3.0 Land and Water Resource Inventory

As required in Minnesota Rules Section 8410.0060, this section of the plan provides a general description and summary of:

- Existing land uses and proposed development in local and metropolitan comprehensive plans.
- Topography.
- Soil.
- General geology.
- Groundwater resources, including groundwater and surface water connections if defined in an approved and adopted county groundwater plan.
- Precipitation in the Minneapolis-St. Paul metropolitan area.
- Surface-water resources including streams, lakes, wetlands, public waters, and public ditches.
- Water quality and quantity including trends of key locations and 100-year flood levels and discharges.
- Stormwater systems, drainage systems, and control structures.
- Regulated pollutant sources and permitted wastewater discharges.
- Fish and wildlife habitat and rare and endangered species.
- Water-based recreation areas.
- Priority areas for wetland preservation, enhancement, restoration, and establishment.

This section also identifies where detailed information can be obtained for many of these areas of concern.

CITY OF BLOOMINGTON MINNESOTA

Municipal Boundary

Watershed Management Organizations

- Lower Minnesota River
- Nine Mile Creek
- Richfield-Bloomington
- Riley-Purgatory-Bluff Creek

N

0 1

Miles

WATERSHED MANAGEMENT ORGANIZATIONS
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-1

USDA 2016 NAIP Imagery via MnGeo

BARR

Barr Footer: ArcGIS 10.4.1, 2018-01-26 09:47 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-1 Watershed Management Organizations.mxd User: rcs2

3.1 Land-Use and Public Utilities Services

Existing land use and the Land-Use Guide Plan for areas within the City are described in the Land-Use element of the Bloomington Comprehensive Plan. Almost all of the land in Bloomington is now nearly fully developed. The existing land-use map includes these categories: residential (44.8%), public/quasi-public/conservation (27.8%), commercial (6.8%), industrial/ warehouse (5.2%), and vacant (1.4%). The Land-Use Guide Plan adds more detail to the previous designations. Figure 3-2 shows existing land use as indicated in the Land-Use Guide Plan (updated in 2016). Proposed redevelopment areas are primarily located in three areas within the City: Normandale Lakes District, Penn-American District, and the South Loop District. Figure 3-3 depicts the anticipated future land use based on Metropolitan Council 2030 data.

3.2 Topography

The topography in Bloomington is characterized by three landscape units: highlands, outwash plain, and river valley. These landscape units formed as a result of the retreat of the Wisconsin Glacier over 10,000 years ago. The highlands area is concentrated in the northwest and western portions of Bloomington. The outwash plain covers the majority of central and east Bloomington, while the river valley comprises those lands adjacent to the Minnesota River.

CITY OF BLOOMINGTON MINNESOTA

Municipal Boundary

Met Council Generalized Land Use 2016

- Farmstead
- Single Family Detached
- Manufactured Housing Park
- Single Family Attached
- Multifamily
- Retail and Other Commercial
- Office
- Mixed Use Residential
- Mixed Use Industrial
- Mixed Use Commercial and Other
- Industrial and Utility
- Extractive
- Institutional
- Park, Recreational or Preserve
- Golf Course
- Major Highway
- Railway
- Airport
- Agricultural
- Undeveloped
- Water

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Miles

EXISTING LAND USE
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-2

BARR

USDA 2016 NAIP Imagery via MnGeo

Barr Footer: ArcGIS 10.4.1, 2018-01-26 09:49 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-2 Existing Land Use.mxd User: rcs2

CITY OF BLOOMINGTON MINNESOTA

- Municipal Boundary

Planned Land Use

- General Business
- Community Commercial
- Regional Commercial
- Conservation
- High Density Residential
- Medium Density Residential
- Low Density Residential
- High Intensity Mixed Use
- South Loop Mixed Use
- Lindau Mixed Use
- Industrial
- Innovation and Technology
- Office
- Public
- Quasi-Public
- Right of Way
- Water

N

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Miles

ANTICIPATED FUTURE LAND USE
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-3

USDA 2016 NAIP Imagery via MnGeo

BARR

Barr Footer: ArcGIS 10.4.1, 2018-04-10 08:18 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-3 Anticipated Future Land Use.mxd User: rcs2

Surface drainage basins in the City are a result of variations in topography and are reflected in the three different landscape units. The extensive urbanization of the City has greatly altered the natural topography, creating more defined drainage patterns.

Slope is important for determining stormwater runoff rates and susceptibility to erosion. The steepest slopes are located along the Minnesota River and Nine Mile Creek corridors, shown in Figure 3-4. Steep slopes are prone to erosion and limit options for land development. The Minnesota Department of Natural Resources (MnDNR) and the Bloomington Steep Slope Ordinance define steep slopes prone to erosion as those with slopes steeper than 12% and very steep slopes as those steeper than 18%.

3.3 Soils

This section provides information about the soils present in the City of Bloomington.

3.3.1 Hydrologic Soil Groups and Infiltration

In addition to slope, soil composition and land-management practices determine the impact of soils on water resource issues. Soil composition affects the rate and volume of stormwater runoff. The shape and stability of aggregates of soil particles—expressed as soil structure—influence the permeability, infiltration rate, and erodibility (i.e., potential for erosion) of soils. The infiltration capacities of soils affect the amount of runoff directly resulting from rainfall. Higher soil infiltration rates lower the potential for runoff, as more precipitation is able to enter the soil. Conversely, soils with low infiltration rates produce high runoff volumes and high peak-discharge rates, as most or all of the rainfall moves as overland flow.

The Natural Resources Conservation Service (NRCS—formerly the Soil Conservation Service) has established four general hydrologic soil groups:

- **Group A:** Low runoff potential—high infiltration rate
- **Group B:** Moderate infiltration rate
- **Group C:** Slow infiltration rate
- **Group D:** High runoff potential—very slow infiltration rate

Combined with land use, hydrologic soil grouping (A-D) may be used to estimate the amount of runoff that will occur over a given area for a particular rainfall amount. The most current soils data for the City of Bloomington are based on the Soil Survey Geographic

dataset (SSURGO) from the NRCS and are presented in Figure 3-5. Prior to 2013, the dominant hydrologic soil group in the Twin Cities was Group B. However, in 2014, the NRCS reclassified many of these soils as Group C.

In large portions of central and east Bloomington, soil groups are defined as Not Rated/Not Available (55.4%). This classification is typically assigned to areas where development has altered the existing soil or data were unavailable prior to development. Hydrologic soil groups or infiltration rates are typically not determined after development (historically this classification was referred to as "Urban Soils"). The remaining 44.6% of the City consists of Hydrologic Soil Group A (13.8%), Group B (6.8%), Group C (10.5%), and Group D soils (13.5%).

Development is another factor that may increase the potential for high volumes of runoff. As land is developed for urban use, much of the soil is covered with impervious surfaces, and soils in the remaining areas are significantly disturbed and altered. Development often results in consolidation of the soil and tends to reduce infiltration capacity of otherwise permeable soils, resulting in significantly greater amounts of runoff. Grading, plantings, and tended lawns tend to dominate the pervious landscape in urbanized areas and may become more important factors in runoff generation than the original soil type. The hydrologic soil groups map (Figure 3-5) provides general guidance about the infiltration capacity of the soils throughout the City (where information is available). Soils should be inspected on a site-by-site basis as projects are considered.

CITY OF BLOOMINGTON MINNESOTA

Municipal Boundary

Steep Slopes

12% - 18%

Greater than 18%

This map shows slope data from the National Elevation Dataset from the United States Geological Survey.

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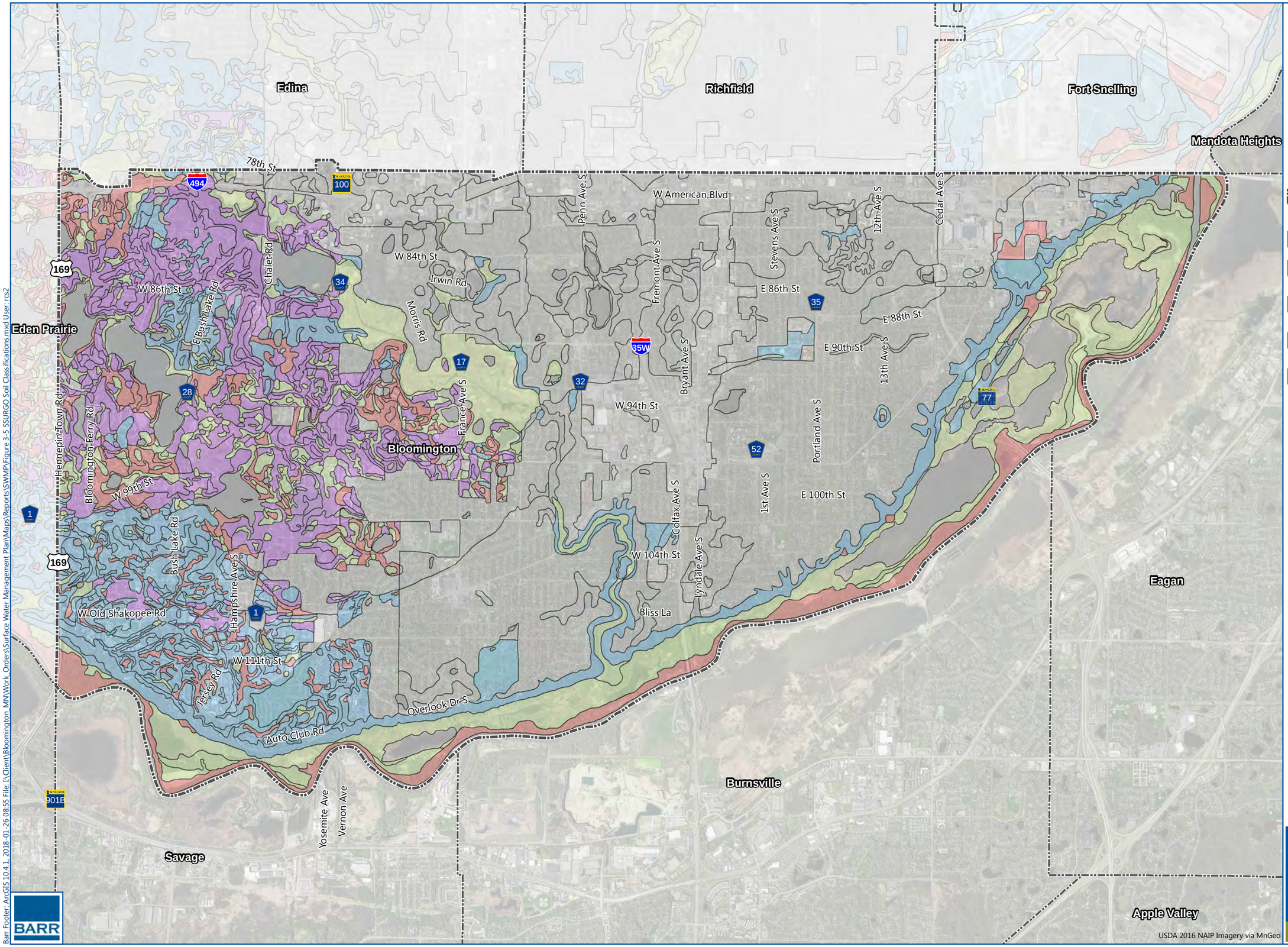
STEEP SLOPES
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-4

USDA 2016 NAIP Imagery via MnGeo

Edina
Richfield
Fort Snelling
Mendota Heights
Eden Prairie
Bloomington
Eagan
Burnsville
Savage
Apple Valley
78th St
W 84th St
W 86th St
Irwin Rd
E 86th St
E 88th St
E 90th St
W 94th St
W 99th St
W 104th St
E 100th St
W American Blvd
W Old Shakopee Rd
W 111th St
Bliss La
Overlook Dr S
Auto Club Rd
Chalet Rd
E Bush Lake Rd
Morris Rd
Penn Ave S
Fremont Ave S
Stevens Ave S
12th Ave S
Cedar Ave S
Bryant Ave S
France Ave S
Portland Ave S
18th Ave S
Colfax Ave S
1st Ave S
Lyndale Ave S
Hennepin Town Rd
Bloomington Ferry Rd
Bush Lake Rd
Hampshire Ave S
Jersey Rd
Yosemite Ave
Vernon Ave
494
100
169
34
35
35W
17
28
32
52
77
1
901B



CITY OF BLOOMINGTON MINNESOTA

Municipal Boundary

2016 SSURGO Hydrologic Soils

- Not rated or not available
- A soils (High Infiltration Capacity)
- B soils (Medium Infiltration Capacity)
- C soils (Low Infiltration Capacity)
- D, A/D, B/D, or C/D soils (Very Low Infiltration Capacity)

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Miles

SSURGO SOIL CLASSIFICATIONS

Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-5

BARR

3.3.2 Superficial Soils

Roughly one-half of the City is composed of artificial fill over glacial outwash. The remainder of the City consists of Peaty Muck-Hayden-Burnsville Association, Hayden-Peaty Muck Association, Esterville-Dickman-Dakota, and Mixed Alluvial Land-Marsh-Chaska Association soils. These associations contain a mix of Group A, B, C, and D (ABCD) soils. In general, wetland, lake, and marsh areas contain Group D soils. Well-drained upland areas generally consist of Group A and C soils. A general characterization of the City's soil associations is summarized here:

- The Peaty Muck-Hayden-Burnsville Association and the Hayden-Peaty Muck Association developed in glacial till contain moderately fine to moderately coarse textured soils; they are characterized by well-drained hilly soils and poorly-drained organic soil depressions.

- The Estherville-Dickman-Dakota Association is a glacial outwash deposit of moderately coarse and medium-textured soils underlain by sand and gravel. This association is nearly level to hilly and has moderately rapid to rapid permeability.

- The Mixed Alluvial Land-Marsh-Chaska Association is directly adjacent to the Minnesota River and subject to flooding. It contains organic marsh areas and moderately coarse-textured to moderately fine-textured soils that formed in alluvium.

Additional information on the soils within the City is included in the Hennepin County Geologic Atlas and Hennepin County Soil Survey available at the Water Resource Library at the Bloomington Public Works facility.

3.4 Geology and Groundwater Resources

The following sections contain information about the geology and groundwater in the City of Bloomington.

3.4.1 Geology

The City's surface geology is characterized by glacial till and sand and sediment deposits along former Glacial River Warren terraces. Composition of glacial till in the northwest portion of the City includes various till types deposited by the glacial Des Moines Lobe-Grantsburg Sublobe; these tills include loam, clay loam, and sandy loam. The remainder of the City lies within a Glacial River Warren terrace; surface deposits contain sand, gravelly sand, and loamy sand, overlain by thin deposits of silt, loam, or organic sediment. The total depth

of glacial till, sand, and sediment deposits covering the bedrock varies from 100–300 feet. Much of this area is now covered by artificial fill and has been developed. The area directly adjacent to the Minnesota River consists of clayey floodplain alluvium. Bedrock formations underlying the City include Prairie du Chien Dolomite, Jordan Sandstone, and St. Lawrence and Franconia Formations.

3.4.2 Groundwater Resources

Several aquifers are present within the City:

- The Mt. Simon-Hinckley Aquifer is the deepest in the Bloomington area. It is present at elevations ranging from 600–700 feet above sea level and consists of the Mt. Simon and Hinckley Sandstones.

- The Eau Claire Formation—which consists of siltstone, sandstone, and shale—sits above the Mt. Simon-Hinckley Aquifer. This formation has generally low permeability.

- Above the Eau Claire Formation is the Wonewoc Sandstone. It is a sandstone with moderate-to-high permeability. This formation has not been highly utilized in the Twin Cities because higher and more accessible groundwater sources are available.

- The Franconia-Ironton-Galesville Aquifer is present in the City at elevations ranging from 700–800 feet above sea level. It consists of the Franconia Formation and Ironton and Galesville Sandstones. The St. Lawrence Formation confines the aquifer in most areas.

- The St. Lawrence Formation consists of dolostone interlayered with thin intervals of siltstone and, in some areas, very fine-grained glauconitic sandstone and shale. It has very low vertical hydraulic conductivity.

- The Tunnel City Group is a rock formation with low permeability. It is often grouped with either the Wonewoc Sandstone or the St. Lawrence Formation.

- The Jordan Sandstone Aquifer consists of two distinguishable layers: sandstone and sandstone with some siltstone and shale. There is a range of hydraulic conductivities in this layer depending on location.

- The uppermost aquifer, the Prairie Du Chien-Jordan, ranges in elevation from 700–800 feet above sea level in this area. It is composed of Jordan Sandstone and the

Prairie Du Chien Group. In some areas of Bloomington, the St. Lawrence Formation or Franconia Formation are the uppermost bedrock layers. Therefore, the Prairie Du Chien-Jordan Aquifer is not present in these areas. The Prairie du Chien-Jordan Aquifer is high-yielding, more easily tapped than deeper aquifers, has very good water quality, and is continuous throughout most of the area.

The regional aquifer with the highest water quality is the Mt. Simon-Hinckley Aquifer, but it is more expensive to use than the Prairie du Chien-Jordan Aquifer because of its greater depth. Minnesota statutes limit appropriations from the Mt. Simon-Hinckley Aquifer to potable water uses where there are no feasible or practical alternatives and where a water conservation plan is incorporated with the appropriations permit. The pattern of flow in the Mt. Simon-Hinckley Aquifer differs greatly from the pattern in the overlying Prairie du Chien-Jordan Aquifer. In general, the Mt. Simon-Hinckley Aquifer has little or no hydraulic connection with the surficial groundwater system or major streams.

The Prairie du Chien-Jordan Aquifer is the most heavily used aquifer in Hennepin County. The MnDNR closely reviews permits for groundwater withdrawals from the Prairie du Chien-Jordan Aquifer to ensure that withdrawals will not cause drawdown effects on nearby regionally significant water resources. The aquifer is recharged in areas where thin permeable drift overlies the limestone layers. Some recharge of this aquifer occurs locally from percolation through the overlying glacial deposits or St. Peter Sandstone. However, hydrogeologic characteristics suggest this recharge would only minimally contribute to aquifer flow. Regional recharge of the Prairie du Chien-Jordan Aquifer occurs to the south of the Minneapolis-St. Paul metropolitan area. Groundwater movement in the aquifer is generally from west to east, toward the Mississippi River.

Within the City, groundwater wells partially serve the City and private water needs. Each of these wells has a groundwater appropriation permit from the MnDNR. Figure 3-6 shows the locations of the DNR-permitted groundwater appropriation sites within the City, including the six municipal wells sourced from the Prairie du Chien-Jordan, Jordan, Jordan-St. Lawrence, and Mt. Simon-Hinckley Aquifers.

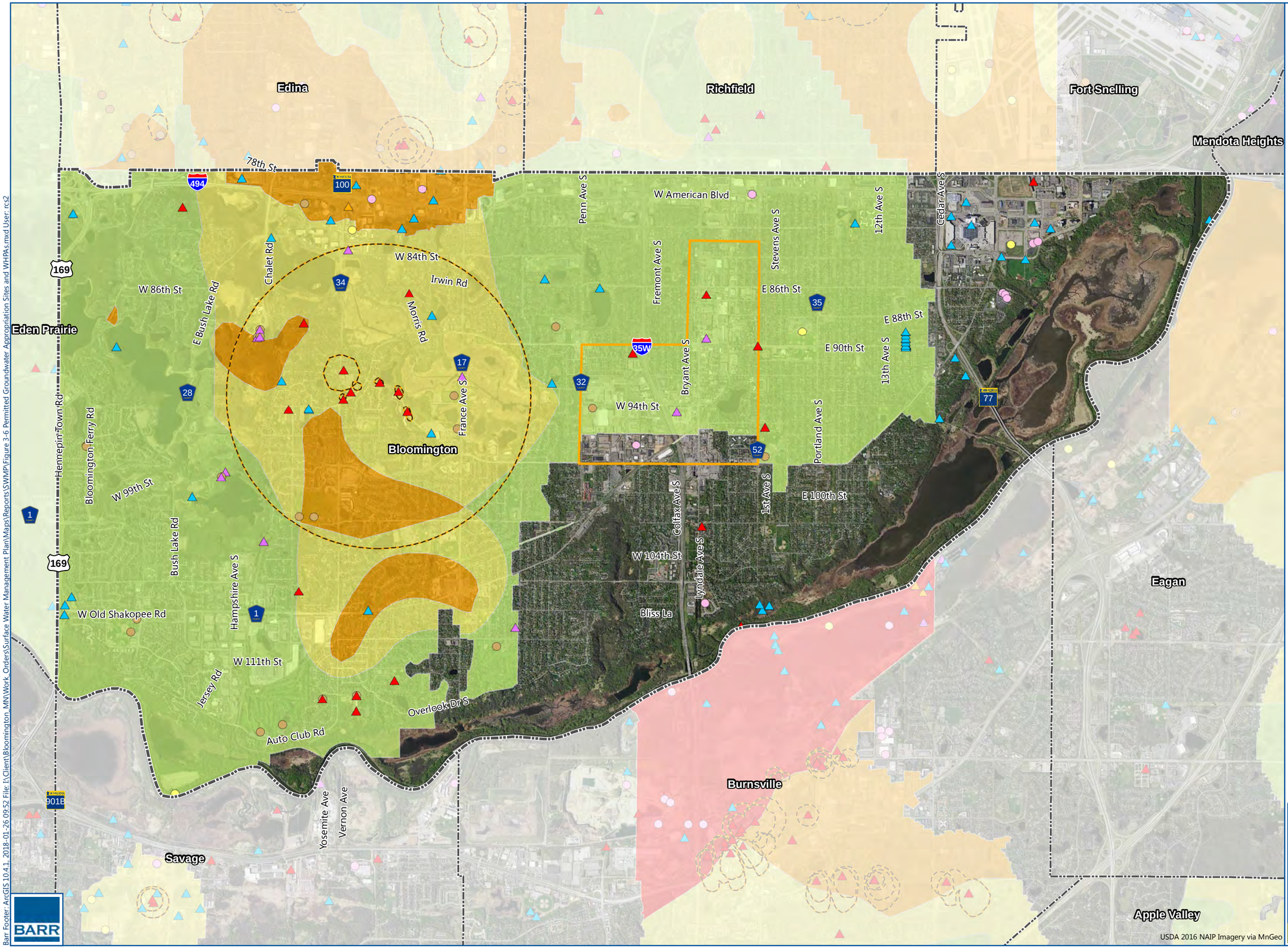
Additional groundwater resource data for areas within the City are available at the Bloomington Public Works' Resource Library and wellhead protection plans are located with the Utilities Division.

3.4.3 Wellhead Protection Areas

The increasing population in the Twin Cities metropolitan area has increased pressure on groundwater quantity as well as quality. The Minnesota Department of Health (MDH) is responsible for the protection of groundwater quality and aims to prevent contaminants from entering the recharge zones of public water supply wells through its wellhead protection program. This includes the development of wellhead protection plans (WHPPs) and guidance to limit the potential for groundwater contamination. Wellhead protection efforts may restrict or prevent the use of certain stormwater best management practices (BMPs) within these areas to prevent potentially contaminated stormwater from reaching groundwater supplies. Figure 3-6 shows the location of municipal water supply wells and delineated wellhead protection areas (WHPAs) within the City.

The *City of Bloomington Wellhead Protection Plan Parts 1 &2*, completed in April 2004 and updated in 2014, contains specifics on the six municipal wells as well as delineated WHPA and Drinking Water Supply Management Area boundaries, as required by Minnesota Rule 4720.

Additional information on the City's geology and aquifers is included in the Hennepin County Geologic Atlas and Hennepin County Soil Survey available at the Water Resource Library at Bloomington Public Works.



CITY OF BLOOMINGTON MINNESOTA

- Municipal Boundary
- DWSMA Emergency Response Area
- SuperFund Site

DWSMA Vulnerability

- Very High
- High
- Moderate
- Low

Ground Water Appropriation Permits

- Agricultural Irrigation
- Industrial Processing
- Non-Crop Irrigation
- Power Generation
- Special Categories
- Water Level Maintenance
- Water Supply

Minnesota Department of Health DWSMA boundaries align with the 2014 Bloomington WHPP Amendment.

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Miles

PERMITTED GROUNDWATER APPROPRIATION SITES AND WHPAS Surface Water Management Plan City of Bloomington, MN

FIGURE 3-6

USDA 2016 NAIP Imagery via MnGeo

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Barr Footer: ArcGIS 10.4.1, 2018-01-26 09:52 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-6 Permitted Groundwater Appropriation Sites and WHPAs.mxd User: rcs2

3.5 Climate and Precipitation

The Minneapolis-St. Paul area has a humid continental climate, characterized by moderate precipitation (normally sufficient for crops), wide daily-temperature variations, large seasonal variations in temperature, warm and humid summers, and cold winters with moderate snowfall. The mean annual temperature for Bloomington is 46.2°F, as measured at the Minneapolis/St. Paul (MSP) airport station (1981–2010). Climatologists use the most recent three consecutive decades to calculate climatological averages such as temperature and precipitation. Mean monthly temperatures vary from 15.6°F in January to 73.8°F in July (1981–2010). According to the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC), extreme temperatures recorded at MSP (or downtown Minneapolis prior to April 1938 when the location of official measurement was changed to MSP) were a high of 108°F on July 14, 1936, and a low of -34°F on January 1, 1936, and January 19, 1970. For the 1981–2010 climate-normal period, the average date for the latest freezing temperatures was April 26, while the average date for the first autumn frost was October 7. The average frost-free period (growing season) is approximately 160 days.

Table 3-1 summarizes precipitation data for the MSP airport station. Average total annual precipitation at the MSP airport station is 30.6 inches (1981–2010). Annual precipitation recorded at downtown Minneapolis and MSP has ranged from a low of 11.5 inches in 1910 to a high of 40.2 inches in 1911. The mean monthly precipitation varies from 4.3 inches in August to 0.9 inches in January (1981–2010). From May to September, the growing season months, the average rainfall (1981–2010) is 19.03 inches, or about 62 percent of the average annual precipitation.

Snowfall averages 54.4 inches annually at the MSP airport station (1981–2010). Extreme snowfall records ranged from 98.6 inches during the 1983–1984 season to 14.2 inches during the 1930–1931 season.

Average weather imposes little strain on the typical drainage system. However, extremes of precipitation and snowmelt are important for the design of flood-control systems. NOAA has data on extreme precipitation events that can be used to aid in the design of flood-control systems. Extremes of snowmelt most often affect major rivers, the design of large stormwater-storage areas, and land-locked basins; extremes of precipitation most often affect the design of conveyance facilities.

Table 3-1 Historical Precipitation Summary for Minneapolis-St. Paul Area

Month	Rainfall							Snowfall		
	Mean (in)	Max (in)	Year of Max	Min (in)	Year of Min	1-day Max (in)	Year of 1-day Max	Mean (in)	Max (in)	Year of Max
January	0.90	3.63	1967	0.05	1892	1.21	1967	12.2	46.4	1982
February	0.77	3.25	1922	0.03	1894	1.90	1930	7.7	26.5	1962
March	1.89	4.75	1965	0.09	1910	1.66	1965	10.3	40.0	1951
April	2.66	7.00	2001	0.16	1987	2.58	2006	2.0	21.8	1983
May	3.36	10.33	1906	0.21	1934	3.39	2012	0.0	3.0	1946
June	4.25	9.82	1990	0.22	1988	3.28	2003	0.0	T	1995
July	4.04	17.90	1987	0.11	1936	10.00	1987	0.0	T	1994
August	4.30	9.32	2007	0.20	1925	7.36	1977	0.0	T	1992
September	3.08	7.77	1903	0.41	1940	4.96	1903	0.0	1.7	1942
October	2.43	6.42	1911	0.01	1952	4.83	2005	0.6	8.2	1991
November	1.77	5.29	1991	0.02	1939	2.91	1940	9.3	46.9	1991
December	1.16	4.27	1982	T	1943	2.47	1982	11.9	33.2	1982
Annual	30.61	40.32	2016	11.54	1910	--	--	54.4	101.5	1983

Mean values based on 1981–2010 period; minimum and maximum values based on downtown Minneapolis
(1891– 1938) and MSP (1938–2014) records

T = trace amount

Source: Minnesota Climatology Working Group (www.climate.umn.edu)

In 2013, NOAA published Atlas 14, Volume 8 (Atlas 14), which is now the primary source of information regarding rainfall in the region. Atlas 14 supersedes publications Technical Paper 40 (TP-40) and Technical Paper 49 (TP-49) issued by the National Weather Bureau (now the National Weather Service) in 1961 and 1964. Improvements in Atlas 14 precipitation estimates include denser data networks, longer (and more recent) periods of record, application of regional frequency analysis, and new techniques in spatial interpolation and mapping. Atlas 14 provides estimates of precipitation depth (i.e., total rainfall in inches) and intensity (i.e., depth of rainfall over a specified period) for durations from 5 minutes up to 60 days.

Runoff from spring snowmelt is also important in this region, but is not provided in Atlas 14. The Soil Conservation Service's (now the NRCS) *National Engineering Handbook, Hydrology, Section 4,* presents maps of regional runoff volume.

Table 3-2 lists selected precipitation and runoff events used in designing stormwater management systems and flood protection infrastructure.

Table 3-2 Selected Rainfall and Snowmelt Runoff Events

Type	Event Frequency	Duration	Depth (inches)
Rainfall	2-year	24 hour	2.83
	5-year	24 hour	3.54
	10-year	24 hour	4.24
	25-year	24 hour	5.37
	50-year	24 hour	6.37
	100-year	24 hour	7.50
	10-year	10 day	8.01
	100-year	10 day	10.1
Snowmelt[1]	10-year	10 day	4.7
	25-year	10 day	5.7
	50-year	10 day	6.4
	100-year	10 day	7.1

Source: NOAA Atlas 14—Volume 8. Station: Minneapolis-St. Paul International Airport and *Hydrology Guide for Minnesota (U.S. Department of Agriculture Soil Conservation Service—NRCS)*

[1] *Snowmelt depth reported as liquid water.*

Even with wide variations in climate conditions, climatologists have found four recent, significant climate trends in the Upper Midwest (Minnesota Weather Almanac, Seeley, 2006):

- Warmer winters
- Higher minimum temperatures
- Higher dew points

- Changes in precipitation trends—more rainfall coming from heavy thunderstorm events and increased snowfall

According to the Soil and Water Conservation Society's (SWCS) 2003 report on climate change, total precipitation amounts in the United States (and in the Great Lakes region) are trending upward, as are storm intensities. Higher-intensity precipitation events typically produce more runoff than lower-intensity events with similar total precipitation amounts; higher rainfall intensities are more likely to overwhelm the capacity of the land surface to infiltrate and attenuate runoff. Precipitation records in the Twin Cities area show that average annual precipitation has increased, illustrated by the following examples:

- **Minneapolis-St. Paul Airport station:** The average annual precipitation increased from 28.32 inches (1961–1990 average) to 30.61 inches (1981–2010 average), an 8.1% increase (data from the Minnesota Climatology Working Group website: http://climate.umn.edu/).

- **St. Paul station:** The average annual precipitation increased from 30.30 inches (1961–1990 average) to 33.45 inches (1981–2010 average), a 10.4% increase (data from the Minnesota Climatology Working Group website: http://climate.umn.edu/).

Comparison of precipitation depths between TP-40 and Atlas 14 indicates increased precipitation depths for more extreme events. As noted by the SWCS, increased storm intensities result in increased soil erosion and increased runoff. The Minnesota Pollution Control Agency's (MPCA) climate-change website states that increased flooding could also result from more intense precipitation events: http://www.pca.state.mn.us/index.php/topics/climate-change/index.html.

3.6 Surface Water Resources: Water Quantity and Quality

Bloomington has an abundance of lakes, ponds, and wetlands. The City is subdivided into 22 major subwatersheds based on drainage areas that are tributary to its major surface water resources (see Figure 3-7). Other governmental units have identified or inventoried surface water resources within Bloomington, specifically related to their management jurisdictions:

- All water bodies—Nine Mile Creek Watershed District (NMCWD), Riley-Purgatory-Bluff Creek Watershed District (RPBCWD), Lower Minnesota Watershed District (LMWD), and Richfield-Bloomington Water Management Organization (RBWMO)

- Public waters basins, watercourses, and wetlands—Minnesota Department of Natural Resources
- Public ditches—NMCWD manages County Ditch No. 1, which is located downstream of West 84th Street to the Marsh Lake Dam.
- National Wetland Inventory—U.S. Army Corps of Engineers (USACE)
- Minnesota River—US. Fish and Wildlife Service and the MPCA

Available surface water resource data for the City is summarized in this section. Detailed information has been included either in appendices to this report or has been identified by reference and is available in the Water Resource Library at Bloomington Public Works. A list of Bloomington's past drainage reports and studies is shown in Table 3-3.

3.6.1 Water Quantity

The City is divided into nine subwatershed areas, which are shown on Figure 3-7. An XP-SWMM-based hydrologic and hydraulic computer model (developed by Barr Engineering Co.) has been developed for each of these subwatersheds. A valuable tool, XP-SWMM is useful for specific site-drainage studies and improvements, allows the City to assess flood risk, and provides design frequency flood elevations (such as the 100-year event, peak water-surface elevation).

3.6.1.1 Flood Insurance Studies

A Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) was completed for some areas of the City in 2016. The FIS consisted of a study report, a set of floodway and floodplain delineation maps, and a set of Flood Insurance Rate Maps (FIRMs). The FEMA floodplains in the City are shown in Figure 3-8.

This study provides the basis for floodplain-management regulations, including the Flood Hazard Overlay District Sec. 19.38.02 of City Code. The FIS and FIRM maps are available in the Bloomington Public Works Water Resources Library and are incorporated by reference. These studies and the results of City hydrologic/hydraulic modeling efforts are also available in the Water Resources Library. Many of the improvements discussed in these studies have been implemented or have been given special attention during the design process for new development, redevelopment, and City projects. The City will define critical 1-percent annual-chance-event flood elevations using the best available information, including using flood elevations developed by WMO's. More information about the best available 1-percent annual-chance-event flood elevations is discussed in Section 4.1.2.

Table 3-3 City of Bloomington Inventory of City Drainage Reports/Studies

Date Completed	Name of Report	Author
Nov. 1964	Review of Proposal by State of MN Water Pollution Control Commission for Classification and Standards for the Lower Minnesota River	Rohlich, Polkowski, Boyle
Nov. 1964	Report on Groundwater Inflow Lower MN River	Douglas Barr
Mar. 1967	Feasibility Study Mt. Normandale Lake and Marsh Lake (Upper Nine Mile Creek)	Barr Engineering Co.
Sept. 1967	Report of the Marsh Lake Study Committee to Planning Commission	Author Undocumented
May 1970	Marsh Lake Plan	Marsh Lake Development Committee
Nov. 1971	Hydrological Study of Hyland-Bush-Anderson Lakes	Barr Engineering Co.
Mar. 1972	Storm Water Runoff at Hyland Lake Park	Hennepin County Park Reserve District
Jun. 1973	Preliminary Design Mt. Normandale Lake (Upper Nine Mile Creek)	Barr Engineering Co.
Mar. 1975	Hyland Lake Water Quality Study	Hennepin County Park Reserve District / Riley Purgatory Creek WD/ Barr Engineering Co.
Aug. 1975	Hyland Lake Restoration Preliminary Design	Hennepin County Park Reserve District/ Barr Engineering Co.
Jul. 1977	Ponds North of 84th Street between France and Normandale (Skriebakken)	COB
Nov. 1977	Draft Report Part 1 Rainstorm of August 30 - 31, 1977	COB
Sept. 1978	Hydrologic and Hydraulic Analysis of the Oxboro Lake to Nine Mile Creek Storm Water System	Barr Engineering Co.
Dec. 1978	Smith Pond Wright's Lake Storm Sewer System	Barr Engineering Co.

Date Completed	Name of Report	Author
Dec. 1978	Hydrologic and Hydraulic Analysis James Avenue Storm Sewer System	Barr Engineering Co.
Jul. 1980	Engineer's Report 105th Street Construction	Nine Mile Creek WD/ Barr Engineering Co.
May 1981	Draft Feasibility Study St. Edward's Pond	COB
Jun. 1981	Stadium Area Storm Drainage Study	TKDA
Feb. 1983	Storm Water Management Plan Normandale Center Area (Upper Nine Mile Creek)	Barr Engineering Co.
Mar. 1986	MOA FEIS	COB & BRW, Inc.
Mar. 1986	Storm Sewer at 99th and Grand Avenue (Hopkins D.A.)	COB
Jan. 1988	Storm Water Management Analysis Colorado Pond Drainage Basin	Barr Engineering Co.
Jan. 1988	Storm Water Management Analysis Penn Lake Drainage Basin	Barr Engineering Co.
Jan. 1988	Property Damage and Flood Elevation Comparisons	COB
Jan. 1988	Smith Pond-Wrights Lake Drainage Study	TKDA
Jan. 1988	Drainage Analysis for the York-Nine Ponds Area	Eugene A. Hickok
Jan. 1988	Summary Storm Water Management Analysis	Author Undocumented
Jan. 1988	Storm Water Management Analysis Brookside Area	Author Undocumented
Jan. 1988	Storm Water Management Analysis Skriebakken Pond	Author Undocumented
May 1988	Storm Sewer Report (Rain Storm of July 23 - 24, 1987)	COB

Date Completed	Name of Report	Author
Jun. 1988	Feasibility Study Diversion of Richfield Storm Sewer into I-494 Storm Sewer (Smith Pond)	TKDA
Jan. 1989	Lower Valley Bank Stabilization and Restoration Engineer's Report (Lower Nine Mile Creek)	Barr Engineering Co.
Dec. 1990	Storm Water Management Analysis Oxboro Lake Drainage Basin	Barr Engineering Co.
Apr. 1991	I-494 Reconstruction Preliminary Draft Water Resources Technical Report	BRW
Jul. 1991	I-35W EIS Water Resources Special Study	SRF Consulting
Jun. 1992	Analysis of Alternatives for Storm Sewer Improvements 8800 Block of Lyndale Avenue (Oxboro)	COB
Apr. 1997	Bush Lake Outlet Project Engineer's Report	Barr Engineering Co.
Undated	Report on Permanent Ponding Areas	COB
Jan. 1998	Nine Mile Creek UAA	Barr Engineering Co.
Aug. 2000	XPSWMM/P8 Analysis of Smith Ponds/Wright's Lake	WSB & Associates, Inc.
Aug. 2000	XPSWMMP/P8 Analysis of Riley Purgatory DA	WSB & Associates, Inc.
Oct. 2000	I-494 Reconstruction Final EIS Review Draft	SRF Consulting
Apr. 2001	AUAR Airport South	SRF Consulting
Sept. 2001	Nine Mile Creek/Bloomington UAA	Barr Engineering Co.
Jan. 2002	2001 Wetland Health Evaluation Program	Hennepin Conservation District
Mar. 2002	Bloomington Airport South District Stormwater Treatment Study	SRF Consulting Group, Inc. Montgomery Watson Harza

Date Completed	Name of Report	Author
Apr. 2002	Bush Lake UAA	Barr Engineering Co.
Aug. 2002	Hampshire Pond Drainage District Modeling Summary	Barr Engineering Co.
Apr. 2003	2002 Wetland Health Evaluation Program	URS
Feb. 2004	2003 Wetland Health Evaluation Program	URS
Apr. 2004	Bloomington Culvert Replacement Project Engineer's Report	Barr Engineering Co.
Jan. 2005	Normandale Lake UAA	Barr Engineering Co.
Apr. 2005	2004 Wetland Health Evaluation Program	URS
Jan. 2006	Oxboro Lake Hydrologic and Hydraulic Modeling	Barr Engineering Co.
June 2006	2005 Wetland Health Evaluation Program	URS
Mar. 2007	2006 Wetland Health Evaluation Program	URS
Aug. 2007	Nondegradation Load Assessment Report	Barr Engineering Co.
Oct. 2007	Nondegradation Report	City of Bloomington
Apr. 2008	2007 Wetland Health Evaluation Program	Hennepin County Environmental Services
Feb. 2009	2008 Wetland Health Evaluation Program	Hennepin County Environmental Services
Dec. 2009	2009 Wetland Health Evaluation Program	Hennepin County Environmental Services
Jan. 2010	Water Quality and Aquatic Plant Conditions in 28 Lakes and Ponds in Bloomington, Minnesota	Blue Water Science

Date Completed	Name of Report	Author
Nov. 2010	NE Penn Drainage Area Improvement Project Feasibility Report	Barr Engineering Co.
Jan. 2011	Bloomington Wetland Inventory Update	WSB
Jan. 2011	Lake Soil Fertility Evaluation for Bush Lake, Bloomington, Minnesota	Blue Water Science
Feb. 2011	Water Quality and Aquatic Plant Conditions in 26 Lakes and Ponds in Bloomington, Minnesota	Blue Water Science
Apr. 2011	2010 Wetland Health Evaluation Program	Hennepin County Environmental Services
Nov. 2011	Aquatic Plan Point Intercept Survey for Bush Lake, Bloomington, Minnesota	Blue Water Science
Feb. 2012	Water Quality and Aquatic Plant Conditions in 27 Lakes and Ponds in Bloomington, Minnesota	Blue Water Science
May 2012	2011 Wetland Health Evaluation Program	Hennepin County Environmental Services
Apr. 2013	Fish Surveys of Four Stormwater Ponds With Fathead Minnow Removal in Three Ponds in Bloomington, Minnesota in 2012	Blue Water Science
May 2013	2012 Wetland Health Evaluation Program	Hennepin County Environmental Services
Oct. 2013	Mt. Hope Redevelopment Drainage Area Model Update	Barr Engineering Co.
Mar. 2014	Water Quality for 27 Ponds in Bloomington, Minnesota in 2013	Blue Water Science
Mar. 2014	Fish Surveys and Fish Removal in Four Stormwater Ponds in Bloomington, Minnesota in 2013	Blue Water Science
May 2014	2013 Wetland Health Evaluation Program	Hennepin County Environmental Services
Jan. 2015	Colorado Pond Subwatershed Stormwater Study	Barr Engineering Co.

Date Completed	Name of Report	Author
Apr. 2015	2014 Wetland Health Evaluation Program	Hennepin County Environmental Services
May 2015	Fish Evaluation and Groundwater Flow into Four Stormwater Ponds in Bloomington, Minnesota in 2014	Blue Water Science
May 2016	2015 Wetland Health Evaluation Program	Hennepin County Environmental Services
Jan. 2017	2016 Wetland Health Evaluation Program	Hennepin County Environmental Services
July 2017	Preliminary Engineering Report for the NE Penn Area Stormwater Improvements	Bolton and Menk
July 2017	Lower Bloomington Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.
July 2017	Marsh Lake Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.
July 2017	Colorado-Hampshire Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.
July 2017	Purgatory Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.
July 2017	Skriebakken-Penn Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.
July 2017	South Loop Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.
July 2017	West Bloomington Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.
July 2017	York-France Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.
July 2017	Smith-Wright Watershed Hydrologic and Hydraulic Modeling	Barr Engineering Co.

Date Completed	Name of Report	Author
July 2017	Oxboro Lake Hydrologic and Hydraulic Modeling	Barr Engineering Co.

CITY OF BLOOMINGTON MINNESOTA

Drainage Basins
Municipal Boundary
Public Water Inventory Basins

Edina
Richfield
Fort Snelling
Mendota Heights
Eden Prairie
Bloomington
Eagan
Shakopee
Savage
Burnsville
Apple Valley

Upper Nine Mile Creek Subwatershed
Skriebakken Subwatershed
Penn Lake Subwatershed
Smith Pond Subwatershed
Airport South Subwatershed
Bush Lake Subwatershed
Marsh Lake Subwatershed
Oxboro Lake Subwatershed
11th Ave. Subwatershed
Colorado Pond Subwatershed
West Marsh Lake Subwatershed
Brook Side Subwatershed
3rd Ave. Subwatershed
Riley Purgatory Subwatershed
South Glen Subwatershed
Hopkins Road Subwatershed
10th Ave. Subwatershed
Lower Nine Mile Creek Subwatershed
Hampshire Pond Subwatershed
Overlook Lake Subwatershed
York Ave. Subwatershed
France Ave. Subwatershed

78th St
W 84th St
W 86th St
W American Blvd
E 86th St
E 88th St
E 90th St
W 94th St
W 99th St
W 104th St
W Old Shakopee Rd
W 111th St
Irwin Rd
Chalet Rd
Penn Ave S
Fremont Ave S
Bryant Ave S
Stevens Ave S
12th Ave S
Cedar Ave S
18th Ave S
Portland Ave S
1st Ave S
Colfax Ave S
Lyndale Ave S
Bliss La
Overlook Dr
Jersey Rd
Auto Club Rd
Yosemite Ave
Vernon Ave
Hennepin Town Rd
Bloomington Ferry Rd
E Bush Lake Rd
Wentz Rd
France Ave S

494
100
169
35W
77
34
35
32
28
17
52
1
901E

USDA 2016 NAIP Imagery via MnGeo

N

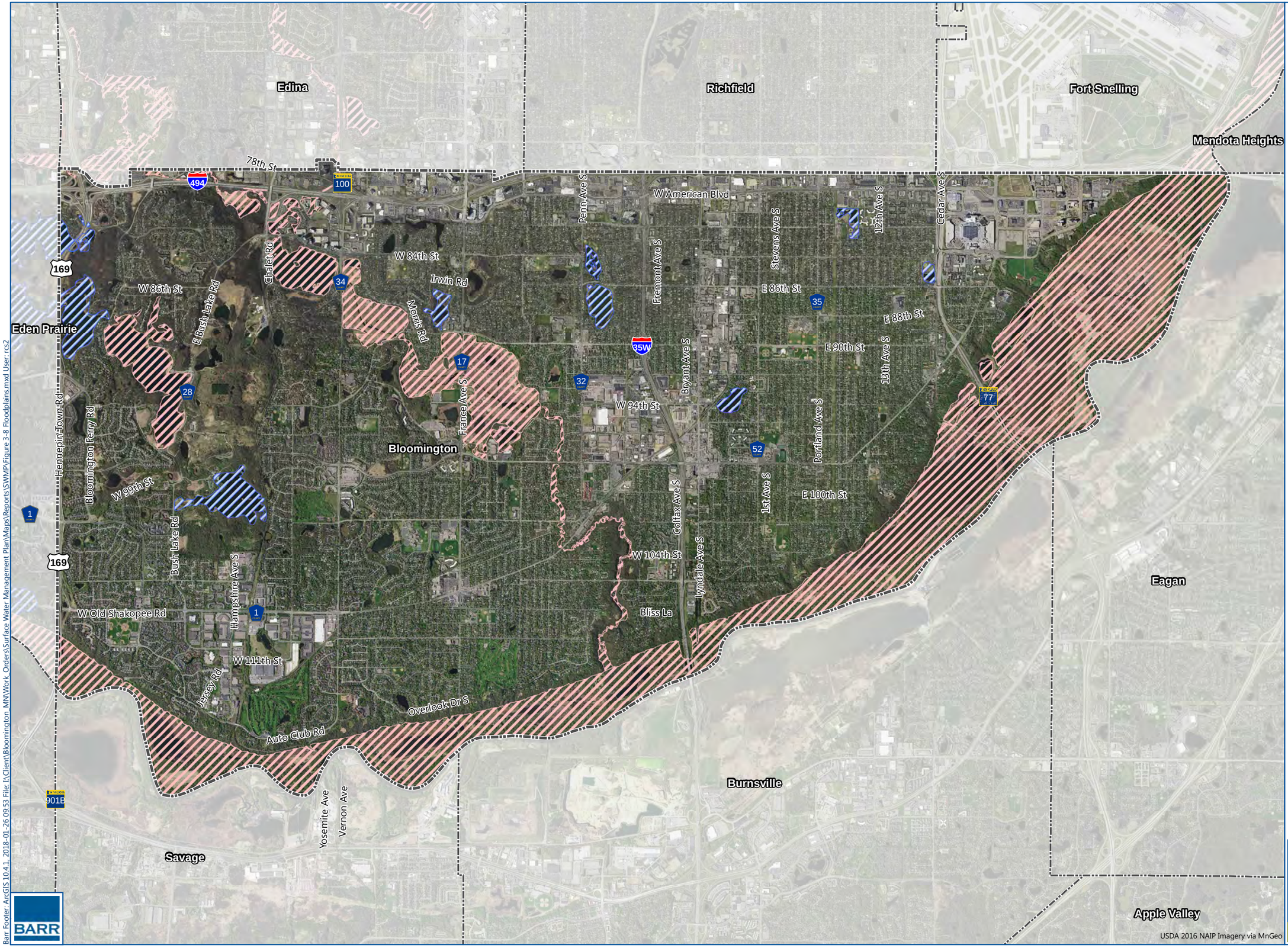
0 1
Miles

SUBWATERSHEDS
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-7

Barr Footer: ArcGIS 10.4.1, 2018-01-26 09:52 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-7 Subwatersheds.mxd User: rcs2

BARR



CITY OF BLOOMINGTON MINNESOTA

Municipal Boundary

2016 FEMA Flood Insurance Study

Floodway

1% Annual Chance Flood

N

0 1

Miles

FLOODPLAINS
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-8

USDA 2016 NAIP Imagery via MnGeo

BARR

Barr Footer: ArcGIS 10.4.1, 2018-01-26 09:53 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-8 Floodplains.mxd User: rcs2

3.6.2 Water Quality and Pollutants

The sources of water pollution in Bloomington are many and varied. The location of these potentially contaminated or hazardous waste sites should be considered when sites are redeveloped and BMPs are implemented. The presence of soil contamination, if not removed, may limit or prevent infiltration as a stormwater management option.

3.6.2.1 Point-Source Pollution

There are many permitted sites, hazardous-waste generators, and contaminated sites within the City. The MPCA maintains a database of these sites, including permitted sites (air, industrial stormwater, construction stormwater, and waste water discharge), hazardous-waste-generating sites, leak sites, petroleum brownfields, tank sites, unpermitted dump sites, and sites enrolled in the Voluntary Investigation and Cleanup (VIC) program. This information is available online through the MPCA's *What's In My Neighborhood* program, and is presented in Figure 3-9.

3.6.2.2 Non-Point Source Pollution

In contrast to sites with known hazards, non-point source pollution cannot be traced to a single source. Instead, pollutants are carried from land to water in stormwater or snowmelt runoff, in seepage through soil, and through atmospheric transport.

As part of the Stormwater Pollution Prevention Program (SWPPP) the City has an Illicit Discharge Detection and Elimination Program (IDDE) which prohibits non-stormwater discharges to the stormwater system. The City considers IDDE to be a high-priority topic and distributes public education materials focused on eliminating non-stormwater discharges to the storm sewer system.

The City promotes the use of Hennepin County's Hazardous Waste Drop-Off facility for proper disposal of household solid or liquid waste. Homeowners are also provided with information on the proper disposal of yard waste and how to use that waste in an environmentally responsible manner. The program also educates residents on the proper disposal of household waste including waste oil, paints, and solvents. The drop-off site for household hazardous waste is the South Hennepin Recycling and Problem Waste Drop-Off Center at 1400 West 96th Street. The City also publishes information pertaining to recycling, lawn care, hazardous waste, and water quality on its website and in the Bloomington Briefing (City Newsletter). Additionally, the City includes IDDE-related activities in all storm sewer infrastructure-related inspections (such as education, detection of illegal storm sewer connections, and clean-up activities).

CITY OF BLOOMINGTON MINNESOTA

- Municipal Boundary
- SuperFund Site

Pollutant Source

- Air Permit
- Feedlot
- Hazardous Waste
- Investigation and
- Solid Waste
- Tanks and Leaks
- Water Quality
- Multiple Activities

This map shows information from the Minnesota Pollution Control Agency web application called What's In My Neighborhood (http://www.pca.state.mn.us/WIMN/index.cfm).

The sites shown may have been mitigated and cleaned up.

N

0 1
Miles

IDENTIFIED POLLUTANT SOURCES
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-9

USDA 2016 NAIP Imagery via MnGeo

BARR

Barr Footer: ArcGIS 10.4.1, 2018-02-01 14:31 File: J:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-9 Identified Pollutant Sources.mxd User: rcs2

3.6.2.3 Water Quality Monitoring Locations

The NMCWD and the Metropolitan Council (Met Council) operate monitoring stations along Nine Mile Creek at three locations in Bloomington: West 78th Street (NMCWD), West 98th Street (NMCWD), and West 106th Street (Met Council). More information about water quality monitoring in the NMCWD watershed, can be found in Section 2.3 and Figure 2-6 of the NMCWD Fifth Generation Water Management Plan. Figure 3-10 of this LSWMP shows the location of past and present City monitoring sites used to collect water quality or quantity data.

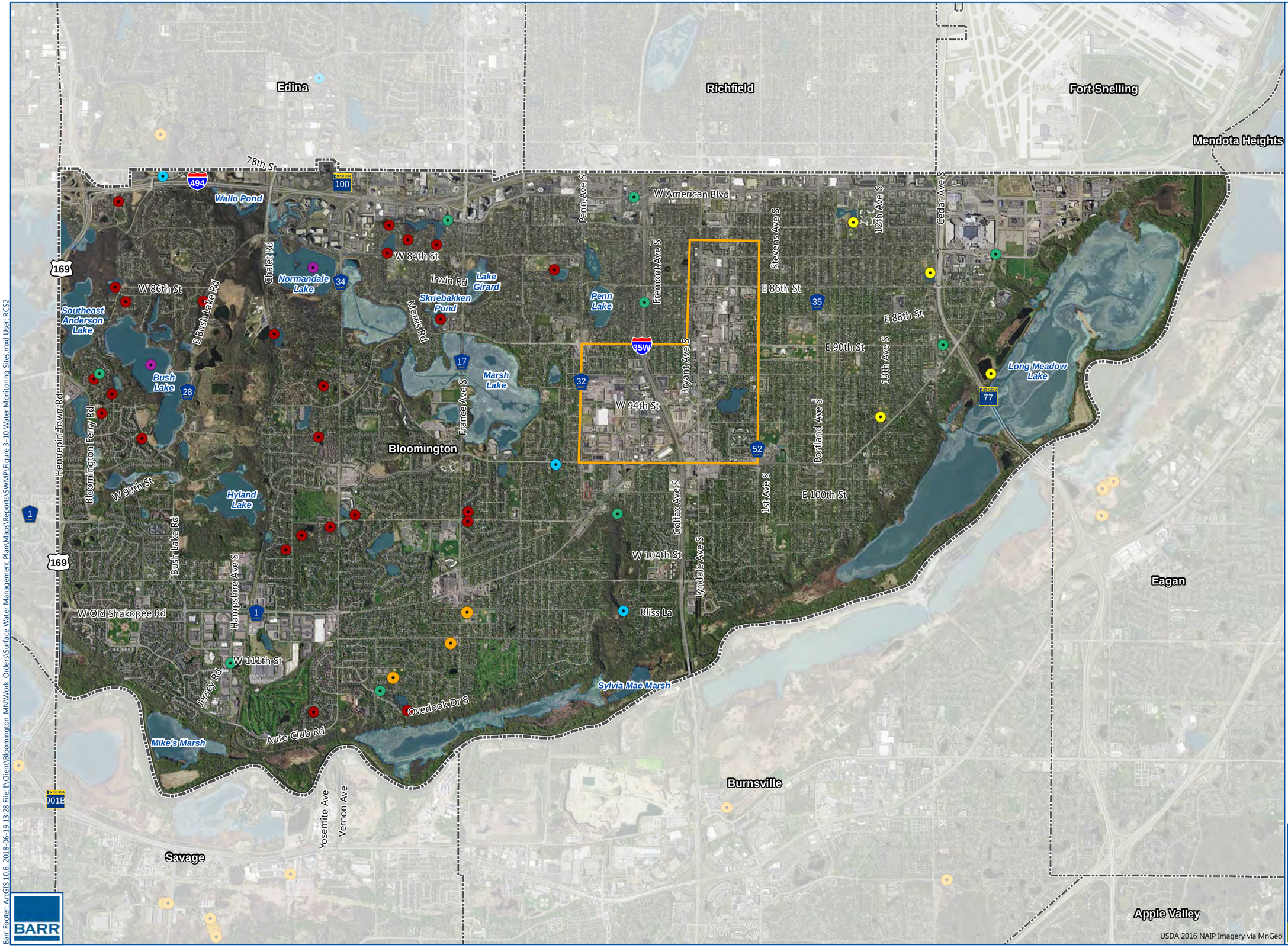
In 2009 the City began sampling 25 ponds throughout Bloomington with grab samples taken once per month during the summer months of June, July, and August. Data collected includes total phosphorus, Secchi depth, conductivity, chlorophyll *a*, dissolved oxygen, temperature, ortho-phosphorus, and total suspended solids. Starting in 2016 data on chloride has also been collected.

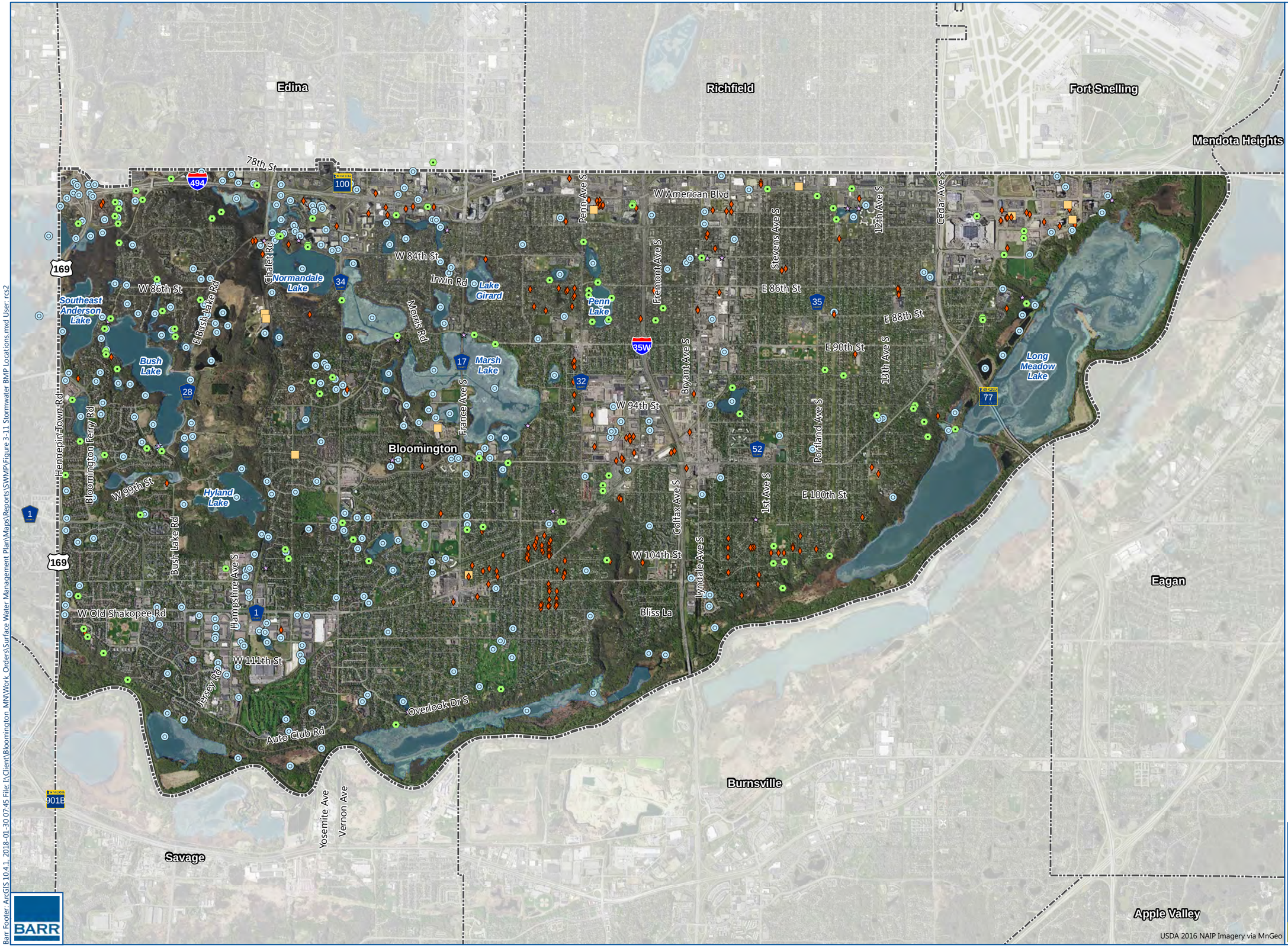
The City also participates in Hennepin County's Wetland Health Evaluation Program (WHEP). WHEP is an environmental monitoring program facilitated by Hennepin and Dakota Counties; it focuses on assessing the condition and health of wetlands throughout these counties.

Since 2001, WHEP volunteers have been monitoring wetland health throughout Bloomington. Teams of citizen scientists assess local wetlands by identifying and quantifying the biological communities of each site. Volunteers collect aquatic macroinvertebrates including insects, leeches, small crustaceans, and snails. Teams also focus on wetland vegetation by inventorying the plant community.

3.6.2.4 City-Maintained BMPs and Water Quality Improvement Programs

In addition to the series of ponds and wetlands that are part of the storm sewer system the City has many other BMPs that help improve the quality of runoff water prior to discharging to downstream resources. BMPs include trap manholes and other structural stormwater treatment practices such as underground swirl chambers and floatable controls. Additional BMPs include volume-retention-type BMPs such as raingardens, pervious pavements, swales, and underground infiltration chambers. Figure 3-11 shows the existing structural BMPs being used to improve water quality within the City.


Edina
Richfield
Fort Snelling
Mendota Heights
Eagan
Burnsville
Savage
Apple Valley
Bloomington
78th St
W American Blvd
W 84th St
W 86th St
E 86th St
E 88th St
E 90th St
W 94th St
W 99th St
W 104th St
E 100th St
W Old Shakopee Rd
W 111th St
Bliss La
Overlook Dr S
Auto Club Rd
Irwin Rd
Wallo Pond
Normandale Lake
Lake Girard
Skriebakken Pond
Penn Lake
Southeast Anderson Lake
Bush Lake
Marsh Lake
Hyland Lake
Long Meadow Lake
Sylvia Mae Marsh
Mike's Marsh
Penn Ave S
Fremont Ave S
Stevens Ave S
12th Ave S
Cedar Ave S
Chalet Rd
E Bush Lake Rd
Morris Rd
Bryant Ave S
France Ave S
18th Ave S
Portland Ave S
1st Ave S
Colfax Ave S
Lyndale Ave S
Hampshire Ave S
Bush Lake Rd
Bloomington Ferry Rd
Hennepin Town Rd
Jersey Rd
Yosemite Ave
Vernon Ave
494
100
169
35W
35
34
17
28
32
52
77
1
901B
CITY OF BLOOMINGTON MINNESOTA
Municipal Boundary
SuperFund Site
Public Water Inventory Basins
MN DNR Observation Well
Water Quality Monitoring Locations
MCES WOMP
Monitored by COB
Monitored by COB as RBWMO
Monitored by NMCWD
Expired
N
0
1
Miles
WATER MONITORING SITES
Surface Water Management Plan
City of Bloomington, MN
FIGURE 3-10
USDA 2016 NAIP Imagery via MnGeo
BARR
Barr Footer: ArcGIS 10.6, 2018-06-19 13:28 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-10 Water Monitoring Sites.mxd User: RCS2



CITY OF BLOOMINGTON MINNESOTA

- Municipal Boundary

BMP Type

- Filtration
- Infiltration
- Ponds
- Special Treatment Structure
- Trap Manhole
- Public Water Inventory Basins

This map shows BMP data from the City of Bloomington (01/05/2018).

N

0 1

Miles

STORMWATER BMP LOCATIONS Surface Water Management Plan City of Bloomington, MN

FIGURE 3-11

USDA 2016 NAIP Imagery via MnGeo

BARR

Barr Footer: ArcGIS 10.4.1, 2018-01-30 07:45 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-11 Stormwater BMP Locations.mxd User: rcs2

The City has identified schedules to maintain the different BMPs and sweeps all streets twice per year. Additional sweeping occurs throughout the spring, summer, and fall months in high-priority areas.

In 2016 the City upgraded its brine-making equipment, significantly increasing the efficiency of producing brine mixture and decreasing treatment time from two days to one day. The equipment allows the City to produce a brine that better meets the characteristics of the storm event and significantly decreases the amount of salt applied to City surfaces.

3.6.2.5 Previous Studies

A variety of water quality studies have been completed for the City. Many of these studies are listed in Table 3-3and are also available in the Water Resources Library at Bloomington Public Works.

In October 2007 the City completed a Nondegradation Report to satisfy the requirements of its 2006 Municipal Separate Storm Sewer System (MS4) Permit. The purpose of the Nondegradation Report was to determine whether additional control measures could reasonably be taken to minimize the impacts of any significant new or expanded discharge based on two time periods: from 1988 to 2007 (the date of the City's last LSWMP) and from 2007 to 2020. To evaluate the impacts of estimated changes in stormwater discharge loading of total suspended solids, total phosphorus, and runoff volume, a loading assessment was completed.

To provide additional information on existing and future water quality within the City, an urban water quality model was developed. The computer program used for this modeling is the "Program for Predicting Polluting Particle Passage through Pits, Puddles, and Ponds" referred to as the P8 Urban Catchment Model. The P8 urban water quality model predicts the generation and transportation of stormwater runoff pollutants within the City. This model can estimate pollutant loadings, concentrations, and removal efficiencies for basins subject to single or continuous rainfall events. The model simulates the performance of a variety of treatment devices including swales, buffer strips, detention ponds, flow splitters, infiltration basins, and general devices.

P8 models have been completed for many of the subwatersheds in the City. The P8 water quality modeling results include the following:

- Estimations of water quality parameters
- Average treatment efficiencies of stormwater detention basins within the City

- Water quality parameters including:
  - Total suspended solids (TSS)
  - Total phosphorous (TP)

The concentrations of individual water quality parameters estimated by the P8 water quality model may vary significantly from values obtained from field monitoring. This inconsistency is due to the extreme variation in water quality parameter concentrations from individual subwatersheds. However, the estimated removal efficiencies of treatment basins are comparable to the removal efficiencies determined from field investigations.

Monitoring results and additional information on the P8 water quality modeling effort are available in the Water Resources Library at Bloomington Public Works.

3.6.2.6 National Pollutant Discharge Elimination System (NPDES) Phase II

The City has submitted its NPDES Phase II Stormwater Program permit and developed a SWPPP. Phase II requires MS4s in urban areas with populations over 10,000 and under 100,000 to obtain an NPDES permit. Permits for construction sites greater than one acre also require a permit, as well as certain categories of industrial activities that are covered under Phase II. More information regarding this program is included on the City and MPCA websites.

3.6.2.7 Wetlands

In 1997, in accordance with Minnesota Rules 8420.0650, the City completed a Wetland Protection and Management Plan for areas above the Minnesota River bluff line. The plan inventoried approximately 300 wetlands using a slightly modified version of the Minnesota Routine Assessment Methodology for Evaluating Wetland Functions, as permitted under the Wetland Conservation Act (WCA) rules. A second assessment was completed for areas within the Minnesota River Valley during 1999. In 2010, WSB completed an update to the 1997 Wetland Protection and Management Plan. Wetlands are shown in Figure 3-12.

Wetland inventories have been completed by the U.S. Fish and Wildlife Service (USFWS), as published on their National Wetland Inventory Maps. Inventories by the MnDNR have been published in their Protected Waters and Wetlands Map. The City of Bloomington has also completed an inventory map as part of its Wetland Protection and Management Plan.

A copy of the Wetland Protection and Management Plan is available in the Water Resources Reference Library at Bloomington Public Works. Additional information about wetlands is included in Section 4.5.

3.6.2.8 Shore Area Regulation

The City has adopted Shore Area Regulations. An update to the Shore Area Regulations is expected in 2018. The DNR Public Waters/Wetlands that pertain to these Shore Area Regulations are shown on Figure 3-13.

3.6.2.9 Impaired Waters

Some of the City's waterbodies are currently listed on the State's 303d Impaired Waters List. State and federal laws stipulate that once a waterbody is listed as impaired, stressors causing the impairment must be identified and remediation efforts, including development of total maximum daily loads (TMDL) for identified pollutants, need to be initiated. As TMDLs for each reach or waterbody within the City are completed, the City, along with all other industries, construction companies, and others needing a stormwater permit, will be required to submit SWPPPs that incorporate TMDL standards as part of permit requirements. State-listed impaired waters within or adjacent to the City of Bloomington are shown in Figure 3-14.

The Clean Water Act requires the MPCA to identify and restore impaired waters. It is ultimately the responsibility of the MPCA to complete and submit TMDLs to the U.S. Environmental Protection Agency (EPA). Stakeholder involvement in the development of TMDL implementation plans is critical. Table 3-4 is a list of waterbodies located within the City of Bloomington that are included on the State's 303(d) Impaired Waters List.

CITY OF BLOOMINGTON MINNESOTA

- Municipal Boundary
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine
- Public Water Inventory Watercourses

N

0 1 Miles

NATIONAL WETLAND INVENTORY MAP
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-12

USDA 2016 NAIP Imagery via MnGeo

BARR

Barr Footer: ArcGIS 10.4.1, 2018-01-26 09:56 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-12 National Wetland Inventory Map.mxd User: rcs2

CITY OF BLOOMINGTON MINNESOTA

Municipal Boundary
MN DNR Public Waters

N

0 1
Miles

MNDNR
PUBLIC WATERS
Surface Water
Management Plan
City of Bloomington, MN

FIGURE 3-13

BARR

USDA 2016 NAIP Imagery via MnGeo

Barr Footer: ArcGIS 10.4.1, 2018-01-26 09:56 File: I:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-13 MNDNR Public Waters.mxd User: rcs2

CITY OF BLOOMINGTON MINNESOTA

- Municipal Boundary
- Impaired Streams (2016 Draft)
- Impaired Lakes (2016 Draft)
- Public Water Inventory Basins

(DNR ID#)

This map shows the Draft 2016 Impaired Waters List from the Minnesota Pollution Control Agency.

Impairment Type: Mercury in Fish Tissue

Impairment Type: Chloride and Fish Bioassessment

Impairment Type: Nutrients

Impairment Type: Dissolved Oxygen, Mercury in Fish Tissue, Mercury in Water Column Nutrients, PCBs in Fish, Turbidity, and Nutrients

N

0 1 Miles

IMPAIRED WATERS
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-14

USDA 2016 NAIP Imagery via MnGeo

Barr Footer: ArcGIS 10.4.1, 2018-01-26 09:57 File: J:\Client\Bloomington_MN\Work_Orders\Surface Water Management Plan\Maps\Reports\SWMP\Figure 3-14 Impaired Waters.mxd User: rcs2

Table 3-4 List of Impaired Waterbodies within Bloomington

Watershed	Waterbody	Reach	Pollutant/Stressor	Year Listed	Target Start Date	Target Completion	Required Bloomington Action
Nine Mile Creek	Nine Mile Creek	Headwaters to Minnesota River	Chloride	2009	2005	2009	Waste load allocation (WLA) for all MS4 permit holders of combined 5.164 tons/day
			Fish bioassessments	2004	2014	2029	Pending
			Turbidity	TMDL delisted in 2010			N/A
		Marsh Lake to Minnesota River	Fecal coliform	2018	2018	2019	Pending
	Bush Lake		Mercury	1998	1999	2011	Statewide initiative (No reduction required)
	Penn Lake		Nutrients	2018	2018	2019	Pending
Purgatory Creek	Hyland Lake		Nutrients	2008	2014	2018	Pending

Watershed	Waterbody	Reach	Pollutant/Stressor	Year Listed	Target Start Date	Target Completion	Required Bloomington Action
Lower Minnesota River	River Mile 22 to Mississippi River		Mercury	1998	1998	2025	Statewide initiative (No reduction required)
			PCBs	1998	2014	2019	Statewide initiative (No reduction required)
			Dissolved oxygen	---	2004	2009	Lower Minnesota River Watershed Combined WLA of 2.1 lbs. TP/day
			Turbidity	Addressed through South Metro turbidity (see below)			
			Nutrients	2016	2014	2022	Pending
Statewide/ Regional	Mississippi	South Metro	Turbidity	2010	2016	2016	WLA of 154lbs/year/acre TSS for developed land use
	Statewide		Mercury	2004	Unknown	2007	N/A

3.6.3 Fish and Wildlife Habitat and Water Based Recreation Areas

Many areas in Bloomington provide habitat for a variety of small mammals, reptiles, birds, amphibians, and insects. Maintenance of habitat for wildlife species is important for maintaining ecological stability in Bloomington's natural areas. The wetland inventory found in the City's Wetland Protection and Management Plan assesses floral diversity, wildlife habitat, and fisheries habitat for each wetland.

The City's Comprehensive Plan identifies areas of wildlife habitat, travel corridors, and crossing areas. These areas are predominantly located along the Minnesota River Valley, the Nine Mile Creek corridor, and within the Anderson, Bush, and Hyland Lakes complex.

The DNR Natural Heritage database (http://www.dnr.state.mn.us/nhnrp/nhis.html) indicates that a wide variety of unique fish and wildlife habitat exists within the City, much of which is located along the Minnesota River, Anderson Lake, Bush Lake, and Hyland Park Reserve. Additionally, Hyland, Lower Penn, Smith, and Bush Lakes have been stocked with fish by the MnDNR (see Table 3-5).

Table 3-5 MnDNR Classifications of Bloomington Lakes

Waterbody	DNR PWI Number	Fish Species Present (based on classification)
Anderson Lake	62P	BLB, BG, BC
Bush Lake	47P	WS, YB, PS, BC, YP
Hyland Lake	48P	WS, BG, BC, YP, WA
Penn	4P	BLB, BG, BC
Normandale Lake	1045P	WS, BG, BC, YP
Smith Pond	1078P	BG, BC

**BC=black crappie; BG=bluegill; BLB=black bullhead; PS=pumpkinseed; YB=yellow bullhead; YP=yellow perch; WA=walleye; WS=white sucker*

The MnDNR actively stocks and surveys many Bloomington waterbodies:

- Anderson Lake was most recently stocked by the MnDNR in 2015. The MnDNR last completed a fish survey of the Anderson Lakes in 1993.
- Fishing access for Bush Lake is available from a publicly available boat launch and three piers on the lake. The lake fish habitat has been threatened since the introduction of Eurasian watermilfoil, an invasive aquatic plant species. Eurasian watermilfoil was first documented in the lake in 1990, and the lake was listed as infested in 1995. Curly leaf pondweed, another invasive species, is also present.
- The MnDNR stocks Hyland Lake with walleye every two years. Fishing access is available from a boat launch on the northwest shoreline and a public water access on the south end of the lake.
- A fish survey of Penn Lake was last completed by the MnDNR in 2010, and fish stocking was completed in 2010, 2011, 2013, and 2014.
- A fishing pier at Smith Pond is available for use by the public. The pond is stocked annually with Bluegill and Black Crappie.
- The Minnesota Valley National Wildlife Refuge (MVNWR) covers most of the area directly adjacent to the Minnesota River in Bloomington. It contains Long Meadow Lake, which is a riverine marsh re-stocked with fish by the floodwaters of the Minnesota River. The Wildlife Refuge has trails for passive, non-contact recreation, in addition to boating and fishing recreation available on the Minnesota River. Environmental educational opportunities are also available at the MVNWR.

3.6.4 Unique Features and Scenic Areas

The City of Bloomington has many natural areas, water resources, and regional parks. Some of these areas contain rare and endangered species and special habitats. Figure 3-15 outlines the scenic and natural areas located in the City, based on information from the MnDNR Natural Heritage Database.

CITY OF BLOOMINGTON MINNESOTA

- Municipal Boundary
- Other Park Owners
- Bloomington School District #271
- City of Bloomington
- Hennepin County
- State of Minnesota
- Three Rivers Park District
- US Fish and Wildlife

This map shows scenic and natural areas data that was provided by the City of Bloomington (01/19/2018).

N

0 1 Miles

SCENIC/NATURAL AREAS
Surface Water Management Plan
City of Bloomington, MN

FIGURE 3-15

USDA 2016 NAIP Imagery via MnGeo

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