Water Resources Management Plan

Burnsville, Minnesota

SEH No. BURNS135090 4.00

November 6, 2017

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Executive Summary

Purpose and Need

The primary purposes of this Plan is to meet regulatory requirements and to protect and improve surface and ground water resources within the City. There are two primary programs that establish the regulatory need to update the City's Water Resources Management Plan (WRMP or Plan). First, Minnesota Statutes, Sections 103B.201 to 103B.255 and Minnesota Rule, Chapter 8410 comprise the State's Metropolitan Surface Water Management Program (MSWMP). These Statutes and Rules require the preparation of watershed plans by watershed management organizations (WMOs) and the preparation of local (City) water management plans. The City is located within the jurisdiction of three local WMOs including: Black Dog Watershed Management Organization (BDWMO), Lower Minnesota River Watershed District (LMRWD), and Vermillion River Watershed Joint Powers Organization (VRWJPO). These organizations are critical partners in the implementation of the City's overall surface water management program.

In July of 2015, the Minnesota Rules, Chapter 8410 was amended which made significant changes in the timing of local water management plan revisions. Local water management plans must be revised once every ten years in alignment with the local comprehensive plan schedule. The current round of local comprehensive plan updates are due by December 31, 2018. Therefore, all cities and towns in the seven-county metropolitan area must complete and adopt their local water plan between January 1, 2017 and December 31, 2018. Upon adoption by Council, this 2017 WRMP becomes part of the City's overall 2040 Comprehensive Plan.

The second regulatory program, very much related to the goals, policies and standards of this Plan, is the National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Permit Program for Municipal Separate Storm Sewer Systems (MS4) that is administered in the State by the Minnesota Pollution Control Agency (MPCA). The goals, policies and standards of this plan were developed to be consistent with the requirements of the City's NPDES MS4 permit and associated Surface Water Pollution Prevention Plan (SWPPP) as well as the respective WMO plans. The implementation program included in this plan and the SWPPP are intended to be a coordinated effort to realize combined efficiencies.

Building on Past Success

The City's first comprehensive drainage plan was completed in 1966. In 1994, the City completed its first Comprehensive Stormwater Management Plan. Through the 1994 plan, the City formalized a policy of using natural ponds and wetlands as part of the stormwater drainage system. The City completed its second generation plan in 2002 which focused on addressing water quality and quantity (flooding) issues. The third generation plan was completed in 2008 and provided updates to the water quality goals and development design standards. In 2014, the third generation plan was amended with a minor update again focusing on development design standards and updating precipitation frequency estimates published in Atlas 14. These past Plans have established the foundation for addressing numerous flooding and erosion problems, efficiently improving water quality in City water and implementing development standards that are reasonable and effective.

The following projects and accomplishments are just a few of the dozens of projects and actions that the City has completed in the past 15 years to improve water quality, reduce flooding and achieve the City's water resources goals.

- Removal of Earley Lake from the 303(d) Impaired Waters List in 2011.
- Completion of improvements in the Northeast Burnsville area to address widespread flooding issues that occurred in July 2000.
- Construction of Yellow Freight Regional Pond to provide treatment of previously untreated runoff and treatment capacity for future development and redevelopment in the contributing area.

- Black Dog Slope Failure Repair to replace a failed corrugated metal pipe (CMP) and related major ravine erosion problem as part of the City's CMP pipe replacement program.
- Developing and distributing materials and holding numerous educational and public information activities on a wide range of water resources related topics.

Looking Forward

This 10-Year Plan continues to build on the impressive foundation of water resources work completed by the City over the past decades. In the 2002 Plan, the primary focus was water quantity (or addressing flooding) following the extreme rainfall event in July of 2000. Water quality was a close second and had been the top public priority in 1999 and early 2000, prior to July 2000. Today water quality dominates the discussion and the evolution of the NPDES MS4 Permit Program also places an expectation and requirements on the City to continue to make improvements in water quality.

In addition to water quality, public input during the planning process focused on concerns with managing aquatic vegetation. A range of weather and other factors in 2016 created the perfect storm in some ways for significant aquatic vegetation and algae issues in Burnsville's water bodies. The City will continue to provide technical support of landowners, complete vegetation management on selected waters, develop improved educational materials and access to information on required permits what landowners can do and permits they may need to complete those activities. The City has updated it Aquatic Plant Management Policy as part of this Plan update and will be preparing management plans for each of its lakes.

Implementation Program and Funding

The implementation plan includes identification and prioritization of capital improvements, administration, maintenance and inspections, permitting, plan amendments, financing alternatives, public involvement and monitoring programs. Prioritization of improvements was based on a review of all recommended actions.

The Implementation Plan is not a hard and fast commitment to complete each and every activity in the time frame suggested. Rather, it is a suggested course of action that will accomplish the major goals of this plan, to accommodate growth in the community while protecting and improving Burnsville's water resources. The Implementation Plan should be reviewed on an annual basis. At that time, each proposed improvement is to be reconsidered, City budgets adjusted, and additional improvement projects or management activities added to or removed from the program. The City Council is required to specifically approve a project or budget prior to making the funds available for the project or activity.

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Water Resources Management Plan

Prepared for City of Burnsville

1.0 Introduction

This report provides the update to the City of Burnsville's (City) Water Resources Management Plan (2017 WRMP or 2017 Plan) and a look into some of the key issues related to water resources that are facing the City over the next ten years. This section begins with a brief history of water resource management in Burnsville dating back to the 1960's and concludes with the purpose of the plan.

1.1 History

Burnsville has experienced phenomenal growth in the last sixty years, increasing in population from about 600 in 1950 to more than 60,000 today. This growth occurring primarily in the 1950s and 1960s, along with topographic constraints in many areas of the City, contributed significantly to local flooding problems. Numerous small local ponds flooded on occasion because they had limited storage capacity and no natural overflows. The only solution at that time was to drain these ponds into other low spots. Ponds that were receiving water from other locations were subsequently threatened themselves by stormwater that had never been directed to them before, causing legal dilemmas.

The City's first comprehensive drainage plan was completed in 1966. The 1966 drainage plan addressed extreme fluctuations in water levels on Crystal Lake. On several occasions in the late 1960's and in the early 1970's, it became necessary to pump the lake to lower its level. The City ultimately decided to install a gravity storm sewer system so that the discharge (i.e., lake level) would not be subject to the uncertainties of a mechanical pump. The next major hurdle was to construct a large lake/pond north of County Road 42 near the Savage and Burnsville border. The "new" Sunset Pond was created to accept the surface water from the new homes and businesses in west central Burnsville and the outflow of water from Crystal Lake. Shortly after completion of Sunset Pond, the downstream pipes were installed and the Crystal Lake outlet was finally in-place.

In 1994, the City completed its first generation local water resources plan (Comprehensive Stormwater Management Plan, OSM). The City completed its second generation plan in 2002 which focused on addressing water quality and quantity (flooding) issues. The third generation plan was completed in 2008 and provided updates to the water quality goals and development design standards. In 2014, the third generation plan was amended with a minor update again focusing on development design standards and updating precipitation frequency estimates published in Atlas 14.

The Lower Minnesota River Watershed District, the Black Dog and Vermillion River Watershed Management Organizations (WMOs) have in recent years taken steps towards, or completed, updating their watershed plans. Each of these organizations have jurisdiction over water resources related issues within portions of the City and have goals and policies to which this plan must align.

1.2 Purpose

There are two primary programs that establish the regulatory need to update the City's Water Resources Management Plan. First, Minnesota Statutes, Sections 103B.201 to 103B.255 and Minnesota Rule, Chapter 8410 comprise the State's Metropolitan Surface Water Management Program (MSWMP). These Statutes and Rules require the preparation of watershed plans by watershed management organizations (WMOs) and the preparation of local (City) water management plans.

The purposes of the water management programs required by Minnesota Statutes §103B.205 to 103B.255 are to:

- Protect, preserve and use natural surface and groundwater storage and retention systems;
- Minimize public capital expenditures needed to correct flooding and water quality problems;
- Identify and plan for means to effectively protect and improve surface and groundwater quality;
- Establish more uniform local policies and official controls for surface and groundwater management;
- Prevent erosion of soil into surface water systems;
- Promote groundwater recharge;
- Protect and enhance fish and wildlife habitat and water recreational facilities; and
- Secure the other benefits associated with the proper management of surface and groundwater.

In July of 2015, the Minnesota Rules, Chapter 8410 was amended which made significant changes in the timing of local water management plan revisions. Local water management plans must be revised once every ten years in alignment with the local comprehensive plan schedule. The next local comprehensive plans are due December 31, 2018, thus all cities and towns in the seven-county metropolitan area must complete and adopt their local water plan between January 1, 2017 and December 31, 2018. This 2017 WRMP is part of the City's overall 2040 Comprehensive Plan.

The second regulatory program, very much related to the goals, policies and standards of this Plan, is the National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Permit Program for Municipal Separate Storm Sewer Systems (MS4) that is administered in the State by the Minnesota Pollution Control Agency (MPCA). The goals, policies and standards of this plan were developed to be consistent with the requirements of the City's NPDES MS4 permit and associated Surface Water Pollution Prevention Plan (SWPPP) as well as the respective WMO plans. The implementation program included in this plan and the SWPPP are intended to be a coordinated effort to realize combined efficiencies.

1.3 Watershed Organizations

The City is located within four major watershed units. These watersheds are regulated by three local watershed organizations including: Black Dog Watershed Management Organization (BDWMO), Lower Minnesota River Watershed District (LMRWD), and Vermillion River Watershed Joint Powers Organization (VRWJPO). The fourth watershed, Credit River, is administered by the BDWMO for the portion of the watershed within Dakota County. The administrative boundaries for the three local watershed organizations are shown in Figure 1.

1.3.1 Vermillion River Watershed Joint Powers Organization

A 21-member Vermillion River Watershed Management Commission (VRWMC) previously governed the watershed. The legal basis for the commission was a Joint Powers Agreement (JPA), which was formulated on June 15, 1984. The purpose of the Commission was to preserve and use natural water storage and retention in the Vermillion River Watershed to meet Surface Water Management Act goals.

In accordance with the Metropolitan Surface Water Management Act, the WMO began to prepare a second generation plan for managing the water resources of the Vermillion River Watershed. A draft plan dated August 1999 was published and was in the process of review, but was not immediately adopted. Because a new joint powers agreement could not be established, the VRWMC was dissolved and management of the WMO reverted to Dakota and Scott Counties.

The Vermillion River Watershed located in Scott and Dakota Counties in Minnesota, is administered through a Joint Powers Agreement. The counties formed a Joint Powers Organization to exercise leadership in the development of policies, programs and projects that will protect and preserve the water resources in the Vermillion River Watershed. The VRWJPO is governed by a three-member Joint Powers Board (JPB) composed of two Dakota County Commissioners and one Scott County Commissioner. A nine-member citizen advisory Watershed Planning Commission supports the Joint Powers Organization.

Based on tax capacity, Dakota and Scott Counties jointly fund the administration and activities of the VRWJPO. The Counties established special taxing districts within their portions of the Watershed to provide a mechanism for funding VRWJPO costs. A nine-member Watershed Planning Commission (WPC), consisting of eight members from the Dakota County portion of the Watershed and one member from the Scott County portion, provides support to the JPB. The general duties of the WPC are to advise the JPB regarding its duties under the Joint Powers Agreement.

The VRWJPO adopted its first watershed management plan in 2005 and recently in June 2016 adopted a second generation watershed management plan for 2016-2025.

1.3.2 Black Dog Watershed Management Organization

The legal basis for the BDWMO is a Joint Powers Agreement (JPA), which was formulated in June 1985 between the cities of Apple Valley, Burnsville, Eagan, Lakeville and Savage. The WMO was formed in response to the requirements of the State Metropolitan Surface Water Management Act of 1982. The BDWMO's first watershed plan was approved on November 22, 1989.

In 1999, the Dakota County portion of the former Credit River watershed was added to the jurisdiction of the BDWMO. As a result, a revised and restated joint powers agreement was signed by the member communities. The BDWMO and Scott County signed a memorandum of understanding regarding the management of the Credit River watershed in Dakota County.

In 2002, the BDWMO published a second generation watershed management plan and most recently updated their watershed plan in 2012 for the years 2012-2022.

The BDWMO's general purposes include the following:

- Keep regulation at the local level;
- Assist member communities with inter-community issues;

- Monitor, classify and manage strategic water bodies (Crystal Lake, Keller Lake, Lac Lavon and Sunset Pond in Burnsville);
- Monitor, evaluate and/or model stormwater runoff quality;
- Improve the quality of stormwater runoff reaching the Minnesota River;
- Develop policies to be implemented by member cities to achieve the organization's goals; and
- Assess the performance of the BDWMO and the member cities in achieving the organization's goals.

1.3.3 Lower Minnesota River Watershed District

The Lower Minnesota River Watershed District is a watershed district created under Minnesota Statutes 103. The Minnesota Water Resources Board (now the Board of Water and Soil Resources) established the District on March 23, 1960. The District was originally established to be a legal entity for providing local participation to the U.S. Army Corps of Engineers (COE) to construct a navigation channel. The initial focus of the District was based on maintaining the 9-foot navigation channel on the Minnesota River.

This districts first watershed management plan was published in 1961 with a second generation plan completed in 1999. The current third generation plan was originally approved in 2011 and most recently was amended in June 2015.

The affairs of the District are managed by the Board of Managers. The Board is comprised of five county-appointed managers. The District's current purposes differ from its historical focus. The mission of the District is to manage and protect the Minnesota River, lakes, streams, wetlands, and groundwater, and to assist and facilitate in providing river navigation by:

- Promoting open communication, and partnering, with citizens, community organizations, and local, state, and federal agencies.
- Improving and protecting the quality of the Minnesota River and all water bodies in the watershed.
- Minimizing the negative effects of floods and droughts on the Minnesota River and all water bodies in the watershed.
- Collecting and distributing information regarding surface water and groundwater in the watershed to assist in establishing priorities and developing local plans to improve water resources in the watershed.
- Monitoring and understanding the effects of municipal groundwater appropriations and drought on groundwater levels.
- Working with LGUs to enforce the Wetland Conservation Act.
- Assisting and facilitating the efforts of state and federal agencies to maintain the navigation channel.
- Educating stakeholders about the impact they have on the water resources in the watershed and motivating them to change behaviors that have a negative impact.

2.0 Physical Environment and Land Use

The following sections provide a general overview of the major physical environment and land use features within Burnsville. This section is intended to highlight some of the major

features and their general connection to water resources management. Sources for more detailed information are noted where applicable.

2.1 Topography

In general, the land within Burnsville slopes from south to north toward the Minnesota River. At the southern end of the watershed, an upland ridge slopes down to Crystal Lake. Continuing north, the upland transitions into an undulating glacial outwash plain. This area is pitted with shallow depressions surrounded by mounds of glacial till. Further north, the pitted outwash plain gives way to an outwash terrace, just above the Minnesota River floodplain. This transition corresponds roughly to the political boundary between the Black Dog WMO and the Lower Minnesota River Watershed District.

Some areas in east central Burnsville in the vicinity of Alimagnet Lake drain to the east to Alimagnet Lake and ultimately to the Vermillion River. Areas in the southwest corners of the City within the Credit River Subwatershed direct stormwater runoff to the south and west to the Credit River. The highest point within the City of Burnsville is Buck Hill, with an elevation of 1,215 feet above sea level. The lowest point in the City is just above the banks of the Minnesota River at approximately an elevation 700 feet.

High-accuracy digital elevation data, based on data collected using LiDAR technology is available for the entire City of Burnsville through the Minnesota Digital Elevation Mapping Project and the Dakota County GIS online mapping tool. This topographic information can also be viewed and downloaded through the MnDNR supported MnTOPO web application. A hillshaded topographic map based on this digital elevation data is shown in Figure 2.

2.2 Soils

Soil Composition, slope and land management determine the effect of soils on stream and lake water quality. Soil composition and slope are important factors affecting the rate and amount of stormwater runoff. The shape and stability of aggregates of soil particles, expressed as soil structure, influence the permeability, infiltration rate, and erodibility of soils. Slope is important in determining stormwater runoff rates and hence susceptibility to erosion.

Infiltration capacities of soils affect the amount of direct runoff resulting from rainfall. The higher the infiltration rate for a given soil, the lower the runoff potential. Conversely, soils with low infiltration rates produce high runoff volumes and high peak discharge rates.

Four general soil hydrologic groups (HSG) have been established by the Natural Resources Conservation Service (NRCS). These groups are:

HSG A	Low runoff potential – high infiltration rate
HSG B	Moderate infiltration rate
HSG C	Slow infiltration rate
HSG D	High runoff potential – very slow infiltration rate

The hydrologic grouping symbols (A-D) are combined with land use and used to estimate the amount of runoff that will occur over a given area for a particular rainfall amount. Figure 3 illustrates the HSG soil classification from the Dakota County soil survey, however, because of substantial urban development, significant portions of Burnsville are mapped as undefined HSG.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 soil, resulting in significantly greater amounts of runoff.

Most of the soils in Burnsville are well to excessively well drained. Silty and loamy sediments over glacial till can be found throughout the watershed. According to the Dakota County soil survey, there are four general soil types in the Burnsville area: 1) nearly level, silty and loamy soils (on floodplains); 2) level to very steep, silt, loamy, and sandy soils (on outwash plains and terraces); 3) nearly level to steep, loamy and silty soils (on uplands); and 4) gently sloping to very steep, loamy and sandy soils (on uplands and pitted outwash plains).

The Minnesota River Valley includes, on its lowest level, floodplain soils such as alluvium, peat, and muck identified as the Chaska-Minneiska-Colo soil complex. Alluvial soils are usually flood deposits. The particulate sizes range from gravelly sand to silt and clay, with silt and very fine sands being predominant. The alluvial soils are questionable with respect to supporting structures, although some building is economically possible, with wise application of loading techniques. Peat and muck are terms for soils of high organic content. In peat, one can identify some partially decayed vegetative (organic) matter such as reeds, grasses, mosses, and leaves. In muck, the decomposition has advanced to such a stage that the materials are not definable. Peat and muck are poor soils in an engineering sense. These soft materials require expensive methods to support structures.

At the edge of the Minnesota River Valley floodplain, just below the bluffs which border the valley, lie well-drained silt loams and more poorly drained silty clay loams. These soils are a result of erosion of soils on the higher levels of the bluffs.

More detailed soil information may be found in the Soil Survey of Dakota County Minnesota prepared by the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service which can be accessed through the USDA supported Web Soil Survey application. Additional information is available on the Dakota County online mapping tool.

2.3 Geology and Groundwater Resources

The City completed its Wellhead Protection Plan (WHPP) in 2006 following review by the Minnesota Department of Health. The primary goal of a WHPP is to protect the public water supply from harmful contaminants. Dakota County also has a comprehensive Environment and Natural Resource Management Policy Plan recognized by and approved by the BWSR as the new county groundwater management plan in October 2006. The City updated its WHPP in 2014 and the updated maps provide the basis for the prohibited and restricted infiltration zones established in the engineering standards in Appendix C.

From a physical standpoint, bedrock underlies Burnsville at a depth of between 0 and 500 feet, but averages between 100 and 200 feet. Bedrock at a depth of 0 feet corresponds to locations where the rock is exposed at the ground surface. This occurs in the watershed primarily at the bluffs along the Minnesota River. The bedrock is deepest (400 feet or more) beneath steep peaks of glacial till, such as Buck Hill. The uppermost bedrock units underlying the watershed are sedimentary rocks of the Prairie du Chien Group (primarily dolostone), St. Peter Sandstone, Platteville Formation (primarily limestone and dolostone), and the Glenwood Formation (shale). These formations date from the Ordovician Period (approximately 505 to 450 million years ago).

Beneath the uplands of the watershed are layers of shale and limestone, sandstone, dolostone and more sandstone under the outwash terrace. Much of the glacial till was deposited during the Pleistocene Epoch beginning approximately 2 million years ago. The

most recent glacial deposits were laid down about 10,000 years ago by the Wisconsinan glaciation. More detail on the regional stratigraphic column, the vertical relationship of the bedrock units and their approximate thicknesses can be found on the Unites States Geological Survey's (USGS) website.

2.3.1 Surficial Aquifers

Surficial aquifers are water-bearing layers of sediment, usually sand and gravel, which lie close to the ground surface. A map of the surficial geology is displayed in Figure 4. Many domestic and some irrigation wells in the watershed draw water from these aquifers. Since the surficial aquifers are more susceptible to pollution, they are not used for municipal or public supply wells. In some locations in Burnsville, the aquifers could provide sufficient water yield for some non-potable industrial users.

Recharge to the surficial aquifers is primarily through the downward percolation of local precipitation. Some surficial aquifers may also be recharged during periods of high stream stage. Surficial aquifers may discharge to local lakes, streams or to the underlying bedrock.

Met Council completed a study in 2010 which categorized surface water bodies in the metro area as being groundwater discharge features, groundwater recharge features, or groundwater flow through features. The study shows that ponds and lakes in Burnsville are distributed through all three categories.

2.3.2 Bedrock Aquifers

Five major bedrock aquifers are available for water supply in Burnsville. Historically, the major bedrock aquifers are, in order of use and development: 1) Prairie du Chien-Jordan, 2) Mount Simon-Hinckley, 3) Tunnel City-Wonewoc (formerly known as Franconia-Ironton-Galesville), 4) St. Peter, and 5) Platteville. The aquifer used most often for water supply in the area is the Prairie du Chien-Jordan aquifer. 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. As more data on the Prairie du Chien Group and the Jordan Sandstone has become available in recent years, it is now widely held that the units are actually two separate aquifers in most areas with the Oneota Dolomite at the base of the Prairie du Chien Group acting as the (sometimes leaky) aquitard between the two aquifers.

The former Franconia Formation is now known as the Tunnel City Group, the Ironton-Galesville Sandstones are now known collectively as the Wonewoc Sandstone. The Glenwood Formation (shale) lies between the Platteville Formation (limestone and dolostone) and the St. Peter Sandstone. Furthermore, the Franconia-Ironton-Galesville aquifer is now referred to as the Tunnel City-Wonewoc aquifer. Burnsville Well 9 is open to the Tunnel City-Wonewoc aquifer as well as to the Mt. Simon aquifer.

The groundwater level in the Prairie du Chien-Jordan aquifer varies from 700 feet to more than 900 feet above mean sea level as shown in the Dakota County Geologic Atlas. Where the Prairie du Chien is the uppermost bedrock unit, the aquifer is recharged in areas where thin permeable drift overlies the bedrock. Some recharge of this aquifer occurs locally from percolation through the St. Peter Sandstone. However, hydrogeologic considerations suggest this recharge would be a minimal contribution to the aquifer flow. Groundwater movement in the aquifer is generally from south to north, toward the Minnesota and Mississippi Rivers. On the north side of the City along the toe of the bluff and close to the Minnesota River, seeps and springs discharge to the surface from this aquifer.

The aquifer with the least connection to surface contamination and highest potential individual well yields is the Mt. Simon-Hinckley aquifer, but it is more expensive to use than the Prairie du Chien-Jordan because of its greater depth. In addition, there are limitations to its use. The transmissivity of the Jordan aquifer is about a factor of 5 higher than the estimated transmissivity of the Mt. Simon. Given the lower transmissivity in the Mt. Simon, wells may need to be spaced farther apart than in the Jordan to get the same total production from a well field. As for water quality in the Mt. Simon, water from this aquifer generally has concentrations of radionuclides that exceed the maximum contaminant levels (MCLs) so the water needs to be blended with water from another aquifer to reduce the concentrations or treated to remove the radionuclides. Water from the Mt. Simon also generally contains more iron than water from the Jordan. It is generally true that water from the Mt. Simon is less likely to be contaminated by manmade chemicals.

Minnesota statutes limit appropriations from the Mt. Simon-Hinckley aquifer in the Twin Cities metropolitan counties 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 water level of the Mt. Simon-Hinckley is approximately 700 feet above mean sea level. Recharge of the Mt. Simon-Hinckley takes place far north of the watershed, where the bedrock is closer to the surface, and occurs by percolation through the overlying drift and bedrock. Regional groundwater movement in the aquifer is to the southeast. The local direction of groundwater flow in the Twin Cities tends to be toward the Minneapolis-Edina area, due to pumping of the aquifer. The bedrock geology of Burnsville is illustrated in Figure 5.

2.4 Climate and Precipitation

The Twin Cities metropolitan area climate is a humid continental climate, with moderate precipitation, wide daily temperature variations, warm humid summers and cold winters. The growing season varies from 142 days to 202 days, averaging 166 days. Freezing temperatures may occur until the middle of May and after the middle of September.

The nearest “first order” weather recording station is the Minneapolis-St. Paul Metropolitan Airport Station of the U.S. National Oceanic and Atmospheric Administration. The data from this installation is of highest value and accuracy. The National Weather Service forecast office for the metropolitan area, located in Chanhassen, also records weather data. Several Minnesota State Climatological network stations also exist and provide more detailed local weather data, kept by the Minnesota State Climatologist.

The highest temperature on record at the airport station to date was 105°F, set in 1988, and the lowest temperature was –34°F, set in 1970. The extreme conditions tell little except that temperatures range from uncomfortably hot to bitterly cold. Average total annual precipitation at the airport is 30.6 inches (1981-2010 average). The State Climatology Office of the DNR has information about temperature, precipitation and other climate data. Table 1 gives the precipitation summary for the airport station. Generally, the summer precipitation far exceeds that of the winter, the summer rainfall usually being sufficient for proper plant growth. From May to September, the growing months, the average rainfall is 19.0 inches, or about 62 percent of the normal annual precipitation. The normal percent of possible sunshine received in the area is 58 percent.

The annual snowfall averages about 54.4 inches. The heaviest monthly snowfall recorded to date at the Minneapolis-St. Paul International Airport was 46.9 inches of snow for the month of November 1991. The area averages 54 days per year when the snow depth is 6 inches or greater and about 24 days per year when the snow depth is more than 12 inches. Runoff

from snowmelt can occur anytime during the winter, but the more severe snowmelt runoff conditions usually occur in March and early April.

Average weather imposes little strain on the typical drainage system. Extremes of precipitation and snowmelt are important for drainage design. The National Weather Service has data on extreme precipitation events that can be used to aid in the design of drainage systems. Extremes of snowmelt most often affect major rivers, the design of stormwater storage areas, and landlocked basins, while extremes of precipitation most often affect the design of conveyance facilities. Appendix D provides information on 100-year flood elevations, peak discharge rates, storage requirements, and other pertinent hydrologic information for the stormwater retention areas and the trunk conveyance system within the City.

Table 1
Precipitation Summary – Minneapolis/St. Paul Airport Station

Total Precipitation, Inches					Snow, Inches		Days with Precip	
Month	**Mean**	**High Year**	**Low Year**	**1-Day Max Year**	**Mean**	**High Year**	**≥0.01**	**≥1.00**
Jan	0.90	3.63 1967	0.10 1990	1.21 1967	12.2	46.4 1982	8.9	0.0
Feb	0.77	2.14 1981	0.06 1964	1.34 2012	7.7	26.5 1962	7.4	0.0
Mar	1.89	4.75 1965	0.32 1994	1.66 1965	10.3	40.0 1951	9.3	0.2
Apr	2.66	7.00 2001	0.16 1987	2.58 2006	2.4	21.8 1983	107	0.4
May	3.36	9.34 2012	0.53 2009	3.39 2012	0.0	3.0 1946	11.5	0.5
Jun	4.25	11.36 2014	0.22 1988	4.13 2014	0.0	T 2010	11.3	1.1
Jul	4.04	17.90 1987	0.58 1975	10.00 1987	0.0	T 2012	10.2	0.9
Aug	4.30	9.32 2007	0.43 1946	7.36 1977	0.0	T 2013	9.7	1.3
Sep	3.08	7.53 1942	0.30 2012	3.55 1942	0.0	1.7 1942	9.8	0.8
Oct	2.43	5.68 1971	0.01 1952	4.83 2005	0.6	8.2 1991	9.2	0.4
Nov	1.77	5.29 1991	0.02 1939	2.91 1940	9.3	46.9 1991	8.7	0.3
Dec	1.16	4.27 1982	0.00 1943	2.47 1982	11.9	33.6 2010	9.8	0.1
Annual	30.61	17.90 JUL 1987	0.01 OCT 1952	10.00 JUL 1987	54.4	46.9 NOV 1991	116.5	6.0
Notes: Averages 1981-2010, Extremes 1891-2015								

In 2013, the National Weather Service (NWS) released NOAA Atlas 14, Volume 8 which updates the 1961 TP-40 precipitation frequency estimates for the Midwestern states. The

new estimates are based on improvements with denser datasets, longer term datasets to include more recent precipitation trends, and advanced statistical methodologies. As a result of the updated rainfall frequency estimates, the City of Burnsville has updated its current design standards and ordinances to be consistent with this new information. An example of the significance of the new data relates to the total rainfall depth for a 100-year 24-hour storm event changing from 6.0 inches to a depth of 7.5 inches. Table 2 summarizes the precipitation frequency estimates obtained from the NOAA Precipitation Frequency Data Server (PFDS) for a data point in central Burnsville.

Table 2
Atlas 14 Precipitation Frequency Estimates (in inches)

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.35	0.42	0.54	0.64	0.79	0.91	1.04	1.18	1.37	1.52
10-min	0.52	0.62	0.79	0.94	1.16	1.34	1.53	1.73	2.00	2.22
15-min	0.63	0.75	0.96	1.14	1.41	1.63	1.86	2.10	2.44	2.71
30-min	0.88	1.06	1.36	1.62	2.02	2.34	2.68	3.04	3.55	3.96
60-min	1.15	1.37	1.78	2.15	2.74	3.23	3.77	4.37	5.22	5.91
2-hr	1.42	1.69	2.20	2.69	3.46	4.13	4.87	5.69	6.88	7.86
3-hr	1.59	1.88	2.45	3.02	3.93	4.74	5.64	6.66	8.14	9.37
6-hr	1.86	2.20	2.87	3.54	4.63	5.60	6.68	7.89	9.68	11.16
12-hr	2.14	2.50	3.21	3.90	5.00	5.98	7.07	8.27	10.04	11.51
24-hr	2.48	2.82	3.50	4.19	5.31	6.31	7.44	8.70	10.56	12.11
2-day	2.87	3.20	3.87	4.54	5.67	6.68	7.82	9.11	11.01	12.61
3-day	3.13	3.48	4.17	4.86	6.00	7.02	8.17	9.47	11.37	12.97
4-day	3.34	3.72	4.45	5.17	6.33	7.36	8.50	9.78	11.65	13.21
7-day	3.86	4.35	5.22	6.03	7.25	8.28	9.38	10.58	12.29	13.68
10-day	4.35	4.92	5.91	6.77	8.04	9.07	10.15	11.30	12.89	14.16
20-day	5.94	6.66	7.84	8.83	10.21	11.28	12.36	13.47	14.95	16.07
30-day	7.33	8.18	9.55	10.66	12.16	13.30	14.42	15.53	16.97	18.03
45-day	9.14	10.2	11.85	13.16	14.87	16.11	17.29	18.42	19.82	20.79
60-day	10.71	11.97	13.92	15.43	17.35	18.70	19.94	21.09	22.43	23.31
Notes: Latitude 44.7625° Longitude -93.2830° Date/time (GMT): Mon Apr 4 20:24:31 2016										

2.5 Surface Water Resources

The City of Burnsville (City) covers approximately 17,282 acres, of which approximately 2,821 acres, or 16 percent, are wetlands or other water features. These surface water resources include six lakes, 264 wetlands,47 stormwater or other created ponds, and portions of three streams that are located wholly or partially within the City. One of the most prominent features in the City is the Minnesota River and the extensive backwater and wetlands associated with it. This section of the plan discusses surface water resources in Burnsville and their various classifications and categories as well as provides a summary of significant water resources.

2.5.1 Public Waters

Public waters are designated as such to indicate which lakes, wetlands, and watercourses over which MnDNR has regulatory jurisdiction authorized by Minnesota Statutes, Section 103G.201. The statutory definition of public waters includes public waters and public waters wetlands. Figure 6 shows all the MnDNR public waters located within Burnsville based on the DNR public waters inventory.

2.5.2 Metropolitan Council Priority Lakes

The Metropolitan Council has also updated its priority lake list that was first developed in the 1980s as part of the *Water Resources Policy* update. Figure 7 shows the priority lakes for Burnsville. The Metropolitan Council uses the priority lake list to focus its limited resources and support the environmental review process for proposed development.

2.5.3 Wetlands

The City's first Wetland Protection and Management Plan (WPMP) was completed in 1988 (SEH). An updated Wetland Protection and Management Plan (SEH, 2008) was developed to provide the City with an updated wetland inventory and functions and values analysis, to provide enhanced management strategies to preserve and protect the wetland resources, and to comply with local watershed organizations plans. That 2008 Plan was updated in 2017 to incorporate additional clarification of recently adopted State requirements related to vegetative buffers. The regulatory framework developed in the WPMP has been incorporated into the City's existing planning and zoning regulations and implemented by ordinance.

2015 State Buffer Law

Under the Buffer Law signed by Governor Dayton in June 2015, the state has established new requirements to provide protective buffers along Minnesota rivers, streams, and ditches. These buffer strips filter sediment and nutrients, and are intended to improve water quality statewide. A 2016 amendment was also passed, which provided some clarification of the new rules.

The Board of Water and Soil Resources (BWSR) is tasked with the administration of the buffer law, and has established a webpage to serve as a repository for information on the new law. That webpage includes tracking tools, guidance on establishing buffers, implementation guidelines and tools, and updates on policy interpretations.

The Minnesota Department of Natural Resources (MNDNR) was tasked with providing a map of the lakes, rivers, streams, and ditches that are included under the buffer law. These maps are available via the MNDNR website (keyword buffersviewer) and are intended to be continuously updated to ensure that most current information is always available.

In essence, the buffer law requires maintenance of a buffer to protect the state's water resources identified and mapped on a buffer protection map, which are those features identified on the MNDNR buffer map. The buffer law requires the more restrictive of a 50-foot average width, 30–foot minimum width of continuous buffer of perennially rooted vegetation, or the state shoreland standards and criteria adopted by the commissioner under section 103F2.11 and for public drainage systems established under chapter 103E (ditch law) a 16.5-foot minimum width of continuous buffer. Public waters are required to be buffered by November 1, 2017, while public ditches are required to be buffered by November 1, 2018.

Exemptions to the law that are relevant to the City of Burnsville include areas that are used for public or private water access or recreational use areas, which include beach and watercraft access areas. Areas covered by a road, trail, building, or other structure are also exempt, but subject to local setback requirements. The exemption effective applies throughout the City as the City is regulated under the National Pollutant Discharge Elimination System permit and the City has provided water resource riparian protection under its MS4 program and its water resources program through this Plan.

The City of Burnsville contains all or portions of ten Public Water lakes, including Crystal, Keller, Horseshoe, Earley, Twin Lakes, Alimagnet, two ponds within Alimagnet park, Wood Park Pond and Black Dog Lake. Four tributaries to Black Dog Lake are the only stream features within the city limits, and there are no public ditch systems present.

In reviewing the standards, the maps, and the requirements of the buffer law, it appears that for the aquatic features currently identified within the Burnsville city limits, all of the state requirements are met. Additionally, the requirements for providing buffer area for public waters and waterways through the Surface Water Management Plan exceed the state requirements. Under these criteria, there is no further action required by the City of Burnsville to comply with the 2016 buffer law.

As a brief background relating to the City's wetland management program, is it important to recall the extent of water resources with the City. Wetlands and water features constitute 2,821 acres, or about 16 percent of the city area. One of the most prominent features is the Minnesota River and the extensive backwater and wetlands associated with it. The Minnesota River wetlands and Black Dog fen, within the Minnesota Valley National Wildlife Refuge, account for 913 acres. This represents just over half of the wetland habitat within the City.

The WPMP includes an update of the results of a complete field inventory of the City along with an assessment of the quality of the wetland resources completed in 1998. The main objective for the updated WPMP is to provide a current inventory of the wetland resources in the City, differentiate regulated wetlands from other water features, and develop a comprehensive approach to regulate and protect wetlands based on wetland functions and associated public values. It is intended to provide a guide for City staff and residents to make informed decisions about the future development and redevelopment of the City with respect to the protection, conservation, and management of wetland resources.

The WPMP was prepared following the requirements of Mn. Rule 8420.0650, Local Comprehensive Wetland Protection and Management Plans. The WPMP includes:

- Updated inventory of the wetlands in the City; including accurate mapping, functions and values analysis, and classification;
- Differentiation of jurisdictional and regulated wetlands from other water features;
- Development of regulatory and non-regulatory options for wetland preservation and protection;
- Identification of potential wetland mitigation sites within the city;
- Refinement of a GIS-based wetland management system;
- Wetland Buffer requirements updated for consistency with State Law updates passed in 2015.

2.5.3.1 Burnsville Wetland Inventory

An inventory of wetlands was performed in 1997, to assess the extent and distribution of wetlands and to collect data reflective of wetland quality in the City. Data for the function and value assessment was collected during a brief visit to each wetland basin or complex. Collected data include a physical description of the basin and characterization of the plant community, hydrologic characteristics and wildlife and fishery habitat. Characterization of adjacent upland areas was also performed including a description of adjacent land use, disturbances or other influences on each wetland. The field assessment resulted in collection of data on 314 wetlands including 2,681 acres of wetland habitat. These data are summarized in Table 3.

In contrast, there were 532 wetland basins identified on the National Wetland Inventory (NWI) totaling 2,790 acres of wetland habitat. Most of the NWI was mapped between 1982 and 1993 from aerial photography taken between 1974 and 1984. Comparison between the NWI and the 1997 inventory indicates a loss of 218 basins and 109 acres of wetland habitat. This represents a 22 percent loss in the number of wetland basins and a loss of four percent of the wetland habitat in the City since the National Wetland Inventory was assembled in the 1980s. That loss is in addition to the approximately 85.7 percent loss of wetland in Dakota County between the 1860s and the 1980s. Assuming the total wetland loss in the City is similar to that estimated for Dakota County (85.7 percent), there may have been as much as 19,510 acres of wetland habitat in the City of Burnsville in the 1860s. The 1997 inventory reveals a total loss of 86.3 percent of the historic wetland area.

The 1998 wetland inventory was reviewed and updated using recent high-resolution aerial photographs. The previous inventory used field-based attributes, but the boundaries were based on the National Wetlands Inventory (NWI). The NWI is a good reference, but is not accurate enough to substitute for a current wetland inventory. This revised database replaces the former inventory. Review and updating of the 1998 inventory was needed as many of the former basins were not mapped correctly, mapped basins were not present, and some wetlands may have been missed. The results of the 2008 inventory are shown in Figure 8, which includes the management classification for each wetland. The official inventory will reside within the City's GIS database. Table 4 lists the distribution of the wetlands identified in the 2008 inventory.

Table 3
Comparison Between the National Wetland Inventory and the 1997 Wetland Inventory

Wetland Type	Number of Basins			Total Area (Acres)		
	NWI	1997	Net Change	NWI	1997	Net Change
Type 1	24	18	-6	58	62	+4
Type 2	2	12	+10	14	8	-6
Type 3	179	97	-82	1108	944	-164
Type 4	95	66	-29	170	174	+4
Type 5	137	83	-54	1121	1103	-18
Type 6	34	10	-24	88	128	+40
Type 7	59	25	-34	136	166	+30
Riverine	2	3	+1	95	93	-2
Totals	**532**	**314**	**-218**	**2790**	**2678**	**-112**

Table 4
Summary of Basins Based on Wetland Type 2008 Update

Wetland Type	Description	Number of Basins	Total Area (acres)
Type 1	Seasonally Flooded	16	55
Type 2	Wet Meadow	11	12
Type 3	Shallow Marsh	72	1,041
Type 4	Deep Marsh	54	73
Type 5	Shallow Open Water	50	128
Type 6	Scrub Shrub	7	35
Type 7	Wooded Swamp	18	418
Riverine	Rivers and Streams	1	1
Pond	WCA-regulated Stormwater Ponds	35	31
Total		**264**	**1,794**

Figure 8 illustrates the location of various management classes of wetlands throughout the City as presented in the updated 2008 Wetland Protection and Management Plan

One of the requirements of a Wetland Protection and Management Plan was to provide a wetland inventory and functions and values analysis. This was completed with the 1998 Plan, but was reevaluated with the 2008 revision. This was necessitated by several issues that had been detected through review of the 1998 inventory. One of the biggest needs was to differentiate wetlands from other water features. The 1998 plan includes many stormwater treatment ponds, which may still be regulated under the WCA, but would not be subject to buffer, bounce, and water quality pretreatment standards. The 1998 inventory also included lakes, which would also not be regulated as wetlands, but would remain protected as Public Waters, and through the Water Resources Management Plan.

