 above.

8.2.5 Unit 5: North Crestwood / Bender West – HIGH PRIORITY

The northern tip of Clovernook has a number of ditches that are flat and do not flow properly. It is common to find wet ditches in this area even during dry periods. Improvements in this corner of Crestwood are possible either through ditch work, or storm sewer extensions, or a combination of both. We recommend a drainage study to identify these options.

While no reported drainage issues are recorded in Bender West (Garden Grove / Willow Glen) we should include these short streets in the review of Unit 5 issues. We do not anticipate any major improvement needs in these two streets.

8.2.6 Unit 6: West Side – LOW PRIORITY

Unit 6 is the largest drainage unit identified in this report. Despite this, there has not been very many drainage issues reported and we expect that an assessment in this area will not yield a significant improvement need. In general, a well-established side of the city, the west side has well defined ditches and many culverts are properly set and do not need any intervention.

Drainage is also greatly helped by elevation changes throughout the area.

8.2.7 Unit 7: Kletzsch Park Estates – LOW PRIORITY

This small Unit is tucked in between Good Hope Road, Milwaukee River Parkway, Edward Lane, and Green Bay Ave. Roadside ditches are well defined and no reported or observed drainage problems exist, though there are several crushed and rusted out cross culverts present in the neighborhood.

The elevation change from north to south helps in good drainage and no complaints have been recorded on this matter.

8.2.8 Unit 8: River Edge – MEDIUM PRIORITY

Another large Unit, River Edge has a bit of everything – flat ditches as well as steep slopes and good drainage on some streets. Reported ditch and drainage issues in this Unit should be studied and ditching and culvert replacement be scheduled.

River Edge, as one of our largest ditch and culvert service areas, would certainly benefit from improvements in ditch quality, however, we would not anticipate a very extensive ditching project in this area, mainly because we see that almost all of the drainage system is properly designed, properly installed, and properly maintained. Nevertheless, a drainage study is in order.

8.3 Ditch Improvement and Drainage Study Costs

In recent years, Glendale has implemented an annual drainage improvement budget to address drainage ditch issues that may be present. We estimate that each of the units listed herein would be the subject of an annual study, and funded as part of the annual program.

We would budget between \$10,000 and \$20,000 per drainage study, and continued budgeting of \$125,000 per year for ditch and culvert improvements.



Engineering Quality of Life®

Mustafa Emir, PhD, PE

Senior Vice President

Clark Dietz, Inc.
759 N. Milwaukee Street, Suite 624
Milwaukee, WI 53202

☎ 414.315.1933

✉ mustafa.emir@clarkdietz.com

clarkdietz.com

Join us on social media:

