

## APPENDIX 1B: Functional Descriptions of MMSD Asset Systems

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# Functional Descriptions of MMSD Asset Systems

The following sections provide a functional description of the four primary asset systems that are evaluated in the 2050 Facilities Plan (2050 FP):

- Conveyance and Storage Asset System
- Water Reclamation Facilities (WRFs) and Biosolids Asset System
- Watercourse and Flood Management Asset System
- Green Infrastructure (GI) Asset System

The functional description focuses on location of the assets in the service area and general function of the assets.

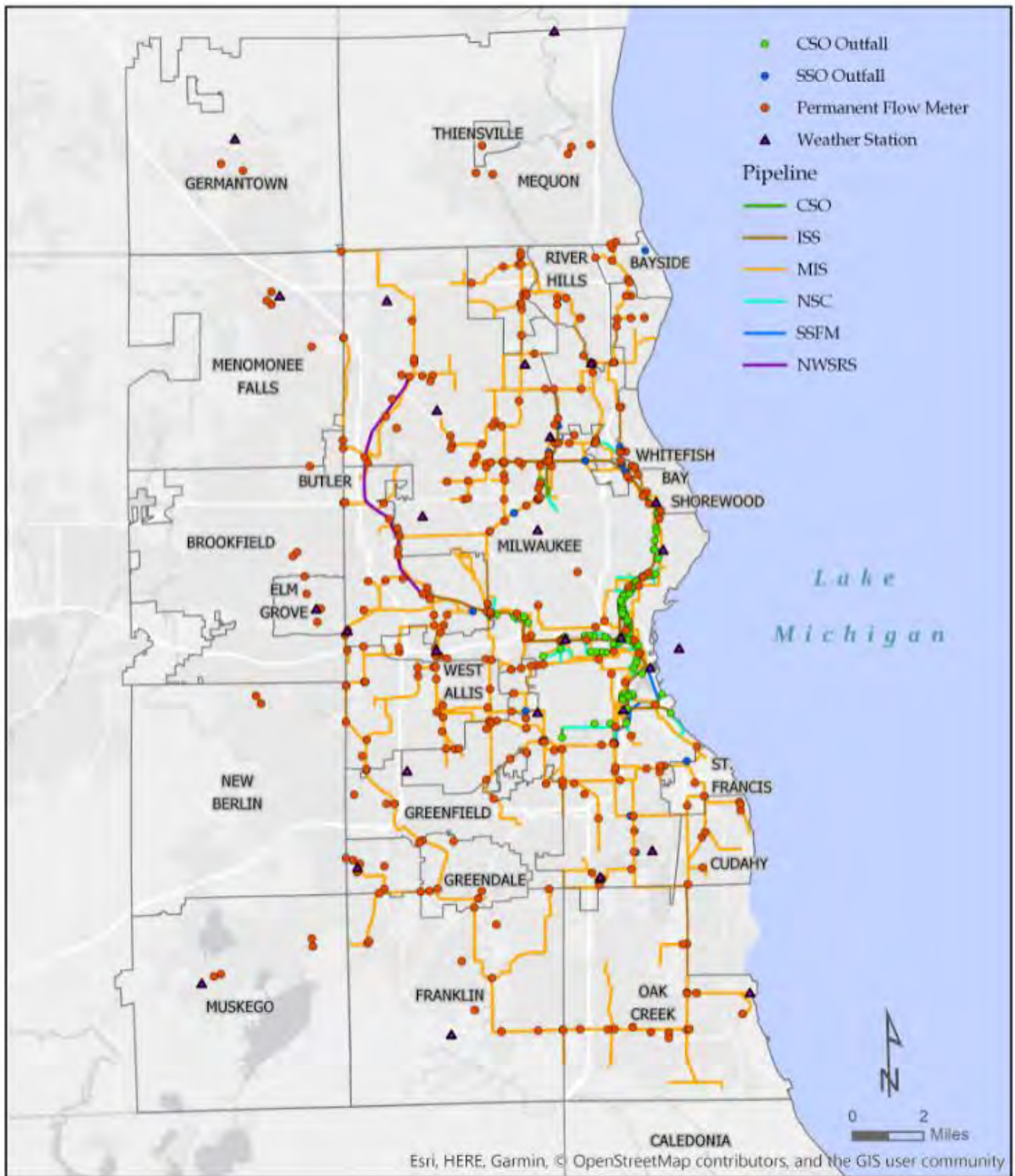
## CONVEYANCE AND STORAGE ASSETS

The physical assets that make up the Conveyance and Storage Asset System consist of the sewers, manholes, flow control structures and associated equipment that convey wastewater from municipal sewer systems to the water reclamation facilities and inline storage system (ISS) as well as the sewer outfalls that provide wet weather relief. MMSD's Conveyance and Storage Asset System starts in the separate sewer area at the manholes that interface with the municipal conveyance systems. The Conveyance and Storage Asset System ends at the head works of the Jones Island Water Reclamation Facility (JIWRF) and South Shore Water Reclamation Facility (SSWRF). A high-level overview of the facilities included in the Conveyance and Storage Asset System are listed below and shown in Figure 1:

- **Metropolitan Interceptor Sewer (MIS):** Receives sanitary wastewater and stormwater from private and municipal separate sewer and combined sewer systems and conveys it to the WRFs. The MIS includes both gravity sewers and pressure sewers.
- **Near Surface Collector (NSC):** Conveys wastewater and stormwater from the MIS to the ISS.
- **ISS:** Stores up to 432 million gallons (MG) of wastewater and stormwater until there is available capacity for treatment at JIWRF and/or SSWRF. The storage system includes a 210 million gallon per day (MGD) pump station.
- **Northwest Side Remote Storage (NWSRS):** Stores up to 89 MG of wastewater and stormwater until there is available capacity for treatment at JIWRF and/or SSWRF.
- **South Shore Force Main (SSFM):** Conveys wastewater and stormwater under pressure from the ISS to a diversion chamber at South 6<sup>th</sup> Street and West Oklahoma Avenue.
- **Combined Sewer Overflow (CSO) Outfalls:** Provide an outlet for wastewater from the combined sewer area. When tributary flows exceed conveyance capacity, storage capacity, or both, these outfalls release wastewater to surface water.
- **Separate Sewer Overflow (SSO) Outfalls:** Provide an outlet for wastewater from the separate sewer area. When tributary flows exceed conveyance or storage capacity or both, these outfalls release wastewater to surface water.
- **Structures:** Flow conveyance to the water reclamation facilities and to storage facilities is operated via different types of structures in the conveyance system including, but not limited to: manholes, intercepting structures, diversion structures, diversion chambers, pump stations, and drop shaft gate structures.

- **Permanent Flow Meters:** Monitor flow at specific locations along the conveyance system.
- **Weather Stations:** Monitor precipitation at 20 locations. Five of the sites also measure rainfall intensity, temperature, wind speed, and wind direction. Barometric pressure is measured at two sites.

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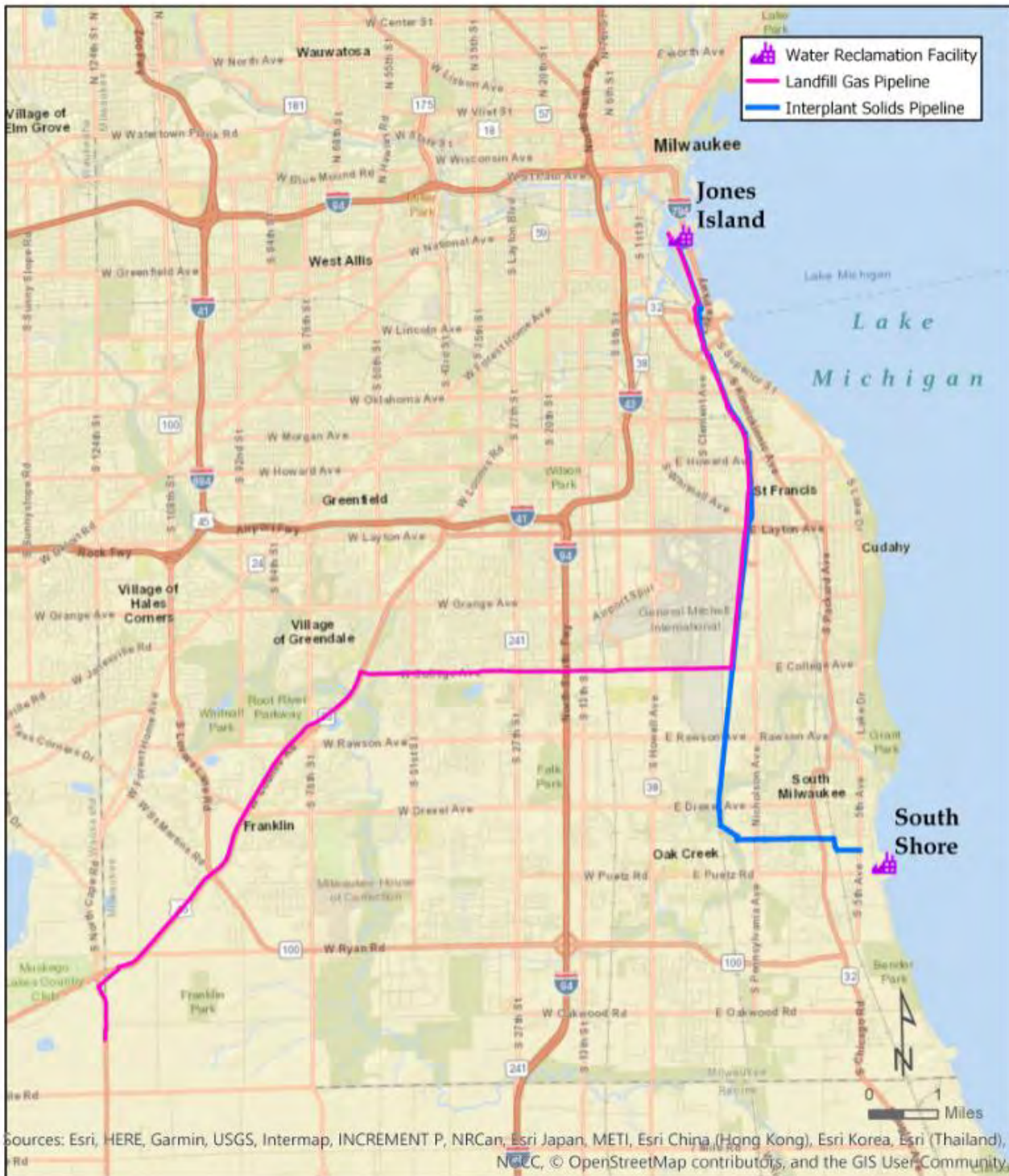


**FIGURE 1: CONVEYANCE AND STORAGE ASSET SYSTEM**

## WATER RECLAMATION FACILITIES AND BIOSOLIDS ASSETS

The facilities included in the WRF and Biosolids Asset System are listed below and shown in Figure 2:

- **Jones Island Water Reclamation Facility:** Located on Jones Island, just south of downtown Milwaukee under the Hoan Bridge, JIWRf is rated at 330 MGD – peak hour, 300 MGD – peak day. JIWRf was put into service in 1925 and is a tertiary treatment facility with activated sludge secondary treatment. JIWRf receives both combined and separate sewer flow from most of the central portions of Milwaukee County and the city of Milwaukee. Major processes at JIWRf include the biosolids handling facilities that produce a fertilizer product called Milorganite® and an electrical generation turbine facility used to provide most of the power to the facility.
- **South Shore Water Reclamation Facility:** Located in Oak Creek, approximately 12 miles south of downtown Milwaukee, SSWRF is rated at 300 MGD – peak hour, 265 MGD – peak day and receives mostly separate sewer flow from the southern, far western, and far northern portions of the MMSD service area. SSWRF was originally put into service in 1968 and is a tertiary treatment facility with activated sludge secondary treatment. Major processes at SSWRF include anaerobic digesters and electrical engine generation facilities used to provide most of the power to the facility.
- **Interplant Solids Pipeline (ISP)** The ISP is a 13-mile long interplant solids pipeline system that conveys biosolids between the two water reclamation facilities. The ISP includes the sludge transfer pipes between JIWRf and SSWRF as well as the related wet wells and pumping systems at both JIWRf and SSWRF.
- **Landfill Gas Pipeline (LFGP)** The LFGP is a 17-mile long pipeline from the Advanced Disposal Services Emerald Park Landfill in Muskego, Wisconsin to the JIWRf LFG metering station that conveys landfill gas (LFG) used to operate the LFG turbines.

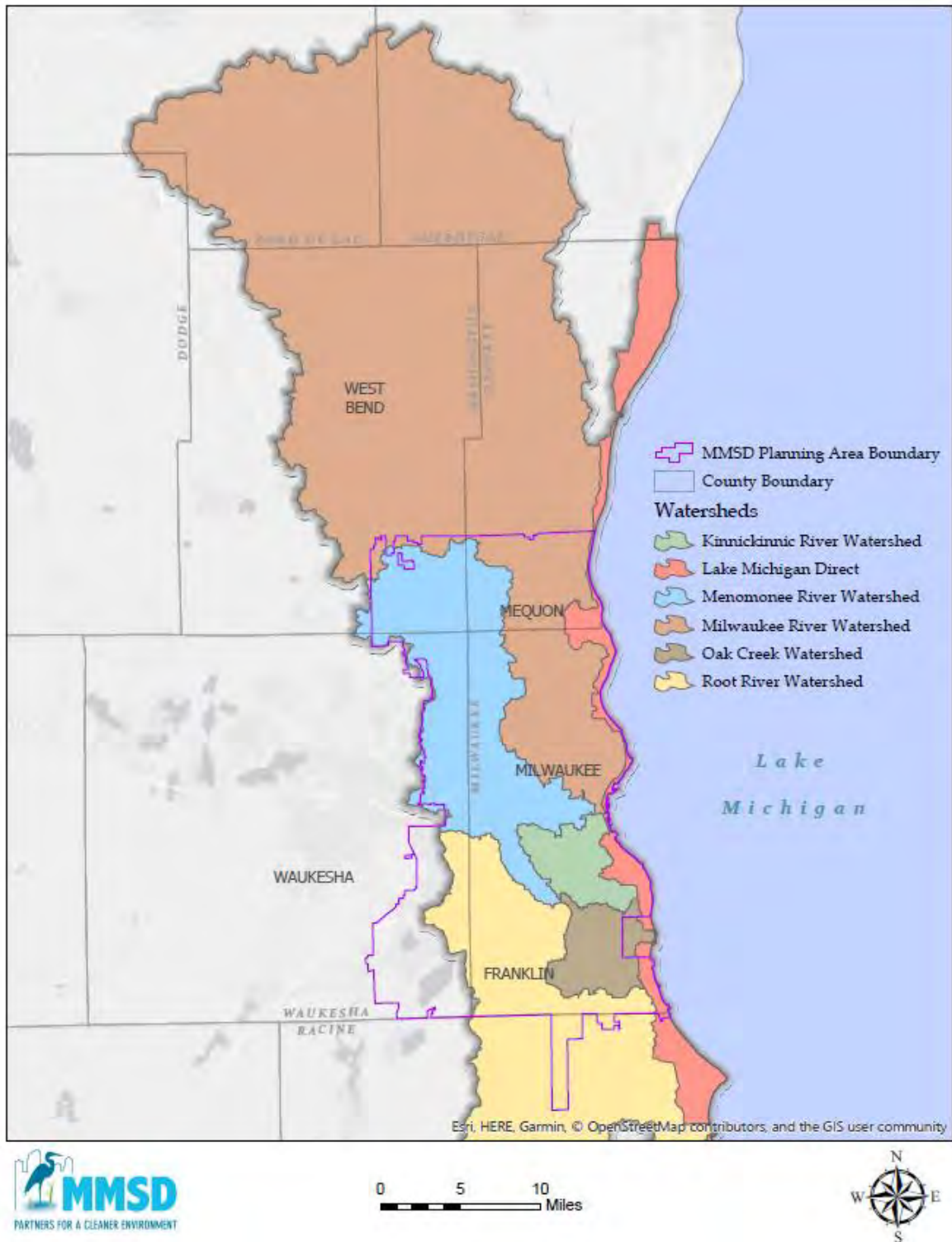


**FIGURE 2: WATER RECLAMATION FACILITIES AND BIOSOLIDS ASSET SYSTEM**

## WATERCOURSE AND FLOOD MANAGEMENT ASSETS

The watersheds included in the Watercourse and Flood Management Asset System are listed below and shown in Figure 3. The Watercourse and Flood Management Asset System includes MMSD assets located on streams for which MMSD has jurisdictional flood management authority. For this system, the term asset does not require MMSD to own the asset, but it does require MMSD to have some type of management responsibility for the asset. Typical assets in this asset system include open channels, culverts, instream hydraulic features, spillways, structural embankments, flap gates, trash racks, and flood management structures. The jurisdictional streams are located within these six watersheds:

- **Kinnickinnic River:** The Kinnickinnic (KK) River watershed drains an area of about 26 square miles, and it is located on the south side of the City of Milwaukee.
- **Lake Michigan:** The only tributary in the Lake Michigan drainage area under MMSD jurisdiction is Fish Creek and its tributary. The creek drains an area of about five square miles. The watershed is predominantly low-density residential.
- **Menomonee River:** The Menomonee River watershed drains an area of approximately 136 square miles. Most of the lower two-thirds of the watershed are nearly fully developed. Significant developable land still exists outside of Milwaukee County.
- **Milwaukee River:** The Milwaukee River watershed drains an area of about 700 square miles within Fond du Lac, Dodge, Sheboygan, Ozaukee, Washington, and Milwaukee Counties. The Milwaukee River is nearly 100 miles in length, although only a small portion of the mainstem is under MMSD jurisdiction. Approximately 25 percent of the watershed is developed, mainly within Milwaukee County.
- **Oak Creek:** The Oak Creek watershed drains an area of about 28 square miles. Approximately 64 percent of the area is within the City of Oak Creek. Oak Creek drains into Lake Michigan through South Milwaukee, which is not part of the MMSD service area.
- **Root River:** The Root River watershed drains an area of about 197 square miles. Approximately 72 square miles are within the MMSD service area and approximately 80 percent of the upper watershed located within Milwaukee and Waukesha Counties is currently developed, with significant developable land remaining in the southern municipalities within these two counties.



**FIGURE 3: GREATER MILWAUKEE WATERSHEDS**



## GREEN INFRASTRUCTURE ASSETS

Since the 1990s, MMSD has implemented and promoted the use of GI assets (referred to as ‘strategies’ in the Regional Green Infrastructure Plan and MMSD Commission policy) because they either hold or slow down the natural flow of water to discharge points and, by doing so, complement grey infrastructure by preserving capacity. [1] In general, MMSD does not own the GI assets included in the 2050 FP, but typically provides funding assistance for their construction and has maintenance oversight responsibility for a period of time after their construction. MMSD does maintain an ownership interest in GI it funds via a conservation easement or covenant. GI uses management approaches and technologies to infiltrate, evapotranspire, capture, and reuse water to maintain or restore natural hydrology. The preservation and restoration of natural landscape features such as forests, floodplains, and wetlands are critical components of GI. On a smaller scale, GI practices include rain gardens, rain barrels, porous pavements, green roofs, bioswales, trees and tree boxes, and rainwater harvesting. Using this holistic approach to watershed management provides natural stormwater and flood management features and helps meet existing and pending water quality regulations while preserving aquatic species, increasing urban biodiversity, and beautifying neighborhoods.

MMSD promotes the following types of key GI assets, as listed in MMSD Commission Policy Resolution 12-106-7 and further explained in Fresh Coast Green Solutions and the Regional Green Infrastructure Plan. [1] [2] [3]

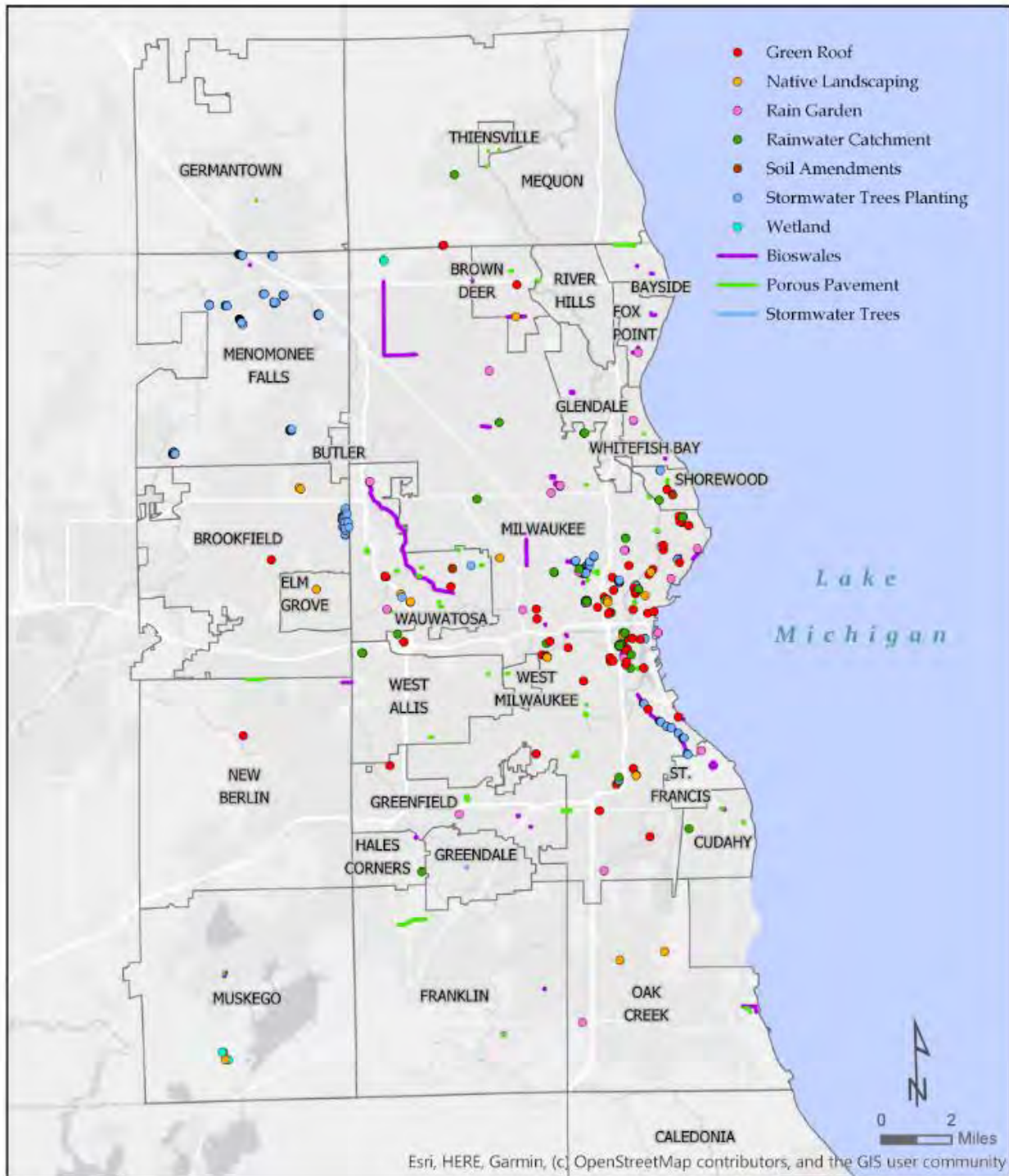
- **Greenways.** Greenways are riparian and non-riparian buffer zones and strips that store and drain stormwater runoff into the ground naturally.
- **Rain Gardens.** Rain gardens are gardens that are watered by collected or pooled stormwater runoff, slowly infiltrating it into the ground along root pathways. They are typically planted with wildflowers and deep-rooted native vegetation, which helps infiltrate rain channeled to them from roofs, driveways, yards and other impervious surfaces. They can be placed near downspouts on homes (although away from building foundations and sewer laterals) and are an excellent means of removing pollutants from stormwater runoff. They should be slightly depressed to adequately hold and infiltrate stormwater runoff.
- **Wetlands.** Wetlands are areas that have soils that are inundated or saturated for part of the year or the entire year.
- **Stormwater Trees.** Stormwater trees can hold rainwater on their leaves and branches, infiltrate it into the ground, absorb it through root systems and evapotranspire it to the atmosphere. They can be used in conjunction with engineered soils and other types of green infrastructure and work best when they are mature (and so are not a quick fix to stormwater issues).
- **Green Roofs.** Green roofs (also known as eco-roofs) are either partially or completely planted with vegetation growing in soil (or a growing medium) to hold rainwater. They can be planted in waterproof trays or on top of a waterproof barrier and can be intensive (like a rooftop park) or extensive (relatively lightweight). They provide stormwater management benefits when they are lush and green as well as when they are dormant.
- **Bioswales.** Bioswales are landscape features that capture and infiltrate runoff and can also remove pollutants. They are depressed catchment areas planted with vegetation, similar to a rain garden, and are usually used along transportation corridors or parking lots. They can be installed as meandering or straight channels, depending on the land that is available, and are designed to maximize the time rainwater spends in the swale.