The primary goals of the updated wetland inventory were to:

- Improve the accuracy of the wetland inventory.
- Differentiate wetlands from other water features.
- Prioritize wetland regulations based on functions and values.
- Identify the status and trends of wetlands from the 1998 inventory through the 2008 revision.

Each wetland within the city has been classified into one of four categories. These categories are the basis for which protection standards have been established. The 1998 inventory attributed classifications based on the Natural Resource Evaluation, supplemented with data from the City's 1994 Stormwater Management Plan, the Dakota County Biological Survey and other sources.

The database and supplemental information were used to determine the classification of each wetland basin by sorting the data according to total points and applying the ranking strategy. The resulting classifications include the following categories:

Protection Areas - Basins with Native Grades of A or B, sites with complete Community Structure, any sites supporting rare species, and any sites within or

adjacent to significant natural communities as identified by the Dakota County Biological Survey. This is comparable to the Preserve Classification used in the MnRAM.

Improvement Areas - Basins with 3 of 4 of the Community Structure criteria, sites greater than ten acres in size, Minnesota Department of Natural Resources Protected Waters and Wetlands (Public Waters), and basins within existing City parks that are not classified as Protection Areas. Although there is some overlap, this classification is similar to the Manage I and Manage II MnRAM classifications.

Management Areas - Remaining wetlands, but generally of low quality and located outside of protected areas. Management wetlands are also likely to receive untreated stormwater runoff, but have not been altered to enhance treatment capabilities. This classification is comparable to the Manage II and Manage III MnRAM classifications.

Management II Areas – These basins include any of the water features that may have been historic wetlands, and would remain subject to the requirement of the Wetland Conservation Act. These basins will have minimal protection standards as they currently function primarily to provide stormwater management.

2.5.4 Major Waterbodies

The City no longer has a separate classification system for City Lakes. Instead, the City will adopt the respective watershed's classification for the lakes. The following subsections provide details on the lake water quality and fisheries in Burnsville's major Lakes. A summary of the physical lake data is provided in Table 5.

Table 5
Physical Lake Data Summary

Name	Surface Area (ac)	Watershed to Surface Area Ratio	Average Depth (ft)	Maximum Depth (ft)
Alimagnet	109	12.8	5	11
Crystal	292	7.4	10	37
Earley	28	31.4	4	8
Horseshoe	12	NA	NA	NA
Keller	63	22.4	5	7
Lac Lavon	60	3.2	15	32
Sunset Pond	60	21	4	9
North Twin	5	34	6.6	12
South Twin	12		3.6	11
Wood Pond	9	18	NA	18

2.5.4.1 Lake Alimagnet

Lake Alimagnet is the sole waterbody in Burnsville that is tributary to the Vermillion River and within the VRWJPO. The majority of the contributing area is in Apple Valley, as is the pumped-outlet. Table 6 summarizes lake quality statistics for Lake Alimagnet. Fish population and additional lake information can be found on MnDNR's Lake Finder by searching and selecting the lake of interest from the menu.

Table 6
Lake Alimagnet Data

Lake Quality Statistics[1]		
DNR Number		19-0021
Total Phosphorus- TP	µg/l	99
Chlorophyll a	µg/l	40
Water Clarity – Secchi Disk	Meters	1
Carlson'sTrophic Status Index	TSI	67
Watershed Area	Acres	1392
Lake Area	Acres	109
Maximum Depth	Feet	11
Average Depth	Feet	5
Public Access		West side of lake
WMO Classification		Recreational
City Classification		Protection
Inlet/Outlet		12 inlets (Burnsville and Apple Valley); pumped outlet in Apple Valley

[1]Based on data collected between June and September 2006 to 2015

2.5.4.2 Crystal Lake

Crystal Lake in southeast Burnsville is within the BDWMO and is considered a strategic water body by BDWMO. The 292-acre lake is highly valued for full contact recreational purposes. Table 7 summarizes lake quality statistics for Crystal Lake. Fish population and additional lake information can be found on MnDNR's Lake Finder by searching and selecting the lake of interest from the menu.

Table 7
Crystal Lake Data

Lake Quality Statistics[1]		
DNR Number		19-0027
Total Phosphorus- TP	µg/l	37
Chlorophyll a	µg/l	20
Water Clarity – Secchi Disk	Meters	2
Carlson's Trophic Status Index	TSI	56
Watershed Area	Acres	2155
Lake Area	Acres	292
Maximum Depth	Feet	37
Average Depth	Feet	10.0
Public Access		Beach, Boat Launch
WMO Classification		Category I
City Classification		Protection
Inlet/Outlet		Inlet from Keller; outlet to South Twin

[1]Based on data collected between June and September 2006 to 2015

2.5.4.3 Earley Lake

Earley Lake is a 23-acre water body located entirely within Burnsville and the BDWMO. The lake is classified as a shallow lake and has no public swimming beaches or public access. It is primarily used for aesthetic viewing and wildlife observation. Table 8 summarizes lake quality statistics for Earley Lake. Fish population and additional lake information can be found on MnDNR's Lake Finder by searching and selecting the lake of interest from the menu.

Table 8
Earley Lake Data

Lake Quality Statistics[1]		
DNR Number		19-0033
Total Phosphorus- TP	µg/l	42
Chlorophyll a	µg/l	8
Water Clarity – Secchi Disk	Meters	2
Carlson'sTrophic Status Index	TSI	54
Watershed Area	Acres	878
Lake Area	Acres	28
Maximum Depth	Feet	N/A
Average Depth	Feet	N/A
Public Access		None
WMO Classification		N/A
City Classification		Improvement
Inlet/Outlet		Inlet from Twin; outlet to Judicial, Sunset

[1]Based on data collected between June and September 2006 to 2015

2.5.4.4 Horseshoe Lake

Horseshoe Lake is referred to as a lake but is a 12-acre wetland located in the cities of Burnsville and Lakeville. The wetland is within the BDWMO, however, it is not a BDWMO strategic water body. There is very little physical lake data and water quality data available for this water body.

2.5.4.5 Keller Lake

Keller Lake is a 52-acre lake located in the cities of Burnsville and Apple Valley within the BDWMO and is considered a strategic water body by BDWMO. The lake is used primarily for fishing, canoeing, and wildlife viewing by the local residents. There is a park on the south side of Keller Lake but no beach or public access. Keller Lake currently discharges to the northeast side of Crystal Lake. Because the lake is so shallow, aquatic plants can grow over the entire lake bed.

Keller Lake is considered a shallow lake by the MPCA and is currently listed on the 303(d) impaired waters list for excess nutrients. The Keller Lake watershed is 1,447 acres (including the lake surface area) that is fully-developed. Roughly 46 percent of this drainage district enters Keller Lake without first passing through some form of water quality treatment. Table 9summarizes lake quality statistics for Keller Lake. Fish population and

additional lake information can be found on MnDNR's Lake Finder by searching and selecting the lake of interest from the menu.

Table 9
Keller Lake Data

Lake Quality Statistics[1]		
DNR Number		19-0025
Total Phosphorus- TP	µg/l	84.9
Chlorophyll a	µg/l	56.6
Water Clarity – Secchi Disk	Meters	1.3
Carlson's Trophic Status Index	TSI	60.5
Watershed Area	Acres	1409
Lake Area	Acres	63
Maximum Depth	Feet	7
Average Depth	Feet	4.6
Public Access		None
WMO Classification		Category III
City Classification		Protection
Inlet/Outlet		Outlets to Crystal Lake

[1]Based on data collected between June and September 2006 to 2015

2.5.4.6 Lac Lavon

Lac Lavon is a unique resource, not only in Burnsville, but also in the Metropolitan area. Lac Lavon's quality is similar to that of lakes in northern Minnesota. One reason for Lac Lavon's quality is its relatively small watershed to lake area ratio of approximately 3.2:1. The lake has an average depth of less than 15 feet and a maximum depth of 32 feet. The 60-acre lake within the BDWMO and is considered a strategic water body by BDWMO. Lac Lavon does not have a public access, nor does it have stormwater inlets or outlets. The former gravel pit area turned lake exemplifies the benefits of thoughtful planning for urbanization, setting a pattern the City hopes to repeat on future planning in the Minnesota River Quadrant relative to the future "Quarry Lake".

Lac Lavon has been stocked in the 1990's with rainbow trout. Trout are a cold water species and their presence is considered an indicator of very good environmental quality. The Black Dog WMO draft plan does not anticipate any increase in total phosphorus loading to the lake. Therefore, maintaining Lac Lavon in its present form, while one of Burnsville's highest priorities, should not require costly management. Lake information and lake quality data for Lac Lavon are summarized in Table 10. Fish population and additional lake information can be found on MnDNR's Lake Finder by searching and selecting the lake of interest from the menu.

Table 10
Lac Lavon Data

Lake Quality Statistics[1]		
DNR Number		19-0446
Total Suspended Solids – TSS	Mg/l	39.0
Total Phosphorus- TP	µg/l	15.4
Chlorophyll a	µg/l	4.8
Water Clarity – Secchi Disk	Meters	3.7
Carlson'sTrophic Status Index	TSI	41.0
Watershed Area	Acres	184
Lake Area	Acres	60
Maximum Depth	Feet	32
Average Depth	Feet	<15
Public Access		None
WMO Classification		Category I
City Classification		Protection
Inlet/Outlet		None
[1]Based on data collected between June and September 2006 to 2015		

2.5.4.7 Sunset Pond

Sunset Pond covers about 60 acres, with a 1,272-acre contributing watershed, or a watershed to lake area ration of 21:1. The pond has a maximum depth of about 9 feet; many areas have a depth of less than 4 feet. The outlet drains north through the Rudy L. Kraemer Nature Preserve and the Sue Fischer Memorial Youth Athletic Complex, where low flows are diverted into water quality ponds and wetland complexes. Table 11 summarizes lake quality statistics for Sunset Pond. Fish population and additional lake information can be found on MnDNR's Lake Finder by searching and selecting the lake of interest from the menu.

Sunset Pond was created by construction of a berm on the north end that is considered a dam under DNR regulations. The dam was the subject of a study in 2007-2008 that evaluated the potential impacts to downstream properties if the dam were to fail. The Sunset Dam study was also updated in 2011. The City coordinated this work with the City of Savage due to potential impacts to the Rose Bluff Development within both cities.

Table 11
Sunset Pond Data

Lake Quality Statistics[1]		
DNR Number		N/A
Total Suspended Solids – TSS	mg/l	52
Total Phosphorus- TP	µg/l	50.1
Chlorophyll a	µg/l	10.8
Water Clarity – Secchi Disk	Meters	2.4
Carlson'sTrophic Status Index	TSI	54.6
Watershed Area	Acres	1272
Lake Area	Acres	60
Maximum Depth	Feet	N/A
Average Depth	Feet	N/A
Public Access		None
WMO Classification		Category II
City Classification		Improvement
Inlet/Outlet		Inlet from Twin; outlet to Judicial, Sunset

2.5.4.8 Twin Lake

Twin Lake (North Twin and South Twin) covers a total of about 18 acres. These basins are very shallow and have minimal available water quality data. South Twin Lake is the primary receiving water for Crystal Lake's discharge. Table 12 summarizes lake quality statistics for Twin Lake. Fish population and additional lake information can be found on MnDNR's Lake Finder by searching and selecting the lake of interest from the menu.

Table 12
North and South Twin Lake Data

Lake Quality Statistics[1]		
DNR Number		19-0028
Total Suspended Solids - TSS	mg/l	N/A
Total Phosphorus- TP	µg/l	70
Chlorophyll a	µg/l	18.7
Water Clarity – Secchi Disk	Meters	1.7
Carlson'sTrophic Status Index	TSI	1.0
Watershed Area	Acres	N/A
Lake Area	Acres	18
Maximum Depth	Feet	N/A
Average Depth	Feet	N/A
Public Access		None
WMO Classification		N/A
City Classification		Improvement
Inlet/Outlet		Inlet from Crystal and Wood; outlet to Earley

2.5.4.9 Wood Pond

Wood Pond lies “off-line” of the Crystal Lake outlet system. The pond is located northeast of Earley Lake and is positioned to receive runoff only from its’ own direct contributing area. The 9-acre pond has a contributing area of 160 acres, or a watershed to lake area ratio of almost 18 to 1. The maximum depth of the pond is 15 feet. Wood Lake is used primarily for canoeing and fishing. There is no public beach or boat landing on the lake. Table 13 summarizes lake quality statistics for Wood Pond. Fish population and additional lake information can be found on MnDNR’s Lake Finder by searching and selecting the lake of interest from the menu.

Table 13
Wood Pond Data

Lake Quality Statistics[1]		
DNR Number		19-0024
Total Suspended Solids - TSS	mg/l	52
Total Phosphorus- TP	µg/l	39.8
Chlorophyll a	µg/l	14.5
Water Clarity – Secchi Disk	Meters	1.5
Carlson’s Trophic Status Index	TSI	53.2
Watershed Area	Acres	160
Lake Area	Acres	9
Maximum Depth	Feet	15
Average Depth	Feet	N/A
Public Access		None
WMO Classification		N/A
City Classification		Improvement
Inlet/Outlet		Outlets to Twin Lakes

2.5.5 Water-based Recreation Areas

Burnsville has numerous water bodies totally or partially within its borders that are used for water based recreation. The City has two water bodies which are used for a variety of motorized boat recreation: Crystal Lake and Alimagnet Lake. Crystal Lake has a public boat launch and is very heavily used by motorized boats. Alimagnet Lake only has a public canoe launch making motorized boat launching difficult and as a result of the motorized use tends to be limited to lakeshore owners. Internal combustion motors are prohibited on all other lakes and ponds in Burnsville with the exception of Keller Lake, which has a 5-horsepower limit. Electric trolling motors are allowed on all lakes except Sunset Pond.

The public does use other lakes in Burnsville for water-related recreation such as non-motorized boating, fishing, hiking on trails adjacent to water and birdwatching. The primary lakes are Keller Lake, Lac Lavon, Sunset Pond, Earley Lake and Wood Lake. The City has parkland adjacent to each of these as well as Crystal and Alimagnet Lakes.

2.6 Stormwater

2.6.1 Watersheds and Drainage Areas

Most of Burnsville lies within the larger Minnesota River Basin in east central Minnesota. The Minnesota River Basin includes several smaller watershed units including the Lower Minnesota and Black Dog (including the old Credit River watershed). About 6 percent of Burnsville is within the Vermillion River watershed, which is part of the Mississippi River

basin. Figure 9 shows the major subwatersheds, including an overview of the water resource inventory and storm sewer system. This information was from the City's Stormwater Management Plan, the WMO Plans, topographic data, and storm sewer as-built drawings. A more detailed map showing drainage areas and corresponding subcatchment identifications is provided in Figure D-1 in Appendix D of this Plan.

The Vermillion River Watershed dominates Dakota County. The watershed stretches from Elko/New Market in the southwest to Lake Alimagnet in Burnsville in the northwest to Hastings in the east before discharging to the Mississippi River upstream of Red Wing.

The Black Dog Watershed covers parts of Burnsville, Lakeville, Apple Valley, Eagan and Savage. It includes the old Credit River watershed that covers southwest Burnsville. About 67 percent of Burnsville is within the Black Dog Watershed, comprising about 72 percent of the total watershed area. One of the primary goals of the watershed management organization (WMO) is to maintain or improve quality in the key ("strategic") water bodies in the watershed. Three lakes in Burnsville have been identified as strategic water bodies by the Black Dog WMO: Crystal Lake; Keller Lake; and Lac Lavon. The WMO will monitor these waterbodies, but leave direct management in the hands of the City. None the less, Burnsville's water quality goals for these waterbodies must meet or exceed the reasonably attainable water quality goals established by the Black Dog WMO. The WMO will also facilitate solutions to inter-community problems.

The remaining 27 percent of Burnsville lies within the Lower Minnesota River Watershed District (LMRWD). The LMRWD stretches along the Minnesota River valley from St. Paul to Chaska, mirroring the river both north and south. Significant resources that lie within both Burnsville and the Lower Minnesota River Watershed District include the Minnesota Valley National Wildlife Refuge, and Black Dog Lake.

2.6.2 Discharge, Storage Areas, and Floodplains

Appendix D also provides information on 1% (100 year) flood elevations, peak discharge rates, storage requirements and other pertinent hydrologic information for ponds and wetlands, and for the trunk conveyance system. The information in Appendix D has been updated as part of this plan development process with a city-wide hydrologic/hydraulic model utilizing the updated Atlas 14 rainfall estimates. The information should be used as a starting point in the development planning process, recognizing that new information may be available for these water bodies relative to the potential risks of flooding.

In 2016, the Federal Emergency Management Agency (FEMA) published a revised Flood Insurance Study (FIS) for Dakota County. This study and corresponding Flood Insurance Rate Maps (FIRMs) supersede the previous county-wide FIS published in 2011. The initial (2011) county-wide FIS incorporated two Letters of Map Revision (LOMR). Updated base flood elevations were established for Twin Lakes and Earley Lake (SEH, 2004) in central Burnsville and for the Cam Ram Wetland Area (SEH, 2005) in southwest Burnsville. These LOMRs were reviewed and approved by the Minnesota Department of Natural Resources and FEMA. The Special Flood Hazard Areas for Burnsville are shown in Figure 10.

In 2016 FEMA revised the FIS for Dakota County. Burnsville's local flood ordinance does not specifically include elevations, but instead refers to the official FEMA map panels. The extent of the changes from 2016 are provided below showing both the 2011 and 2016 elevations for the major water bodies. All waters were adjusted by 0.1 foot to account a datum adjustment by the Department of Natural Resources (confirmation from DNR is pending).

Table 14
Base Flood Elevations (BFEs) for Major Water Bodies

Lake	2011 FEMA FIS 1% Chance Flood	2016 FEMA FIS 1% Chance Flood
Alimagnet Lake	959.0	959.1
Crystal Lake	936.0	936.1
Earley Lake	911.9	912.0
Keller Lake	936.0	936.1
North Twin Lake	923.8	923.9
South Twin Lake	923.5	923.6

2.7 Pollutant Sources

The MPCA identified numerous leaking underground storage tank (LUST) sites in Burnsville. The MPCA also has lists showing registered above and underground storage tanks, permitted feedlots, and permitted wastewater discharges.

Information on pollutant sources is available from the MPCA What's in My Neighborhood online application. This detailed information has not been included here as it is subject to frequent change and may be obtained by calling the MPCA or visiting the MPCA's website. Pollutant source information is also available from the Dakota County Environmental Management Department. The Department maintains maps and a database that display MPCA-reported LUSTs, MPCA-reported spills, MPCA-registered ASTs and USTs and Dakota County-licensed hazardous waste generators. This information may be accessed by the public upon reasonable request to the County.

In Burnsville, urban runoff is one of the primary pollutant sources of concern. Urban runoff pollutants include sediment, nutrients, oxygen-demanding substances, toxic chemicals, chloride, bacteria, and floatable trash and litter. The pollutant loads from urban surfaces will typically vary by land use and percent impervious surfaces. Stormwater runoff in Burnsville is regulated by the NPDES MS4 permit program.

2.8 Natural Resources

In 1999, Burnsville created its first Natural Resource Master Plan, and one of the first in all of the Minneapolis/St. Paul metropolitan area. This progressive act set in motion programs and policies to protect Burnsville's natural resources, such as a prairie management plan, and goose and deer management policies, and initiated a policy to direct the private development of remaining open space in an environmentally sound manner.

The City completed an update to the Natural Resources Master Plan (NRMP) in 2007. The work behind the NRMP assesses the current state of natural resources in Burnsville and makes recommendations for their preservation and restoration on both public and private lands. The updated plan also reviews and makes recommendations for Burnsville's various natural resources related plans and policies, in order to synchronize the effort to manage natural resources.

In creating this document, a study was conducted to survey the ecological status of Burnsville's publicly owned upland natural areas. New in this plan is an extensive urban forestry component which evaluates and makes recommendations for street trees, developed park trees and natural areas forests. The entire city, including private lands, was mapped for land cover type which maps developed and undeveloped land throughout the city. The

inventory found that Burnsville has made great strides in protecting and improving water resources, protecting and restoring prairies, and is taking an ecological approach in developing private open space.

Forces degrading Burnsville's natural resources, however, are mounting, and Burnsville should next direct attention to its upland natural resources, in particular its remaining natural woodlands and trees in built areas. Degradation caused by invasive species encroachment, and the stress put on native plant communities due to the urban heat island effect (caused by heat accumulated on pavement) and changes in climate have the potential to degrade Burnsville's natural areas. Communities throughout the metro area are all facing these challenges.

To complement Burnsville's current work to protect natural resources, the NRMP recommends actions to be taken to protect and enhance its vulnerable natural resources. The plan makes recommendations for monitoring, land management and restoration of publicly and privately owned lands.

2.8.1 Natural Communities and Rare Species

The Minnesota DNR produces the Minnesota County Biological Survey identifying natural communities and rare species. The Dakota County survey map was completed in 1997. It identifies where evidence indicates the presence of rare plant and animals as shown in Figure 11.

Based on information from the Minnesota Department of Natural Resources County Biological Survey, rare animal species documented in Burnsville are Peregrine falcon, Bell's vireo, Blanding's turtle, Acadian flycatcher, Hooded warbler, Red-shouldered hawk, and Cerulean warbler. The first three were all in the vicinity of the Minnesota River Valley within the Bluff Valley Resource Management Unit (RMU) and the others fall within the Southwest RMU. Additional rare species in Burnsville are plants. They are found in several locations but primarily together in undisturbed natural communities.

2.8.2 Trout Streams

Minnesota has 687 designated trout streams, totaling 3,782 miles. Another 1,923 designated trout stream tributaries add 2,715 miles of streams. Most streams are in the southeast and northeast. But there are trout streams as far to the southwest as Windom and as far to the northwest as Park Rapids. Designated trout streams have more stringent levels of permitting and regulatory programs that apply to those seeking water use appropriations and permits for work in a stream. And because a designated trout stream is a public water, all new designations would be required by state law to have a buffer of perennial vegetation or approved alternative practices that protect water quality.

Burnsville had three designated trout streams identified in the 2002 WRMP that were based on data from DNR's protected waters database and one (planned) future trout lake. These trout waters include:

- Unnamed Trout Stream #1
- Unnamed Trout Stream #4 (Naas Creek)
- Unnamed Trout Stream #7.

DNR has initiated work to better represent the actual waters that can sustain trout and update their official lists and mapping accordingly. Following DNR's proposed removal of trout streams from the official list, local residents and Trout Unlimited initiated efforts to investigate

the potential restoration of Unnamed Stream #4 (Naas Creek) and keep it on the list. The organization convinced the DNR to keep Naas Creek and nearby Harnack/Black Dog Creek in Eagan (which was also in danger of being removed from the list) as a protected waterway and to research both streams' potential for restoration.

New data revealed that Naas Creek, which is a tributary of Black Dog Lake in Burnsville, could potentially be restored. However, the restoration plan is not without challenges as a portion of the steam is blocked by sediment accumulation at culvert crossing the railroad tracks. In addition, native brook trout require water temperatures between 34 and 74 degrees Fahrenheit. Stormwater continues to flow into Naas Creek from nearby neighborhoods, which raises the temperature above the 74 degrees. If the DNR deems restoration feasible, efforts to restore the creek are expected to take years. The City of Burnsville will work cooperatively with these organizations if they move forward with restoration efforts.

DNR has prepared a draft assessment of each of the streams in the vicinity of Burnsville. A summary of the results of that preliminary assessment is provided below:

- Unnamed #1 would have limited potential to support trout to justify stocking due to the stream's length, width, area with sufficient base flow, and potential effects from beaver impoundments. Stream temperatures remained suitable for trout throughout the summer. The stream has abundant overhanging vegetation though little pool or spawning habitat was available.
- Unnamed #4 (Naas Creek) appeared to have flow, combination of substrate and habitats to marginally support trout and angling. Present opportunities to improve stream conditions for trout would need to include reducing conditions that cause stream warming. Most importantly these would need to include removing stormwater contributions and narrowing the ponds. Limitations would still exist due to stream length, beaver dams that would require active management to reduce the future potential for warming and Minnesota River flooding. The Minnesota River Valley has flooded the entirety of this stream. The floods could eliminate trout, if present, due to the limited length of the stream or available refuge habitat. If habitat improvement does occur management should be directed for Brook Trout and maximum stream temperatures should not exceed 72F.
- Unnamed #7 is a stream with limited potential for establishment of a permanent trout population. With this and previous investigations citing reasons such as a small stream with poor physical habitat, temperatures too high and low base flow. This investigation found stream temperatures suitable for trout throughout the summer, however during 2015 flow appeared to be inadequate even during a year with average rainfall.

2.8.3 Fens

During review of the River Ridge Boulevard/Cliff Road Walmart project in 2011, the DNR was consulted for input on potential new discharged to the Black Dog fen wetland complex. On August 25, 2011, DNR staff (Groundwater Hydrogeologist and Plant Ecologist) conducted a field review of the fen complex and found that the calcareous fen community that was previously mapped and included on DNR's official list of calcareous fens (Fen ID No. 242) was no longer present. The former fen areas were dominated almost entirely by invasive and/or undesirable species, primarily reed canary grass, common reed and stinging nettle. Although scattered pockets and individuals of native species were encountered, no plant species indicative of calcareous fens were identified. The ground surface was moist, but we observed no evidence of active groundwater discharge necessary to sustain a calcareous fen.

DNR indicated that it may not be possible to definitively determine the cause of the demise of the calcareous fen community, but suggested it is likely due to the combined effects of inundation by stormwater (nutrient laden, which has been shown to give reed canary grass a competitive advantage over native species) and disruption of groundwater hydrology possibly caused by some combination of reduced infiltration in the upland recharge areas, groundwater withdrawals, the ditch, the railroad tracks, and the sewer line that runs roughly east-west through the complex.

The calcareous fen is still on the official list of fens. DNR strongly encouraged the project proposer and the City of Burnsville to aggressively pursue alternatives that will further reduce the volume of runoff from this project (and future projects) to the wetland complex however this location is also within the city's WHPP area and infiltration is prohibited. Any chance of restoring the fen community will be compromised by additional stormwater input. The City provided information to DNR in 2011 that implementation of their new development and redevelopment runoff standards had reduced runoff volume to the fen complex by 18 acre-feet since 2005.

One of the Black Dog Lake Fen areas on DNR's official list of calcareous fens (Fen ID No. 31929) remains in relatively good condition. While this calcareous fen area was not likely to be affected by the Walmart project, it could be jeopardized by reduced infiltration and/or increased groundwater pumping within the watershed. DNR will continue to work with the MPCA and the City of Burnsville on their stormwater standards to further reduce discharges to the fen complex in order to protect the remaining fen area and to facilitate possible restoration of the fen that has been eliminated.

2.8.4 Greenways and Corridors

Greenways and corridors potentially serve as movement pathways for plants and animals and bridge disjointed complexes of natural communities. Often they are linear and follow streams and rivers.

The primary linear greenway or corridor running through Burnsville is the Minnesota River Valley, which runs along the northern border of the City. This area has been and should continue to be the focus of any efforts to connect areas managed by Burnsville and state and federal government agencies.

Other corridors in the City include McAndrews Road, a Dakota County greenway corridor that is intended to connect to the Lake Marion South Creek and Minnesota River greenways. The City is a partner with Dakota County and other cities in the Dakota County Greenway Collaborative. The most recent development in Burnsville along McAndrews Road is Costco which has green space incorporate along the roadway. At minimum, green space adjacent to McAndrews Road for other adjacent projects should be similar to the width and treatments at the Costco site.

2.8.5 Resource Management Units

Resource management units (RMUs) are high concentrations of natural resource sites and important lakes and rivers. Lakes and rivers are not listed in the sites database for the reasons explained under inventory. All lakes in RMUs are considered high priority natural resources and as such are justified for the same staff and funding as high priority resources in the sites database.

RMUs contain high (protection), medium (improvement), and low (management) priority sites. The focus of management activities will be on the high priority sites. From an ecological

perspective low and medium priority sites can have an effect on high priority sites and will be protected and managed to the extent that they affect high priority sites. All sites will be managed to at least maintain their current qualities to the extent possible.

The three categories of sites are:

High Priority Sites (Protection) - Sites with native community grades of A and B, any sites with rare species, and sites with complete community structure. These sites will receive priority for protection and management and priority for funding, regardless of whether or not they fall within a Resource Management Unit.

Medium Priority Sites (Improvement) - Sites with native community grades of C, all sites greater than 10 acres, and areas which meet 3 or 4 of the community structure criteria. These sites will be focused on for improvement when they are part of a Resource Management Unit.

Low Priority Sites (Management) - Sites with native grades of D, and areas which meet only 1 or 2 of the community structure criteria. Resources will be directed towards maintaining these sites, unless part of a Resource Management Unit Improvement Plan.

2.9 Land Use

Figure 12 shows existing land use in Burnsville. Intense commercial development is clustered along I-35W, County Road 42 and Highway 13. The anticipated future land use in Burnsville is illustrated in the Comprehensive Plan Future Land Use Guide Plan Map (available in the 2040 Comprehensive Plan).

Burnsville is completely within the Metropolitan Urban Service Area (MUSA), the area delineated by the Metropolitan Council for sanitary sewer service.

There were less than about 1,200 acres of vacant land in the City of Burnsville as of 2002. As of 2008, the number changed to 404 acres. Many of these properties contain or are adjacent to wetland habitat identified during the field inventory. Development of the properties, or purchase by the City, may produce opportunities for improvement or protection of existing wetlands or creation or restoration of wetland habitat. Development in these open areas will require final end use plans to be approved as part of the PUD zoning approvals.

2.9.1 Land Development Density

Only a small percentage of Burnsville remains to be developed. In general, smaller lot sizes and increased impervious surface coverage run counter to what would normally be recommended on a watershed management basis. For areas tributary to trout streams any time the level of impervious cover exceeds the 12-15% level, the resource will be permanently degraded (Galli, 1991).

The shoreland zoning standard established by the Minnesota Department of Natural Resources limits impervious cover to 25 percent. However, outside the shoreland zone, much higher levels of cover are allowed via existing zoning. Even if less than 10 percent of the City remains to be developed, long-term water resource impact of redevelopment as well as current and near term development are concerns. The Metropolitan Council strongly encourages increased residential densities and intensification of development to utilize regional infrastructure to its fullest potential. These objectives can conflict with other agencies seeking resource protection for waters, natural areas and impervious surface reduction. Redevelopment of the City will require careful attention to these factors and a balanced approach to maintain/enhance water resources. The City will need to retrofit and continue to improve treatment facilities to accommodate intensification of the urban landscape. Value

based decisions will be needed to balance the costs associated with increased urban development and implementation of the best practices to accommodate the development.

2.9.2 Minnesota Valley National Wildlife Refuge, Recreation Area and State Trail

The Minnesota Valley National Wildlife Refuge, Recreation Area and State Trail (shown on Figure 13) were established as a result of efforts of local citizen groups to protect the Lower Minnesota River Valley. The Big River Regional Trail was authorized by the state legislature in 1969. Federal legislation entitled “The Minnesota Valley National Wildlife Refuge Act of 1976” declared that the policy of the Congress would be to preserve the Minnesota River Valley and, as a federal action, establish the 9,500-acre Minnesota Valley National Wildlife Refuge and an adjacent 8,000-acre wildlife recreation area.

There are approximately 24,000 acres of existing and authorized wildlife refuge, parks, trails, and open space located along the Minnesota River corridor. These lands are managed in accordance with the “Minnesota Valley National Wildlife, Recreation Area, and State Trail: Comprehensive Plan, July 1984.” The plan was produced by the Department of the Interior, U.S. Fish and Wildlife Service, and the Minnesota Department of Natural Resources.

The refuge portion of the area is managed by the U.S. Fish and Wildlife Service with two main objectives: to provide habitat for a diversity of plants and animals and to provide opportunities for people to observe and learn about the valley’s wildlife.

The recreation area is managed by local, city, and county governments and by the DNR. These agencies are developing recreational and educational opportunities that are compatible with the valley’s natural resources.

2.9.3 Southwest Burnsville

The southwest area of the City contains rolling topography with areas of very steep slopes, as well as many of the largest remaining stands of trees in the community. The area is zoned rural residential requiring one-acre lots when City sewer services are available and two-acre lots when City sewer is not available.

As an update to the 1990 Comprehensive Plan, the City prepared a report entitled Southwest Public Services Study. The study reviewed natural conditions and explored the means and methods for extending public utilities to the area.

The key policy decision that resulted from the study was that the City adopted an official Master Plan for the future of this area and requires all future subdivisions to be consistent with this plan. The resulting plan incorporates a design for the extension of public sanitary sewer, public water service and provision for stormwater drainage improvements.

It is the intent to allow the area to remain unsewered for the foreseeable future. The City has addressed the southwest Burnsville area in more detail in the Master Plan for the area completed as part of the 1990 Comprehensive Plan. Due to updated regulations in the areas including the Wetlands Conservation Act, Shoreland Management, Stormwater Management, there is less development potential than shown in the 1990 Master Plan.

3.0 Goals and Policies

The Metropolitan Council's *2040 Water Resources Policy Plan* is targeted to achieve the following goal:

To protect, conserve, and utilize the region's groundwater and surface water in ways that protect public health, support economical growth and development, maintain habitat and ecosystem health, and provide for recreational opportunities, which are essential to our region's quality of life.

This section of the plan identifies local goals for water resources planning and management functions across 12 categories. The goals of this plan were established in conformance with the goals of the watershed organizations having jurisdiction in Burnsville including the Vermillion River Watershed Joint Powers Organization, Black Dog Watershed Management Organization and the Lower Minnesota Watershed District.

The plan utilizes the following framework for goals, policies, and standards:

- ***Goals*** are a desired end toward which water management efforts are directed. Each goal has several corresponding policies.
- ***Policies*** are governing principles that provides the means for achieving established goals.
- ***Standards*** are an extension of the policies. They provide specific, detailed guidance regarding water management practices. Plan standards are included in Appendix C of this Plan. Table C-1 in Appendix C also summarizes watershed management organization standards applicable to projects in each jurisdiction.

3.1 Goal 1: Water Quality

Goal: Achieve water quality goals in lakes, streams, and wetlands consistent with the intended use and classification.

The water quality goal setting process for Burnsville lakes revolves around their recreational suitability and strives to achieve water quality equal to or better than state water quality standards. The water quality objectives of the Plan are centered on Burnsville lakes that support a full range of recreation uses including swimming. The City of Burnsville has established specific water quality goals for significant water bodies based of community input and diagnostic studies.

To monitor the water quality, a Secchi disk is used to measure the transparency in bodies of water. The depth at which the disk is no longer visible is taken as a measure of the clarity of the water which is related to the water turbidity and abundance of algae. The City Council established the lake clarity goals shown in Table 15.

Table 15
Lake Water Clarity Goals

Lake	City of Burnsville Clarity Goal (meters)[2]	MPCA Clarity Standard (meters)	3-Year Average Clarity (meters)[1]
Alimagnet	1.3	1.0	0.8
Crystal	2.1	1.4	2.1
Earley	1.7	1.0	1.6
Keller[3]	1.8	1.0	0.7
Lac Lavon	3.6	1.4	4.0
Sunset Pond	1.7	1.0	1.9
Twin South	1.4	1.0	1.9
Wood Pond	1.7	1.0	1.7

[1]Based on years 2013, 2014, and 2015 of monitoring data.
[2]Summer Average secchi disk reading
[3] A Use Attainability Analysis is planned to reevaluate the goal for Keller Lake

It is important to note that the City's clarity goals differ from the MPCA's water quality standards which determine if a waterbody is classified as impaired. The City's goals are based on clarity and the city uses a 3-year average of the summer (June-September) average Secchi disk readings. Conversely, the MPCA looks at 10-year summer (June-September) averages and looks at three different metrics: total phosphorus (TP) concentration, chlorophyll-a concentration, and Secchi disk depth. For a waterbody to be classified as impaired, the 10-year average TP concentration must exceed the state standard in addition to one of the other metrics (chlorophyll-a or Secchi disk) not meeting the state standard. The MPCA Secchi disk standard for the lakes in Burnsville is ≥1.4 meters and ≥1.0 meters for Lakes and Shallow Lakes, respectively.

The plan recognizes that for any of the water bodies listed in Table 15, the water clarity goal(s) would be re-evaluated upon completion of any diagnostic studies completed. The basic premise behind revising these goals is to establish realistic clarity goals based upon the characteristics of the lake and its contributing watershed, such that when the goal is met, it will allow the water body (if impaired) to be removed from the impaired waters list. The revised clarity goals are based on the most recent lake monitoring data and lake management plans prepared for each water body.

The Plan allocates funding to implement the strategies identified in the lake management plans to achieve these goals. For waters that are impaired, the City plans to work cooperatively with the local watershed organizations and MPCA to convert the lake management plans in to Total Maximum Daily Load (TMDL) studies. For example, LMRWD implements a Cost Share Incentive Program and Water Quality Restoration Program which helps to provide financial assistance to implement BMPs or carry out studies which will aid in protecting and improving water resources within the LMRWD.

Table 16 presents the policies the city has developed to achieve the water quality goals of this Plan.

Table 16
Water Quality Policies

Subject:	
▸ Water quality in lakes, streams and wetlands.	
Purpose:	
▸ To protect and improve water quality.	
Goal:	
▸ Achieve water quality goals in lakes, streams, and wetlands consistent with their intended use and established classification.	
Water Quality Policies	
Policy 1.1:	Development that disturbs one-half acre or more, or creates 5000 square feet or more of new impervious surface, shall meet the standards of this Plan and the Comprehensive Wetland Protection and Management Plan.
Policy 1.2:	Development that meets the thresholds for coverage under the NPDES Construction Stormwater Permit, shall meet the requirements of the current version of the permit.
Policy 1.3:	Proposed developments must identify reasonable steps to avoid water quality impacts, and to mitigate impacts with appropriate best management practices (BMPs).
Policy 1.4:	The City shall maintain a Standard Operating Procedure to minimize the impact of hazardous spills.
Policy 1.5:	The City shall supplement its regulatory program with an education-based approach to reduce water quality impacts to lakes, creeks and wetlands.
Policy 1.6:	The City shall promote the reduction or minimization of impervious surface areas, and the use of alternative landscape techniques and materials and low impact development (LID)/green infrastructure systems to reduce water quality impacts.
Policy 1.7:	The City will balance protection of wetlands and utilization of wetlands to protect the water quality of other water resources (i.e., wetland, lake, stream) based on wetland classifications in the City Comprehensive Wetland Protection and Management Plan. The City recognizes that all stormwater ponds, and some wetlands, and will continue serve as water quality treatment systems to better protect high priority downstream water resources. These systems will not be part of the water clarity/water quality monitoring program.
Policy 1.8:	The City will manage public properties and facilities in accordance with its NPDES MS4 Program Policy Document.
Policy 1.9:	The City will play an active role in participating in TMDL studies for impaired waters to which the City has discharges.
Policy 1.10:	The City will work with the WMOs in developing and implementing water quality improvement plans and achieving the load reductions necessary to meet TMDLs. .

3.2 Goal 2: Water Quantity

Goal: Manage flooding and minimize related public capital and maintenance expenditure necessary to control excessive volumes and rates of runoff.

Traditional stormwater management deals with just one component of the hydrologic cycle; surface runoff. Large amounts of energy are directed towards alleviating significant negative impacts of surface runoff and flooding on the cultural, water, and natural resources. The

primary management strategy is shifting from detention in both existing natural (wetland) and constructed basins, to low impact development (LID) techniques and Best Management Practices (BMPs) that emphasize reduction of runoff volume and on-site runoff control via infiltration or small volume storage to mimic predevelopment hydrology for more frequent rainfall events. This trend will help remedy the negative impact of storm runoff on lake quality. With increased value placed on wetlands, the number and extent of wetlands that can be used for detention will decline. The approach to water quantity management relates directly to water quality, wetland management, erosion control, and land development strategies. By doing a better job at managing the quantity of runoff, the other goals of this Plan are more easily and efficiently achieved.

Table 17 present policies the City has developed to meet the water quantity goals of this plan.

Table 17
Water Quantity Policies

Subject:	
➢ Stormwater Runoff (Rate and Volume) Management	
Purpose:	
➢ Control runoff and reduce flood hazard risks	
Goal:	
➢ Manage flooding and minimize related public capital and maintenance expenditure necessary to control excessive volumes and rates of runoff.	
Water Quantity Policies	
Policy 2.1:	Low Impact Development (LID) techniques (or volume control/infiltration practices), along with conventional constructed detention ponds for large, infrequent rainfall events, should be relied upon to help mimic pre-development hydrology and to lessen the risks of downstream flooding.
Policy 2.2:	The City shall continue to implement the FEMA Flood Plain Management program and keep ordinances and standards up to date relating to flood hazard risks and management of those risks.
Policy 2.3:	Where volume control/infiltration practices are not feasible, the City prefers regional detention areas to small, on-site ponds. If regional detention is not feasible small-scale on site filtration is preferred.
Policy 2.4:	Emergency overflows or outlets to drainage systems shall be provided in basins or collection areas adjacent to structures to minimize the risk of flooding.
Policy 2.5:	Encroachment (placement of fill or structures) into the flood plain and flood way below the established 1-percent critical flood levels shall be prohibited except when it is shown to not increase the flood stage, prevent an increase in the flood profile, and minimize excessive velocities.
Policy 2.6:	The minimum building elevation shall be set in accordance with City code and the standards of this plan. Future development areas adjacent to landlocked basins should be evaluated in more detail through evaluations of updated hydrologic modeling tools.
Policy 2.7:	The City shall attempt to acquire easements covering public ponds, wetlands, flood plains and ditches as part of land development approvals.
Policy 2.8:	The City has and will continue to evaluate lift stations to manage lake levels and water quality and will not limit itself to the use of gravity flow stormwater conveyance systems.

3.3 Goal 3: Erosion Prevention and Sediment Control

Goal: Minimize soil erosion through increased education and enforcement.
Erosion and sediment is a major contributor to water pollution. Stormwater runoff from streets, parking lots, and other impervious surfaces carries suspended sediment consisting of fine particles of soil, dust, and dirt in moving water. Abundant amounts of suspended sediment are carried by stormwater runoff when erosion occurs.

Regulatory efforts by the City, State and watershed organizations will control a major portion of the sediment generated and delivered to water resources. Street maintenance and an effective sweeping program will also have a positive impact. The City does not control or regulate sediment generated from sources outside the limits of Burnsville. Where gully erosion has occurred and been identified as an issue the City will continue work to address these issues and implement restoration efforts.

Table 18 presents policies the City has developed to achieve the erosion control goals of this Plan.

Table 18
Erosion Prevention and Sediment Control Policies

Subject:	
➢ Erosion Prevention and Sediment Control	
Purpose:	
➢ To minimize erosion and sedimentation	
Goal:	
➢ Minimize soil erosion through increased education and enforcement	
Erosion Control Policies	
Policy 3.1:	Erosion and sedimentation control plans shall be prepared and followed for all projects subject to the standards of this plan.
Policy 3.2:	The City shall maintain and update as necessary its erosion control ordinance.
Policy 3.3:	The City shall provide education of erosion control needs and methods to prevent/reduce erosion and sedimentation.
Policy 3.4:	The City shall maintain its practice of inspecting sites prior to earthwork activities commencing on the site to ensure the proper practices are in place.
Policy 3.5:	Horizontal, terrestrial buffer zones are encouraged around existing wetlands and stormwater ponds. New development or redevelopment projects must provide a buffer zone around wetlands and are encouraged to provide buffers around existing stormwater ponds. Buffers are required around new storm ponds, resulting from new development or re-development. Buffers shall be maintained in native vegetation, to provide habitat for wildlife. (See also Table 19)
Policy 3.6:	The City will maximize the use of bioengineering approaches whenever practicable for slope stabilization and permanent erosion control projects.

3.4 Goal 4: Wetland Management

Goal: Maintain or increase the amount of wetland acreage, and increase the wetland functions and values within the City, in accordance with the adopted Comprehensive Wetland Protection and Management Plan.

The key to meeting the City's wetland goal is the implementation of its Comprehensive Wetland Protection and Management Plan (WPMP). The City completed a major update to the Wetland Protection and Management Plan (WPMP) in 2008 with a minor amendment in 2017 that focused on updates to the vegetative buffer requirements to be consistent with State requirements.

The purpose of the WPMP is to establish a wetland protection and management program that protects, conserves, and manages the quality of the wetlands within the City. The benefits of establishing a separate WPMP include having a current functions and values assessment for management activities, supporting wetland ordinance development, allowing greater flexibility in sequencing and replacement standards for wetlands, and establishing a baseline dataset for improvement and management of wetlands within the City.

2015 State Buffer Law

Under the Buffer Law signed by Governor Dayton in June 2015, the state has established new requirements to provide protective buffers along Minnesota rivers, streams, and ditches. These buffer strips filter sediment and nutrients, and are intended to improve water quality statewide. A 2016 amendment was also passed, which provided some clarification of the new rules. See Section 2.5.3 of this Plan for more information on the new law.

Table 19 provides a summary of the updated buffer requirements as they affect each of the different City wetland classifications and mapped DNR Public Waters. Because the City is covered under the NPDES MS4 Permit, the City is exempt from the 2015 Buffer Law as provided for in BWSR's MS4 Exemption Policy (June 2016). A map of the City's 2008 wetland inventory is provided as Figure 8, which is discussed in more detail in Section 2.5.3.1 of this plan.

Table 19
Summary of Buffer Requirements

City Wetland Classification	Permanent Buffer Strip Average Width (feet)	Minimum Permanent Buffer Zone Width (feet)	Vegetation
Protection	50	30	100% Native
Improvement	35	25	100% Native
Management	25	20	Majority Native
Management II	20	20	Majority Native
DNR Mapped[1] Public Waters (per 2015 Buffer Law[2])			
Waters, streams and ditches	City defers buffer requirements to State Buffer Law requirements		NA

[1]Mapped on MNDNR webpages key word "buffersviewer"
[2]Minnesota State Statutes Chapters 103B, 103E, 103C, 103D, 103F, and 103G

Table 20 presents policies the City has developed to help achieve the wetland management goals. Please refer to the Wetland Protection and Management Plan for more detail.

Table 20
Wetlands Policies

Subject: ➢ Wetland Management
Purpose: ➢ To utilize, protect, preserve and enhance wetlands.
Goal: ➢ Maintain or increase the amount of wetland acreage, and increase the wetland functions and values within the City, in accordance with the adopted Comprehensive Wetland Protection and Management Plan
Wetland Policies
Policy 4.1: The City shall administer wetland protection and mitigation in accordance with the Minnesota Wetland Conservation Act.
Policy 4.2: The City will distribute information on pertinent water and wetland management issues via it's typical means utilizing multiple sources. to communicate opportunities for residents to participate in wetland management activities.
Policy 4.3: The City will update its WPMP as needed and continue to implement the wetland regulatory standards included in the WPMP, the WRMP and City Code.

3.5 Goal 5: Public Participation, Information and Education

Goal: Increase public participation and knowledge in management of the water resources.

Public involvement is a strategy that recognizes people want to be involved in decisions that affect any facet of their life. It creates and implements opportunities for the public to participate in the processes that lead to decision-making.

The City's web site (www.burnsville.org) is an alternative medium to provide municipal information to both City residents and those people who live outside Burnsville. An electronic version of the water resources management plan will ultimately be accessible on the web. Because the Plan has such a wide audience from engineers and planners, to developers and citizens, to scientists and educators, electronic access to the text and mapping creates a better understanding of the goals, policies and activities of this Plan.

The City will continue to distribute information on pertinent water and wetland management issues via the Burnsville Bulletin. The Bulletin will promotes opportunities for residents to participate in water resources management activities.

The City will make an ongoing effort on both a City-wide and watershed level toward educating the public by distributing information to its residents on responsible practices they should employ to protect water resources within the community.

Table 21 presents policies the City has developed to achieve the public participation, information and education goals of this plan.

Table 21
Public Participation, Information and Education Policies

Subject:	
➢ Enhancement of Public Participation, Information and Education	
Purpose:	
➢ Encourage active community involvement in water resources management.	
Goal:	
➢ Increase public participation and knowledge in management of the water resources.	
Public Involvement Policies	
***Policy 5.1*:**	The City will use a public involvement process in resource management decision-making (i.e., the Parks and Natural Resources Commission).
***Policy 5.2*:**	The City will use a variety of media, including newsletters, brochures, local cable television and the City's Website and social media, to inform the community about water resource management program activities and concerns. The City will make an ongoing effort on both a local and regional level by distributing information to residents on practices they may implement to help protect and improve water resources.
Policy 5.3:	The City will work with existing public and private resources to increase public participation in water resources management and disseminate information regarding this Plan and the City's overall program.
Policy 5.4:	The City will establish model interpretive sites for public education.
Policy 5.5:	The City will continue to educate elected officials on water resources management needs and issues.
Policy 5.6:	The City will investigate methods of producing school educational events/programs and implement the program/methods if feasible.

3.6 Goal 6: Monitoring

Goal: Implement a comprehensive water resource monitoring program.

Water resources monitoring is not a one-dimensional activity. Monitoring takes different forms and has different characteristics, depending on its purpose and intended uses. The DNR, MPCA, Metropolitan Council, the Watershed Organizations and citizen volunteers have conducted monitoring in Burnsville. Volunteers are vital to Burnsville's water quality data collection efforts on lakes and wetlands. Two programs provide valuable data to the City so it can make appropriate water management decisions.

- Dakota County's **Wetland Health Evaluation Program (WHEP)** program utilizes volunteer citizen scientists to gather data about wetlands. Visit the WHEP website to see wetland monitoring reports.

- Volunteers in the Metropolitan Council's **Citizen-Assisted Monitoring Program (CAMP)** monitor eight Burnsville lakes, including, Crystal, Keller, Lac Lavon, Alimagnet, Sunset Pond, South Twin, Earley, and Wood Pond. They collect water samples and data such as water clarity and temperature. To see the CAMP lake water quality reports, please visit the CAMP website.

The City acknowledges the stream protection efforts in Burnsville by the Lower Minnesota River Watershed District and the DNR. Monitoring trout stream segments in the City will also be evaluated and coordinated with the Watershed Organizations and DNR. Table 22 summarizes the City's monitoring program strategy and Table 23 presents policies the City has developed to meet the monitoring goals of this plan.

Table 22
Water Resource Monitoring Program Summary

Monitoring Location	**Type of Monitoring**	**Monitoring and Follow-up Activities**
Black Dog Lake	Monitoring by Xcel	City to work with Xcel to analyze monitoring data.
Trout Streams	Temperature	Coordinated between local WMOs and DNR
Alimagent, Keller, Crystal, Lac Lavon, Wood Pond, Earely Lake, Sunset Pond, South Twin Lake	Annual participation in CAMP program	Five year cycle of aesthetic and habitat monitoring annually per BDWMO for Keller, Crystal, and Lac Lavon
Wetland Monitoring	Reference wetlands to be selected by the City	Four wetlands per year, two of which are reference wetlands
Stormwater Ponds/outfalls	Visual and Sediment accumulation surveys	Once in 5 years per NPDES MS4 Policy

Table 23
Monitoring Policies

Subject:	
➢ Water Resource Monitoring Program	
Purpose:	
➢ To make informed data-supported water resource management decisions at the local level.	
Goal:	
➢ Implement a comprehensive water resource-monitoring program.	
Monitoring Policies	
Policy 6.1:	The City will continue to conduct monitoring programs to develop baseline and long-term water quality records.
Policy 6.2:	The City will continue to cooperate with all public agencies to conduct monitoring projects and share monitoring data with them.
Policy 6.3:	The City will continue citizen-monitoring programs.

3.7 Goal 7: Maintenance and Inspection

Goal: Preserve the function of water resource facilities through routine inspection and regular maintenance activities.

Inspections help to spot potential problems before they become major problems. Routine maintenance reduces the long-term costs related to drainage system maintenance, while helping achieving water quantity and water quality goals. BMP maintenance agreements with private pond owners gives the City a tool in case private ponds are not maintained. In addition, documentation and acquisition of proper ponding easements over public ponds is very important.

The City of Burnsville's Public Works Department developed a Stormwater Drainage System Maintenance Plan in November 1992 (OSM, 1994). This plan was effectively replaced by the 2016 SWPPP policy. These plans assure that the City's system of stormwater retention/treatment basins and stormwater conveyance systems are adequately inspected and maintained to assure that they meet their design functions. Outlined below is a summary of the various inspection and maintenance activities the City intends to undertake in regard to achieving these goals. Inspections of the system are critical, and a requirement of the City's NPDES MS4 Permit Program.

- The City will inspect stormwater best management practices (BMPs), storm sewer outfalls and material storage and handling areas in accordance with its NPDES Program Policy.
- The City will sweep the streets in accordance with its NPDES Program Policy. Specifically, this will require prioritization of sweeping activities to be focused around areas draining to water bodies having high recreational use potential. Spring sweeping will occur as soon as possible after snow melt.

The City is responsible for maintenance of stormwater practices on City property and drainage easements, Dakota County and MnDOT are responsible for maintenance of practices on their respective properties and private systems are the responsibility of the property owners.

Table 24 presents policies the City has developed to achieve the maintenance and inspection goals of this plan.

Table 24
Maintenance and Inspection Policies

Subject:	
➢ Maintenance and inspection of the drainage system, ponds and water quality treatment practices	
Purpose:	
➢ To maximize system performance and comply with NPDES MS4 Program Permit requirements.	
Goal:	
➢ Preserve the function of water resource facilities through routine inspection and regular maintenance activities.	
Maintenance and Inspection Policies	
Policy 7.1:	The City will follow its MS4 Policy relating to inspection and maintenance of stormwater management facilities (ponds, rain gardens, sump manholes, etc.).
Policy 7.2:	The City shall require maintenance of privately constructed water quality treatment facilities through formal maintenance agreements.
Policy 7.3:	The City shall require adequate maintenance-related access for public and private water resources facilities (i.e., ponds, etc.).
Policy 7.4:	Pond clean-out activities shall be prioritized based on water quality benefits of downstream wetlands, lakes and streams and flood detention benefits.
Policy 7.5:	The City of Burnsville will sweep the streets at least two times annually per NPDES MS4 policy.
Policy 7.6:	The City will continue its snow plowing and snow/ice control policy that balances public safety and environmental protection. The City will evaluate new snow/ice control technologies and guidance from sources such as MnDOT on a regular basis.

3.8 Goal 8: Recreation, Fish, and Wildlife

Goal: Manage water recreation activities and improve fish and wildlife habitat.

The goal of the DNR Division of Fish and Wildlife (DFW) is to protect and enhance the fishery resource and the aquatic biological community for their long-term recreational, ecological, aesthetic, and economic benefits to the state. DNR has oversight and permitting responsibility for the management of fisheries in the waters of the state. The DNR also requires permits for controlling or removing aquatic plants or invertebrates in protected waters or wetlands. The concept of ecosystem management requires that not just a species of interest be managed in a given water body, but that all plants, animals, and the physical and chemical constituents of the environment be part of the management program.

The City has developed policies to achieve the goal of this section. The policies are presented in Table 25.

Table 25
Recreation, Fish and Wildlife Policies

Subject:	
➢ Water resource-based recreational activities and wildlife interests	
Purpose:	
➢ To enhance water recreational facilities, and fish and wildlife habitat.	
Goal:	
➢ Manage water recreation activities and improve fish and wildlife habitat.	
Recreation, Fish and Wildlife Policies	
Policy 8.1:	Natural areas, and wildlife habitat intended for preservation, shall be protected with appropriate BMPs during construction.
Policy 8.2:	Horizontal, terrestrial buffer zones required in the wetland standards shall be maintained in native vegetation, to provide habitat for wildlife. (See Table 19)
Policy 8.3:	The City shall support programs for controlling exotic and invasive species of plants and animals.
Policy 8.4:	The City shall balance water recreational activity with water quality and habitat issues.
Policy 8.5:	The City will seek to preserve the Priority Sites identified in the Natural Resources Master Plan when related to a water resources project/activity.
Policy 8.6*:*	The City will Promote intergovernmental cooperation in protecting and improving areas with shared responsibility
Policy 8.7:	The City will encourage changes to current landscaping requirements which will encourage the use of native plant materials, enhance pollinator habitat and maximizing biodiversity.
Policy 8.8:	The City will encourage development along the Minnesota River Valley Area which will enhance its use as a recreational area and support the preservation of natural resources in a manner consistent with this Plan.
Policy 8.9**:**	The City will provide management of aquatic plants on all lakes in accordance with its Aquatic Plant Management (APM) Policy. The City will provide technical support to homeowner groups that wish to control aquatic weeds on water bodies not specifically addressed in the APM Policy.

3.9 Goal 9: Groundwater Protection

Goal: Prevent contamination of the aquifers and promote ground water recharge and conservation.

The City completed its Wellhead Protection Plan (WHPP) in 2006 following review by the Minnesota Department of Health. The overall goal of a WHPP is to protect the public water supply from harmful contaminants. It is a preventative program, keeping harmful contaminants from entering the public water supply system. Dakota County also has a Ground Water Protection Plan that was adopted in April 2000. In 2006 the county decided to integrate all of its water management objectives, including groundwater protection, in a comprehensive Environment and Natural Resource Management Policy Plan. That plan was

recognized by and approved by the BWSR Board as the new county groundwater management plan in October 2006 and it serves as the current county groundwater protection plan. The City's Wellhead Protection Plan Amendment was approved by MDH on September 26, 2013. The updated maps provide the basis for the prohibited and restricted infiltration zones established in the engineering standards in Appendix C.

In June 2015, the City of Burnsville adopted a Drinking Water Protection Overlay District (DWPOD) ordinance [City Ordinance 10-8-12]. This ordinance is meant to help protect the City's drinking water supply in an area in the northern part of the City determined "highly vulnerable" to contamination. This determination was based on the type and location of wells, surface water supply areas, geomorphology and aquifer characteristics in the area. The ordinance established standards and regulations for landowners and businesses, whose uses have the potential to contribute to drinking water contamination - such as storage tanks, outdoor storage and chemical usage.

It is a high priority for the City to maintain a clean and safe public water supply. The primary purpose of the DWPOD is to establish acceptable land-use practices, and develop performance standards to minimize risks to the City's drinking water supply. Table 26 presents policies the City has developed to achieve the ground water goals of this plan.

Table 26
Ground Water Policies

Subject:	
➢ Ground Water Protection and Sustainability	
Purpose:	
➢ To protect and sustain ground water resources by understanding and accounting for ground water/surface water interactions and promoting conservation.	
Goal:	
➢ Prevent contamination of the aquifers and promote ground water recharge and conservation.	
Ground Water Protection and Sustainability Policies	
Policy 9.1:	The City shall use and maintain the Drinking Water Protection Environmental Overlay District (adopted in 2015) to protect groundwater and surface water resources.
Policy 9.2:	The City shall require and promote, according to City ordinances, proper well abandonment.
Policy 9.3:	The City will require and promote stormwater infiltration in areas of the City that are not highly susceptible to groundwater contamination.
Policy 9.4:	Design and installation of on-site wastewater systems shall be in accordance with the standards set forth in Minnesota Rules, Chapter 7080, the Individual Sewage Treatment System (ISTS) Act and the City adopted Subsurface Sewage Treatment Systems ordinance (adopted in 2011).
Policy 9.5:	The City will implement and enforce the existing Water Conservation policies. The City will work with surrounding communities to implement conservation goals as recommended in the "Regional Drinking Water Supply, Groundwater Recharge and Stormwater Capture and Reuse Study" (Southeast Metro Area Study).
Policy 9.6:	The City shall encourage the use of alternative landscape techniques and materials to reduce dependency on ground water supplies.
Policy 9.7:	The City will encourage the use of "gray water" and/or stormwater to reduce reliance on potable water in accordance with state and local standards and guidance.

3.10 Goal 10: Regulatory Responsibilities

Goal: Maintain regulatory authority at the local level while recognizing the role of other local, state and federal entities and complying with specified programs and requirements.

Several entities will have administrative responsibilities within the planning area. For a local water management effort to be successful, each entity's commitment and role must be clearly understood. Those currently having some level of administration responsibility include the City, Watershed Organizations, Dakota County, the Metropolitan Council, MnDNR, MPCA, the U.S. Army Corps of Engineers, BWSR, EPA, and FEMA.

The major task of administering this plan will be in the permitting process. It is the intent of the City to assume the role of permitting for all land alteration, thereby enforcing the policies and standards of this plan. The City's existing permit procedures include water management elements outlined in this Plan. Surface water management elements will be reviewed at the same time all other permits are reviewed. The stormwater elements will meet the design standards of this plan (Appendix C).

The City's administrative responsibilities include, but are not limited to the following:

- Comprehensive Plan update(s);
- Land use regulation;
- Ordinance review and amendment;
- Local plat review and amendments;
- Permits;
- Wetland Management as LGU;
- Groundwater - wells;
- Participation and cooperation with the programs of the WMOs, DNR and Dakota County;
- Hydrologic model updates;
- Financing Alternatives;
- Capital improvements; and
- Conveyance system/pond maintenance;

A summary of the key steps in the City's permit process for development activities is provided in Appendix F. A checklist for development projects is also included. Hydrologic and hydraulic analysis, design information and requirements are provided in Appendices C and D.

The City of Burnsville has several codes and ordinances that relate to surface water management. The City's regulatory controls satisfy state and local requirements for water resources management. No new regulatory controls are required to insure plan implementation per Minnesota Statutes 103B and 8410 Rules. Local WMOs have authority to review City regulatory controls that affect resources under WMO jurisdiction.

The City has developed the policies in Table 27 to help meet the regulation goals of this Plan.

Table 27
Regulatory Policies

Subject:	
➢ Regulatory Responsibility	
Purpose:	
➢ Align regulatory controls with stormwater practices to maximize the protection of water resources	
Goal:	
➢ Maintain regulatory authority at the local level while recognizing the role of other local, state and federal entities and complying with specified programs and requirements.	
Regulatory Responsibilities – Policies	
Policy 10.1:	The City shall continue to implement its stormwater management ordinance.
Policy 10.2:	The City shall update ordinances and programs as needed to remain consistent with local, regional and national programs related to stormwater management.
Policy 10.3:	The City shall inform WMOs of projects within the respective jurisdictions which impact strategic waterbodies or MnDNR Public Waters.

3.11 Goal 11: Finance

Goal: Establish funding sources to finance water resources management activities.

Paying for water management projects has become more complex in recent years. In the past, special assessments against benefited properties financed most of the necessary improvements. However, the financial options have broadened considerably. The question is: Which method(s) best suit the needs of the City? Discussion on the funding source options for water resources management is discussed more in Section 7.1 Funding Sources.

The City has developed policies to achieve the finance related goals of this Plan as shown in Table 28.

Table 28
Finance Policies

Subject:	
➢ Paying for Water Resources Management	
Purpose:	
➢ To adequately finance management activities in an equitable manner.	
Goal:	
➢ Establish funding sources to finance water resources management activities	
Finance Policies	
***Policy 11.1*:**	The City shall continue use of the Stormwater Utility Fund to fund the majority of water resources activities/projects and shall budget to ensure its longevity and cost effectiveness to City tax payers.
Policy 11.2:	The City will actively pursue grants, donations, and in-kind contributions to help fund water resources management.
Policy 11.3:	The City shall assist citizens and businesses in their efforts to improve water quality, decrease the volume of runoff leaving a property and improve wetlands through the water resource enhancement grant program.
Policy 11.4:	The City shall encourage the WMOs to finance inter-community issues and projects.
Policy 11.5:	The City shall support the establishment of Lake Improvement Districts formed by petition in cases where inter-community funding is necessary and WMO funding is not available. Lake Improvement Districts are established in accordance with Minnesota Statutes, section 103B.501-103B.581. Minimum guidelines and requirements for the formation of LIDs are found in Minnesota Rules Part 6115.0900-6115.0980.
Policy 11.6:	The city may determine cost allocation on a project by project basis if funding sources other than the Stormwater Utility grants are used. Contributing area, tax value, percent of runoff, total pollutant loading and/or other units of measure may also be considered as a basis for determining cost allocations.
Policy 11.7:	Private development shall be responsible for funding all on-site stormwater facilities and may be requested to contribute funds for construction, expansion and/or maintenance of off-site conveyance or ponding systems.

3.12 Goal 12: Land Use Management

Goal: Recognize the relationship between land use and water resources management.

One of the recent trends in planning for future growth is the concept of sustainable development. Sustainable development involves communities finding ways to meet their residents' needs for such things as good jobs, schools and housing without wasting or degrading the natural resources upon which future prosperity depends (Minnesota Planning, 1995). Although "growth" and "development" are often used interchangeably, they imply very different things for a community. "Growth" suggests bigger while "development" can mean

getting better or achieving potential. By following the path towards sustainable development, communities can:

- Save money on infrastructure costs, such as roads, sewers, schools and police and fire protection, by avoiding duplication and anticipating future needs.
- Help ensure that the public costs of supporting new growth do not outweigh the public benefits.
- Spur environmentally sustainable economic development by providing current and prospective businesses with information about areas' future.

Burnsville formally adopted a Sustainability Plan in 2009 and incorporated sustainable principles into the current 2030 Comprehensive Plan. Sustainability is defined by the Minnesota State Legislature as follows:

> *"Development that maintains or enhances economic opportunity and community well-being while protecting and restoring the natural environment upon which people and economies depend. Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs."*

Within Burnsville's Sustainability Plan there are fourteen Best Practice Areas (BPAs) of which, the following BPAs pertain to water resource management and the objectives of this Plan:

- Adopt land use policies that provide incentives to reduce sprawl, preserve open space, expand and enhance green corridors as redevelopment occurs and to create a walk- able community.
- Help educate public schools and private industry about sustainable practices utilizing the ARROW program to educate business about sustainability and provide an educational campaign that reaches out to the school districts, private industry and professional associations about how they can be sustainable and incorporate sustainable practices into daily operations.
    - Protect and improve surface and groundwater resources. Develop an educational program aimed at reducing water wasted through irrigation through smarter practices, investigate new design standards and incentives to emphasize the use of natural drainage systems over built stormwater systems and seek ways to modify street improvement projects to provide less impervious surface, utilize rainwater gardens, porous pavement and other techniques.

The City has developed policies to help meet the land use goals of this plan. These policies and activities are presented in Table 29.

Table 29
Land Use Policies

Subject:	
➢ Land Use Management	
Purpose:	
➢ Revise ordinances and policies to promote sustainable growth.	
Goal:	
➢ Recognize the relationship between land use and water resources management	
Land Use Policies	
Policy 12.1:	The City shall continue to promote the use of Low Impact Development practices to replicate pre-development hydrology.
Policy 12.2:	Burnsville will continue to encourage proof of parking and endorses shared-parking and green "snow storage" areas to minimize impervious surfaces.

4.0 Resolved Issues & Past Project Examples

As discussed previously, this Plan builds on the previous Plans adopted by the City in 1994, 2002 and 2008. Each of those previous Plans contained an assessment of problem areas and called for implementation actions to address those issues. The following sections provide descriptions of past example projects and resolved issues.

4.1 Yellow Freight Pond

Yellow Freight Pond is a regional pond that was completed in 2014 where no previous stormwater treatment practice existed. The 5.5-acre wet pond was created to provide Water Quality Volume (WQV) credits for development and redevelopment projects within the 208-acre contributing drainage area. Immediately adjacent to this project was a combined project between MnDOT, Dakota County and the City to reconstruct the TH13 and County Road 5 interchange as well as several adjacent local streets. The majority of the runoff from the MnDOT ROW continues to bypass the Yellow Freight Pond through a channel that extends along the west side of the pond. That channel was stabilized as part of the work on Yellow Freight Pond.


Yellow Freight Pond


MnDOT runoff bypass channel

Yellow Freight pond provides an estimated pollutant removal of 38 tons of Total Suspended Solid removal on an annual basis and 162 pounds of Total Phosphorus removal on an annual basis. The City will make WQV credits available to new and redevelopment projects in the contributing drainage area as they progress through the permitting process.

4.2 Black Dog Slope

Following an intense rainfall in 2014, severe erosion occurred in a wooded ravine situated between Bluff Court (at the top of the slope) and Black Dog Park (at the bottom of the slope near the football field parking lot). The eroded area was located on the upper portions of the ravine, spanning about 250 feet in length and varying in depth from 2 to 14 feet. The 18-inch corrugated metal pipe (CMP) storm sewer line that had been installed decades before was severely damaged by the erosion and


Before Project: Slope failure and damaged CMP pipe

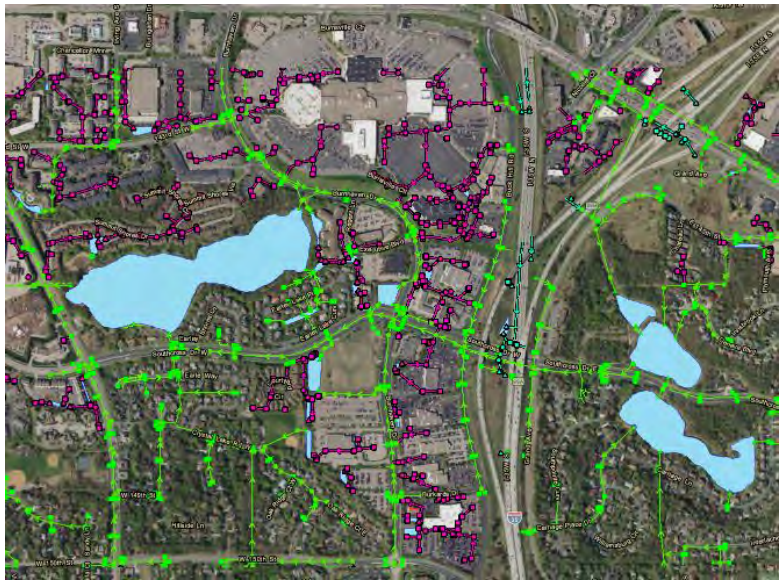
corrosion of the pipe may have contributed to the slope failure. Multiple pipe segments were completely exhumed and detached from one another and two manholes were severely damaged.

The condition of the CMP pipe likely contributed to the erosion and is a major reason what the City has a program specifically to assess and replace CMP pipes on a regular basis. Specifically, leakage from the rusted pipe bottom, pipe joints, or at pipe-manhole connections may have saturated and softened the soils around the pipe. The improvements consisted of placing a new and larger diameter High Density Polyethylene Pipe (HDPE) Pipe along the length of the slope and restoring the slope with native vegetation.


After Project: New HDPE Pipe installed and slope restored with native vegetation

4.3 Earley Lake

Earley Lake was listed on the MPCA's 2008 303(d) Impaired Waters List due to excess nutrients (phosphorus) and required a Total Maximum Daily Load (TMDL) study to be completed. The lake was first listed on the MPCA's 303(d) list in 2002, prior to the MPCA establishing water quality standards specifically for shallow lakes. However, based on the 10-years of water quality data from about 2001 to 2010, Earley Lake was meeting the MPCA's shallow lake standards, and the MPCA ultimately removed Earley Lake from the 303(d) Impaired Waters list in September 2011.



Much of the credit for removing Earley Lake from the impaired waters list and improving the quality of the water body goes to the City for projects and activities they completed in the contributing watershed. Projects such as the following each played a role, and will continue to provide treatment of stormwater that enters Earley Lake:

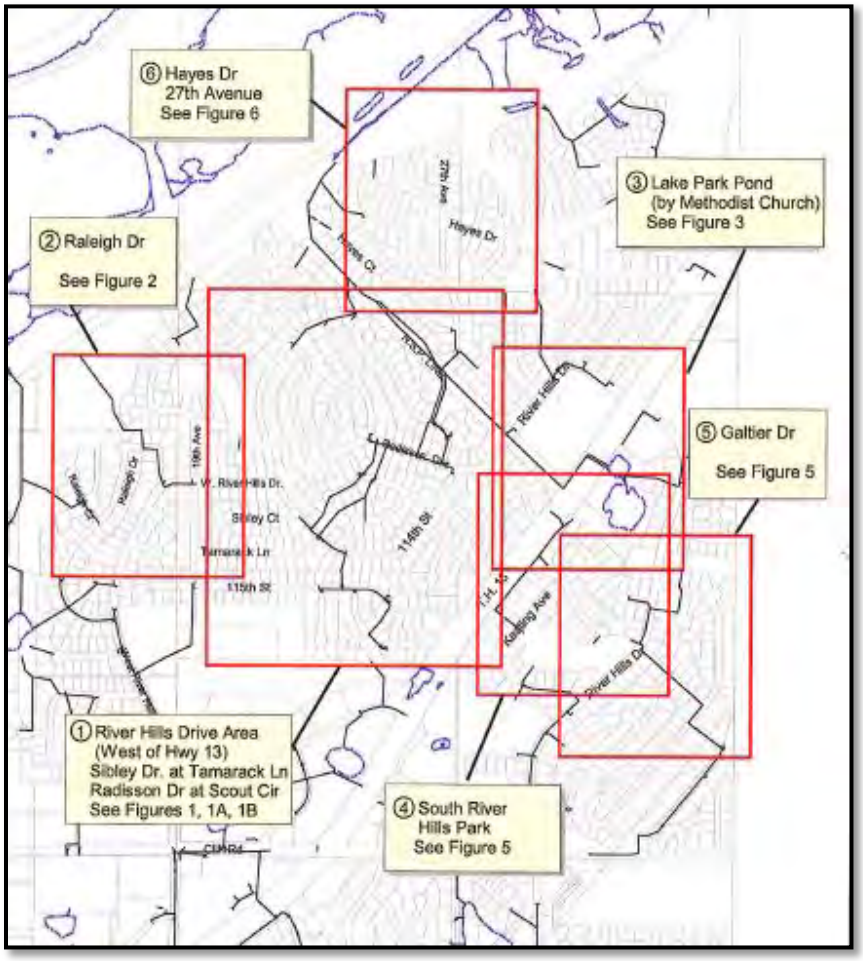
- Regent at Burnsville Diversion and Pond (2002). This project involved installing a low flow diversion structure and pipe in the existing 78-inch storm sewer that comes from the Burnsville Center Area. The diverted water routes to a pond that was built to treat this runoff before discharging to the lake.

- North Twin Pond (2014). While this was contructed after delisting of the lake, the project will have an impact on the ongoing load reductions to Earley Lake. This pond treats previously untreated flows from the Golden Triangle area before entering North Twin Lake and North Twin routed directly into Earley Lake.

- Additional Ponds and BMPs installed including: Burnhaven-Southcross Pond located at the northeast corner of Burnhaven and Southcross, Toyota Pond and many others in the contributing watershed.

4.4 Northeast Burnsville flooding prevention

An extreme rainfall event hit Burnsville in July of 2000, in the midst of working on the 2002 WRMP, and resulted in the identification of some significant problems areas throughout the City. One of the areas of focus was northeast Burnsville, for which the City completed a detailed field review and modeling analysis of issues in the area and developed recommended improvements to address the flooding that occurred in 2000. The Report "Northeast Burnsville – Comprehensive Flood Study: Proposed Engineering Solutions for Improving the Drainage System" (SEH 2001) identified specific improvements throughout the area that have all been completed, except for the final project which is planned for early 2017. Since improvements have been made little to no issues have been reported for extreme event rainfalls in recent years, confirming that the system is largely working as intended.



5.0 Assessment of Current Issues

As required by the new Minnesota Rules Chapter 8410, adopted in July of 2015 and Minn. Stat. 103B.235, local water management plans need to include an assessment of both existing and potential water resource-related problems/issues. This section outlines the existing issues the City has identified while section 6.0 identifies emerging and potential future problems.

Based on survey results from the public input process, an assessment of known issues by City staff and in consideration of regulatory responsibilities, the following items have been identified as the leading existing water-resource related problems the community of Burnsville faces:

- water quality
- water quantity/flooding
- vegetation management

These issues, as well as erosion and sedimentation are discussed in the following sections. The same topics are also tied to the City's Goals and Policies in section 3.0 and actions to move toward resolving these issues are identified in section 7.0.

5.1 Water Quality

Improving and maintaining water quality within receiving water bodies is the highest priority issue for the City in the years ahead. Water quality is driven by several factors including the type of land use and impervious cover within the contributing watershed and the extent of water quality treatment practices (or BMPs) installed or implemented throughout the watershed. Where receiving water bodies currently do not meet current state water quality standards or City goals, the primary mechanism to get the desired result is to implement additional physical BMPs, maintain and/or improve the function of existing physical BMPs and/or improve the effectiveness of management practices within the watershed.

Where this Plan refers to receiving water bodies, the water features included are the natural lakes, wetlands, streams and rivers that are managed for water quality. The physical BMPs that are installed within the watersheds to improve water quality before it reaches these waters are the City system that removes and collects pollutants before it reaches downstream water bodies. For example, a stormwater pond may look and in some ways function like a natural water body even though it is functioning as a treatment device to remove sediment, debris and pollutants from the surface water runoff and accumulate these materials for removal at a later date. In Burnsville, many of these stormwater ponds are natural water bodies that have been altered in some way to serve the function of a stormwater pond. These manmade and natural basins that serve as treatment systems are not managed for water quality, but instead are managed to maintain a designed level of treatment function. When that level of function is reduced over time, the City programs a maintenance project (i.e., pond clean program) to restore or improve the treatment device's function.

5.1.1 Impaired Waters

The MPCA has updated the 303(d) Impaired Waters list every two years, with the most recent draft list published for 2016. Table 30 summarizes the waters within Burnsville on the draft 2016 Impaired Waters list.

Table 30
2016 Draft Impaired Waters Summary

Water body name	Affected designated use	Pollutant or stressor	TMDL Plan Approval Year
Crystal Lake	Aquatic Consumption	Mercury in Fish Tissue	
Crystal Lake	Aquatic Recreation	Nutrient/eutrophication biological indicators	2011
Keller Lake	Aquatic Recreation	Nutrient/eutrophication biological indicators	2011
Lac Lavon	Aquatic Consumption	Mercury in fish tissue	2007
Minnesota River	Aquatic Consumption	Mercury in fish tissue/water column	2008
Minnesota River	Aquatic Consumption	PCB in fish tissue	
Minnesota River	Aquatic Life	Dissolved oxygen	2004
Minnesota River	Aquatic Life	Nutrient/eutrophication biological indicators, turbidity	
Lake Alimagnet	Aquatic Recreation	Nutrient/eutrophication biological indicators	2015

The City has taken an active role in developing TMDL studies and implementation plans for the nutrient/eutrophication impairments to these waters (the MPCA is leading the efforts to address mercury impairments on a much larger scale). Water quality is often directly related to the level of nutrients in the water body. While nutrients comprise only one category of substances that can effect water quality, nutrients, principally phosphorous, must be controlled to achieve the water quality goals of this Plan. Phosphorous is almost always the limiting factor to plant growth. Increase the phosphorous and the plant species dominating the lakeshore, open water, or marsh will certainly shift to favor those plants which can best take advantage of the increased supply of phosphorous.

The City partnered with the Black Dog WMO to complete TMDL studies on Crystal and Keller Lakes which was approved by the EPA in September 2011. Earley Lake was also assessed during this study but was delisted and taken off of the 303(d) Impaired waters list in 2010. The VRWJPO completed the Vermillion River Watershed Restoration and Protection Strategy project in 2015 which addressed 27 impaired water bodies, one of which was nutrient impairment for Lake Alimagnet.

The portion of the City that drains to the Vermillion River also has E. Coli bacteria and dissolved oxygen impairments. As part of the City's NPDES permit program, the City will continue to track activity related to TMDL studies on each of these waters and respond according to the requirements of the permit program as well as continuing cooperative relationships with watersheds and other cities in managing flows and pollutant loads to intercommunity and downstream waterbodies.

5.1.2 Pollution Prevention

Good “Housekeeping” practices are a way for individuals and the City to make a difference in water quality. Many people do not realize that organic materials, like leaves and grass clippings, fertilizer and pesticides, and pet waste can disrupt the ecosystem of a lake or wetland. One of the six main elements of what the City needs to follow to comply with the NPDES MS4 Permit Program is Good Housekeeping for Municipal Operations. This includes practices such as street sweeping, good lawn mowing practices, reducing the use of chemicals and fertilizers and many others. These same type of practices are great examples of things each individual resident or business owner in the City can also do.

5.1.2.1 Street Sweeping

Leaves and grass clippings that make their way to lakes are doing even more damage than fertilizers, pesticides and motor oils. Once in the lakes, these organic materials decay, releasing phosphorus. The excess phosphorus increases algae growth, inhibiting the growth of other aquatic plants. When algae die and decay, they exert a biochemical oxygen demand (BOD) on the lake, depleting available oxygen for fish.

The City currently sweeps streets a minimum of twice per year, with more frequent sweeping completed as staff resources are available. Fall leaf sweeping of the whole City was conducted for the first time in 2001.The street-sweeping plan focuses resources on areas around the highest quality resources first, before moving out farther into the watershed.

5.1.2.2 Ice Control Priorities

In 2006-2007 the City revised its policy on street sanding and went to all salt application for ice control. Only on very rare occasions does the City use sanding to supplement the salt applications. The City has been pre-wetting the pavements and using anti-icing agents. The City has identified the four high-priority snow and ice control areas and has established a priority system for street deicing activities. The system generally follows the order below.

- Thoroughfares;
- Commercial/Industrial;
- Collectors and steep grades; and
- Residential intersections.

MPCA recommends a low-salt diet for Minnesota waters. When snow and ice melts, the salt goes with it, washing into our lakes, streams, wetlands, and groundwater. It takes only one teaspoon of road salt to permanently pollute 5 gallons of water. Once in the water, there is no way to remove the chloride, and at high concentrations, chloride can harm fish and plant life. Less is more when it comes to applying road salt. The MPCA webpage has more detailed information on salt use and best practices to reduce use and manage ice including an online tool to help winter maintenance organizations assess operations, identify opportunities to reduce salt use using proven BMPs and track progress. The goal is to maintain performance while reducing salt use and saving money.

5.1.2.3 Fertilizer Application

Fertilizer may be necessary for a healthy lawn, but the nutrients in fertilizer can be harmful to lakes and wetlands. Phosphorus from fertilizers runs off lawns and ultimately discharges to area lakes and wetlands. One pound of phosphorus can yield 500 pounds of algae. Algae can turn a lake green and damage or even kill the lake’s ecosystem.

Fifteen to thirty percent of phosphorus in urban runoff comes from lawns. In general, the soils in Burnsville are already rich in phosphorus. Applying the right fertilizer, in the right amount,

ensures a healthier lawn and healthier lakes and healthier wetlands. The City adopted a phosphorus free fertilizer ordinance in 2001 in direct response to this planning process and in advance of the State law enacted in stages between 2002 and 2005. The City's fertilizer ordinance prohibits fertilizers near water bodies, requires commercial applicators to be licensed, and requires everyone to use phosphorus-free fertilizer unless a soil test is conducted to verify the need for phosphorus.

5.1.2.4 Animal Waste

From time to time, metro area beaches are occasionally closed for short periods during the peak swim season as a result of high fecal coliform bacteria levels. Fecal coliform is a direct result of pet and migratory waterfowl (especially Canadian geese) waste. An education-based approach can reduce this problem. Although many people enjoy seeing Canadian geese, the geese often wear out their welcome when they become too numerous on lawns, parks and golf courses. Yards, beaches and docks become fouled with their feces. The fecal matter contributes to poorer water quality by increasing nutrient loading. The City has a Canada Goose Management Plan to address nuisance goose populations. Information on the program is available on the City website.

In addition to being an aesthetic issues, pet waste can also be a significant concern if allowed to runoff directly into surface waters resulting in added nutrient and fecal bacteria loading. The City has pet waste bags available at the Alimagnet off-leash dog park to help reduce the extent of pet waste subject to runoff and regularly publishes articles in local newsletters regarding the need to pick up after pets.

5.1.3 NPDES MS4 Permit

The City has implemented the USEPA's Phase II Stormwater Regulations (Title 40 Code of Federal Regulations, Part 122). The approach of the Phase II permit is to address water quality by focusing on six specific programming elements as shown in the inset below, for implementation of Best Management Practices (BMPs).

Six Minimum Control Measures for the NPDES Permit

(1) Public education and outreach on stormwater impacts;
(2) Public involvement/participation;
(3) Illicit discharge detection and elimination;
(4) Construction site stormwater runoff control;
(5) Post-construction stormwater management in new development and redevelopment; and
(6) Pollution prevention/good housekeeping for municipal operations.

The Minnesota Pollution Control Agency is the NPDES permitting authority for the federal rule implementation. The MPCA implemented the Municipal Separate Storm Sewer System (MS4) permit program in 2003 and made revisions to the permit in 2006. The City prepared its original Stormwater Pollution Prevention Plan (SWPPP) in 2003 and applied for coverage under the permit as required by MPCA. The City's 2003 SWPPP was approved and the City operated under the permit by completing the measurable goals identified in each of the Best Management Practices (BMPs) within the SWPPP.

The MPCA finalized revisions to the permit again in 2013 and required permit holders to apply for reauthorization of coverage for the revised permit. The revisions included additional

water quality treatment provisions, additional work on inventories of the storm system and updating ordinances and official controls to be consistent with the new permit requirements. The City applied for coverage in December of 2013 and the MPCA placed the City's proposed updates on Public Notice in February 2014. Following the public notice period the City received approval of coverage under the new permit in April 2014.

5.1.3.1 Anti-degradation Assessment

The reissuance of the permit by MPCA in 2006 required cities to revise their SWPPPs and reapply for permit coverage. The City reapplied and obtained coverage based on the 2006 SWPPP and has since added BMPs that address Anti-Degradation (referred to in 2006 as Nondegradation) requirements and a process for tracking impaired waters within the City and responding to planned or competed Total Maximum Daily Load (TMDL) studies and implementation programs.

In 2007, the City evaluated the past, current and potential impacts of land use on loading of various pollutants to City waters. The City was one of 30 cities required to complete a Nondegradation Assessment and Report that looked at the average annual loading of three pollutants (listed below) at 1988, 2005 and projected 2020 land use conditions. The three pollutants are:

- Total Suspended Sediment (TSS)
- Total Phosphorus (TP)
- Annual Runoff Volume

A new Anti-degradation Rule was adopted by MPCA in November 2016. The proposed standards within this WRMP establish runoff volume control for both new development and redevelopment that meet the expectations of the Anti-degradation requirements for the MS4 Program. Any new requirements would be addressed in revisions to the MS4 General Permit when that permit update (which starts in 2018) is completed.

5.1.4 Individual Sewage Treatment Systems

The Individual Sewage Treatment System (ISTS) Act was signed into law on May 10, 1994 (Anon., 1994), to reduce contamination of surface and ground water caused by inadequate septic systems. The law includes requirements for minimum sewage treatment standards, new construction, replacement of ISTS, disclosure of sewage-system information to property buyers and a mandatory licensing program for all ISTS professionals, including designers, site evaluators, installers, inspectors and pumpers. In Burnsville, these systems are regulated by City Code Chapter 11, Subsurface Sewage Treatment Systems (SSTS) that was adopted in 2011.

Approximately 229 properties in southwest Burnsville continue to be served by on-site waste water systems. A poorly maintained system can represent a significant threat to water quality, especially when the system is adjacent to significant wetlands and/or lakes. It is the responsibility of the property owner to maintain the system in proper working order.

5.1.5 Subwatershed Assessments

5.1.5.1 Alimagnet Lake Subwatershed

In 1991, a diagnostic Feasibility study was prepared for Lake Alimagnet. As part of that study, specific lake goals were established for the lake. The total phosphorus goal was set at 81 µg/l. The lake is aging rapidly, with chronic occurrences of blue-green algae and a past history of fish kills. The data suggests that a reduction of external phosphorus loading was necessary to reduce the blue-green algae blooms. There are 12 storm sewer inlets to the

lake within Burnsville and Apple Valley, three of which contribute 71 percent of the runoff. The 81 µg/l goal was to be achieved after all identified watershed improvements were made.

In 2005, the Cities of Burnsville and Apple Valley funded a Lake Management Plan which included a lake assessment of the estimated annual total phosphorus load and in-lake modeling to re-evaluate the lake goal and implementation of improvement projects. Phosphorus concentrations in Alimagnet are higher than lakes in the North Central Hardwood Forest ecoregion (one of seven areas within Minnesota defined as having a large expanse of land containing a geographically distinct collection of plants, animals, natural communities and environmental conditions). At the time of the 2005 lake assessment, the recent 2003 growing season phosphorus average was 113 µg/l for Alimagnet while the predicted average phosphorus concentration across the ecoregion is 54 µg/l. The more recent 10-year summer average total phosphorus concentration (from June 2006 to September 2015) is 99 µg/l.

An important finding of the watershed and in-lake modeling was that Alimagnet Lake will need both watershed and lake projects to meet the predicted ecoregion phosphorus concentration of 54 µg/l. This should produce a summer average Secchi disc reading of 1.2 m (4.0 ft). The water quality of a shallow lake system, like Alimagnet Lake, is greatly affected by in-lake processes such as internal recycling of nutrients that have accumulated in bottom sediment and relationships between fish, rooted aquatic plants, and algae.

More recently in 2015, the VRWJPO published the Vermillion River Watershed Restoration and Protection Strategy report which set an allowable TP wasteload allocation of 62.4 lbs/yr for Burnsville. Estimated load reduction required for Burnsville is 25.6 lbs/yr (29% of the current estimated load of 88.0 lbs/yr). A total load reduction of 167.5 lbs/yr from all sources is estimated to achieve a state water quality standard of a total phosphorus concentration of equal to less than 60 µg/l and a clarity equal to or greater than 1.0 meter.

5.1.5.2 Crystal Lake Subwatershed

In the 1990's, water quality concerns on Crystal Lake lead to the development of a hypolimnetic (bottom) withdrawal and chemical treatment system by the Black Dog WMO. The system was installed in 1995 and began operating in 1996. The plan was to remove water from the bottom of the Crystal Lake water column where phosphorus was present, mix in ferric chloride and allow the mixture to safely settle in Keller Lake before the water returned through the existing culvert connecting the two lakes.

From the beginning, the system was plagued with odor problems. Hydrogen sulfide that naturally occurs in the lower water column was being released when the water was withdrawn for treatment, resulting in citizen complaints. Use of the system was discontinued indefinitely in 1999. In reviewing the decision, the Black Dog WMO reasoned that there might be more cost effective means to accomplish water quality improvements on Crystal Lake. An unexpected benefit was a significant, though short-term improvement in Keller Lake's water quality due to the injection of treated water. The system did not produce the desired improvements on Crystal Lake.

During a July 2000 public meeting, Crystal Lake residents indicated that their preference was to first address water quality issues on Crystal Lake in advance of potential modifications to the outlet system identified in a hydraulic study to address high water level concerns. While no improvements were proposed as part of the 2002 Plan update process, the study suggested that if the project is pursued, the BDWMO would complete a cost allocation analysis to determine if other cities will contribute funding for the project. The BDWMO may also be involved in assigning costs to the parties involved.

The City believes that the revised (2008) water clarity of 2.1 meters (from 2.6 in the 2002 Plan) is an appropriate long-term goal for Crystal Lake. This revised goal is based on the findings of the Crystal and Keller Lake Use Attainability Analysis (2003). The City is committed to continuing work with the WMO to prioritize implementation projects under consideration in the watershed.

In 2011, the BDWMO published the EPA approved Crystal, Keller, Lee and Earley Lakes - Final TMDL Report which set an allowable TP wasteload allocation (WLA) of 67 lbs/year for Burnsville. The existing conditions TP load for Burnsville is estimated to be 67 lbs/yr which is equal to the WLA so the load reduction goal is to meet anti-degradation requirements (i.e. no load increase). The majority (94%) of the phosphorus reduction needed to achieve the water quality standards for Crystal Lake would need to come from controlling the internal sources of phosphorus loading. The MPCA has started the process of re-evaluating Crystal Lake to determine if it can be de-listed from the impaired waters list.

5.1.5.3 Earley Lake Subwatershed

In the mid-to-late 90's, Earley Lake had a clarity range of less than 1.5 meters. Due to its position in the watershed, Earley Lake receives a considerable inflow and pollutant loading both from direct runoff from large impervious areas like Burnsville Center as well as from the upstream discharge from the Crystal-Keller Lake systems. In 2002, a diversion structure was installed in the trunk storm line coming for Burnsville Center and that diverted flow to a sedimentation basin within the Regent at Burnsville property. As a result of that project along with significant efforts and implementation activities since the 2002 WRMP was adopted, Earley Lake was removed from the impaired waters list in 2010. See Section 4.3 for more information on improvements within the Earley Lake Subwatershed and the removal of Earley Lake from the impaired waters list in 2011..

There has been considerable interest in Earley Lake as expressed by an active Lake Shore owners association. The Black Dog WMO Plan indicates that contact recreational activities like swimming are not supported by current lake quality due to excessive algae blooms in mid-to-late summer. The lake is not considered a strategic water resource by the WMO. Because so much of the contributing watershed is comprised of high value, commercial real estate, watershed controls may be very costly to implement. A goal of maintaining Earley Lake clarity at 1.7 meters is achievable and challenging at the same time.

5.1.5.4 Keller Lake Subwatershed

Keller Lake has typically been rated by Metropolitan Council as having clarity less than 1 meter and high to severe levels of algae. The lake has an average depth of only 4.6 feet and a maximum depth of only 7 feet. The 63 acre lake has a watershed to surface area ration of 22 to 1 which helps to explain its current quality (as example, Lac Lavon has a ratio of 3.2 to 1). Aside from 1998 when Keller's water quality improved significantly as a result of the Crystal Lake hypolimnetic withdrawal system discharges (see Section 5.1.5.2), the lake has had a very high phosphorus concentration. At the same time water quality improved, the lake experienced explosive plant growth. Based on current transparencies, the recreational suitability index would indicate very limited recreation uses based on citizen perception.

Keller Lake's predicted phosphorus load could increase by about 7 percent without additional treatment or BMPs. With BMPs implemented in the watershed, the BDWMO estimates that the phosphorus load would increase approximately 4 percent. The predicted future in-lake total phosphorus concentration is expected to change very little. It is important to recognize that both Burnsville and Apple Valley, both with contributing watershed to the lake are permitted MS4s and are required to meet their waste load allocation as established in the

TMDL by implementing BMPs within the watershed. While these improvements will improve water quality entering the lake, they will not address the significant internal load to the lake.

Additional efforts should be undertaken to re-establish citizen expectations for intended uses. The BDWMO set an action level for Keller Lake at 0.7 meters of clarity.

In 2011, the BDWMO published the EPA approved Crystal, Keller, Lee and Earley Lakes - Final TMDL Report which set an allowable TP wasteload allocation of 82 lbs/yr for Burnsville. Estimated load reduction required for Burnsville is 74 lbs/yr (47% of the current estimated load of 156 lbs/yr). This reduction is estimated to achieve a total phosphorus concentration of equal to less than 54 µg/l and a clarity equal to 1.4 meters. The City completed a project in 2017 that will remove an estimated 74 lbs/yr and will meet the City' load reduction target identified in the TMDL Report. The City's lake quality goal for Keller Lake is 1.8 meters of clarity. This goal will be re-evaluated as part of a Use Attainability Analysis study of the lake to be completed in 2018-2019.

5.1.5.5 Twin Lake Subcatchment

Any increase in Crystal Lake water quality should also result in an improvement in the water quality in both North and South Twin Lakes. In general, Twin Lake has very limited active recreational suitability. The 2002 WRMP stated that the water quality goal should be 0.9 meters based on conditions at the time. However, based on the desire for better quality and in consideration of proposed improvements in contributing drainage areas, the clarity goal was established at 1.7 meters.

Since that time the City has separated the management of Twin Lake into two parts and created unique goals for South Twin and North Twin. A goal of 1.7 meters has been retained on North Twin, while a goal of 1.4 meters has been established for South Twin.

In the early 2000's, the City experimented with barley straw bundles at the inlet to South Twin with some limited short-term success. The chemical reaction between the water and the straw helps to control filamentous algae which is prevalent on South Twin. The City continues to support resident efforts to use barley straw to improve water quality of small ponds throughout the City.

In 2013, the City constructed a new regional stormwater basin named North Twin Pond to treat stormwater inflow in the northwest corner of North Twin Lake. The basin treats previous untreated inflow and provides a portion of the treatment credit for the undeveloped land in the immediate contributing drainage area and helps to improve the water quality in North Twin Lake as well as in downstream Earley Lake.

5.1.5.6 Sunset Pond Subcatchment

Sunset pond has a current 3-yr average summer water clarity of 1.9 meters. The pond's history and purpose in the overall drainage system must be considered when developing a management strategy for the Pond. The primary natural focus of the water body is wildlife viewing from the perimeter trail system. Therefore, intensive efforts to improve the pond water quality are probably not warranted when one considers the fact that this is a created and not a natural water body, and that quality is "average". The City's water clarity goal is established as 1.7 meters.

5.1.5.7 Wood Pond Subcatchment

In the mid-1990's, a citizen-driven study was completed by the City. The study addressed water quality and water levels concerns. One major issue was that ponding easements did

not exist over the properties adjacent to the pond. As a result, easement purchases were executed with the property owners.

In October 1997, the Lake was treated with aluminum sulfate (alum). From April 1996 to October 1997, pre-alum treatment sampling identified a mean total phosphorus value of 51.2 µg/l. Similar post-monitoring from April to October 1998 showed total phosphorus values of 30.8 µg/l. Over the same one year period, chlorophyll-a concentrations actually increased while overall transparency improved only slightly. The monitoring period also showed above average precipitation, which often produces an increased watershed loading and related poorer quality.

The 1998 summertime grade for the pond improved from less than 2 meters of clarity to over 2 meters of clarity, but the values returned to less than 2 meters level in 1999. Year 2000 monitoring (Metropolitan Council, 2001) shows nutrient and Secchi disc readings reverted to pre-project levels in Wood Pond. Secchi disc transparency for the past 3 years (2013-2015) have averaged 1.7 meters matching the goal for Wood Pond of 1.7 meters.

5.2 Flooding

Through the public input process developing this plan in 1999 to early 2000 there was a clear consensus that water quantity issues should be a high priority in the plan. In the original draft of the plan in 2002, water quantity was set as Goal number 2, indicating it was the second highest priority. In July of 2000, a significant storm event hit much of Burnsville, resulting in several major areas of flooding. This event prompted the City to make flooding the highest priority and Goal 1 in that 2002 WRMP.

Since that time, the flooding areas identified in the 2002 plan have largely been addressed or improved. While areas of flooding and flood risk remain, the issue of water quality has moved to priority number 1 (Goal 1) for the 2017 plan, with flooding a close second as priority 2 (Goal 2). Flooding in several areas of the City resulting from another large rainfall event in August 2015 played a key role in maintaining water quantity (i.e., flooding) issues as a high priority of this Plan.

Figure 14 illustrates the location of flooding resulting from the August 2015 storms. These areas have been assessed by staff on a preliminary basis and have either been resolved, are in the process of evaluated further or are included in the Capital Improvements Program section of this plan.

Several of the more substantial historic flooding issue areas have been subject to extensive analyses and capital improvements such that they no longer pose a significant risk. However, in order to provide some background on these areas and some of the work that has been done over the past 15 years, a few of the City's highest profile water quantity issues are summarized in the following paragraphs.

5.2.1 River Hills/ Northeast Burnsville

Heavy rains in July 2000 focused attention on area-wide drainage problems in northeast Burnsville. A detailed model of pipe capacities was completed as part of the planning process and are summarized in the report titled Northeast Burnsville – Comprehensive Flood Study: Proposed Engineering Solutions for Improving the drainage System (SEH, March 2001).

The majority of storm sewer improvements needed to address flooding problems in northeast Burnsville were completed prior to 2007 as part of the City's street reconstruction program.

The final project to be completed near 11024 Bluff Court is scheduled to be completed in 2017.

5.2.2 Keller-Crystal-Twin-Earley Lake System

Starting in southeast Burnsville with Keller and Crystal Lakes, the City has a chain of connected water bodies that are connected through a series of storm sewer pipes. The system routes to the north and west through South and North Twin Lakes, then through Earley Lake and Sunset Pond before discharging through a large box culvert into the Minnesota River. This system has been the subject of extensive modeling and evaluation of high waters for decades. Any improvement or change in one of the upstream water bodies to reduce flooding or high water levels has the potential to create unintended consequences downstream. Therefore, as the discussions in the following subsections elude to, any future improvement studies will need to consider the system as a whole.

5.2.2.1 Keller Lake

In the mid-90s, a study was prepared to evaluate options to increase the discharge from Keller Lake to Crystal Lake (SEH, 1996). No improvements to the system were made. The conditions that precipitated the study appear to have been short-term. However, improvements to Crystal Lake's outlet may also improve the conditions observed on Keller Lake in 1996. The analysis of the 1996 study and the more extensive 2001 study will be reevaluated with the updated model and new rainfall data.

5.2.2.2 Crystal Lake

The City's first comprehensive drainage plan (Barr, 1966) addressed extreme fluctuations in water level on Crystal Lake. The City ultimately decided to install a deep gravity storm sewer outlet. The next major hurdle was to construct a large lake/pond north of County Road 42 near the Savage City border. Sunset Pond was created, in part, to accept surface water from the homes and businesses in west central Burnsville and also the outflow of water from the Crystal Lake system. The development of Sunset Pond required a dam to be built to hold back the water. Shortly after completion of Sunset Pond the downstream pipes were installed and the Crystal Lake outlet was finally in-place. The Sunset Pond dam represents a hazard if it breaks or breaches. The City regularly inspects and maintains the dam.

Crystal Lake's high water levels have created concerns relative to lost recreational opportunities and shoreline erosion. Potential modifications to the outlet system were identified that will significantly reduce the duration of high water levels on the lake in a special study of the Crystal and Keller Lake systems. The recommended (future) improvements included replacement of nearly 1,000 lineal feet of existing storm sewer immediately downstream of Crystal Lake, ending at Crystal Lake Road and Eileen Circle. The proposed 48 inch diameter outlet would replace the in-place 36 inch pipe and would lower the pipe elevation at Crystal Lake by one-foot. The results would increase the peak discharge by nearly 100 percent, decrease the 100 year peak by 0.75 feet and reduce the duration of high water levels above 934 from an estimated 18 days to about 7 days. These improvements were not completed in larger part due to the significant cost of replacing 1000 feet of large diameter pipe. The recommendations of the 2001 study will be reevaluated with the updated model and new rainfall data.

5.2.2.3 South Twin Lake

Local flooding relative to existing flood easements continues to be a concern, although, to date, no structures (homes or buildings) have been impacted by the high water levels. Proposed modifications to the existing outlet structures could increase the discharge capacity at lower water levels. However, during further evaluation of this system, it was determined

that those changes would not result in substantial improvements, without major modifications to the downstream conveyance system in Southcross Drive. Improvements were completed to install a trash guard at the outlet to help reduce the plugging of the outlet by floating debris. In 2014 a regional water quality pond was constructed in the northwest inlet area to North Twin. While this pond was primarily focused on providing water quality benefits, the project also reduces the risk of significant debris in North Twin that would otherwise tend to plug the outlet for the combined lakes.

Quantity issues will be addressed to some extent in the larger connected system by the outlet improvements and similar improvements at Crystal Lake, Earley Lake and future controls from the "golden triangle" tributary northwest of North Twin. Through extensive study, the conclusion has been reached that there is not a cost-effective way to significantly reduce the bounce in South Twin Lake. One of the recommendations of the 2001 Lake Level Analysis was to increase the outlet weir length on North Twin to increase the rate of discharge from the system and reduce the duration of high water levels on North and South Twin. These recommendations will be reevaluated in light of new rainfall frequency data and the updated model.

5.2.2.4 Earley Lake

Prior to improvements completed in 2002, the duration of high water levels on Earley Lake had caused frequent citizen complaints and the upstream drainage system improvements were not expected to mitigate the problem. The 28-acre lake has an 878-acre direct contributing area, or a watershed-to-lake-area-ratio of 31:1. Following a flood event in July 2000, of the City completed improvements in the spring of 2002. The results of these improvements yielded a reduction in the peak high water level on the order of 3 feet. With the increases in rainfall depths as evident in the data in Atlas 14, the risk of high water levels on Earley Lake remain for extreme rainfall events.

5.3 Recreation, Wildlife, and Habitat

5.3.1 Goose Control

Although many people enjoy seeing Canada geese, the birds often wear out their welcome when they become too numerous on lawns, parks and golf courses. Yards, beaches and docks become fouled with their feces, and the fecal matter ultimately contributes to poorer water quality.

The City has prepared a comprehensive goose control plan (Burnsville, Canada Goose Management Program, July 2001). Burnsville has limited quality breeding sites for Canada geese, as many of the City's ponds are deep, have steep slopes and are without islands. These conditions limit the amount of emergent vegetation that normally provides ideal goose habitat. One exception is Sunset Pond, which is considered among the top three Canada goose breeding sites in the Metropolitan area.

The following list summarizes the key activities of the City's goose management program:

- Document goose damage through a complaint/damage recording system;
- Maintaining an ordinance to prohibit water fowl feeding;
- Removal of aggressive geese or problem geese that may create traffic hazards;
- Reduce population of geese near beaches to fewer than 15 birds;

- For safety purposes, reduce population of geese to fewer than 10 birds in the summer near elder care facilities;
- Reduce population to fewer than 30 birds near Alimagnet, Crystal, Kraemer, and Sunset Pond Parks; and
- Reduce population to fewer than 15 birds near small parks, wetlands, residential and commercial areas and cemeteries where damage has been noted.

5.3.2 Aquatic Plant Management

Aquatic plants are an essential part of lake and wetland communities and managing aquatic plants is an important factor in achieving the City's water resources goals. Managing aquatic plants can help towards improving water quality, creating or maintaining healthy aquatic habitat conditions, improving recreational use and enhancing the aesthetic value of Burnsville's lakes. More specifically, healthy aquatic plant communities:

- Remove coliform bacteria and nutrients from the water and lake bottom;
- Help prevent shoreline erosion by breaking up wave action;
- Provide natural food and shelter for fish and wildlife; and
- Are one of the primary producers in the aquatic food chain; and affect the chemical, physical and biological -characteristics of our lakes. For instance, a one-acre stand of bulrush can remove an amount of phosphorus equal to that present in wastewater created by 33 persons during the four-month growing season.

The City has had an Aquatic Plant Management (APM) Policy (Policy 5.147) that provides the basis for the City's overall strategies and program to manage aquatic plants. The policy was updated as part of this 2017 WRMP Plan update based on extensive input from lakeshore residents and lake users during the public input process in 2016-2017. The primary strategies include education and technical assistance as well as completing aquatic plant management in portions of selected water bodies.

Based on the level of interest and comments relating to this topic during the 2016-2017 WRMP Update public input process, the City will be developing more information on the program strategies, especially in the areas of providing educational materials and technical support information. The City will allocate funds to its operating budget for removal of aquatic vegetation. The City will also work with local partners such as Dakota County to implement invasive species management efforts (e.g. signage, education, inspection, and enforcement) in the City's lakes. Aquatic invasive species are discussed more in section 5.3.3.

Grant funding is available for some lake management activities through the City's Water Resources Enhancement Grant Program. This program may fund development of lake management plans and lake assessments, shoreline improvements and buffers, for example. This program does not fund aquatic plant management activities.

5.3.2.1 Permitting

The DNR requires permits for controlling or destroying aquatic plants or invertebrates in protected waters or wetlands. The permit program is based on Minnesota Rules, Chapter 6280 Aquatic Nuisance Control. While more detail is available on the DNR's website, there is generally a 150 foot zone from the shoreline out that is the responsibility of the lakeshore owners to manage, while outside of that 150 foot zone, the City may complete aquatic vegetation control in selected areas.

5.3.2.2 Chemical Control of Aquatic Plants Near Shore

According to Chapter 6280, the lesser of fifteen percent (in home rule charter or statutory City, or a town only) of the littoral area or 100 feet of shoreline per individual riparian property owner may be treated. There is an associated fee with the permit.

5.3.2.3 Controlling Algae and Excess Vegetation in Lakes

5.3.2.3.1 *Alum Treatment*

Historically alum (aluminum sulfate) has been widely used to clarify and purify drinking water. Twenty years ago, the rule of thumb was that a single treatment with alum could prevents algae blooms for two to five years or more, depending on how much phosphorus enters the lake and its hydraulic residence time. The length of time that alum can be effective has improved in recent years. While some improvement in managing algae blooms may be seen, the improved water clarity generally allow increased light penetration into the water column and may result in increased aquatic vegetation growth in the water body. Alum treatment requires extensive planning, in particular to determine the amount of alum needed and appropriate permits from the DNR are needed.

5.3.2.3.2 *Copper Sulfate*

Some locales treat lakes with copper sulfate ($C_USO_4\,5H_2O$). The cupric ions (C_{u2}^+) inhibit both respiration and photosynthesis in algae. Copper sulfate is more toxic in soft, acid water than in alkaline water. Copper sulfate is an excellent algaecide, but it is without appreciable residual toxicity. Although copper sulfate may be quite effective in reducing phytoplankton abundance in lakes and ponds, it does little for the long-term condition. In other words, phytoplankton photosynthesis quickly returns to pre-treatment levels. As dead algae fall to the bottom and decompose, their phosphorus content is released to support another round of plant growth. In addition, the dissolved oxygen content (DO) of the lake/pond may be lowered or be completely depleted. Concentrations of copper sulfate used for phytoplankton control are seldom directly toxic to fish, but they do kill large numbers of invertebrate fish food organisms.

5.3.2.4 Weed Harvesting

Weed harvesting falls into two categories; mechanical and non-mechanical. Mechanical harvesting entails a barge-like machine to cut and collect lake weeds. Harvesters need at least two feet of freeboard to operate, creating a lot of floating vegetation. Most operations dispose of aquatic plants by using a shore conveyor, a transport barge or by making multiple trips to shore. Mechanical harvesting can produce weed fragments. Approximately 5 to 15 percent of the total cutting cannot be cleaned up immediately because of wind and wave action that washes the vegetation away. A partial solution is to use a cutter, because plants are not stacked on the back of the unit weighing it down like they are with a harvester. A cutter can work in as little as 9 inches of water.

Non-mechanical harvesting includes hand harvesting (pulling), raking, hand-held weed cutters and dragging. Non-mechanical harvesting can be highly effective. Careful pulling and hand raking can remove roots as well as stems and leaves, thereby minimizing re-growth of the plants for several years. The City uses mechanical methods to harvest vegetation.

5.3.2.5 Aeration

Whole-lake or hypolimnetic (bottom water) aeration has been utilized to improve water quality by creating an oxygen rich zone directly above the lake bottom that reduces the release of phosphorus from the sediments. In general, whole lake aeration is used to avoid winter fish kill. *Winter Aeration* is generally supported by DNR when it benefits and/or does not harm the fishery. *Summer Aeration* should be used with caution, because the impacts these systems

have on nutrient dynamics and fisheries is difficult to predict on individual lakes. Summer aeration may be beneficial, neutral, or detrimental to the fishery, depending on the lake and the system.

5.3.3 Aquatic Invasive Plant Species

5.3.3.1 Purple Loosestrife

Purple loosestrife *Lythrum salicara* L. is a perennial plant of European origin that is invading and degrading wetlands all across North America. Purple loosestrife forms dense, monotypic stands that replace native plant species in wetlands and lake shore habitats, degrading food, shelter, and nesting sites for native wildlife. The plant will grow in up to seven feet of water. Purple loosestrife's high seed production (each plant can produce 120,000 seeds) produces large seed banks that can last for many years, allowing the plant to recover quickly after disturbance.

Common native plants such as cattails, sedges, smartweed and others cannot compete with purple loosestrife. Consequently, animals that rely on native plant vegetation for food, shelter, and breeding areas are displaced. Loosestrife infested wetlands are also less suitable to waterfowl because of the elimination of nesting sites and valuable food plants (waterfowl do not feed on loosestrife). Wetland mammals, like muskrats cannot utilize the plant in any way. Loosestrife is thought to be a poor nutrient assimilator.

Currently there is no chemical or mechanical means that provide long-term control of established stands of purple loosestrife. However, biological control, the use of natural enemies to control a pest, shows promise as a long-term method of reducing the effects of purple loosestrife on native aquatic environments.

Efforts to control these infestations mechanically or with herbicides are very costly, must be repeated annually and do not provide long-term control. Conventional control, including cutting, burning, water level manipulation and herbicide treatment, have been largely unsuccessful except where small, isolated stands can be removed by hand or treated with herbicide. While conventional methods do kill purple loosestrife plants, once it has become established, its large seed banks, which are nearly impossible to destroy, allow rapid reestablishment. Each cut segment can generate a new plant.

Biological techniques reunite pest species, like purple loosestrife, with their natural enemies, such as insects, can keep many plant species from becoming pests. Successful biological control will not eradicate purple loosestrife, but it will significantly reduce the plant's negative effects on native species.

Four species of European insects have been released in North America to control purple loosestrife since 1992; one root-mining weevil, one flower-feeding weevil, and two leaf eating beetles. Of the species, the root-mining weevil and the leaf eating beetles will be the most important for the control of purple loosestrife due to the damage they cause to plant roots, leaves and stems. Burnsville has tried biological control of purple loosestrife at Crystal West Park and Alimagnet Park with somewhat limited success.

5.3.3.2 Eurasian Watermilfoil

Eurasian watermilfoil can severely limit water recreational activities such as swimming, boating and fishing. It forms dense rooted mats of vegetation that reach the water surface. It can shade and crowd out native plants, reducing the biodiversity of aquatic ecosystems and harming fish and wildlife. There is little hard evidence so far for negative ecological impacts. However, given these concerns, it is necessary to confine this exotic plant and limit its spread in Minnesota.

Eurasian watermilfoil is a submerged aquatic plant native to Europe and Asia. Since its introduction to North America, during the 1940's, it has spread to nearly 40 states and three Canadian provinces. In Minnesota, milfoil was first discovered in Lake Minnetonka in 1987. By 1992, 55 Minnesota lakes had Eurasian watermilfoil infestations.

Eurasian watermilfoil is a perennial plant that spreads by vegetative propagation. It spreads when the plant fragments into pieces, which can take root and grow into new plants. Milfoil plants break into fragments naturally or when watercraft got through milfoil beds. Water currents can carry fragments within and between water bodies.

Current attempts to eradicate or control milfoil in Minnesota rely primarily on herbicides. However, in consideration of public and professional concerns regarding herbicides, DNR has begun to investigate alternative control methods. According to DNR (Anon., 1993), efforts should now be made towards an Integrated Pest Management (IPM) approach for milfoil control that could ultimately include a combination of biological controls, improved use of herbicides and alternative methods such as mechanical control.

The DNR plan includes four major goals:

- Contain milfoil in Minnesota to existing water bodies and prevent the establishment of new infestations;
- Eradicate or control milfoil infestations in Minnesota in a way that does as little harm as possible to lake ecosystems;
- Support and conduct research needed to improve milfoil management; and
- Ensure that milfoil is considered in lake management.

Table 31 displays the Eurasian watermilfoil infestations that are documented and listed by the DNR for Burnsville Lakes.

Table 31
Eurasian Watermilfoil Infested Waters

Water body name	Year listed as infested	Year species was first confirmed
Alimagnet	2014	2012
Crystal	1995	1991
Earley	2006	2005
Keller	2006	2005
Lac Lavon	1995	1988
Sunset Pond	2004	2002
Twin Lakes	1997	1996

5.3.3.3 Curly-leaf Pondweed

Curly-leaf pondweed looks similar to native pondweeds but it is often the first pondweed to come up in early spring forming dense mats that appear reddish-brown in the water and dies by mid-summer. The leaves of the plant, which are actually green, are approximately 2-3 inches long and arranged alternating on a stem. The leaves have small serrations around the edges which distinguishes it from claspingleaf pondweed. Similar to Eurasian watermilfoil, it can shade and crowd out native plants, reducing the biodiversity of aquatic ecosystems.

The MNDNR does not see the eradication or elimination of curly-leaf pondweed from lakes as a realistic goal although dense mats than interfere with lake recreation can be managed with mechanical harvesting or treatment with endothall herbicide. Partial-lake treatments done in early spring when water temperatures are between 50 and 60°F are most effective in controlling curly-leaf pondweed.

5.4 Erosion and Sedimentation

Phosphorus is often transported to surface water through soil erosion but can also be transported to waters in a variety of other mechanisms. Nevertheless, erosion control is extremely important in the effort to improve water quality. Soil erosion and sediment deposition also can create pond performance and maintenance issues.

Ponds and drainage facilities are impacted by erosion and sediment from a variety of sources including construction sites and street sanding in the winter. The coarse sediment accumulates in ditches and ponds where runoff velocities are low. Usually a sand delta appears at a storm sewer outfall that is a visible indication of the effectiveness of erosion and sediment control measures and road maintenance activities of the past winter. As the sediment builds up over time, it reduces the capacity of the drainage system and the pollutant removal capabilities of ponds by reducing storage volume below the outlet, and reduces infiltration rates. Extending the life of facilities involves source control and elimination of the material that causes the problem.

Although stream bank erosion and sedimentation is a natural process, they can be accelerated as a result of human actives which increase peak flow rates and can severely damage stream bank vegetation, cause bottom scour and accelerate the erosion process. Each of the Watershed Organizations in Burnsville is specifically addressing this issue. Burnsville's efforts to control the rates of discharge provide adequate control at this time. The City Plan may be amended in the future, as necessary, to remain consistent with future stream protection strategies of the Watershed Organizations.

5.4.1 Sediment Resuspension

Studies dating back to the early 1970's found powerboat engines could produce significant stirring of bottom sediments in shallow lakes. (Wright, 1991).

Those same studies, according to Wright (1991), found that the activity of a 100-hp outboard motor causes significant increases in turbidity, ortho-phosphorus and total phosphorus. As powerboats stir up the nutrient-rich bottom sediments, phosphorus can be released, accelerating algae growth. The same studies establish a clear relationship between engine size and mixing depth as illustrated in Table 32. Mixing depth is defined as the maximum depth at which the engine stirred up the water.

Wright (1991) concludes by indicating that although the scientific literature cannot resolve the political issues related to powerboat controls, power boating is likely to have harmful impacts on shallow lakes.

Table 32
Mixing Depths of Power Boats

(Reported by Wright, 1991, based on Yousef. 1974)

Horsepower	Mixing Depth

10	6 feet
28	10 feet
50	15 feet

Power boating restrictions were discussed with the public during the preparation of the 2002 WRMP. Based on the discussions, powerboat restrictions were not adopted as a current water quality tool. The topic was not raised during either open house or in the online comments for the 2017 WRMP Update.

6.0 Assessment of Emerging/Future Issues

As required by the new Minnesota Rules Chapter 8410, adopted in July of 2015 and Minn. Stat. 103B.235, local water management plans need to include an assessment of both existing and potential water resource-related problems. This section outlines the emerging and potential future problems the community is likely to face within the next 10 years.

As the City strives to increase the overall awareness and understanding of water resources management with in the City, providing information on emerging issues and anticipated future issues will put the City in a better position to reduce potential impacts and be better able to respond as these potential emerging issues become the issue of the day. This plan provides some basic background to a few of the known future issues the City is or will be facing. One of the methods the City plans to get ahead of these issues and to increase awareness is to develop education programs in the local schools on an annual basis. The topics below provide a good starting point for such a program.

6.1 Invasive Species

Invasive species are species which are not native and cause economic or environmental harm, or harm to human health. The MnDNR is the heading the State's efforts to curb the spread and minimize harmful effects of nonnative species. One aquatic invasive species of particular concern throughout Minnesota is zebra mussels which are discussed further in the following section.

6.1.1 Zebra Mussels

Zebra mussels are a devastating aquatic invader that once introduced, can quickly overtake a lake. Just one of the zebra-striped, clam-like creatures – which grow to the size of a fingernail – can produce 30,000 to 40,000 eggs per season. Zebra mussels can form dense colonies on rocks, wood, metal and cement surfaces. They out-compete native mussel species for food and oxygen.

Zebra mussels feed on algae and water fleas, out-competing fish and potentially impacting the fishery by improving water clarity which allows young fish or small fish to be more easily preyed upon. The overall impact of an infestation would be a diminished recreation use of a particular lake.

As of August 2016, the MnDNR has confirmed zebra mussels in 121 lakes, rivers and wetlands. Currently none of the bodies of water in Burnsville have confirmed zebra mussel infestations. To help stop the spread of this invasive species the MnDNR recommends the following activities regardless of whether a water bodies is infested or not:

- Clean all aquatic plants, zebra mussels, and other invasive species from boats, trailers, and water-related equipment.
- Drain water from your boat, ballast tanks, motor, live well and bait container. Remove drain plugs and keep drain plugs out while transporting equipment.
- Dispose of unwanted bait in the trash. To keep live bait, drain the water and refill the bait container with bottled or tap water.

The City has signs posted at designated boat launch areas to inform and educate boaters on these requirements.

6.2 Groundwater Sustainability

The most basic definition of sustainability is “meeting our current needs without sacrificing the ability of future generations to meet their own needs.” One of these needs of our community now and for future generations is a safe and reliable source of drinking water which makes it essential to preserve and protect the groundwater aquifers which supply the City’s drinking water.

Burnsville has developed a multi-layered groundwater model focusing on the Burnsville well field, Kraemer Quarry, Black Dog Fen and Savage Fen. The model will be utilized in design of groundwater withdrawal and minimization of impacts to protected surface waters. The City is currently working with the Minnesota Department of Natural Resources and Metropolitan Council in developing a groundwater management plan.

6.3 Climate Change

Minnesota experiences a wide variation in climate conditions (droughts and floods, heat and cold), however, even with these wide variations, climatologist have found four significant climate trends in the Upper Midwest (Minnesota Weather Almanac, Seeley, 2006):

- Warmer winters
- Higher minimum temperatures
- Higher dew points
- Changes in precipitation trends

The City recognizes the importance of resiliency and in a water resources context resiliency can be attributed to the ability to adapt to the climate-related variability and reduce the vulnerability of the community to extreme events. The City has for example amended the stormwater management standards to recognize the updated Atlas 14 depths and distributions and will endeavor to continue to adapt its policies and standards with the climate change trends.

6.4 Maintenance of the Stormwater System

6.4.1 Removal and Disposal of Accumulated Sediment

The City owns and operates more than 240 stormwater ponds and sediment collection devices throughout the City. The sediment collected in these ponds has been found to contain potentially hazard metals and other chemicals. Prior to removal of the sediment, it must be tested for the level of chemicals present. If found to exceed regulatory levels, the material excavated must be placed in a licensed landfill.

In June 2015, the MPCA published the document Managing Stormwater Sediment Best Management Practice Guidance to provide municipalities guidance on when sediment removal is needed and what steps to consider during the course of managing a sediment removal project. The City has also developed a pond assessment tool that prioritizes potential pond cleanout and maintenance activities based in part on the estimated pollutant removal efficiency of each pond. At the initiation of a pond assessment, the City shall evaluate the City owned and operated stormwater treatment ponds to determine the highest priority pond for clean out or maintenance. Prioritization may be based on the following factors:

- Age of pond.
- Value of sediment removal – an analysis of how much phosphorus is removed per dollar spent

- Contributing drainage area characteristics. (Size, land use, upland treatment, etc.)
- Known concerns based on inspections.
- Type and location of receiving water.
- Sensitivity of receiving water.

The City reviews potential pond maintenance needs and opportunities on an annual basis. Based on that review and the availability of funds, the City implements projects on an annual basis. The City adjusts the number of pond maintenance work based on available budget, staff availability, and other factors that may affect the process.

6.4.2 Environmental Manhole Cleaning

Sump manholes have been constructed in strategic areas to trap coarse sediment. As of 2017, the City has a total of 102 sump (environmental) manholes that are cleaned annually unless complaints are received or patterns of maintenance indicate a greater frequency is necessary. The locations listed below are the priority areas near lakes having environmental manholes, with these structures scattered throughout the City.:

- Lac Lavon Drive;
- Blue Bill Bay;
- Pershing Circle;
- Maple Island;
- East Crystal Lake Road;
- Sue Fischer Memorial Park (Youth Athletic Complex); and
- Burn-Haven Drive at the Regent at Burnsville Senior Housing Community.

6.4.3 Stormwater Facility Maintenance Agreements

Many communities require pond maintenance agreements with private pond owners for ponds constructed to meet City standards due to development. An example stormwater facility maintenance agreement that is used by the City is available in the City's NPDES MS4 Program Policy document. The agreement is intended to give the City a tool to require the property owner to maintain BMPs if they are no longer functioning as they were originally designed and approved. The agreement is intended to be used as a model for establishing maintenance agreements on ponds and non-pond stormwater facilities (e.g., rain gardens, bioretention areas, porous pavements, etc.) and is set up to transfer to Developer's successors and assigns with respect to the Subject Property of the agreement.

7.0 Implementation Program and Funding

From the goals and subwatershed assessments, a related Implementation Plan has been established. The implementation plan includes identification and prioritization of capital improvements, administration, maintenance and inspections, permitting, plan amendments, financing alternatives, public involvement and monitoring programs. Prioritization of improvements was based on a review of all recommended actions.

The Implementation Plan is not a hard and fast commitment to complete each and every activity in the time frame suggested. Rather, it is a suggested course of action that will accomplish the major goal of this plan, to accommodate growth in the community while protecting and improving Burnsville's water resources. The Implementation Plan should be reviewed on an annual basis. At that time, each proposed improvement is to be reconsidered, City budgets adjusted, and additional improvement projects or management activities added to or removed from the program. The City Council is required to specifically approve a project or budget prior to making the funds available for the project or activity. The funding source for the implementation program is the stormwater utility.

Table 33 displays the Water Resources Implementation Plan for the years 2018-2027.

Table 33
Water Resources Implementation Plan

Line	Implementation Project	2018	2019	2020	2021	2022
1	Public Outreach (Elem Ed) Consultants/Educators	10,000	10,000	10,000	10,000	10,000
2	Trout Stream #4 Restoration Development Cost Sharing	10,000				
3	Aquatic Vegetation Management Communication Plan	15,000				
4	Trail Corridor Water Resources Public Education		10,000			
5	Private Pond Maintenance Options Study and Report			20,000		
6	H&H Model Evaluation - HWL vs EOF with ATLAS 14	50,000				
7	Resiliency Assessment of Major Drainage Systems	40,000				
8	Resiliency Improvements		350,000			
9	Keller Lake to MN River Water Level H&H Analysis and Report		75,000			
10	KMM Levee Inspection and Report				10,000	
11	MRQ Stormwater and Floodplain Study and Report					50,000
12	Keller Lake UAA			35,000		
13	Stormwater System Asset Management Risk Analysis	50,000				
14	TMDL & WQ BMP CIP Maintenance Plan	20,000				
15	Park Drainage Improvements Neill and Alimagnet	155,000	150,000			
16	Bicentennial Park Outlet Repair	25,000				
17	Street Reconstruction	450,000	450,000	500,000	500,000	500,000
18	Street Rehabilitation	100,000		120,000		120,000
19	Maintenance Overlays				70,000	
20	Street Project Storm Sewer Televising	40,000	40,000	40,000	50,000	50,000
21	Host Landfill Projects	40,000	30,000	30,000	30,000	40,000
22	Lateral Drainage Modifications	90,000	90,000	90,000	90,000	90,000
23	Pond Cleanout/Outfall Imp. Program	330,000	345,000	345,000	360,000	360,000
24	CMP Rehabilitation	30,000	30,000	30,000	30,000	30,000
25	County Overlays	55,000	65,000	65,000	65,000	65,000
26	Lift Station Rehab	250,000		250,000		250,000
27	Future Ponds/Water Quality			1,000,000		1,100,000
28	Ravine Restoration		500,000		500,000	
29	WRMP Update				50,000	
30	Contract Patching	60,000	60,000	70,000	70,000	70,000
31	Alum Treatment			25,000		
	STORMWATER MANAGEMENT TOTAL	**1,820,000**	**2,205,000**	**2,630,000**	**1,835,000**	**2,735,000**

Table 33 (Continued)
Water Resources Implementation Plan

Line	Implementation Project	2023	2024	2025	2026	2027
1	Public Outreach (Elem Ed) Consultants/Educators	10,000	10,000	10,000	10,000	10,000
2	Trout Stream #4 Restoration Development Cost Sharing					
3	Aquatic Vegetation Management Communication Plan					
4	Trail Corridor Water Resources Public Education					
5	Private Pond Maintenance Options Study and Report					
6	H&H Model Evaluation - HWL vs EOF with ATLAS 14					
7	Resiliency Assessment of Major Drainage Systems					
8	Resliency Improvements					
9	Keller Lake to MN River Water Level H&H Analysis and Report					
10	KMM Levee Inspection and Report					
11	MRQ Stomrwater and Floodplain Study and Report					
12	Keller Lake UAA					
13	Stormwater System Asset Management Risk Analysis					
14	TMDL & WQ BMP CIP Maintenance Plan					
15	Park Drainage Improvements Neill and Alimagnet					
16	Bicentennial Park Outlet Repair					
17	Street Reconstruction	500,000	500,000	550,000	550,000	550,000
18	Street Rehabilitation	120,000	120,000	120,000	140,000	140,000
19	Maintenance Overlays	70,000		70,000		70,000
20	Street Project Storm Sewer Televising	50,000	50,000	50,000	50,000	50,000
21	Host Landfill Projects					
22	Lateral Drainage Modifications	100,000	100,000	100,000	100,000	100,000
23	Pond Cleanout/Outfall Imp. Program	375,000	375,000	390,000	390,000	405,000
24	CMP Rehabilitation	30,000	30,000	30,000	30,000	30,000
25	County Overlays	65,000	75,000	75,000	75,000	75,000
26	Lift Station Rehab		300,000		300,000	
27	Future Ponds/Water Quality	1,100,000			1,200,000	
28	Ravine Restoration		600,000			600,000
29	WRMP Update				100,000	100,000
30	Contract Patching	70,000	70,000	80,000	80,000	80,000
31	Alum Treatment	30,000			35,000	
	STORM WATER MANAGEMENT TOTAL	2,520,000	2,230,000	1,475,000	3,060,000	2,210,000

7.1 Funding Sources

The financial goal for this WRMP is to establish equitable funding sources to pay for water resources management activities. For the activities called out in this Plan, planning-level estimates of capital expenditures have been made. The major categories of funding sources are (1) Ad Valorem Taxes; (2) Special Assessments; (3) System Development Charges (Building Permits, Land Development Fees); (4) User charges; and (5) Grants. Following is a description and financing principles used with each of these financing mechanisms.

City policies and financial plan regarding water resources management plan activities are based upon overall property contributions to runoff and pollutant loading.

Roughly 40% of the respondents in the 2016 Water Resources Program Public Input Survey indicated that the get the sense that the City (local) program is under-funded while 58% get the sense it is adequately funded or don't know. Of the respondents, 55% were Lakeshore Residents and the most significant issue identified in the comments was aquatic vegetation weed control. This is largely a nuisance issue that is currently funded at levels that the City believes is sufficient for long term management of aquatic vegetation.

A renewed focus will be placed on securing grants, enlisting regional watershed funding, seeking local partnerships with adjacent communities and private entities.

Table 34 illustrates the advantages and disadvantages of the different financing methods and each method is discussed in more detail in the following subsections.

Table 34
Advantages and Disadvantages of Different Funding Alternatives

Funding Method	Advantages	Disadvantages
User Charges or Stormwater Utility (already in-place in Burnsville)	• Properties causing or contributing to the need for runoff management pay relative to their contribution to the problem. • Self-financing system not in competition with general services funds. • Existing and new developments both pay. • Flexibility in the system. • Continuous source of revenues. • Specific dedicated fund. • Administrative structure for collection already in place.	• Some initial costs in development of rate formula and philosophy. • May require an expanded administrative structure. • Not all payees into the system may benefit equally from their contributions.
Ad Valorem Tax	• Administrative structure for collection in place. • Simple and accepted source of revenue. • Allows for a larger revenue base. • Through tax districts contributors pay.	• No incentive to reduce runoff or pollution. • No relationship to level of benefits received. • Discontinuous source of revenue. • Limitations on amount of expenditures due to budget constraints. • Competition with other City services (i.e., police, fire).
Special Assessments	• Only benefited properties pay. • Revenues from assessment are applied to a specific project cost. No competition with general services. • Benefits directly related to cost for service. • Assessment can be deferred in hardship cases.	• Rigid procedural requirements. • Runoff contributions cannot be assessed. • Difficult to determine and prove benefit. • May place an unfair burden on some segments of the population.
System Development Charges	• New development generating runoff pays for runoff management. • Administrative structure for reviewing plans and collecting fees is in place. • Systems can be tailored to the specific needs through regulatory changes. • Revenues are applied to water management. No competition with general services.	• Only addresses problems within the vicinity of the new development, not usually in existing developments. • Only address prevention not correction of major problems. • Limited usefulness as a financing mechanism.
Grants	• Reduce cost burden to residents in the community.	• Undependable source of revenue. • Increase administrative costs for securing and managing the funds. • Most often grants require cost sharing and thus additional funding source. This results in double administrative costs due to several funding sources. • Limited availability on an irregular schedule. • Requires considerable lead-time from application to receiving funds.

7.1.1 Ad Valorem Tax

General taxation is the most common revenue source used to finance government services including minor maintenance measures for drainage and water quality facilities. Using property tax has the effect of spreading the cost over the entire tax base of a community.

7.1.2 Special Assessments

Municipalities are familiar with the use of special assessments to finance special services from maintenance to construction of capital improvements. The assessments are levied against properties benefiting from the special services. The philosophy of this method is that the benefited properties pay in relation to benefits received. The benefit is the increase in the market value of the properties.

7.1.3 User Charges or Stormwater Utilities

User charges, which support stormwater utilities, are a mechanism by which a City can generate funds through billings similar to water and sewer billings. The principle is to charge for services rendered to properties generating runoff, as well as the service to properties being protected from the effects of runoff, without consideration to an increase in market value of the property. Eight different land use classifications are used to calculate specific rates.

7.1.4 Grants

A wide range of grants are available for surface water management and nonpoint source pollution. However, it is generally not a good financial practice to rely on grants for a service program. This source of revenue is not dependable and requires constant speculation as to its availability. Grants are useful but should only be used to supplement a planned local revenue source. Examples of some available granting agencies and past grant programs are shown in Table 35. More compete and up-to-date grant program information is available on MPCA's and BWSR's websites. Local watershed organizations and the City may also have programs for specific activities.

Table 35
Example Grant Programs

Granting Agency	Grant Program
Environmental Protection Agency	Urban Waters Small Grants
	Environmental Education Grant
	Section 319 – Clean Water Act
U.S. Army Corps of Engineers	Section 22 Planning Assistance to States
U.S. Fish and Wildlife Service	Wildlife Restoration Program
	Sport Fish Restoration Program
Minnesota Department of Natural Resources	Flood Hazard Mitigation Program
	Conservation Partners Legacy Grant
	Outdoor Recreation Grant Program
	Dam Safety Grant Program
	Water Recreation Cooperative Acquisition and Development Program
	Fishing Pier Grant Program
	Natural and Scenic Area Grant Program
	Aquatic Invasive Species Grants
Metropolitan Council	Water Efficiency Grant Program
	Regional Parks Operation and Maintenance Funds
	Livable Communities Grant
	Pilot Green Infrastructure Grant Program
Minnesota Pollution Control Agency	Clean Water Partnership
	Surface Water Assessment Grants
Minnesota Public Facilities Authority	Point Source Implementation Grants
Minnesota Board of Water and Soil Resources	Clean Water Fund Grants

8.0 Amendment Process

The Water Resources Management Plan is intended to extend through the year 2027. For the plan to remain dynamic, an avenue must be available to implement new information, ideas, methods, standards, management practices, and any other changes which may affect the intent and/or results of the Plan. Amendment proposals can be requested any time by any person or persons either residing or having business within the City.

Staff's intent is to revisit the goals, policies, tools and progress of the Plan on a five-year basis. The five-year average water quality results will be reviewed, the effectiveness of regulatory programs will be evaluated, and the success of public improvement projects will be assessed. Based on the five-year reviews, the WRMP will be updated to produce a truly dynamic plan.

This plan and all subsequent amendments will become part of the City's Comprehensive Plan (adopted by reference) as part of the adoption process for this plan and Comprehensive Plan update. The plan does not have to be re-submitted as a formal comprehensive plan amendment, subject to additional review, at a later date. The adopted City Plan will satisfy Metropolitan Council's requirements and will be thereby recognized as an amendment to the City's Comprehensive Plan. Minor amendments include the following changes:

- formatting or reorganization of the plan;
- revision of a procedure meant to streamline administration of the plan;
- clarification of existing plan goals or policies;
- inclusion of additional data not requiring interpretation;
- expansion of public process; or
- adjustments to how an organization will carry out program activities within its discretion.

Conversely, major amendments include such things that change the essence of goals, policies, and other significant procedural components of the plan.

8.1 Request for Amendments

Written requests for a plan amendment are submitted to the City staff. The request shall outline the need for the amendment as well as additional materials that the City will need to consider before making its decision.

8.2 Staff Review

A decision is made as to the validity of the request. Three options exist;

- Reject the amendment;
- Accept the amendment as a minor issue, with minor issues collectively added to the plan at a later date; and
- Accept the amendment as a major issue, with major issues requiring a formal amendment including communications with the WMOs and Dakota County. In acting on an amendment request, staff shall recommend to the City council whether or not a public hearing is warranted.

8.3 Council Consideration

The amendment and the need for a public hearing shall be considered at a regular or special Council meeting. Staff recommendations should also be considered before a decision(s) on an appropriate action(s) is made.

8.4 Public Input and Council Approval

This step allows for public input based on public interest. Council shall determine when and how the public input should occur in the process. Based on the public input, Council could approve of the amendments and direct staff to proceed with the Agency Review process.

In Burnsville, the Parks and Natural Resources Commission (PNRC) is responsible for reviewing the Plan and making recommendations to Council. The public input process is generally completed through a series of open house meetings and in 2016, an online survey was used, to gather additional input.

8.5 Agency Review Process

8.5.1 Metropolitan Council and Dakota County Review

The Draft Plan is sent to Metropolitan Council to be reviewed for consistency with the requirements under the new Minnesota Rules Chapter 8410, adopted in July of 2015 and Minn. Stat. 103B.235. Plan and Comments from Metropolitan Council are due to the City within 45 days and are concurrently sent to each of the three watershed organizations for consideration during their review.

The Draft Plan is sent to Dakota County to be review for consistency with the County Water Plan. The County has 60 days to complete their review and provide comments directly to the City.

8.5.2 Watershed Organization Approval

All proposed amendments must be reviewed and approved by the appropriate WMOs prior to final adoption of the amendments. Draft and final amendments may be sent electronically to the WMO and draft amendments must show deleted text as stricken and new text as underlined. The watershed organizations have 60 days to complete their review and to provide comments directly to the City.

The City finalizes the Plan based on addressing the comments in consultation with WMO staff. The WMO then takes formal Board action to approve the Plan, generally contingent upon the City making the final edits agreed to through the comment process.

8.6 Council Adoption

Final action on an amendment, following approval by the watershed organizations is Council adoption. However, prior to the adoption, an additional public hearing may be held to review the Plan changes and notify the appropriate stakeholders.

9.0 Definitions and Acronyms

9.1 Definitions

Ambient Monitoring: Monitoring which focuses on baseline conditions and possible trends.

Aquatic Bench: A relatively flat sloped area or bench, generally having a width of 10- to 15-feet around the inside perimeter of a permanent pool that is approximately one-foot deep. Normally vegetated with emergent plants, the bench augments pollutant removal, provides habitat, conceals trash and water level drops, and enhances safety.

Aquatic Macrophytes: Rooted plants, either submerged, floating leafed, or emergent, and floating or floating leaf plants growing in public waters.

Aquatic Nuisance: The presence of leeches, snails that carry swimmer's itch, or any growth of aquatic vegetation or algae in such numbers or such abundance as to interfere with boating, swimming, or other aquatic recreation or beneficial water use.

Base Flood Elevation (BFE): The elevation shown on the Flood Insurance Rate Map for Zones AE, AH, A1-A30, AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO, V1-V30, and VE that indicates the water surface elevation resulting from a flood that has a one percent chance of equaling or exceeding that level in any given year (also commonly referred to as the 100-year event). See also Flood (and related definitions).

BMP (Best Management Practice): A combination of land use, conservation practices, and management techniques, which when applied to a unit of land will result in the opportunity for a reasonable economic return with an acceptable level of water quality or water quantity improvements.

Biodiversity: The variety of interrelated plant and animal life forms that occur in a water body.

Biological Monitoring: Periodic surveys of aquatic biota as an indicator of the general health of a water body. Biological monitoring surveys can span the trophic spectrum, from macro-invertebrates to fish species.

Bog: A mat, either attached to or resting on the bottom or floating, that is normally made up of dead organic matter held together by various types of living plants.

Buffer: The use of land, topography, difference in elevation, space, fences, or landscape planting to screen or partially screen a use or property from the vision of another use or property, and thus reduce undesirable influences such as: sight, noise, dust, and other external effects. For a vegetative buffer, the use of natural and/or established vegetation that receive or intercept sheet flow runoff thus slowing runoff velocities and allowing sediment within runoff to settle or be filtered by the vegetation

Buffer Strip: An area of vegetated ground cover abutting a water body that is intended to filter sediment or other pollutants from runoff.

Chlorophyll: The green pigment of plants necessary for photosynthesis, the process by which plants produce energy from sunlight.

Comprehensive Plan: As defined in Minnesota Statutes 394.21, the policies, statements, goals and interrelated plans for private and public land and water use, transportation and community facilities that guide future development (and growth).

Design Storm: A rainfall event of specified size and return frequency that is used to calculate the peak discharge rate at selected locations in a stormwater system.

Detention: The temporary storage of runoff from rainfall and snowmelt events to control peak discharge rates and provide an opportunity for physical, chemical and biological treatment to occur.

Development: The construction, installation or alteration of any structure, the extraction, clearing or other alteration of terrestrial or aquatic vegetation, land or the course, current or cross section of any water body or water course or division of land into two (2) or more parcels (source: Burnsville City Code 10-8-2 and 10-4-2). See also re-development and new development.

De-Watering: Process used in detention/retention facilities whereby water is completely discharged or drawn down to a pre-established pool elevation by way of a perforated pipe. De-watering allows the facility to recover its design storage capacity in a relatively short time after a storm event. Dewatering is also used to temporarily remove surface or ground water from a construction site in order to allow the construction to take place.

Disturbed Area (or Disturbance): An area which is susceptible to erosion because the vegetative or non-vegetative cover has been temporarily or permanently removed or altered. This may be accompanied by mixing or removal of some soil horizons. For the purposes of this Plan and associated development standards, disturbed area includes all areas of the project site that are within the construction limits.

Drawdown: The gradual reduction in water level in a pond BMP due to the combined effects of outflow from an outlet structure, infiltration and evaporation.

Draining: The removal of surface water or ground water from the surface of the land or from within the soil profile.

Dredging: To enlarge or clean accumulated sediment out a water body, watercourse, or wetland.

Drop Structure: Placement of logs with a weir notch across an open channel. Water flowing through the weir creates a plunge pool downstream of the structure which dissipates energy and can also create beneficial fish habitat. A drop structures may also be a storm sewer manhole that has a drop of six to eight feet or more between the inlet pipe and outlet pipe invert elevations. Drop structure manholes require a more detailed hydraulic analysis to evaluate the forces of flows in the structure and the potential reduction in flow capacity due to air entrainment.

Easement: A grant of one or more property rights by a property owner for use by the public, a corporation, or another person or entity.

Ecologically Harmful Exotic Species: Non-native aquatic plants or wild animals that can naturalize, have high propagation potential, are highly competitive for limiting factors, and cause displacement of, or otherwise threaten, native plants or native animals in their natural communities.

Ecosystem: A complex, interdependent system of humans, their built environments, other animals, plants and other organisms, and the natural physical and chemical environment upon which life depends.

Emergent Plant: An aquatic plant that is rooted in the sediment but whose leaves are at or above the water surface. Such wetland plants provide habitat for wildlife and waterfowl in addition to removing urban pollutants.

End of Pipe Control: Water quality control technologies suited for the control of existing urban stormwater at the point of storm sewer discharge to a stream. Due to typical space constraints, these practices are usually designed to provide water quality control rather than quantity control.

Erosion: The process by which the land's surface is worn away by the action of wind, water, ice or gravity.

Excessive Algae Bloom: Some or all of the following conditions are present: algae population is dominated by glue-green algae; secchi disc reading is typically 2 feet or less; floating mats or scums of algae have accumulated on the downwind shore; or decomposition of accumulated algae has occurred releasing a blue-green pigment and causing an offensive odor.

Exfiltration: The downward movement of runoff through the bottom of an infiltration BMP into the subsoil.

Exotic: A species which is not native to Minnesota but has been introduced from other states or continents to Minnesota.

Extended Detention: A stormwater design feature that provides for the gradual release of a volume of water over a period of 24 to 48 hours or more to increase settling of urban pollutants, and protect channels from high water levels and flooding.

Extended Detention (ED) Ponds: A conventional ED pond temporarily detains a portion of stormwater runoff for up to 24 hours after a storm using a fixed orifice. Such extended detention allows urban pollutants to settle out. The ED ponds are normally "dry" between storm events and do not have any permanent standing water. An enhanced ED pond is designed to prevent clogging and resuspension. It provides greater flexibility in achieving target detention times. It may be equipped with plunge pools near the inlet, a micropool at the outlet, and utilize an adjustable reverse-sloped pipe at the ED control device.

Fen: A wetland featuring grasses and sedges, created when a high water table and a lack of runoff keep the ground continuously moist and deprived of oxygen. Plants that die in these conditions do not break down into the soil because there is not enough oxygen to support the microorganisms and bacteria that do this work. Dead plants build up and compress over thousands of years into thick, partially decayed mats of peat. Fen's are kept continuously wet and cool by the ground water supply.

Filling: The act of depositing any rock, soil, gravel, sand or other material so as to fill a water body, watercourse, or wetland.

Flood (and related definitions): A temporary rise in the water level of lake, pond or wetland, or in the stream flow or stage of an open channel that results in inundation of the areas adjacent to the main waterway or water body. Other commonly referred to flood-related terms include:

- Floodplain: Floodplains are lowland areas adjoining lakes, wetlands, and rivers that are susceptible to inundation of water during a flood and that are included on the City's Flood Insurance Rate Map. The mapped floodplain is the area covered by the

100-year flood and it is usually divided into districts called the floodway and flood fringe. Areas where floodway and flood fringe have not been determined are called approximate study areas or general floodplain areas. Any development within a floodplain area requires a Conditional Use Permit from the City and/or FEMA.

- General Floodplain Area: The general floodplain area is determined using the best available data, in lieu of performing a detailed engineering study. These data may be from soils mapping, experienced high water profiles, aerial photographs of previous floods, or other appropriate sources. There are no associated published 100-year flood elevations with general floodplain delineations, unlike detailed study areas. General floodplain area is synonymous with approximate study area and unnumbered A-Zone.
- Flood Fringe: That portion of the 100-year floodplain outside of the floodway.
- Floodway: The floodway is the channel of a river or other watercourse and the adjacent land areas which would actively convey the 100-year flood plus 0.50-foot.

- Flood Frequency: The average frequency, statistically determined, for which it is expected that a specific flood stage or discharge may be equaled or exceeded.
  - 1% Chance Flood: The flood having a one-percent (1%) chance of being equaled or exceeded in any given year. A one-percent (1%) chance flood is synonymous with Base Flood, Regional Flood, or 100-year flood. Any development within this area requires a Conditional Use Permit from the City.
  - 100-Year Flood: The flood having a one-percent (1%) chance of being equaled or exceeded in any given year. A 100-year flood is synonymous with Base Flood, Regional or 1% Chance Flood. Any development within this area requires a Conditional Use Permit from the City.
  - Regional Flood**:** A flood which is representative of large floods known to have occurred generally in Minnesota and reasonably characteristics of what can be expected to occur on an average frequency in the magnitude of the 100-year recurrence interval. Regional flood is synonymous with the term “base flood" used in the Flood Insurance Study. Any development within this area requires a Conditional Use Permit from the City.

- Flood Obstruction: Any dam, well, wharf, embankment, levee, dike, pile, abutment, projection, excavation, channel rectification, culvert, building, wire, fence, stockpile, refuse, fill, structure or matter in, along, across or projecting into any channel, watercourse or regulatory flood hazard area which may impede, retard or change the direction of the flow of water, either in itself or by catching or collecting debris carried by such water, or that is placed where the flow of water, either in itself or by catching or collecting debris carried by such water, or that is placed where the flow of water might carry the same downstream to the damage of life or property.
- Flood Proofing: A combination of structural provisions, changes or adjustments to properties and structures subject to flooding primarily for the reduction or elimination of flood damages to properties, water and sanitary facilities, structures and contents of buildings in a flood hazard area in accordance with the Minnesota State Building Code.
- Regulatory Flood Protection Elevation (RFPE)**:** The elevation established by local ordinance to which all new floodplain development must be protected against flood

damage. In Burnsville, the required low building elevation may be higher than the RFPE for some water bodies.

Forebay: An extra storage area provided near an inlet of a pond or BMP to trap incoming sediments, reducing the amount that accumulates in a pond or BMP.

Freeboard: A factor of safety usually expressed in feet above a certain flood level. Freeboard compensates for the many unknown factors (e.g., waves, ice, debris, etc.) that may increase flood levels beyond the calculated level. The vertical distance between the regulatory high water level determined by hydrologic modeling and flood protection elevation (e.g., low floor or opening of a building, overflow elevation of a road).

Herbicide: A chemical which is designed to kill vascular plants; vascular plants are those which have internal systems for transporting nutrients, water and gases.

Impervious Surface: The portion of the buildable parcel which has a covering which does not permit water to percolate into the natural soil. Impervious surface shall include, but not be limited to, buildings, all driveways and parking areas (whether paved or not), sidewalks, patios, swimming pools, tennis and basketball courts, covered decks, porches, and other structures. Open, uncovered decks are not considered impervious for the purposes of this ordinance. The use of patio blocks, paver bricks or class 5 gravel material are considered impervious surfaces as a majority of water runs-off the surface rather than being absorbed into natural soils underneath.

Infiltration Basin: An impoundment where incoming stormwater runoff is stored until it gradually infiltrates into and through the soil of the basin floor.

Infiltration Trench: A conventional infiltration trench is a shallow, excavated trench that has been backfilled with stone to create an underground reservoir. Stormwater runoff diverted into the trench gradually exfiltrates from the bottom of the trench into the subsoil and eventually into the water table. An enhanced infiltration trench has an extensive pretreatment system to remove sediment and oil. It requires an on-site geotechnical investigation to determine appropriate design and location.

Infrastructure: Public facilities and services, including transportation, water and sewer, telecommunications, recycling and solid waste disposal, parks and other public spaces, schools, police and fire protection, and health and welfare services.

Integrated Management Practice (IMP): A range of small-scale stormwater controls or practices distributed throughout a site and intended to maintain flow patterns, filter pollutants and re-create or maintain existing site hydrology.

Littoral Area: Any part of a body of water 15 feet deep or less.

Lowest Floor: The lowest floor of the lowest enclosed area (including a basement). An unfinished or flood-resistant enclosure, usable solely for parking of vehicles, building access, or storage in an area other than a basement area, is not considered a building's lowest floor provided that such enclosure is not built so as to render the structure in violation of requirements.

Lowest Floor Elevation (LFE) or Low Building Elevation (LBE): The elevation of a building's lowest allowable floor above the one percent chance flood elevation established in this plan or the BFE defined by FEMA.

Low Impact Development (LID): An approach to stormwater management intended to protect water resources, reduce storm sewer infrastructure costs and provide a more attractive stormwater management system. LID practices include reduced impervious surface coverage, disconnected impervious areas, infiltration systems, bioretention areas, rain barrels, green roofs, porous pavements and a long list of additional innovative stormwater treatment practices which are intended to mimic the natural hydrology of a site and minimize the resulting impacts to receiving waters.

Monotypic: A pure stand of one type of vegetation with few other aquatic plant species present.

Native: A plant or animal species that naturally occurs in Minnesota and has not been introduced from another state or continent.

Natural Community: A community developed over time through natural ecosystem processes. Some natural communities are climax and some are perpetually successional due to ever-changing environmental factors. An extreme example of the latter is a river or lake beach where persistent wave or flooding action restricts significant vegetation establishment and succession towards a climax community.

Natural Resource Analysis: A report in map and text form identifying the existing natural features of a parcel of land and the relationship of a proposed use to the existing natural conditions of the parcel. Used in the determination of appropriate means to preserve and manage areas unsuitable for development in their natural state due to physical constraints or special protection status.

New Development: Development of a property or portion thereof that is currently not developed.

NURP: Nationwide Urban Runoff Program, a study by the U.S. Environmental Protection Agency. A key component of this program was to assess the effectiveness of urban runoff detention/retention basins (e.g., wet ponds and other BMPs) in removing pollutants from stormwater runoff. NURP ponds are generally accepted in the area as ponds which have a pollutant removal efficiency on the order of 60 % for total phosphorus and 90 % for total suspended solids.

Nutrient Spiraling: The cumulative effect of nutrient loading on water resources in moving from headwaters of watershed to the most down stream end.

Off-Line BMP: A water quality facility designed to treat a portion of stormwater (for example: 0.5 to 1.0 inches per impervious acre) which has been diverted from a stream or storm drain.

Off-Line Treatment: A BMP system that is located outside of the stream channel or drainage path. A flow diverter is used to divert runoff from the channel and into the BMP for subsequent treatment.

Ordinary High Water Level: The boundary of public waters and wetlands, and shall be an elevation delineating the highest water level which has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly that point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial. For watercourses, the ordinary high water level is the elevation of the top of the bank of the channel. For reservoirs and flowage, the ordinary high water level is the operating elevation of the normal summer pool. This elevation is set by the Minnesota department of Natural Resources.

Peat Sand Filter: BMP, utilizing the natural adsorptive features of fabric or hemic peat, which consists of a vertical filter system with a grass cover crop, alternating layers of peat and sand and a sediment forebay feature. The peat sand filter is presently used for municipal waste treatment systems and is being adapted for use in stormwater management.

Permanent Pool: A 4 to 10-foot deep pool in a stormwater pond system between the bottom of the pond and the elevation of the outlet pipe or structure. The permanent pool provides removal of urban pollutants through settling and biological uptake. Also referred to as the dead storage component of a wet pond.

Perennial: A plant that persists from year to year and usually produces reproductive structures in two or more different years.

Pondscaping: A method of designing the plant structure of a stormwater wetland or pond using inundation zones. The proposed wetland or pond system is divided into zones which differ in the level and frequency of inflow. For each zone, plant species are chosen based on their potential to thrive, given the inflow pattern of the zone.

Porous Pavement: An alternative to conventional pavement whereby runoff is diverted through a porous asphalt, concrete or paver block layer and into an underground stone reservoir. The stored runoff then gradually infiltrates into the subsoil.

Potential Stormwater Hotspots (PSH). Commercial, industrial, institutional, municipal and/or other operations that may produce or present a higher risk of spills, leaks or illicit discharges. PSH may include gas stations, petroleum wholesalers, vehicle maintenance and repair, auto recyclers, recycling centers, scrap yards, landfills/solid waste facilities, wastewater treatment plants, airports, railroad stations and highway maintenance facilities.

Predevelopment: Predevelopment is defined as the conditions on the project site prior to the proposed improvements.

Public Waters: Water basins assigned a shoreland management classification by the Commissioner under Sections 103F.201 to 103F.221, except wetlands less than eight (8) acres in size that are classified as natural environment lakes. Waters of the state that have been finally determined to be public waters or navigable waters by a court of competent jurisdiction. Meandered lakes, excluding lakes that have been legally drained. Water basins previously designated by the Commissioner for management for a specific purpose such as trout lakes and game lakes pursuant to applicable bylaws. Water basins designated as scientific and natural areas under Section 84.033. Water basins located within and totally surrounded by publicly owned lands.

Water basins where the State of Minnesota or the federal government holds title to any of the beds or shores, unless the owner declares that the water is not necessary for the purposes of the public ownership. Water basins where there is a publicly owned and controlled access that is intended to provide for public access to the water basin. Natural and altered water courses with a total drainage areas greater than two (2) square miles. Natural and altered water courses designated by the Commissioner as trout streams. Public waters wetlands, unless the statute expressly states otherwise.

Reach: A hydraulic engineering term to describe a longitudinal segment of a stream or river influenced by the natural or man-made obstruction. In an urban area, the segment of a stream or river between two (2) consecutive bridge crossings would most typically constitute a reach.

Redevelopment: Any development including but not limited to rebuilding, renovation, revision, remodel, reconstruction or redesign of or at an existing development.

Retention: The permanent storage of runoff from rainfall and snowmelt events with volume reduction coming from infiltration evaporation or emergency release.

Retrofit: The creation/modification of stormwater management systems in developed areas through the construction of wet ponds, infiltration systems, wetland plantings, steam bank stabilization, and other BMP techniques for improving water quality and creating aquatic habitat. A retrofit can consist of the construction of a new BMP in the developed area, the enhancement of an older stormwater management structure, or a combination of improvement and new construction.

Riprap: A combination of large stone, cobbles and boulders used to line channels, stabilize banks, reduce runoff velocities, or filter out sediment.

Riser: A vertical pipe extending from the bottom of a pond BMP that is used to control the discharge rate from a BMP for a specified design storm.

Runoff (Stormwater): The overland and near surface flow from stormwater and snowmelt.

Runoff Conveyance: Methods for safely conveying runoff to a BMP to minimize disruption of the stream network, and promote infiltration or filtering of the runoff.

Runoff Pretreatment: Techniques to capture or trap coarse sediments before they enter a BMP to preserve storage volumes or prevent clogging within the BMP. Examples include forebays and micropools for pond BMPs, and plunge pools, grass filter strips and filter fabric for infiltration BMPs.

Surface Area-to-Voids Ratio (SA/V): The surface area to volume ratio is a useful measure of the capacity of stormwater wetland to remove pollutants via sedimentation, adsorption, and microbial activity. The SA/V ratio can be increased by either increasing the surface area of a wetland or increasing the internal structural complexity within the wetland.

Sand Filter: A relatively new technique for treating stormwater, whereby the first flush or runoff is diverted into a self-contained bed of sand. The runoff is then strained through the sand, collected in underground pipes and returned back to the stream or channel.

Secchi Disc: An 8-inch, white metal plate, attached to a calibrated rope use as a standard measure of water transparency.

Sediment Forebay: Stormwater design feature that employs the use of a small settling basin to settle out incoming sediments before they are delivered to a stormwater BMP. Particularly use full in tandem with infiltration devices, wet ponds or marshes. See also Forebay.

Shoreland: Land located within the following distances from public waters: one thousand feet (1,000') from the ordinary high water level of a lake, pond, or flowage; and three hundred feet (300') from a river or stream, or the landward extent of a floodplain designated by ordinance on a river or stream, whichever is greater. The limits of shoreland may be reduced whenever the waters involved are bounded by topographic divides which extend landward from the waters for lesser distances and when approved by the Commissioner of the DNR.

Short Circuiting: The passage of runoff through a BMP in less than the theoretical or design treatment time.

Slope: The degree of deviation of a surface from the horizontal, usually, expressed in percent or degrees.

Stormwater Treatment: Detention, retention, filtering or infiltration of a given volume of stormwater to remove urban pollutants, reduce the runoff volume and/or reduce the potential for flooding.

Stream Buffer: A variable width strip of vegetated land adjacent to a stream that is preserved from development activity to protect water quality aquatic and terrestrial habitats. See also buffer and buffer strip.

Structure: Anything which is built, constructed or erected; an edifice or building of any kind; or any piece of work artificially built up and/or composed of parts joined together in some definite manner whether temporary or permanent in character. Among other things, structures including but not limited to buildings, gazebos, decks, retaining walls, walls, fences over six feet (6') in height, and swimming pools.

Treatment Volume (Vt): The volume of stormwater runoff that is treated within a BMP. Typically expressed in terms of inches (i.e., depth) over the impervious area or inches over the contributing drainage area to a treatment system.

Underdrain: Plastic pipes with holes drilled through the top, installed on the bottom of an infiltration BMP, or sand filter, which are used to collect and remove excess runoff.

Undeveloped Property: Any property within the City on which no development (as defined in City Code 10-4-2) has occurred.

Vacuum Sweeping: Method of removing quantities of coarse-grained sediments from porous pavement in order to prevent clogging. Not effective in removing fine-grained pollutants.

Vegetated Filter Strip: A vegetated section of land designed to accept runoff as overland sheet flow from upstream development. It may adopt any natural vegetated form, from grassy meadow to small forest. The dense vegetative cover facilitates pollutant removal. A filter strip cannot treat high velocity flows; therefore, they have generally been recommended for use in agriculture and low-density development. A vegetated filter strip differs from a natural purpose of pollutant removal. A filter strip can also be an enhanced natural buffer, however, whereby the removal capability of the natural buffer is improved through engineering and maintenance activities such as land grading or the installation of a level spreader. A filter strip also differs from a grassed swale in that a swale is a concave vegetated conveyance system, whereas a filter strip has a fairly level surface.

Vegetation, Native: The pre-settlement group of plant species native to the North American continent that were not introduced as a result of European settlement.

Vegetative Propagation: Plant reproduction by means other than seeds, such as by fragments.

Watershed: The 81 major watershed units delineated by the State of Minnesota Watershed Boundaries 1979 map.

Wetland: Lands transitional between terrestrial and aquatics systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this definition, wetlands must have three (3) of the following attributes:

- A predominance of hydric soils.

- Inundation or saturation by surface or ground water at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions.
- Under normal circumstances, support a prevalence of such vegetation.

Wetland Classification System: The City of Burnsville's Wetland Protection and Management Plan classifies wetland basins according to the following system:

Protection Areas - Basins with Native Grades of A or B, sites with complete Community Structure, any sites supporting rare species, and any sites within or adjacent to significant natural communities as identified by the Dakota County Biological Survey. This is comparable to the Preserve Classification used in the MnRAM.

Improvement Areas - Basins with 3 of 4 of the Community Structure criteria, sites greater than ten acres in size, Minnesota Department of Natural Resources Protected Waters and Wetlands (Public Waters), and basins within existing City parks that are not classified as Protection Areas. Although there is some overlap, this classification is similar to the Manage I and Manage II MnRAM classifications.

Management Areas - Remaining wetlands, but generally of low quality and located outside of protected areas. These wetlands are also likely to receive untreated stormwater runoff, but have not been altered to enhance treatment capabilities. This classification is comparable to the Manage II and Manage III MnRAM classifications.

Management II Areas – These basins include any of the water features that may have been historic wetlands, and would remain subject to the requirement of the Wetland Conservation Act. These basins will have minimal protection standards as they currently function primarily to provide stormwater management.

Wetland Mitigation: Regulatory requirement to replace wetland areas destroyed or impacted by proposed land disturbances with artificially created wetland areas.

Wet Pond: A conventional wet pond has a permanent pool of water for treating incoming stormwater runoff.

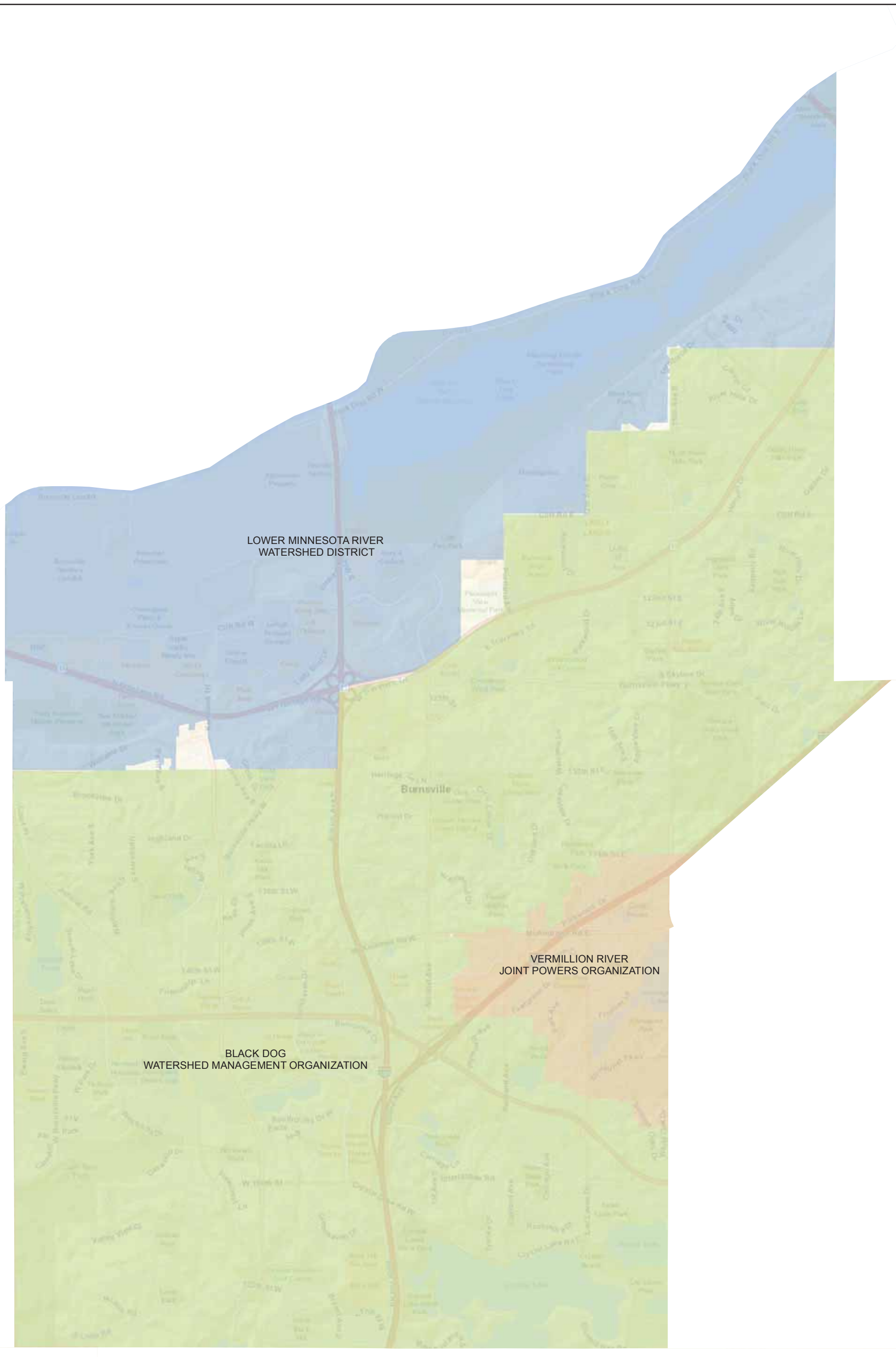
Zoning District: An area or areas of the City (as delineated on the Zoning Map) set aside for specific uses with specific regulations and provisions for use and development

Zoning District Overlay: A zoning district containing regulations superimposed upon other zoning district regulations and superseding the underlying zoning district use regulations.

9.2 Acronyms

BMP	Best Management Practices
BWSR	Minnesota Board of Water and Soil Resources
DNR	Department of Natural Resources
EPA	United States Environmental Protection Agency
EPI	Effective Percent Impervious
EQB	Environmental Quality Board
EQC	Environmental Quality Committee
GIS	Geographic Information System
SWCD	Soil and Water Conservation District
IMP	Integrated Management Practice
LID	Low Impact Development
MPCA	Minnesota Pollution Control Agency
MS4	Municipal Separate Storm Sewer System
MUSA	Metropolitan Urban Services Area
NPDES	National Pollutant Discharge Elimination System
NURP	Nationwide Urban Runoff Program
ppb	parts per billion (equivalent to µg/l)
SWPPP	Stormwater Pollution Prevention Plan (or Program)
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSS	Total Suspended Solids
WD	Watershed District
WMO	Water Management Organization
WRMP	Water Resources Management Plan

List of Figures



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Map by: rnestingen
Projection:
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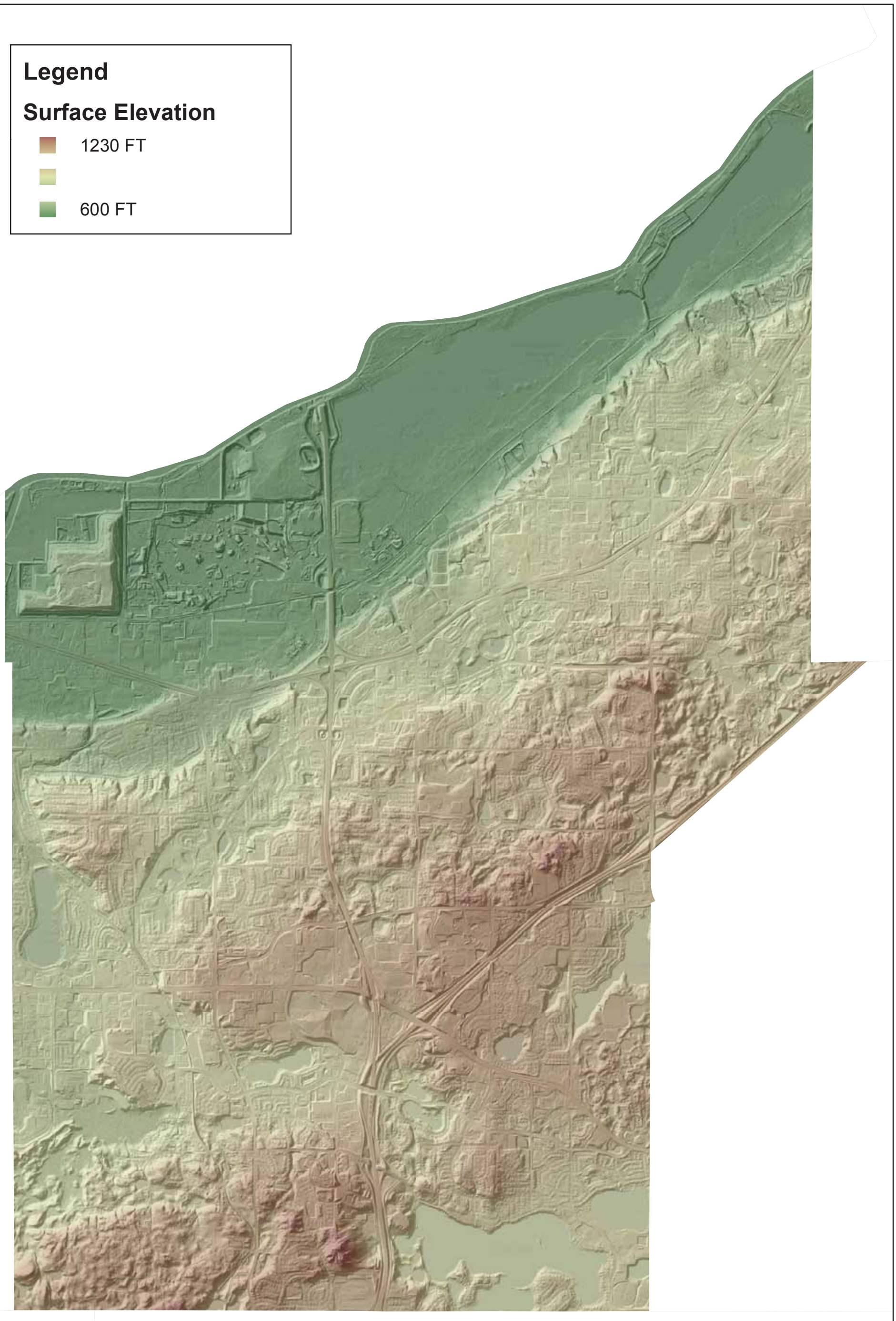
LOCAL WATERSHED ORGANIZATIONS

WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure
1



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HILLSHADED SURFACE ELEVATION

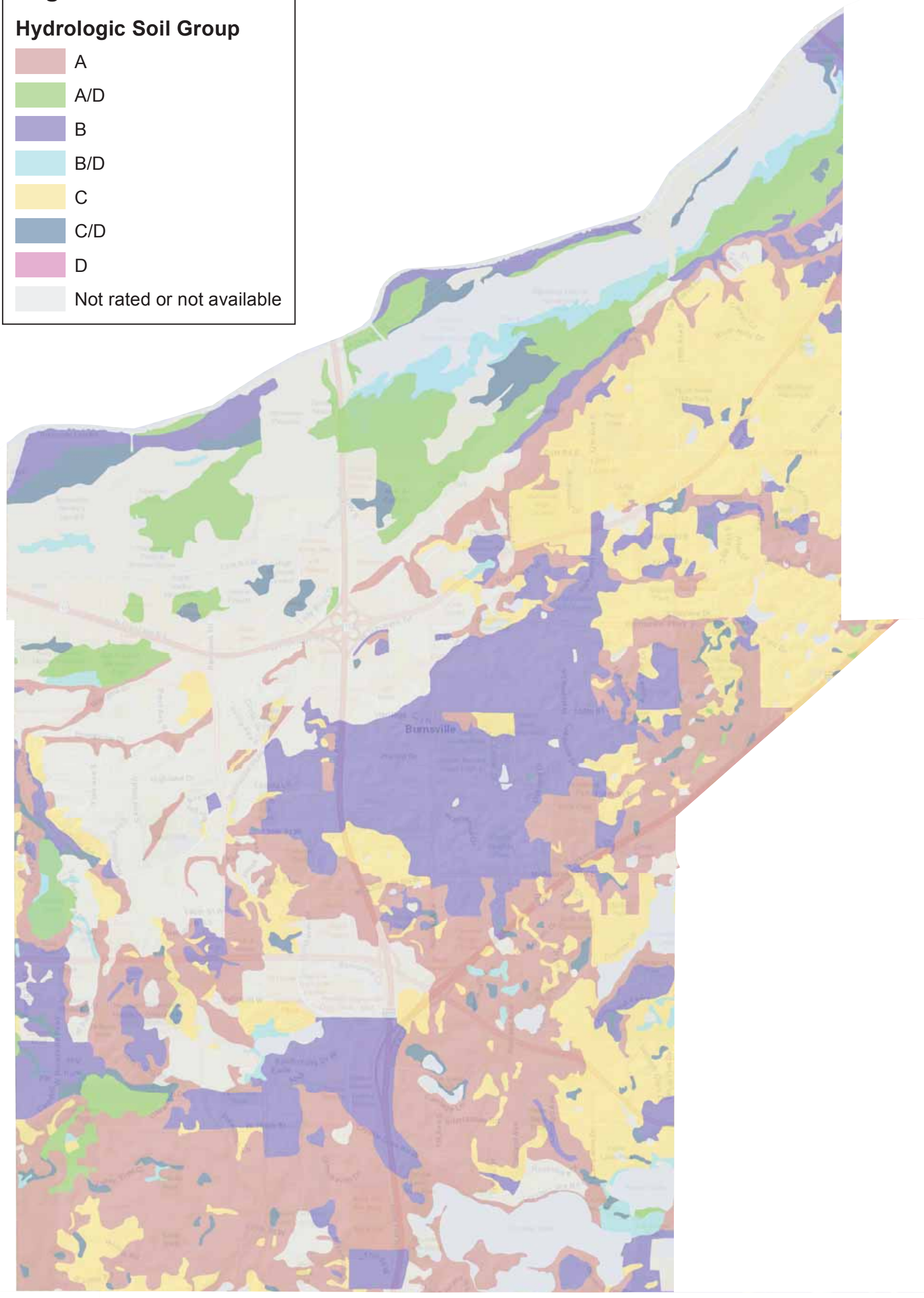
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 2

Legend

Hydrologic Soil Group

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available



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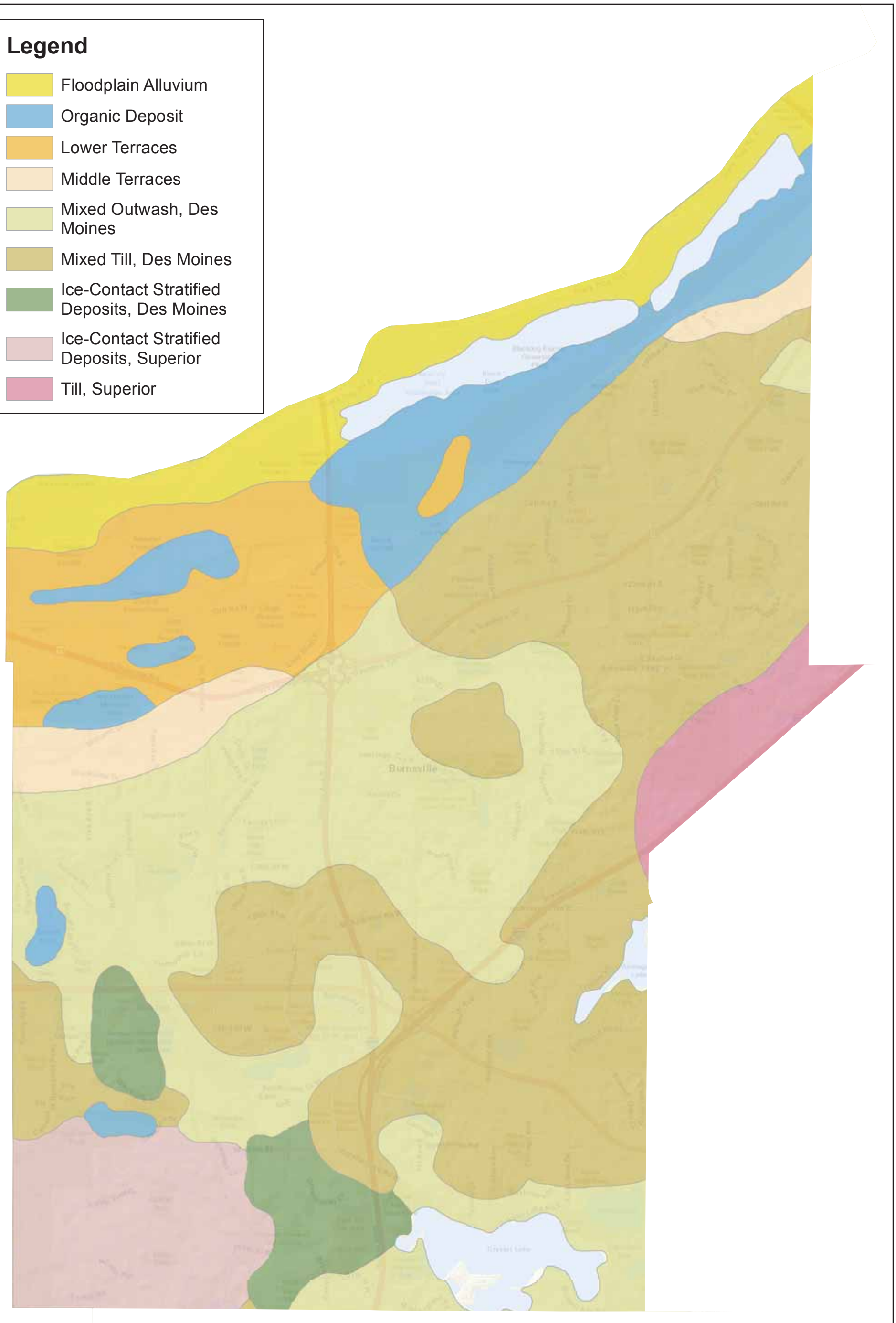
HYDROLOGIC SOIL GROUP
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 3

Legend

- Floodplain Alluvium
- Organic Deposit
- Lower Terraces
- Middle Terraces
- Mixed Outwash, Des Moines
- Mixed Till, Des Moines
- Ice-Contact Stratified Deposits, Des Moines
- Ice-Contact Stratified Deposits, Superior
- Till, Superior



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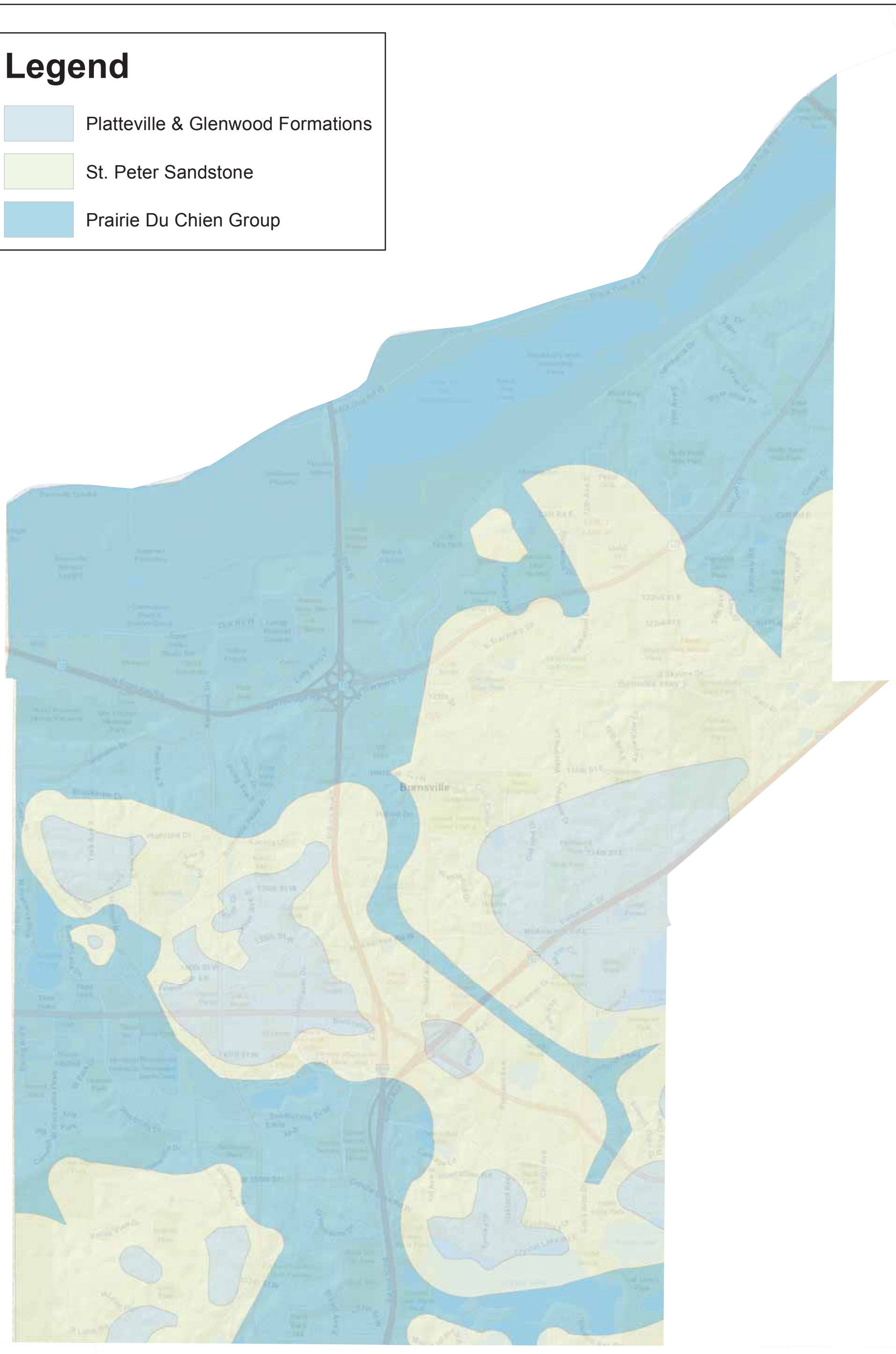
SURFICIAL GEOLOGY

WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 4

Legend

- Platteville & Glenwood Formations
- St. Peter Sandstone
- Prairie Du Chien Group



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Print Date: 1/11/2017

Map by: rnestingen
Projection:
Source:

BEDROCK GEOLOGY

WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 5

Legend

- Public Water Watercourse
- Public Ditch/Altered Natural Watercourse
- Public Waters Basins

Trout Stream #1
Trout Stream #4
Trout Stream #7
Black Dog (19008300)
Unnamed (19010900)
Unnamed (19011000)
Unnamed (19015200)
Unnamed (19017000)
Unnamed (19017200)
Unnamed (19011100)
Unnamed (19017100)
Unnamed (19017400)
Unnamed (19019100)
Unnamed (19011300)
Unnamed (19019300)
Unnamed (19019400)
Unnamed (19011400)
Unnamed (19019200)
Unnamed (19021000)
Unnamed (19021100)
Burnsville
Unnamed (19011600)
Unnamed (19011500)
Unnamed (19011700)
Alimagnet (19002100)
Unnamed (19036400)
Wood Park (19002400)
Unnamed (19034300)
Earley (19003300)
Unnamed (19035700)
Twin (19002800)
Unnamed (19038000)
Unnamed (19038100)
Keller (19002500)
Crystal (19002700)
Horseshoe (19003200)
Unnamed (19035900)

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PUBLIC WATERS INVENTORY
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 6

Legend

Metropolitan Council 2014 Priority Lakes

Crystal

Laclavon

Burnsville

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MET. COUNCIL PRIORITY LAKES

WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 7

Legend

Restorable Wetlands

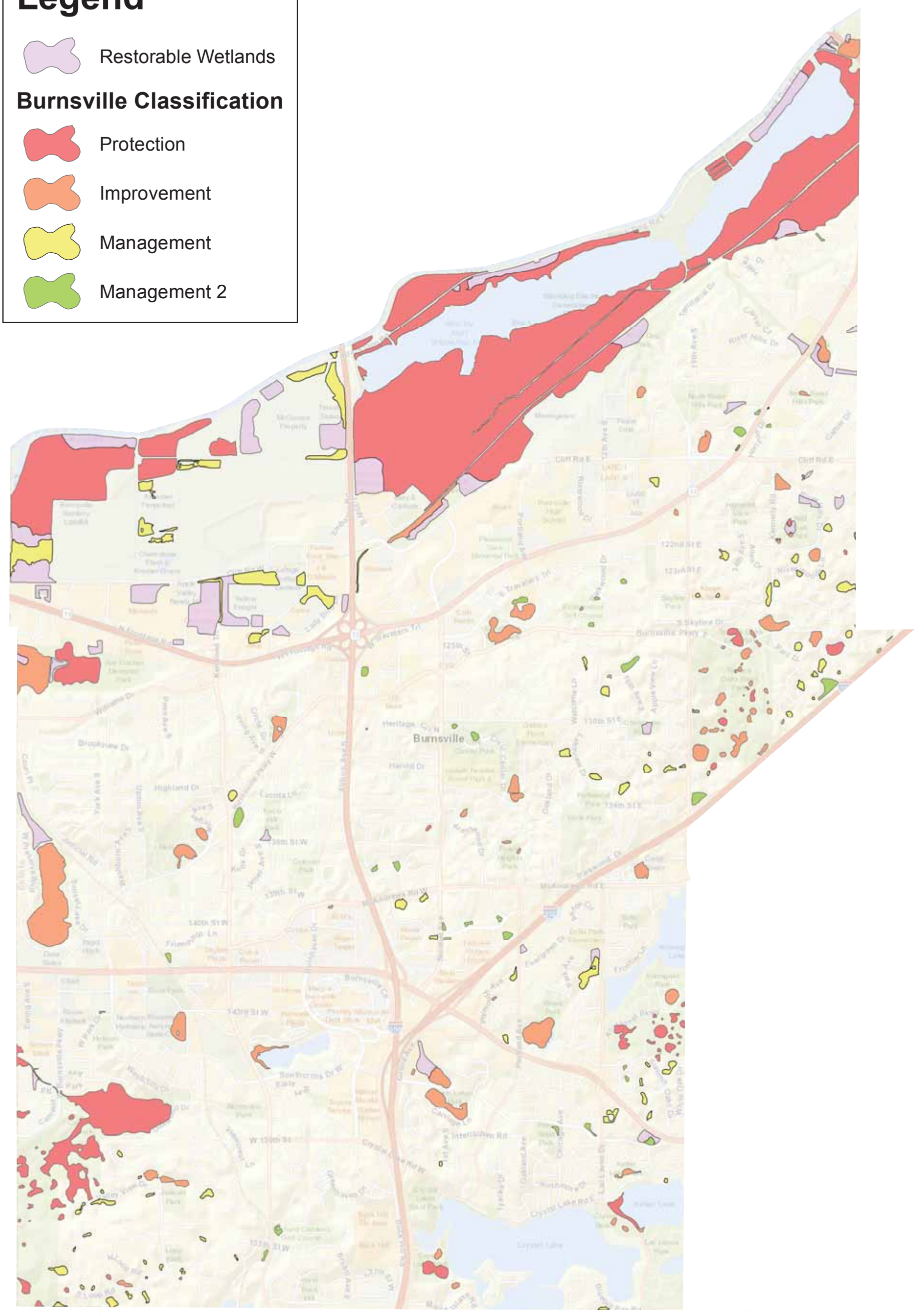
Burnsville Classification

Protection

Improvement

Management

Management 2



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Source:

BURNSVILLE 2008 WETLAND INVENTORY

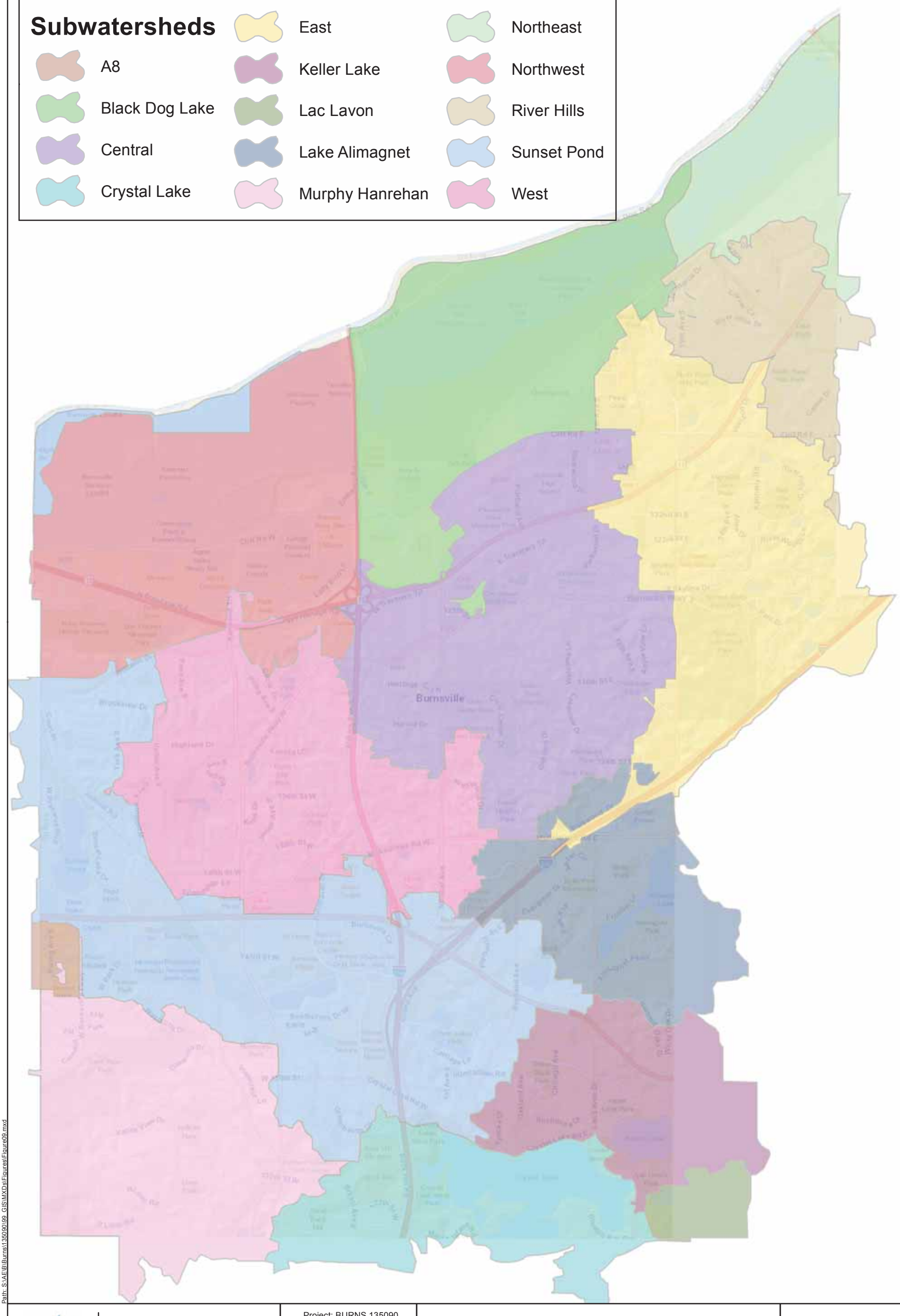
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 8

Legend

Subwatersheds

- A8
- Black Dog Lake
- Central
- Crystal Lake
- East
- Keller Lake
- Lac Lavon
- Lake Alimagnet
- Murphy Hanrehan
- Northeast
- Northwest
- River Hills
- Sunset Pond
- West



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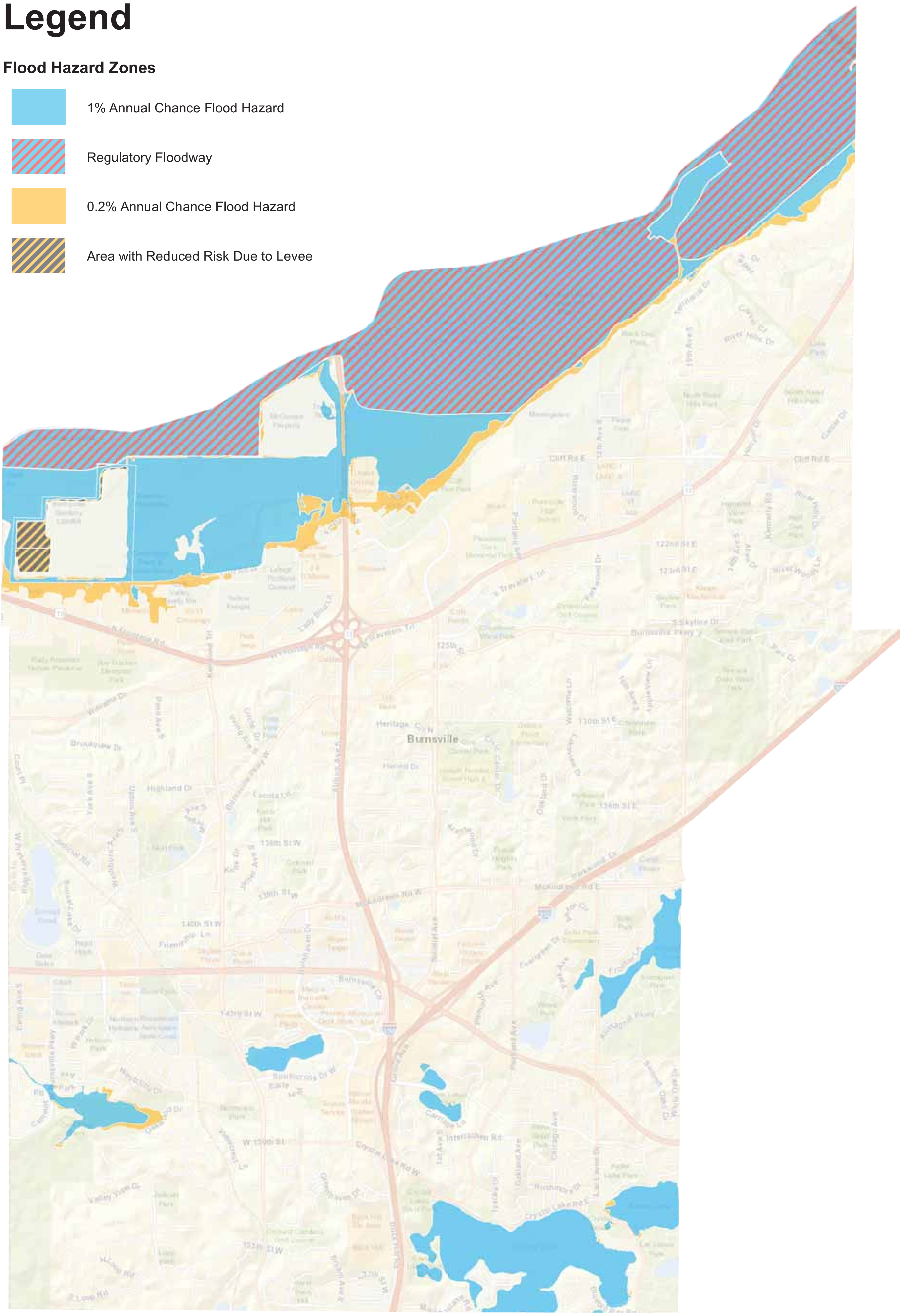
SUBWATERSHEDS
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 9

Legend

Flood Hazard Zones

- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- 0.2% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee



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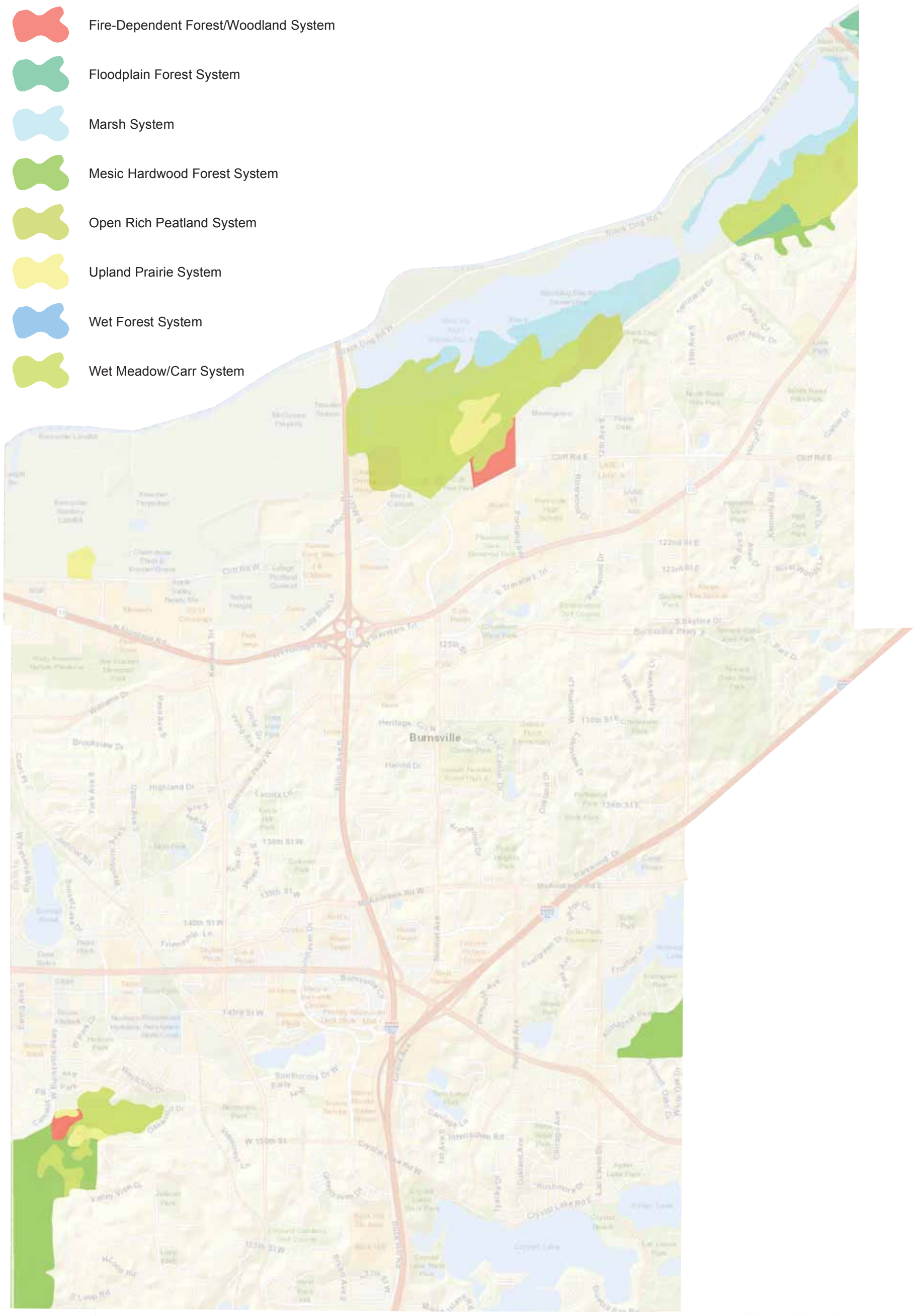
SEH	3535 VADNAIS CENTER DR. ST. PAUL, MN 55110 PHONE: (651) 490-2000 FAX: (888) 908-8166 TF: (800) 325-2055 www.sehinc.com	Project: BURNS 135090 Print Date: 1/11/2017 Map by: rnestingen Projection: Source:	***SPECIAL FLOOD HAZARD AREAS*** WATER RESOURCES MANAGEMENT PLAN Burnsville, Minnesota	Figure 10

Legend

- Fire-Dependent Forest/Woodland System
- Floodplain Forest System
- Marsh System
- Mesic Hardwood Forest System
- Open Rich Peatland System
- Upland Prairie System
- Wet Forest System
- Wet Meadow/Carr System



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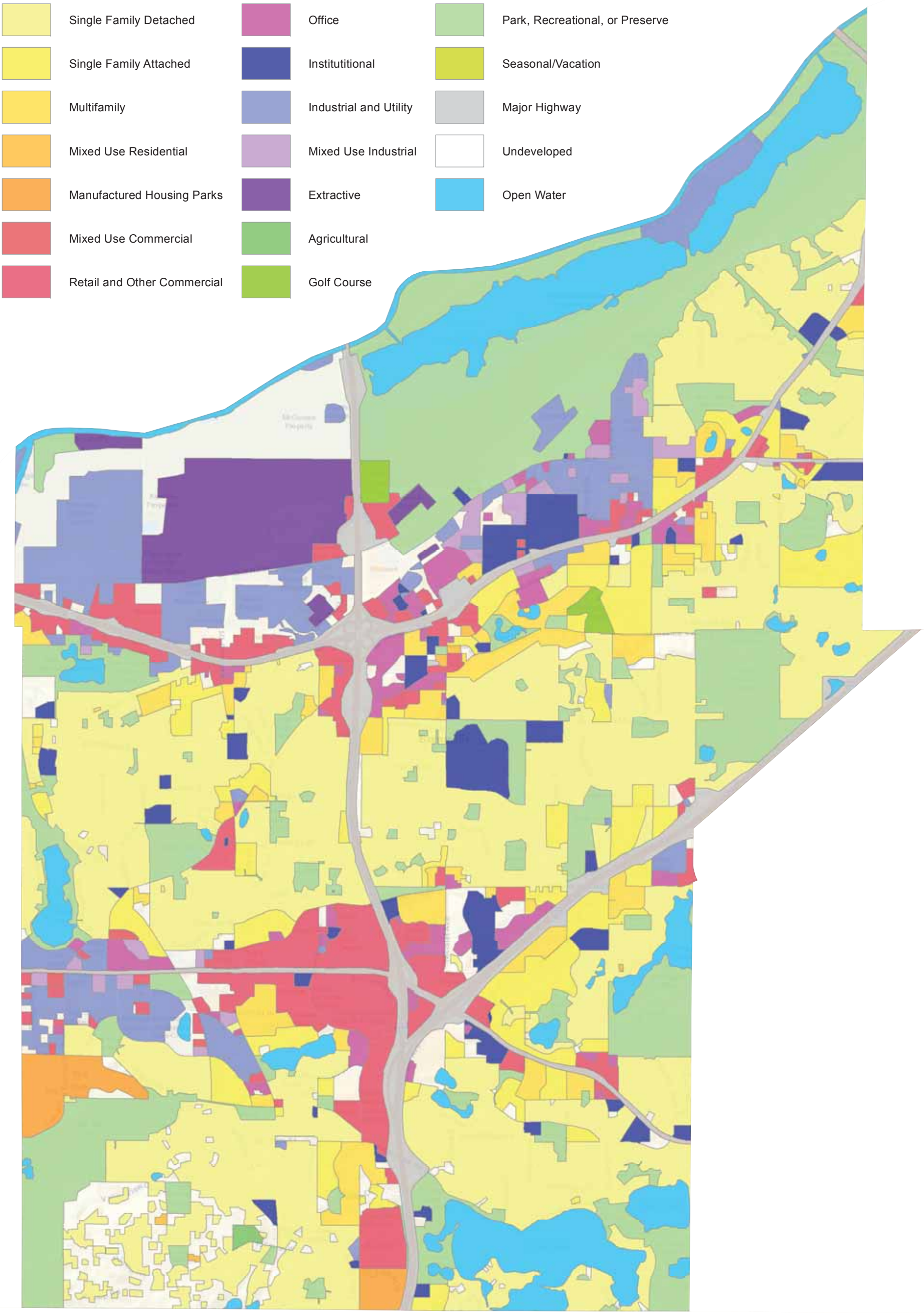
NATURAL PLANT COMMUNITIES

WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 11

Legend

- Single Family Detached
- Single Family Attached
- Multifamily
- Mixed Use Residential
- Manufactured Housing Parks
- Mixed Use Commercial
- Retail and Other Commercial
- Office
- Institutitional
- Industrial and Utility
- Mixed Use Industrial
- Extractive
- Agricultural
- Golf Course
- Park, Recreational, or Preserve
- Seasonal/Vacation
- Major Highway
- Undeveloped
- Open Water



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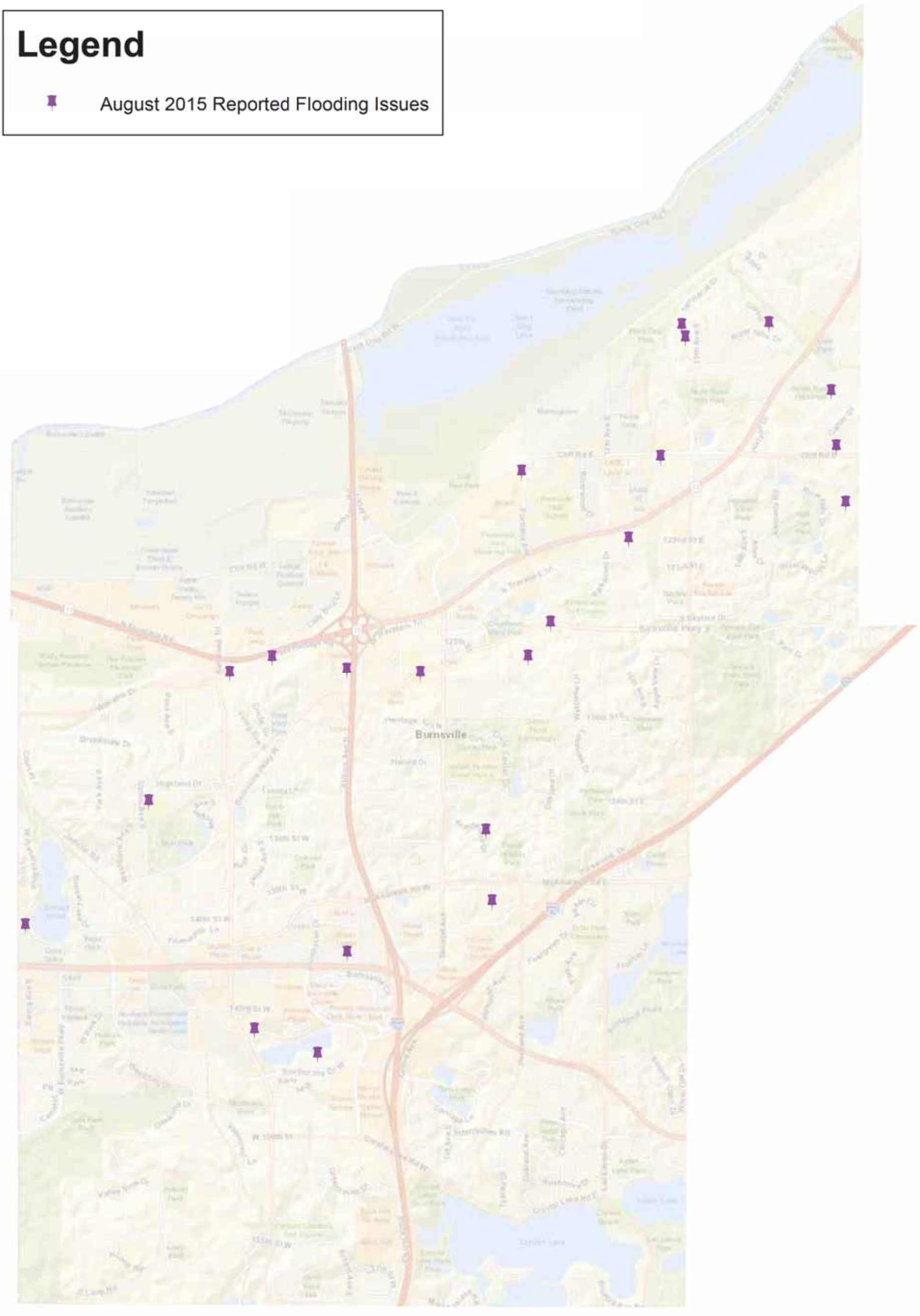
Source:

EXISTING LANDUSE
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 12

Legend

August 2015 Reported Flooding Issues



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Map by: rmestingen
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AUGUST 2015 REPORTED FLOODING
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure 14

Appendix A

Minnesota River Quadrant Analysis

Building a Better World for All of Us®

MEMORANDUM

TO: WRMP - MRQ File

FROM: Ron Leaf, PE | Sr. Water Resources Engineer

DATE: February 9, 2017

RE: MRQ Issues Summary
SEH No. 135090 14.00

The Minnesota River Quadrant (MRQ) is an area of Burnsville consisting of approximately 825 acres situated in the northwest corner of the City. The area is bounded on the south by TH 13, on the east by I-35W, on the north by the Minnesota River, and extends just past the Waste Management Landfill to the west. In January 2006, the City of Burnsville contracted with DSU to prepare a land use plan for the MRQ that assumed full development of the MRQ area. The plan detailed the future land uses, creation of the future Quarry Lake, road locations and even conceptual stormwater pond locations. The intent of this memorandum is to summarize the current and anticipated future stormwater issues that will need to be considered as the area redevelops. The issues identified below correspond to the items highlighted in the attached Exhibit 1.

Stormwater Standards

The entire area within the MRQ flows north into the Minnesota River. The Minnesota River is a protected resource, and all development activities within the corridor must conform to the City's most strict storm water management standards. In order to protect the City's existing drinking water source, the City has identified areas of high vulnerability for drinking water contamination and prohibited infiltration within these areas. Much of the eastern portion of the MRQ area is located within the prohibited infiltration boundary. Additionally, any development disturbing more than one acre must complete and obtain a Minnesota Pollution Control Agency (MPCA) National Pollutant Discharge Elimination System (NPDES) permit.

Future Quarry Lake

Future Quarry Lake is situated at the existing Kraemer quarry location and the current south sump area serves as a surface water source for the City of Burnsville's drinking water system. Once current quarry (mining) activities have ceased, groundwater will recharge the cavity and form Quarry Lake. Steps have already taken place to protect the south sump from negative impacts and the future long term plan for the MRQ will need to continue those efforts. One of the key recommendations for future consideration of the lake is to allow for, or create, sufficient shallow water zones that are established with a primary goal of supporting fish habitat.

Flood Hazard Areas

The areas shown in Exhibit A for designated Federal Emergency Management Agency (FEMA) floodplain include 1% Chance Flood Zone (100 Year Flood), the 0.2% Chance Flood Zone (500 Year), Floodway and an area that has reduced flood hazard risk due to protection by a FEMA Certified Levee. The levee is inspected annually by City staff to identify any required maintenance needs. City Code establishes the requirements for projects with these designated flood hazard areas.

Landfills

There are two landfills within the MRQ including the Waste Management (WM) Landfill in the western portion of the MRQ, and the Freeway Landfill in the far northeastern extent of the MRQ. The WM landfill is currently still in operation and is protected on the west boundary by the levee system mentioned above.

The Freeway Landfill has been the subject of extensive study in the past decade. The MPCA's Closed Landfill Program (CLP) evaluates landfill data and uses a scoring model to determine risk at each site. Landfills with high risk scores receive a high ranking on the CLP's Risk Priority List. In a report by the MPCA titled *Closed Landfill Program: 2013 Report to the Legislature* (December 2013), the Freeway Landfill was ranked number six in site risk priority list for landfills within the State. In 2016 the Freeway Landfill had moved up to priority ranking number two.

Yellow Freight Pond and Lady Bird Pond - Regional Ponds

City and SEH staff completed several studies intended to evaluate options for regional ponding to meet future water quality treatment needs in the MRQ. The initial Minnesota River Quadrant Memorandum (SEH, July 18, 2006) looked at the extent of ponds within the DSU Land Use Plan and estimated treatment relative to required treatment standards in place at that time. That memorandum was revised in February 2008 to account for the City's revised storm water treatment standards.

A second study of possible pond locations was completed and summarized in the Minnesota River Quadrant (MRQ) Pond Options Memorandum (SEH, July 25, 2007). That memorandum was the basis for refining regional pond implementation projects including Yellow Freight and Lady Bird Pond. These ponds effectively provide water quality treatment credit for all areas within the area shown in Exhibit A and labelled Regional Treatment Area. A more detailed memorandum is available for each pond and is intended to serve as the basis for individual sites being able to demonstrate that water quality treatment requirements are met for the purposes of the City standards and the NPDES Construction Permit requirements.

rbl
Exhibit A – Minnesota Rover Quadrant. Issues Summary

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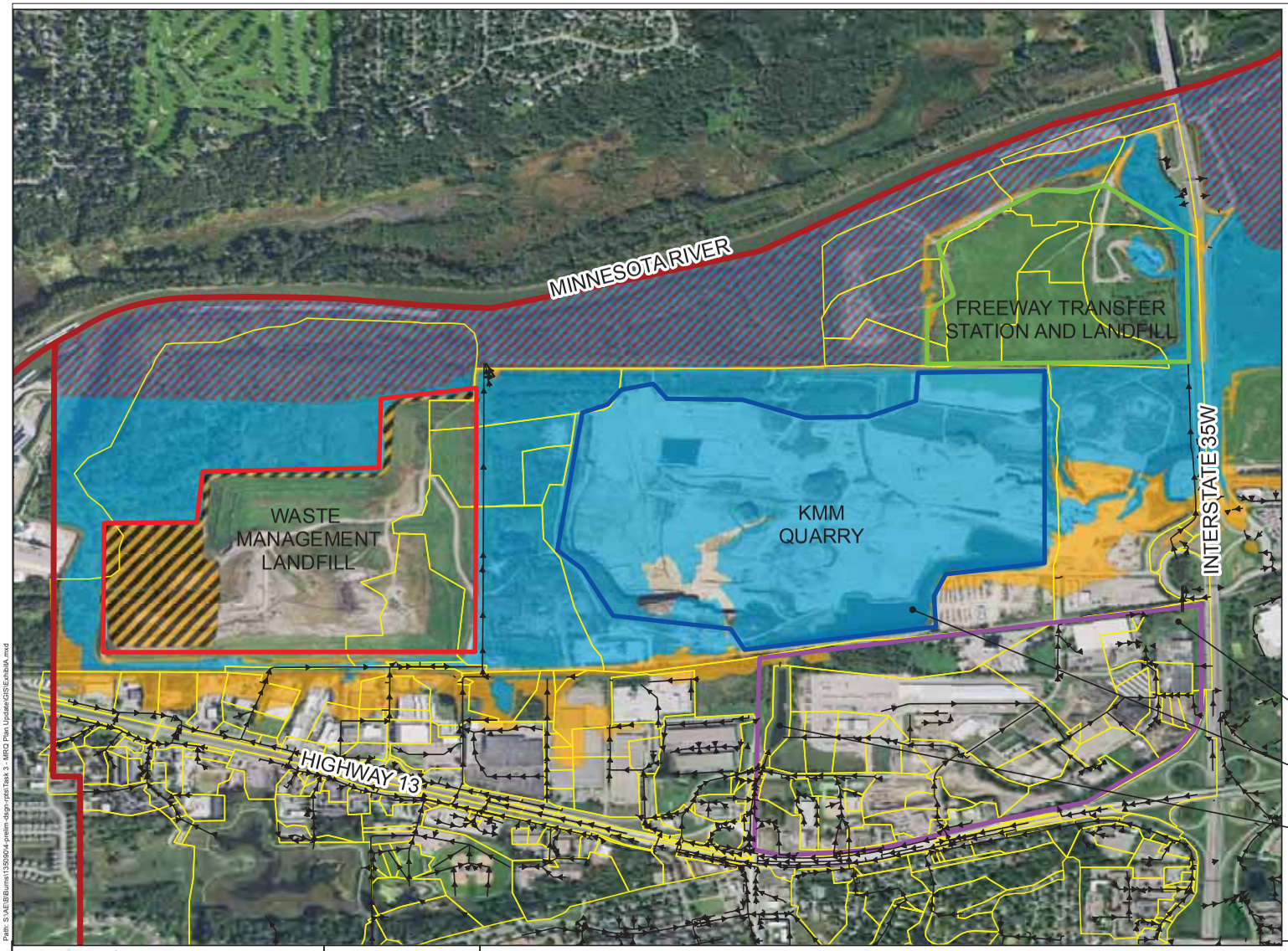

Legend

- City Boundary
- CITY STORM SEWER (18" AND GREATER)
- MAINTAIN ANNUAL LEVEE
- REGIONAL TREATMENT AREA
- FREEWAY LANDFILL
- FUTURE QUARRY LAKE
- DRAINAGE AREAS
- 1 PCT ANNUAL CHANCE FLOOD HAZARD (100-YR)
- FLOODWAY
- 0.2 PCT ANNUAL CHANCE FLOOD HAZARD (500-YR)
- AREA WITH REDUCED FLOOD RISK DUE TO LEVEE
- LADY BIRD POND
- SOUTH SUMP SURFACE WATER SUPPLY INTAKE
- YELLOW FREIGHT POND

0 0.1 0.2 0.4 0.6 0.8 Miles

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Map by: EKE
Projection:
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MINNESOTA RIVER QUADRANT

ISSUES SUMMARY
BURNSVILLE, MINNESOTA

EXHIBIT A

Appendix B

Volume Control/Infiltration Worksheet

Volume Control / Infiltration Practice Worksheet – Revised 2017

Burnsville, MN

Owner / Developer Name: _____

Site Name/Block or Outlot ID:_____

Step 1: Determine the site areas for your project.

a. Total site area in acres. _____ acres

b. For New Development Projects:

1. What is the proposed new impervious area within the site. _____ acres

c. For Redevelopment Projects:

1. Site area to be redeveloped. _____ acres

2. Percent of site redeveloped (= 100*(1.c.1 / 1.a)). _____ %

3. New impervious area within the redevelopment. _____ acres

4. Redeveloped impervious area within the redevelopment. _____ acres

Step 2: New Development Projects - Calculate volume required for infiltration/filtration.

a. New Impervious Volume = Step 1.b.1 x 1.1 inch x 1/12 (ft./inch) x 43,560 (sq.-ft./acre)

= _____ x 1.1 x 1/12 x 43,560 = _____ cu.-ft

Step 3: Redevelopment Projects < 50% Redevelopment - Calculate volume required for infiltration/filtration.

a. New Impervious Volume = Step 1.c.3 x 1.1 inch x 1/12 x 43,560

= _____ x 1.1 x 1/12 x 43,560 = _____ cu.-ft

b. Redevelopment Volume = Step 1.c.4 x 0.55 inch x 1/12 x 43,560

= _____ x 0.55 x 1/12 x 43,560 = _____ cu.-ft

c. Total Volume = Step 3.a + Step 3.b = _____ cu.-ft.

Step 4: Redevelopment Projects > 50% Redevelopment - Calculate volume required for infiltration/filtration.

a. New Impervious Volume = Step 1.c.3 x 1.1 inch x 1/12 x 43,560

= _____ x 1.1 x 1/12 x 43,560 = _____ cu.-ft

b. Redevelopment Volume = Step 1.c.4 x 1.1 inch x 1/12 x 43,560

= _____ x 1.1 x 1/12 x 43,560 = _____ cu.-ft

c. Total Volume = Step 4.a + Step 4.b = _____ cu.-ft.

Volume Control / Infiltration Practice Worksheet – Revised 2017

Step 5. Infiltration Rate and Maximum Draw Down Time

Infiltration practices must be designed to draw down to the bottom of the practice within 48 hours. The maximum ponding depth shall be based on the soil infiltration rate determined from site-specific soils investigation data taken from the location of proposed infiltration practices on the site. The soils investigation requirement may be waived for smaller property practices (such as residential systems) where the maximum ponding depth is one (1) foot or less.

Infiltration Rate = _____ in/hr. (refer to the Minnesota Stormwater Manual for Guidance)

Step 6. Determine water quality volume for infiltration practices.

For each of the practices you will use, enter the data in the table provided below to summarize total water quality volume and total annual phosphorus removal. Note that TP removal data is not required if infiltration practices fully satisfy the water quality volume requirements for the site. Provide detail in the plans to support the data noted.

BMP Name / ID	Water Quality Volume (cubic-feet)	Annual Total Phosphorus (TP) Removal (lbs)
Totals =		

Step 7. Determine water quality volume and TP Removal for non-infiltration BMPs

For each of the non-infiltration practices you will use, enter the data in the table provided below to summarize total water quality volume and total annual phosphorus removal. Note that TP removal data is required if infiltration practices do not fully satisfy the water quality volume requirements for the site. Provide detail in the plans to support the data noted.

BMP Name / ID	Water Quality Volume (cubic-feet)	Annual Total Phosphorus Removal (lbs)
Totals =		

Step 8. Confirm Water Quality Volume Requirements Are Met.

The total volume provided in Step 6 must be equal to or greater than the volume required in Step 2 (New Development), Step 3 (Redevelopment disturbing less than 50% of the site) or Step 4 (Redevelopment Disturbing 50% or more of the site).

For projects where infiltration practices listed in Step 6 do not fully satisfy the water quality volume requirement, pollutant removal standards apply. New development portions of a site are required to achieve 75% TP removal on an annual basis and redevelopment portions of a site are required to achieve 60% TP removal on an annual basis. See Appendix C for more detailed information.

Appendix C

Engineering Standards

Appendix C – Development Standards

The City of Burnsville has developed specific requirements in this section that apply to development and redevelopment projects. These standards are intended to help achieve the water resource goals of the City's Water Resources Management Plan (WRMP) and help the City maintain compliance with the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit program and the related NPDES/SDS General Construction Stormwater Permit. This summary highlights important aspects of the requirements for storm water quality, discharge rate and volume control, wetland management and erosion control.

This summary does not provide a complete listing of the requirements of this Plan or City Code. Note that other state and local watershed management organization rules and standards may also apply to development and redevelopment projects. For the convenience of users of this document a summary of the watershed rules and standards having jurisdiction within Burnsville is provided at the end of this Appendix in Table C-1. For a more detailed listing of requirements see the specific policies of the WRMP, the applicable City ordinances and watershed standards, or consult with City staff on your specific project.

To accomplish these goals, it is important to the City to have consistent approaches to evaluating proposed development projects. Therefore, all hydrologic, hydraulic and water quality analyses must be prepared and submitted in a format that will allow for a timely and efficient review by City staff. Project designers and/or developers are encouraged to schedule and complete a pre-design meeting with the City before any data will be accepted. The purpose of the meeting is to specifically address approvals and permits, pond requirements, trunk storm drain analysis, wetland impacts, water quality treatment, erosion control and discharge to lakes and sensitive wetland resources.

The stormwater management performance standards the City of Burnsville has adopted are similar to the MPCA Minimal Impact Design Standards (MIDS). The MIDS standards enable and promote the implementation of low impact development and other stormwater management techniques. Controlling a post-development runoff volume equivalent to 1.1 inches from the impervious surfaces is utilized as an approach to mimic the site's natural, pre-development hydrology. In addition to the hydrologic and water quality benefits anticipated through adoption of performance standards similar to MIDS, the MIDS performance criteria are being promoted and implemented statewide by many communities and watershed management organizations to standardize and streamline stormwater management regulatory programs for developers and communities. This enables developers to utilize standardized modeling methods and credit calculation tools such as the MIDS calculator.

1) <u>General</u>

   a) Water quality treatment, volume control, water quantity and rate control requirements apply to any project which results in one-half acre or more of disturbed area or 5,000 square feet or more of new impervious area. For the purposes of these standards, the new impervious area shall be considered the cumulative new impervious area.

   b) All maintenance, repair, resurfacing, reconditioning, or reconstruction activities on impervious surfaces, which do not involve constructing impervious surfaces outside of the existing impervious surfaces are exempt from rate, water quality, water quantity and volume control standards.

c) Construction Site Erosion and Sediment Control standards apply to all projects.

d) Additional requirements applicable to projects in Shoreland Areas are defined in City Code Section 10-8-10.

e) Any project within a floodplain area requires a permit from the City, County, MnDNR, and/or FEMA.

f) The owner shall submit the information listed in Section 10 of these Standards for review by the City.

g) Any project within the jurisdiction of the Vermillion River Watershed JPO that has obtained a variance from these standards by the City, must be reviewed and approved by the Vermillion River JPO.

2) Water Quality Treatment.

a) Infiltration / Volume Control Requirement:

i) For all new impervious portions of a project, a runoff volume of 1.1 inch must be treated in infiltration practices. The extent of infiltration / volume control practices required shall be determined using the worksheet in Appendix B.

ii) For all redevelopment impervious portions of a project on sites that redevelop greater than 50% of the site, a runoff volume of 1.1 inches from the reconstructed impervious surfaces must be treated in infiltration practices. The extent of infiltration / volume control practices required shall be determined using the worksheet in Appendix B.

iii) For all redevelopment impervious portions of a project on sites that redevelop less than or equal to 50% of the site, a runoff volume of 0.55 inches from the reconstructed impervious surfaces must be treated in infiltration practices. The extent of infiltration / volume control practices required shall be determined using the worksheet in Appendix B.

iv) Projects in the Vermillion River Watershed that create one or more acre of new impervious surface must control runoff volume for the 2-year, 24-hour storm event (2.75 inches) to the predevelopment volume.

b) Pollutant Removal Requirements. For projects that have met the infiltration/volume control requirements above, the pollutant removal requirements are considered to be met. For projects where infiltration is prohibited or restricted (see Items 3.a. and 3.b.), the following pollutant removal standards apply prior to reaching a downstream receiving water:

i) For new development portions of a site, provide treatment to remove 75% TP as modeled on an annual basis.

ii) For redevelopment portions of a site, provide treatment to remove 60% TP as modeled on an annual basis.

iii) Design engineers and developers shall determine the pollutant removal efficiency of the BMP(s) incorporated into the site plan using the available industry standard models including P8 (and using a standard NURP 50th percentile particle size distribution for the analysis), MIDS calculator, WinSLAMM or a comparable model approved by the City. As an alternative to preparing a site-specific model, the development may provide a treatment volume (dead storage) of not less than 2.5 inches calculated over the contributing drainage area to the

pond. For example, a 1-acre site that drains to a common treatment pond would be required to provide a dead storage volume of 0.21 acre-feet or 9,000 cubic feet.

3) Volume Control / Infiltration Practices.

a) Infiltration systems are prohibited:

i) Where industrial facilities are not authorized to infiltrate industrial stormwater under an NPDES/SDS Industrial Stormwater Permit issued by MPCA.

ii) Where vehicle fueling and maintenance occur.

iii) Where the bottom of the infiltration basin is less than 3 feet to bedrock or seasonally saturated soils.

iv) Where high levels of contaminants in soil or groundwater will be mobilized by infiltration.

v) Within the areas designated as Very High Vulnerability and High Vulnerability within the Drinking Water Supply Management Area (DWSMA) identified in Figure C-1

b) The City restricts the use of infiltration systems in areas:

i) With low permeability soils (i.e., Hydrologic Soil Group D soils) or where a confining layer exists below the proposed basin. Filtration or conservative drawdown rates should be considered in designing systems in HSG C soils.

ii) Within 1,000 feet upgradient or 100 feet down gradient of active karst features.

iii) Within the areas designated as: Moderate Vulnerability; and Low to Very Low Vulnerability within the Drinking Water Supply Management Area (DWSMA) identified in Figure C-1;

iv) Where soil infiltration rates are more than 8.3 inches per hour.

c) For linear projects not meeting the exemption in Part 1.b., and where the lack of right-of-way precludes the installation of volume control practices that meet the requirements in Part 2 (Water Quality Treatment) and Part 3 (Volume Control/Infiltration Practices), the City may allow a lesser volume control on the construction site provided a reasonable attempt has been made to obtain right-of-way during the project planning process and:

i) One or more of the prohibited or restricted site conditions listed above exists; and

ii) The owner implements other practices (e.g., evapo-transpiration, reuse, conservation design, green roofs, etc.) on the construction site that may not fully meet the volume control requirements of Part 2 (Water Quality Treatment).

d) Infiltration practices shall provide for pretreatment of the runoff. Examples of pretreatment include a mowed grass strip between a curb-cut and a small rain garden, a sump manhole or manufactured sediment trap prior to an infiltration basin and a sediment forebay as the first cell of a two-cell treatment system. Where the infiltration system captures only clean runoff (e.g., from a rooftop) pretreatment may not be required.

e) Infiltration practices must be designed to draw down to the bottom elevation of the practice within 48 hours. The maximum ponding depth shall be based on the soil infiltration rate determined from site-specific soils investigation data taken from the location of proposed infiltration practices on the site. The soils investigation requirement may be waived for

smaller residential property practices where the maximum ponding depth is one (1) foot or less.

f) The design shall incorporate a diversion or other method to keep construction site sediment from entering the infiltration system prior to final stabilization of the entire contributing drainage area.

g) The design shall incorporate provisions that will prohibit construction equipment from compacting the soils where infiltration practices are proposed.

h) A plan for maintenance of the system must be submitted that identifies the maintenance activities and frequency of activities for each infiltration practice on the site.

i) See part 8 for additional basin design details.

4) Water Quantity / Flood Control.

a) The low building elevation shall be set to the higher of the following:

i) Where an effective Base Flood Elevation (BFE) has been established and is included in the City's FIRM, the low floor elevation adjacent to a surface water body shall be established in accordance with the City's Floodplain ordinance. The ordinance establishes the Regulatory Flood Protection Elevation (low floor elevation) at not less than one (1) foot above the BFE plus any increase due to encroachment of the floodway.

ii) The low floor elevation shall be two (2) feet or more above the 100-year/24-hour event as determined by a technical evaluation by a qualified engineer or hydrologist.

b) An emergency overflow shall be incorporated into the site design at or above the BFE or modeled high water level to convey a 100-year discharge away from buildings to the next downstream water body. Existing, natural or man-made emergency overflows shall be analyzed as part of the design process. The lowest opening shall be at least 1.5 feet above the emergency overflow elevation of the adjacent water body, unless the analysis shows that adequate storage volume exists within the basin to provide a reasonable level of protection from potential flooding. Where a natural overflow does not exist, the designer shall consider the possibility of long duration events, such as multiple-year wet cycles and high runoff volume events (e.g., snowmelt events that last for many weeks) when evaluating high water elevations and outlets from landlocked basins.

c) Fill around a building or structure shall be above the BFE and extend a horizontal distance of at least 15 feet in all directions.

d) For underground parking structures with a low floor elevation below the high water level or emergency overflow elevation, the drainage system within the parking structure shall include anti-backflow devices and flood protection to minimize the impacts of high ground water levels during flood events.

e) Projects in the Vermillion River Watershed must not result in a net loss in floodplain storage.

f) For landlocked basins, where additional stormwater volume is proposed to be routed, consideration shall be given to the effects of increased flood levels on trees and vegetation and potential for erosion.

5) Rate Control.

a) Discharge rates leaving the site must not exceed the existing rates for the 2, 10 and 100-year, critical duration (24-hour) storm events, using the updated Atlas 14 rainfall depths and antecedent moisture conditions 2 (AMC-2). The storm distribution shall be a NRCS MSE 3 MN distribution or the nested distribution for Atlas 14 based data. Discharge rates leaving the site should be reduced from existing rates where feasible. Predevelopment is defined as the conditions on the project site prior to the proposed improvements.

   i) For projects in the Vermillion River Watershed, discharge rates leaving the site must not exceed the predevelopment rates for the 1-year critical duration storm in addition to, the 2-year, 10, and 100-yr, 24-hour events. Predevelopment is defined as the conditions on the project site that existed in 2005.

b) On-site rate controls may not be needed if downstream (regional) facilities can be shown to adequately detain/retain the runoff to existing conditions and in accordance with the rates established in Appendix D of this Plan. In this case, the developer or design engineer shall submit a technical evaluation completed by a qualified engineer or hydrologist which must be review and approved by the City Engineer.

c) Where a flow rate variance involves inter-community issues or significant water bodies, the regulatory jurisdiction shall have a review role. Any variances shall be reflected in subsequent plan submittals.

d) Project sites discharging directly to the Black Dog Fen must not increase the discharge rate from the site for the 1-year event.

e) For proposed outlets from landlocked basins, an analysis of the water quality and flooding impacts on intercommunity flows or any downstream strategic waterbodies shall be prior to construction of the outlet. If analyses indicate a potential adverse effect on water quality or increased flood potential, the city must notify the watershed organization prior to approving the outlet.

6) Special Waters and Wetlands.

a) Developments shall meet the requirements of the National Pollutant Discharge Elimination System (NPDES) permit program for all applicable requirements of the most recent permits including, but not limited to the following:

   i) Sites discharging to Trout Stream #1, #4 or #7, must incorporate BMPs that address: runoff temperature requirements; maintain an undisturbed buffer zone of at least 100 feet between the project site and the trout stream; and cover exposed slopes that are steeper than 3:1 (H:V) within three days of the disturbance.

b) Horizontal vegetated buffer zones shall be established and/or maintained around existing wetlands and storm water treatment ponds. New development and redevelopment projects shall provide a buffer zone around wetlands in accordance with the requirements in the City's Wetland Protection and Management Plan. Storm water ponds with a permanent pool of water (i.e., wet ponds) shall have an average 20-foot buffer around the perimeter of the basin. The buffer shall extend form the normal water level to the top of the pond slope.

Wetland Classification	Permanent Buffer Strip Average Width (feet)	Minimum Permanent Buffer Zone Width (feet)	Percentage Native Vegetation

Protection	50	30	100% Native
Improvement	35	25	100% Native
Management	25	20	Majority
Management II	20	20	Majority

c) Water level fluctuations in wetlands shall be managed in accordance with the City's Comprehensive Wetland Protection and Management Plan. A rise (bounce) in elevation greater than 12 inches during a 10-year storm shall be avoided.

d) New discharge points to all wetlands and waters must include pretreatment. New direct discharges to Management II wetlands must have at least grit removal prior to discharge.

e) State of Minnesota Buffer Law (Minnesota Statutes 2014, sections 103B.101, subdivision 12; 103E.315, subdivision 8; Minnesota Statutes 2015 Supplement, sections 103B.101, subdivision 12a; 103F.48, subdivisions 1, 3, 4, 7, 8, 10 and CHAPTER 85--S.F. No. 2503l 2016 amendments) requires the establishment of either a 50-foot average, 30-foot minimum, continuous buffer of perennial rooted vegetation around all public waters, streams, and public ditches as identified and mapped on a buffer protection map. The buffer protection map is maintained by the Minnesota Department of Natural Resources, through a buffer mapping website (http://arcgis.dnr.state.mn.us/gis/buffersviewer/). The buffer law is administered by the Board of Water and Soil Resources (BWSR), with technical support for land owners provided by the Dakota County Soil and Water Conservation District. Resources requiring protection under the buffer law are present in the City of Burnsville, but are limited to ten public waters, and four unnamed streams draining into Black Dog Lake. These aquatic resources currently meet the standards of the buffer law, and no action is required to comply with the recently implemented legislation. The current buffer standards incorporated in the Burnsville Surface Water Management Plan exceed the state requirements for the aquatic resources, which protects these resources should adjacent land use change.

7) Design Computations.

a) All hydrologic data shall be completed using NRCS methodology; i.e. HydroCAD or TR20/TR55, XP-SWMM or a comparable, City approved method. Hydraulic calculations will be accepted in the rational method format or in commonly used software packages such as FHWA HY-8, or XP-SWMM or a compatible, City approved method. These computations shall be submitted to the City, upon request.

b) Rainfall amounts for hydrologic analysis shall be based on Atlas 14 data. Burnsville analyses shall use the values in the following table for 24-hour design events.

Return Frequency	Rainfall Depth (inches)
2-year	2.9
10-year	4.3
100-year	7.5

c) Local storm sewer systems shall be designed for the 10-year storm event. The Rational Method shall be the preferred methodology for the design of local systems. Culvert crossings or storm systems in County or State right-of-way may have a design frequency which differs from the City's 10-year design storm. The designer shall contact each agency/unit of government to

determine the appropriate design frequency for hydrologically-connected systems.

d) For culvert outlet velocities less than or equal to 4 fps, check shear stress to determine if vegetation or riprap will be adequate. If vegetation is used, temporary erosion control during and immediately follow construction shall be used until vegetation becomes established. For velocities greater than 4 fps, energy dissipaters shall be designed in accordance with MnDOT Design Criteria.

e) High water elevations for landlocked areas (basins where no outlet exists) shall be established by first estimating the normal or initial water surface elevation at the beginning of a rainfall or runoff event using a documented water budget, evidence of mottled soil, and/or an established ordinary high water level. The high water level analysis shall be based on runoff volume resulting from a 100-year/10-day runoff (7.2 inches and saturated or frozen soil conditions [CN=100]) and/or the runoff resulting from a 100-year back-to-back event. The high water elevation shall be the higher of these two conditions.

8) Additional Pond and Infiltration System Design Criteria. Newly constructed or expanded/modified ponds and basins shall be designed and constructed to meet the following:

a) Any storm water pond constructed within the prohibited infiltration zone in Figure C-1, must meet the following criteria:

i) The basin bottom and side walls shall be constructed by compacting at least a 1-foot thickness of soils having at least 20 percent fines (at least 20% passing a #200 sieve). The bottom must have at least a 3-foot vertical separation to the seasonally-high groundwater elevation and/or bedrock.

ii) If a 3 foot separation to bedrock or the seasonally-high groundwater elevation cannot be obtained, the basin bottom and sidewalls shall be constructed of materials and methods that are approved by the City Engineer. Possible liner materials may include compacted cohesive soils, geosynthetic materials, plastic liner, soil additives or other materials.

iii) The seasonally-high groundwater elevation shall be determined by assessing soil mottling or soil coloration that indicates temporary saturation of the soil.

b) All ponds or basins shall:

i) If the pond will have a permanent pool of water, have an aquatic bench having a 10:1 (H:V) slope for the first 10 feet from the normal water level into the basin.

ii) Have a 3:1 maximum slope (above the NWL and below the 10:1 bench, if a wet pond);

iii) Maximize the separation between inlet and outlet points to prevent short-circuiting of storm flows;

iv) Be made accessible for maintenance and not be entirely surrounded by steep slopes or retaining walls which limit the type of equipment that can be used for maintenance. Vehicle access lane(s) of at least 10 feet shall be provided, at a slope less than 15 percent from the access point on the street or parking area to the pond, to accommodate maintenance vehicles. Maintenance agreements will be required when the pond is not located on City property.

v) Have a skimming device designed to remove oils and floatable materials up to a five-year

frequency event. The skimmer shall be set a minimum of 12 inches below the normal surface water elevation shall control the discharge velocity to 0.5 feet per second.

c) For wet ponds, an average 4 feet of permanent pool depth (dead storage depth) shall be provided. This constraint may not be feasible for small ponds (less than about 3 acre-feet in volume or less). In such cases, depths of 3-4 feet may be used. To prevent development of thermal stratification, loss of oxygen, and nutrient recycling from bottom sediments, the maximum depth of the permanent pool should be less than or equal to 10 feet.

d) Structural BMPs proposed as a stand-alone device or as part of the overall treatment system, shall be designed in accordance with standard engineering principles and practices.

9) Construction Site Erosion and Sediment Control.

a) The City's Erosion Control Ordinances shall be followed for all projects, including those not regulated under the NPDES construction permit. Construction site erosion and sediment control practices shall be consistent with those required by the NPDES Construction Stormwater General Permit Section IV-Construction Activity Requirements, however, formal permit coverage is not required for sites disturbing less than one acre.

b) Prior to the start of any excavation or land disturbing activity for the site, the owner or contractor must have in place and functional an approved method of erosion control. The contractor must have received authorization from the City prior to commencing construction activities.

c) Development projects shall meet the requirements of the National Pollutant Discharge Elimination System (NPDES) construction permit program, including the requirement to prepare and follow a storm water pollution prevention plan (SWPPP). The owner shall submit proof of receipt and approval by MPCA of the permit application prior to commencing construction. A copy of the SWPPP prepared in accordance with the NPDES permit requirements, shall be submitted to the City if requested by the City Engineer. Site plans shall include:

i) Best management practices (BMPs) to minimize erosion.

ii) BMPs to minimize the discharge of sediment and other pollutants.

iii) BMPs for dewatering activities.

iv) Site inspections and keeping records of rainfall events.

v) Maintenance of BMPs during construction.

vi) Management of solid and hazardous wastes.

vii) Final stabilization of the site including the use of perennial vegetation and/or other methods on all exposed soils.

viii) Computations and documentation regarding the sizing and location of temporary sediment basins.

10) Storm Water Plan Submittals.

a) Property lines and delineation of lands under ownership of the project proposer.

b) Delineation of the subwatersheds contributing runoff from off-site, and proposed and existing subwatersheds on-site.

c) Location, alignment and elevation of proposed and existing stormwater facilities.

d) Delineation of existing on-site wetlands, shoreland and/or floodplain areas. Removal or disturbance of stream bank and shoreland vegetation should be avoided. The plan shall address how unavoidable disturbances to this vegetation will be mitigated.

e) Existing and proposed 100-year high water level elevations on-site.

f) Existing and proposed site contour elevations related to NAVD 1988 datum.

g) Construction plans and specifications of all proposed stormwater management facilities.

h) Stormwater runoff volume and rate analyses for existing and proposed conditions.

i) All hydrologic and hydraulic computations completed to design the proposed stormwater quality management facilities. Computations shall include a summary of existing and proposed impervious areas.