- **Porous Pavement.** Porous pavement can reduce and infiltrate surface runoff through its permeable surface into a stone or filter media below. Runoff then percolates into the ground, is conveyed offsite as part of a stormwater system, or is collected and contained for future use. Porous pavement can be asphalt, concrete or pavers, but differs from traditional pavement because it excludes fine material and instead provides pore spaces that store and pass water.
- **Native Landscaping.** Native landscaping (also known as conservation landscaping) is the use of native plant species that can tolerate the drought and flooding cycles of an area because of deep roots and climate-specific adaptations. Native plants are those that evolved in a particular area and are adapted to local climate conditions. Besides use in rain gardens, native landscaping can include prairie and other plants that provide habitat for native animal species.
- **Rainwater Catchment.** Rainwater harvesting encompasses the capture and storage of water, potentially for reuse later. It also provides the ability to reuse stored rainwater for beneficial uses, primarily gardening and lawn watering. Harvesting not only includes the collection systems, but also the rain barrels and cisterns used to store the water. Rain barrels and cisterns are similar, although cisterns tend to be relatively large and sometimes are installed underground.
- **Green Alleys, Streets and Parking Lots.** Green alleys, streets and parking lots are typically in the public right-of-way and can provide a combination of different benefits designed to channel, infiltrate and evapotranspire water. They include permeable pavement, sidewalk planters, landscaped medians and bio-swales, inlet restrictors, greenways and trees (as previously described), and can also take advantage of recycled materials.
- **Soil Amendments.** Soil amendments are materials worked into the soil to enhance its ability to infiltrate or absorb water. Soil amendments increase water holding capacity in lawns and improve grass growth when native landscaping is not preferred.
- **Removal of structures/pavements.** Removal of structures or paving in order to allow infiltration.

The GI assets that MMSD tracks are shown in Figure 4. Several GI asset included in the MMSD Commission policy resolution are not presented in Figure 4. For example, greenways; green alleys, streets, and parking lots; and removal of structures/pavement are made up of other GI assets and are therefore not tracked separately.

MMSD leads several programs that promote the use of green infrastructure, including the following:

- Rain Barrel Program
- Lake Michigan Rain Garden Initiative
- Regional Green Roof Initiative
- Green Infrastructure Partnership Program
- Greenseams®



**FIGURE 4: GREEN INFRASTRUCTURE ASSETS**

## INTER-RELATIONSHIP OF ASSET SYSTEMS

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While it is useful to consider the four asset systems separately, the four asset systems all interrelate and impact each other. The Conveyance and Storage Asset System conveys flow to the WRFs and Biosolids Asset System for treatment. As such, the operation of the WRFs relies on the management of the flows in the Conveyance and Storage Asset System.

The boundary between the Conveyance and Storage Asset System and the WRF and Biosolids Asset System is the point where the flow enters the WRFs. At the Jones Island Water Reclamation Facility (JIWRF), the boundary is located on the downstream side of both the harbor siphons and the ISS head tanks (JIWRF head tank and South Shore Water Reclamation Facility [SSWRF] head tank). The harbor siphons, JIWRF head tank, and SSWRF head tank are all part of the Conveyance and Storage Asset System. At SSWRF, the boundary between the Conveyance and Storage Asset System and the WRF and Biosolids Asset System is located at the upstream side of the metropolitan interceptor sewer (MIS) flow control structure on site. The sewers upstream of the MIS flow control structure are part of the Conveyance and Storage Asset System.

The boundary between the Conveyance and Storage Asset System and the Watercourse and Flood Management Asset System is at the combined sewer overflow (CSO) and separate sewer overflow (SSO) outfalls into the rivers and Lake Michigan, where the CSO and SSO outfalls are part of the Conveyance and Storage Asset System.

The boundary between the WRF and Biosolids Asset System and the Watercourse and Flood Management Asset System is at the discharge point from JIWRF and SSWRF into Lake Michigan.

The boundary between the GI Asset System and the Conveyance and Storage Asset System as well as the Watercourse and Flood Management Asset System is the area where the flow not captured by the GI assets is subsequently captured in the Conveyance and Storage Asset System (via the MIS/ near surface collector [NSC]) or goes into the Watercourse and Flood Management Asset System.

## INTRODUCTION TO ASSET HIERARCHY AND NUMBER OF ASSETS IN EACH SYSTEM

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Assets can be described by what they do, as above. This section briefly introduces each hierarchy terminology and the number of assets. First, asset management requires a consistent level of asset hierarchy by which assets can be classified. Figure 5 shows a high-level summary of the asset hierarchy (Level 1, Level 2, Level 3, etc.) for each of the asset systems, including Administrative assets for reference. The terminology shown on Figure 5 will be used throughout the 2050 FP.



**FIGURE 5: ASSET HIERARCHY SUMMARY BY MAJOR MMSD ASSET SYSTEM**

## REFERENCES

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- [1] Milwaukee Metropolitan Sewerage District, "Commission Policy, Subject: MMSD Infrastructure Includes Green Infrastructure, Index: 1-11.05, Resolution 12-106-7," MMSD, Milwaukee, WI, 2015 (Revision from 2012 document).
- [2] Milwaukee Metropolitan Sewerage District, "Fresh Coast Green Solutions," MMSD, Milwaukee, WI, 2009.
- [3] Milwaukee Metropolitan Sewerage District, "Regional Green Infrastructure Plan," MMSD, Milwaukee, WI, 2013.

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