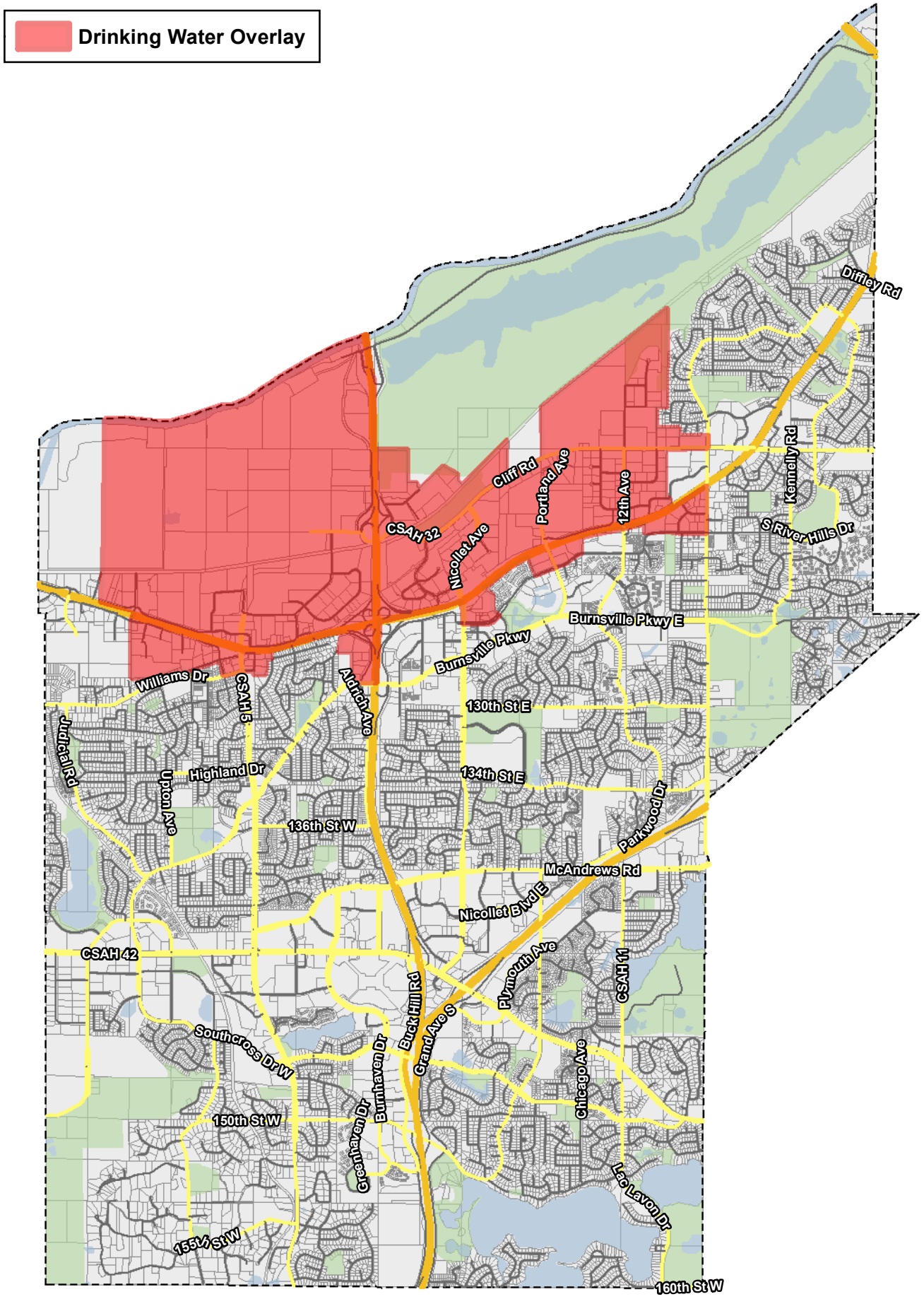
j) Provision of outlots or easements for maintenance access to detention basins, constructed wetlands and other stormwater management facilities.

k) Maintenance agreement between developer and city which addresses sweeping, pond inspection, sediment removal and disposal, etc.

l) Inlets to detention basins, wetlands, etc., shown at or below the outlet elevation.

m) Identification of receiving water bodies (lakes, streams, wetlands, etc.).

n) Documentation indicating conformance with this Plan



City of Burnsville

Drinking Water Overlay

FIGURE C-1

1 inch = 4,300 feet

N

WSB & Associates, Inc.

K:\01880-360\GIS\Maps\Final GIS files\Final DWSMA Burnsville.mxd

Table C-1
Local Watershed Standards Summary

	VRWJPO	LMRWD	BDWMO[2]
Stormwater Management Standards	Applicability: All land disturbing activities (disturbance of <5000 sf may be exempt) Water Quality: Must meet water quality standards established by the MPCA NPDES Construction Stormwater permit Runoff Temperature Control: No specific criteria since other standards (volume control, buffers, etc.) emphasize approaches to control runoff temperature Peak Runoff Rate Control: Proposed peak runoff rates must not exceed the existing (2005 baseline) runoff rates for the 1-, 10-, and 100-yr critical duration storm events. Runoff Volume Control: Development creating ≥ 1 ac of new impervious surface must control the increase in runoff volume from the 2005 conditions for a 2-yr, 24-hr storm event.	Applicability: The disturbance of ≥1 acre of land or creating of ≥10,000 sf new impervious within the High Value Resource Area Overlay District[1] Water Quality: No net increase from existing conditions in TP or TSS to receiving waterbodies Runoff Temperature Control: Stormwater facilities must be designed to minimize an increase in the temperature of receiving trout waters for the 1- and 2-yr, 24-hr events. Peak Runoff Rate Control: The stormwater runoff rate shall not exceed the existing ratefor the 1- or 2-, 10-, and 100-year return frequency storms. Runoff rates shall not accelerate on or off-site watercourse erosion, downstream nuisance, flooding, or damage. Runoff Volume Control: Must comply with the MPCA NPDES Construction Stormwater permit requirements for stormwater runoff volume retention equivalent to 1 in of runoff from impervious surfaces. Regional ponds and practices can be used provided the design is based on the ultimate conditions for the contributing watershed and practices are constructed and operational prior to constructing impervious surfaces within the contributing drainage area.	Applicability: The disturbance of ≥1 acre of land Water Quality: Must meet water quality standards established by the City of Burnsville Peak Runoff Rate Control: Must meet peak runoff rate control standards established by the City of Burnsville Runoff Volume Control: Must meet runoff volume control standards established by the City of Burnsville All new or replaced stormwater management systems and structural BMPs must conform to current standards and engineering practices. Pretreatment is required for stormwater discharge points/outfalls and existing inlets to the stormwater system.

Table C-1 (continued)
Local Watershed Standards Summary

<table>
<tr><th></th><th>VRWJPO</th><th>LMRWD</th><th>BDWMO[2]</th></tr>
<tr><td>Erosion and Sediment Control Standards</td><td>Applicability: All land disturbing activities > 5000 sf, > 30 cy of soil, or changing existing drainage

Standards: Erosion and sediment controls shall meet the standards of the MPCA NPDES Construction Permit and have a SWPPP for projects disturbing more than 1 ac. Erosion and Sediment control plans shall be used for sites disturbing < 1 ac.</td><td>Applicability: The disturbance of ≥1 acre of land or ≥ 5,000 sf within the High Value Resource Overylay District

Standards: Erosion and sediment controls shall meet the standards of the MPCA NPDES Construction Permit and stormwater conveyances must be designed to a 10-year design storm.</td><td>Applicability: All land disturbing activities of ≥ 1 acre.

Standards: Erosion and sediment controls shall meet the standards of the MPCA NPDES Construction Permit</td></tr>
<tr><td>Buffer Standards</td><td>Applicability: Any new lot created by the subdivision of an existing property must maintain a buffer around all wetlands, watercourses, and pubic waters wetlands

Standards: Buffer width varies upon stream classification,
<table>
<tr><th></th><th>Avg.</th><th>Min.</th></tr>
<tr><td>Conservation Corridor</td><td>150</td><td>100</td></tr>
<tr><td>Aquatic corridor principal connector & trout stream</td><td>NA</td><td>100</td></tr>
<tr><td>Aquatic corridor principal connector</td><td>100</td><td>65</td></tr>
<tr><td>Aquatic corridor tributary connector</td><td>50</td><td>35</td></tr>
<tr><td>Water quality corridor</td><td>30</td><td>20</td></tr>
</table>
Or wetland classification
<table>
<tr><th></th><th>Avg.</th><th>Min.</th></tr>
<tr><td>Exceptional quality</td><td>50</td><td>30</td></tr>
<tr><td>High quality</td><td>40</td><td>30</td></tr>
<tr><td>Medium quality</td><td>30</td><td>25</td></tr>
<tr><td>Low quality</td><td>25</td><td>16.5</td></tr>
</table></td><td>NA</td><td>Applicability: Any development maintain a buffer around all wetlands

Standards: Member cities will continue to enforce wetland management standards. Buffer width varies upon wetland classification.
<table>
<tr><th></th><th>Avg.</th><th>Min.</th></tr>
<tr><td>Protect</td><td>50</td><td>30</td></tr>
<tr><td>Improve</td><td>35</td><td>25</td></tr>
<tr><td>Manage 1</td><td>25</td><td>20</td></tr>
<tr><td>Manage 2</td><td>20</td><td>20</td></tr>
</table></td></tr>
</table>

Table C-1 (continued)
Local Watershed Standards Summary

	VRWJPO	LMRWD	BDWMO[2]
Wetland Alteration Standards	Applicability: Whenever there is a proposed activity that may affect a wetland. Standards: Any wetland alteration must comply with the Minnesota Wetland Conservation act (WCA) and other applicable State and Federal regulations	NA	Applicability: Whenever there is a proposed activity that may affect wetland hydrology. Standards: Limits on changes in hydrology and water level bounce during storm event based upon the wetland management classification as defined by the City of Burnsville.
Floodplain Alteration Standards	Applicability: Any change in the floodplain below the 100-year flood elevation. Standards: No net decrease in flood storage capacity below the 100-year flood elevation. New structures must have sufficient freeboard over the BFE as required by local floodplain ordinances.	Applicability: Any alteration below the 100-year flood elevation of any wetland, public water, or subwatershed. Standards: No filling is allowed within the 100-yr floodplain which causes a rise in the 100-yr flood elevation without providing compensatory floodplain storage ≥ the volume of fill. Structures must be 2 ft above 100-yr HWL or 1 ft above EOF, whichever is greater. No permanent structure may be located within the floodway.	Applicability: All new structure construction adjacent to inundation areas. Standards: The BDWMO requires cities to set minimum building elevations at least 1 ft above the critical 100-yr flood elevation for structures adjacent to inundation areas.
Drainage Alteration Standards	Applicability: Any outlet of a landlocked basin with a contributing drainage area of ≥ 100 acres or a drainage alteration to a watercourse, public water or wetland that drains ≥ 640 acres Standards: Sound H&H analysis ensures no adverse downstream flooding, stability or water quality impacts, and runoff volume and peak rate criteria are met.	See Floodplain alteration standards.	Standard: BDWMO requires member cities to protect and maintain downstream drainage systems to provide permanent and safe conveyance of stormwater, and to reduce the frequency and/or duration of downstream flooding. Planned level of protection for trunk conveyors, streams, channels and around wetlands ponds and detention basins shall be based on the 100-year flood. Non-trunk conveyance systems shall provide a min. 5-yr frequency event level of service, preferably a 10-yr frequency event. EOFs shall be incorporated where feasible in designs for events larger than a 100-yr frequency. Multi-stage outlets for smaller storms and maintenance of base flows is encouraged.

Table C-1 (continued)
Local Watershed Standards Summary

	VRWJPO	LMRWD	BDWMO[2]
Shoreline and Streambank Alteration Standards	NA	Applicability: Any shoreline or streambank alteration Standard: Bioengineering techniques shall be used in place of traditional stabilization. Retaining walls shall only be used when no adequate alternative exists.	NA
Stream and Lake Crossing Standards	NA	Applicability: Any road, utility, or structure placed on the bed or bank of a watercourse or waterbody Standards: Hydraulic impact analysis is completed by a qualified PE demonstrating the crossing will retain adequate hydraulic and navigational capacity. Minimum culvert width shall be ≥ bankfull width. Culvert length shall extend beyond side slope toe, alignment and slope should match the stream, and inverts shall be buried 1/6 of height.	NA
Water Appropriation Standard	NA	Applicability: Surface or groundwater appropriation and issuance of a DNR appropriation permit (≥10,000 gal per day or 1M gal per year) Standards: The effects of the proposed appropriation must be defined and a copy of any DNR appropriations permit must be provided to the District. Known non-compliant ISTS within the WHPA shall be upgraded within 3 years.	NA

Table C-1 (continued)
Local Watershed Standards Summary

	VRWJPO	LMRWD	BDWMO[2]
Bluff Standard	NA	Applicability: Any land disturbing activity or land alterations on bluffs within the LMRWD Bluff Overlay District Standards: All grading, clear cutting, removal of vegetation and/or other land-disturbing activities are prohibiting on the bluff and/or bluff impact zone. A minimum of 40 ft setback from the top of bluff/bluffline is required for: • structures, • ISTS and CSTS, and • stormwater ponds, swales, basins or other soil saturation-type features	NA
See For More Information	See Standards for the VRWJPO (2016) for details.	See Appendix K of the LMRWD (2017 draft) plan for details.	See BDWMO Watershed Management Plan (2012) for details.

[1]See Appendix K of the LMRWD (2017 draft) plan for stormwater management standards in High Value Resource Area (HRVA) Overlay district.

[2]The BDWMO reserves the right to review regulations of member cities affecting the BDWMO water resources for compliance with BDWMO performance standards.

Appendix D

Hydrologic and Hydraulic Model Summary

Appendix D - Hydrologic System Information

The City of Burnsville developed this Water Resources Management Plan (WRMP) to analyze its water resources and to establish an overall program to achieve their water resource management goals. These goals are generally intended to reduce or minimize the future impacts of development on the City's natural and water resources and improve the quality of the City's resources.

In 2016 as part of the 2017 WRMP update, the City developed a City-wide xp-swmm hydrologic/hydraulic model. The 2017 model incorporated more detail in the pipe networks for much of the City than had previously been modeled. In general, pipes having a diameter of 18-inches or greater were included in the model and the majority of smaller pipes were excluded. Lake, ponds, wetland and selected depressional storage areas were also included in the City-wide model. For the data presented in the Hydrologic Summary Data Table D-1 in Appendix D, the source of the data for building the model consisted of the following:

- City owned and inventoried ponds (from City provided GIS Database in January 2016) that outlet to the City storm sewer and that had complete storm sewer data available in City GIS Database (i.e., pipe size, inverts).
- Privately owned and inventoried ponds (from City provided GIS Database in January 2016 that outlet to the City storm sewer with complete storm sewer data available in City GIS database.
- Some natural depression areas that were not included in the GIS water body database were developed from available LIDAR data.

The following systems and features were not included in the model:

- Underground Systems.
- Infiltration or filtration Systems (with a few exceptions)
- Privately owned and inventoried ponds without complete storm sewer data available in the City GIS database (i.e., missing pipe size and/or inverts)
- Non-inventoried ponds.

The following descriptions correspond to the information presented in the hydrologic summary table. Note that while the data table report that elevations are in NAVD 88 datum, largely due to the use of the data from the City's GIS data is reported in NAVD 88 datum. Data should be checked by users to confirm elevations noted in as-built plans and site specific surveys.

Storage Area ID

These columns identify the unique storage area ID for each row within the table and corresponds to the drainage areas and the specific pond/water body/storage areas shown Map Figure Series D-1.1 to D-1.12 and D-2.1 to D-2.12. The subwatershed boundaries were generally determined using available contour mapping and storm sewer networks. The boundaries should be considered approximate and should be review during subsequent and more detailed analyses.

Water Body Common Name

The water body common name is listed for lakes and key water bodies.

Surface Area at NWL

The water surface area at normal water level (in square feet) is determined from Lidar data based on the elevation of the water body normal water level, outlet structure, pump control elevation or a DNR established elevation. The surface area at NWL shown are those listed in the City GIS Pond/Water Body data.

Approximate Outlet Size

The approximate outlet size is the approximate outlet pipe size of the associated water body. The approximate outlet sizes shown are those listed in the City GIS Pond/Water Body data. This information should be used for planning purposes only and not for final design.

NWL

The normal water level of the pond is the lowest controlling elevation. It is usually taken as the invert of the outlet structure or the pump control elevation and is the elevation that the pond will drain down to after a rainfall event. The NWL does not reflect the lowest elevation that may be attained naturally by infiltration, evaporation or transpiration. The elevation is listed in National Geodetic Vertical Datum (NAVD 88). The NWL data shown are those listed in the City GIS Pond/Water Body data.

Ordinary HWL

The OHWL listed represents the level reported in the DNR's Lake Finder database for the water body listed in the comments column of the table. The OHWL data shown are those listed in the City GIS data.

100-Year Event (7.45" Rainfall Event)

The 100-year event is also referred to as a rainfall event that has a 1% chance of occurrence in a given year.

> The 100-year high water level data presented in these tables should be viewed as an approximate elevation and the user/designer is encouraged to complete additional analysis prior to initiating site planning, design and obtaining approvals. In general, the City may complete detailed updated modeling upon the initial contact with a project owner and provide the owner with updated high water level and low building elevation information.

HWL (NAVD 88)

The highest water level achieved in a storage area as predicted by the 2017 model for a 100-year event. The model assumes that the water body elevation is equal to the NWL at the beginning of the storm event. The HWL is affected by the accuracy of the data such as drainage area, storage capacity, outlet description and condition, and run-off factors. All of these factors should be reviewed when HWL is considered critical.

BFE from FEMA (NAVD 88)

The regulatory base flood elevation as defined in the most recent flood insurance study or flood insurance rate map. This number is only reported for water bodies that have a defined base flood elevation. The BFE may be more or less than the HWL listed in the previous column if more recent modeling was completed that has not yet been incorporated into an official map change by FEMA. These numbers will not change as a result of any additional analysis requested or required by the City to reevaluate the effects of updated Atlas 14 precipitation data.

Bounce in Pond/Water Body. The difference in elevation between the NWL and the modeled HWL.

Storage. The volume of water stored in the pond between the NWL and the HWL.

Peak Outflow Rate. The maximum discharge rate from a pond through the outlet. This normally occurs when the pond is at the HWL and it assumes the full efficiency of the outlet structure(s).

Approximate Overflow Elevation

The elevation at which the pond would overflow from the surface if the storage capacity is exceeded. The approximate overflow elevations shown are those listed in the City GIS Pond/Water Body data.

Approximate Existing Low Building Elevation

This elevation was determined from the "House-Print" on the contour mapping and does not indicate low-floor or basement elevations. These elevations should be considered approximate due to possible inaccuracies in the mapping and buildings that have been constructed or modified after the mapping was completed. The approximate existing low building elevation shown are those listed in the City GIS Pond/Water Body data.

Low Building Elevation

This elevation is determined based on the standards presented in Appendix C. This should be considered a planning level minimum elevation that is required by City standards. The developer should review the source and quality of data available and evaluate the low building elevation for each site directly to ensure a reasonable level of protection is provided. The low building elevations shown are those listed in the City GIS data.

Freeboard (LBLDG – HWL)

The difference between the low building and 100-year high water level elevations. A negative number indicates that the HWL is higher than the LBLDG. This dimension along with the comments column is intended to highlight areas in the City that could experience problems with flooding. Actual low building elevations, and other pertinent hydrologic data,, should be field verified to determine the extent of the problems. It should be noted that LBLDG elevation may be different elevation than the low floor elevation per City Ordinance.

Risk of Inundation

This column provides a relative risk of inundation of adjacent structures. The relative risk is not intended to take the place of detailed analyses to evaluate risk. Instead it is intended as an initial planning-level starting point. Almost any structure adjacent to a water body may have a risk of inundation during certain hydrologic events. The data is based on approximate overflow elevations and not on actual surveyed field conditions.

Relative Risk of Inundation

Distance Low Bldg. Elevation is Above the BFE or AOE (feet) (1)	**Base Flood Elevation (BFE) or 100-Year HWL**	**Approximate Overflow (AOE)**	**Overall Risk**
≤ 0	HIGH	HIGH	HIGH
0 to 1.5	MODERATE	HIGH	HIGH
1.5 to 2.0	MODERATE	LOW	MODERATE
2.0 or more	LOW	LOW	LOW

1. A value of zero means the low building elevation is at the same elevation of the BFE or EOF. A negative number means the elevation is below the BFE or EOF.

Notes

This column provides miscellaneous notes relating to the drainage area.

Table D-1 Hydrologic Summary Data for the 100-Year Design Storm

Storage Area ID	Water Body Common Name	Surface Area at NWL[1] (Acre)	Surface Area at NWL[1] (Square Feet)	Approx. Outlet Size[1] (inches)	NWL[2]	Ordinary HWL DNR[2] (NGVD 29)	100-Year Event (7.45 in Rainfall Event)					Approximate Overflow Elevation[1]	Approx. Existing Low Building Elevation (LBE)[1]	Low Building Elevation[2]	Freeboard (LBE-HWL) (ft)	Risk of Inundation	Notes[1]
							HWL[2]	BFE from FEMA (NAVD 88)	Bounce (ft)	Storage (acre-ft)	Peak Outflow Rate (cfs)						
BLACK DOG LAKE SUBWATERSHED																	
BDW1-A		1.13	49,034				732.61			9.56	94.1			734.61			
BDW1-B		0.09	3,812							0.00							Cliff Fen Park Rain Garden Cell 1
BDW1-C		0.11	4,633				831.74			0.52	16.7			833.74			
BDW1-E		0.23	10,220		824.00		827.30		3.30	0.67	15.4			829.30			
BDW1-F		0.10	4,279		824.50		827.61		3.11	0.23	5.6			829.61			
BDW1-H		0.09	4,036				843.85			0.15	5.2			845.85			
BDW1-I		0.21	8,935				730.97			0.18	10.7			732.97			
BDW1-J		0.38	16,349		730.00		732.08		2.08	2.38	0.0			734.08			
BDW1-K		0.19	8,226		730.00		734.34		4.34	0.51	0.0			736.34			
BDW1-L		0.49	21,159				738.25			1.43	0.0			740.25			
BDW3-E		0.22	9,522				721.37			1.04	31.3			723.37			
CENTRAL SUBWATERSHED																	
C1-A		0.15	6,706		923.50		927.97		4.47	1.23	38.6			929.97			
C1-B		0.18	7,691				934.33			0.31	0.0			936.33			
C1-C		0.17	7,422				922.86			2.20	2.6			924.86			
C1-D		0.17	7,588		880.00		887.73		7.73	2.16	15.0			889.73			
C1-E		0.26	11,528		878.20		883.00		4.80	1.44	19.6	882.80		885.00			
C1-F		0.54	23,641				926.39			1.21	14.9			928.39			
C1-G		0.12	5,343				853.45			1.80	27.1			855.45			
C1-H		0.42	18,332				742.54			0.94	89.9			744.54			
C1-J		0.05	2,063				744.48			0.40	3.2			746.48			PRIVATE
C1-K		0.15	6,341				836.55			0.63	32.0			838.55			
C1-L		0.75	32,787				840.60			13.18	19.1			842.60			
C1-M		0.58	25,236				877.77			1.91	5.1			879.77			PRIVATE
C1-N		0.18	7,742				744.85			0.27	12.6			746.85			PRIVATE
C1-O		0.04	1,682	8			871.80			0.00	0.7			873.80			
C2-A		0.55	23,929		844.70		854.77		10.07	6.03	22.2			856.77			
C2-B		0.20	8,628		841.50		845.38		3.88	1.09	28.1			847.38			
C2-C		0.21	9,210				854.77			0.37	17.6			856.77			PRIVATE
C2-D		0.14	6,245				863.50			0.42	35.1			865.50			PRIVATE
C4-A	Gateway Pond	1.03	44,806	18	840.00		858.63		18.63	23.62	17.9	859.00	864.00	860.63	5.37	Low	
C4-B		0.08	3,269				931.00			0.00	0.0			933.00			PRIVATE
C5-A	Crosstown West Park Pond	6.58	286,504	48	865.00		872.58		7.58	74.58	38.4	870.00	878.00	874.58	5.42	Low	RECEIVING WATER
C5-B		0.34	14,939				931.35			0.28	89.7			933.35			
C5-C		0.41	17,953		926.50		931.43		4.93	3.19	18.8			933.43			
C6-A		5.06	220,422		869.80		870.31		0.51	24.87	3.0	870.00	876.00	872.31	5.69	Low	RECEIVING WATER
C6-B		1.40	60,768				877.77			0.52	11.3			879.77			
C6-C		0.13	5,789				891.51			1.09	5.4			893.51			
C7-A		0.42	18,389	6	957.10		961.43		4.33	5.54	1.3	961.00	971.00	963.43	9.57	Low	
C8-A		1.35	58,645	no outlet	965.00		971.34		6.34	8.19	4.6			973.34			
C8-B		0.20	8,924				965.00			0.00	0.0			967.00			NO PIPE DISCHARGE
C9-A		2.21	96,149	15	970.00		979.64		9.64	8.09	11.1	978.00	976.00	981.64	-3.64	High	
C11-A		0.79	34,545	24	1014.20		1016.40		2.20	3.28	19.6	1028.00	1022.00	1018.40	5.60	High	
C11-B		0.07	3,047				1017.97			0.15	0.0			1019.97			
C12-A		1.57	68,195	18	1002.40		1003.25		0.85	13.19	2.5	1017.00	1018.00	1005.25	14.75	High	
C13-A		0.99	43,106	12	989.00		992.51		3.51	4.38	3.5	999.00	1000.00	994.51	7.49	High	
C14-A		4.33	188,403	24	963.00		970.44		7.44	44.10	49.1	974.00	972.00	972.44	1.56	High	RECEIVING WATER
C14-B		0.12	5,391				1012.62			3.56	0.0			1014.62			

Table D-1 Hydrologic Summary Data for the 100-Year Design Storm

Storage Area ID	Water Body Common Name	Surface Area at NWL[1] (Acre)	Surface Area at NWL[1] (Square Feet)	Approx. Outlet Size[1] (inches)	NWL[2]	Ordinary HWL DNR[2] (NGVD 29)	100-Year Event (7.45 in Rainfall Event)					Approximate Overflow Elevation[1]	Approx. Existing Low Building Elevation (LBE)[1]	Low Building Elevation[2]	Freeboard (LBE-HWL) (ft)	Risk of Inundation	Notes[1]
							HWL[2]	BFE from FEMA (NAVD 88)	Bounce (ft)	Storage (acre-ft)	Peak Outflow Rate (cfs)						
C14-C		0.64	27,662				1013.12			6.30	3.0			1015.12			
C15-A		1.44	62,760	12	968.50		974.35		5.85	10.03	0.0	978.00	976.00	976.35	1.65	High	
C16-A		0.85	36,862	36	959.50		961.17		1.67	5.06	0.0	961.00	962.00	963.17	0.83	High	
C16-B		0.34	14,647				963.36			0.86	7.7			965.36			
C16-C		0.06	2,667				961.17			1.34	9.2			963.17			
6934		0.00					968.58			0.22	25.8			970.58			Swale W of The Garage
1234002		0.00					986.84			2.51	0.0			988.84			Low spot N of E 130th, W of Welcome Ln
1234003		0.00					972.12			0.04	0.0			974.12			Low spot N of 134th, E of Walnut Dr
CRYSTAL LAKE SUBWATERSHED																	
CL3-A		0.84	36,768	30	983.10		1,031.88		48.78	2.65	13.0	986.80		1033.88			
CL4-A		6.01	261,651				934.55			3.43	0.0			936.55			NO PIPE DISCHARGE
CL4-B		0.02	670		937.80		951.03		13.23	2.89	59.3			953.03			
CL4-C		0.03	1,292				1,026.66			0.34	11.2			1028.66			
CL4-D		0.24	10,334		1039.00		1,039.33		0.33	0.15	7.3			1041.33			PRIVATE
CL4-E		0.34	14,805		1040.00		1,041.79		1.79	1.98	14.2			1043.79			PRIVATE
CL5-A		0.76	33,251	15	938.00		944.24		6.24	7.22	0.0	944.00	950.00	946.24	5.76	Low	
CL6-A	Crystal Lake	290.46	12,652,561	36	933.40	934.50	931.37	936.10	-2.03	228.54	6.9	938.00	940.00	933.37	8.63	Low	RECEIVING WATER
CL6-B		0.10	4,210		935.00		940.50		5.50	0.63	37.7			942.50			
CL6-C		0.92	39,931		933.40		934.65		1.25	0.71	0.0			936.65			
CL7-A		2.02	87,942				942.77			15.24	18.2			944.77			NON CITY
EAST SUBWATERSHED																	
E1-A	Raleigh Pond	1.37	59,628	36	853.20		859.82		6.62	12.94	138.1	867.00	863.00	861.82	3.18	High	
E1-C		1.47	64,125				724.24			3.77	38.4			726.24			
E1-F		0.18	7,945				894.84			1.83	7.0			896.84			
E1-G		0.17	7,360				884.38			0.69	19.4			886.38			
E2-A		1.53	66,515	18	879.00		893.79		14.79	18.06	5.3	903.00	901.00	895.79	7.21	High	
E2-B		0.28	12,258				895.82			1.35	29.1			897.82			
E2-C		0.03	1,238				897.62			0.89	21.0			899.62			
E3-A	Millpond	3.36	146,234	18	879.00		895.89		16.89	80.00	26.3	903.00	901.00	897.89	5.11	High	
E3-B		0.28	12,270		902.00		906.37		4.37	1.31	6.9	906.00		908.37			
E3-C		0.12	5,099				911.43			0.71	28.4			913.43			
E3-D		0.10	4,474				954.56			0.35	0.0			956.56			NO PIPE DISCHARGE
E3-E		0.32	14,095							0.00							NO APPARENT PIPE DISCHARGE
E3-F		0.99	42,931				900.16			9.23	18.6			902.16			
E3-G		0.13	5,707				922.22			0.77	27.4			924.22			
E3-I		0.05	2,284		933.00		935.75		2.75	0.22	12.5			937.75			PRIVATE
E3-J		0.06	2,459		937.00		938.16		1.16	0.12	5.1			940.16			PRIVATE
E3-N		0.05	2,245				918.98			0.20	40.8			920.98			
E3-O		0.14	6,283		922.50		924.40		1.90	0.51	14.5			926.40			
E4-A		2.92	127,098	24	925.00		931.60		6.60	24.34	22.8	933.00	932.00	933.60	0.40	High	
E4-B		0.47	20,445				939.57			0.90	-7.8			941.57			
E4-C		0.02	985				955.08			0.00	0.0			957.08			PRIVATE
E4-D		0.40	17,209				936.00			0.77	0.0			938.00			
E4-E		0.22	9,774				964.10			0.42	12.5			966.10			
E4-F		0.13	5,625				956.50			2.14	14.5			958.50			
E4-G		0.40	17,209				933.53			0.46	0.0			935.53			
E8-A		0.66	28,648				946.90			3.02	0.0			948.90			
E8-B		0.20	8,788	18	958.00		963.26		5.26	0.89	17.4	968.00	970.00	965.26	6.74	Low	
E9-A		2.45	106,551	18	935.50		938.70		3.20	8.65	-14.2	946.00	948.00	940.70	9.30	Low	
E9-B		0.88	38,449	12	953.00		955.14		2.14	3.98	5.2	962.00	968.00	957.14	12.86	Low	

Table D-1 Hydrologic Summary Data for the 100-Year Design Storm

Storage Area ID	Water Body Common Name	Surface Area at NWL[1] (Acre)	Surface Area at NWL[1] (Square Feet)	Approx. Outlet Size[1] (inches)	NWL[2]	Ordinary HWL DNR[2] (NGVD 29)	100-Year Event (7.45 in Rainfall Event)					Approximate Overflow Elevation[1]	Approx. Existing Low Building Elevation (LBE)[1]	Low Building Elevation[2]	Freeboard (LBE-HWL) (ft)	Risk of Inundation	Notes[1]
							HWL[2]	BFE from FEMA (NAVD 88)	Bounce (ft)	Storage (acre-ft)	Peak Outflow Rate (cfs)						
E10-A		0.85	36,886	15	935.50		936.72		1.22	3.60	-10.9	940.00	942.00	938.72	5.28	Low	
E11-A		0.45	19,751	18	935.50		937.66		2.16	1.13	6.0	940.00	944.00	939.66	6.34	Low	
E12-A		0.50	21,608	21	935.80		938.58		2.78	1.80	-10.2	939.60	942.00	940.58	3.42	Low	
E13-A		1.79	77,827	18	935.20		939.30		4.10	7.84	5.1	938.00	948.00	941.30	8.70	Low	
E14-A		1.18	51,234	21	924.40		931.14		6.74	11.62	-14.6	931.00	932.00	933.14	0.86	High	
E14-B		0.29	12,615							0.00	4.3						
E15-A		2.20	95,700		957.10		955.98		-1.12	2.04	-3.6	962.00	966.00	957.98	10.02	Low	
E15-B		0.11	4,978				978.65			0.11	0.0			980.65			NO PIPE DISCHARGE
E16-A	Utecht Pond	5.56	242,102	18	944.00		945.52		1.52	10.49	5.9	948.00	952.00	947.52	6.48	Low	RECEIVING WATER
E16-B		0.28	12,119				950.52			0.40	1.4			952.52			
E16-C		0.44	18,983				950.49			0.32	1.1			952.49			
E16-D		0.11	4,893				958.72			0.73	0.0			960.72			
E16-E		0.10	4,268				954.13			0.19	0.0			956.13			
E17-A		2.56	111,527	36	935.00		935.09		0.09	12.26	0.0	940.00	940.00	937.09	4.91	High	
E18-A		8.18	356,423	21	936.70		939.86		3.16	36.94	6.3	962.00	944.00	941.86	4.14	High	RECEIVING WATER
E19-A		1.69	73,476	42	938.50		940.81		2.31	7.16	38.3	942.00	946.00	942.81	5.19	Low	
E19-B		0.14	6,011				957.63			0.18	0.0			959.63			
E20-A		0.65	28,506	42	946.00		947.47		1.47	0.55	0.0	949.00		949.47			
E21-A		3.26	141,983	12	933.00		935.20		2.20	8.09	-1.5	935.00	950.00	937.20	14.80	Low	
E22-A	Wind Cave Pond	1.04	45,492	12	935.00		935.97		0.97	2.36	5.8	939.00	936.00	937.97	0.03	High	
E23-A		1.40	60,798		957.10		957.92		0.82	3.46	-4.7	962.00		959.92			NO PIPE DISCHARGE
E23-B		0.31	13,692		957.10		972.09		14.99	0.02	0.0	962.00		974.09			NO PIPE DISCHARGE
E23-C		0.45	19,654		957.10		998.13		41.03	0.29	0.0	962.00		1000.13			NO PIPE DISCHARGE
E23-D		0.31	13,692		957.10		972.04		14.94	0.08	0.0	962.00		974.04			NO PIPE DISCHARGE
E23-E		0.31	13,692		957.10		972.02		14.92	0.33	0.0	962.00		974.02			NO PIPE DISCHARGE
E24-A		0.79	34,471	12	988.00		987.21		-0.79	3.64	-1.2	992.00	1014.00	989.21	26.79	Low	
E24-B		0.04	1,660	12	988.00		987.21		-0.79	0.05	0.0	992.00	1014.00	989.21	26.79	Low	
E25-A		1.41	61,416	no outlet			1,002.25			0.35	38.2			1004.25			NO PIPE DISCHARGE
E25-B		0.28	12,068	no outlet			1,014.04			0.48	0.0			1016.04			NO PIPE DISCHARGE
E25-C		0.06	2,722	no outlet			999.74			0.14	0.0			1001.74			NO PIPE DISCHARGE
E26-A		0.23	9,976				975.76			0.65	0.0			977.76			NO PIPE DISCHARGE
E27-A		0.12	5,335				950.69			1.93	0.0			952.69			NO PIPE DISCHARGE
E28-A		0.96	41,846	12	945.00		947.93		2.93	4.51	4.5	948.00	950.00	949.93	2.07	Low	
E29-A		1.40	61,061	15	935.00		935.50		0.50	3.55	3.0	938.00	942.00	937.50	6.50	Low	
E29-B		0.31	13,699				942.06			2.25	0.0			944.06			
E30-B		0.56	24,412	12	960.00		958.84		-1.16	1.74	3.7	962.00	966.00	960.84	7.16	Low	
E31-A		0.39	17,149	12	969.00		969.64		0.64	1.85	0.0	976.00		971.64			NO PIPE DISCHARGE
E32-A		1.14	49,790	12	971.00		976.18		5.18	0.09	0.0	976.00		978.18			NO PIPE DISCHARGE
E32-B		1.14	49,790	12	971.00		976.15		5.15	0.07	0.0	976.00		978.15			NO PIPE DISCHARGE
E32-C		1.14	49,790	12	971.00		971.75		0.75	1.51	0.0	976.00		973.75			NO PIPE DISCHARGE
E33-A		4.28	186,511	12	989.50		992.08		2.58	13.34	2.6	1002.00	1006.00	994.08	13.92	Low	RECEIVING WATER
E33-B		0.66	28,615				996.86			2.91	0.0			998.86			
E34-A		0.63	27,553	12	992.00		991.43		-0.57	1.88	3.4	996.00	1002.00	993.43	10.57	Low	
E35-A		2.39	103,925	24	943.10		968.37		25.27	39.72	0.0	950.00	952.00	970.37	-16.37	Moderate	
E35-B		0.06	2,721				973.84			0.85	60.1			975.84			
E35-C		0.10	4,484				976.15			0.16	1.0			978.15			
E35-D		0.80	35,026	no outlet			966.19			2.53	0.0			968.19			NO PIPE DISCHARGE
E35-F		3.33	145,245				949.04			15.64	-26.8	950.00		951.04			
E35-G		0.10	4,484				973.92			0.15	67.0			975.92			

Table D-1 Hydrologic Summary Data for the 100-Year Design Storm

Storage Area ID	Water Body Common Name	Surface Area at NWL[1] (Acre)	Surface Area at NWL[1] (Square Feet)	Approx. Outlet Size[1] (inches)	NWL[2]	Ordinary HWL DNR[2] (NGVD 29)	100-Year Event (7.45 in Rainfall Event)					Approximate Overflow Elevation[1]	Approx. Existing Low Building Elevation (LBE)[1]	Low Building Elevation[2]	Freeboard (LBE-HWL) (ft)	Risk of Inundation	Notes[1]
							HWL[2]	BFE from FEMA (NAVD 88)	Bounce (ft)	Storage (acre-ft)	Peak Outflow Rate (cfs)						
KELLER LAKE SUBWATERSHED																	
KL1-A		0.12	5,377	12	1,008.00		1010.68		2.68	0.81	6.0	1014.00	1015.00	1012.68	4.32	High	
KL2-A		0.27	11,887	12	994.00		997.28		3.28	0.67	9.1	1001.00	1006.00	999.28	8.72	Low	
KL2-B		0.29	12,705				997.28			0.67	0.0			999.28			
KL3-A		0.18	8,045	12	1,000.00		1004.42		4.42	1.70	4.3	1008.00	1006.00	1006.42	1.58	High	
KL5-A		0.88	38,421	12	978.70		982.88		4.18	1.15	4.1	981.00	986.00	984.88	3.12	Low	
KL6-B		0.06	2,691		996.00		999.07		3.07	0.15	0.0			1001.07			
KL6-C		0.06	2,554		993.30		998.93		5.63	1.18	31.7			1000.93			
KL7-A		0.36	15,755	12	972.70		971.00		-1.70	0.00	0.0	976.00	988.00	973.00	17.00	Low	
KL8-A		0.01	647	15	979.70		982.49		2.79	0.28	8.9	982.00	983.20	984.49	0.71	High	
KL9-A		1.00	43,753	18	954.00		961.92		7.92	9.51	0.0	963.00	988.00	963.92	26.08	Low	
KL9-B		0.36	15,467		988.10		987.98		-0.12	0.29	36.6			989.98			
KL9-C		0.33	14,503		984.80		987.97		3.17	0.77	26.4			989.97			
KL9-D		0.55	23,888		986.40		987.97		1.57	0.74	28.6			989.97			
KL10-A		0.67	29,221	30	972.00		979.72		7.72	7.32	57.5	980.00	976.00	981.72	-3.72	High	
KL10-B		0.16	6,760				984.10			0.47	0.0			986.10			
KL11-A		1.53	66,773	42	944.50		951.63		7.13	9.48	117.3	952.00	951.00	953.63	-0.63	High	
KL11-B	Paha Sapa Park Pond	0.46	20,101		966.30		974.46		8.16	2.53	5.2			976.46			
KL13-A	Keller Lake	55.90	2,435,075	72	934.30	934.50	936.34	936.10	2.04	159.11	37.0	940.00	939.00	938.34	2.66	High	RECEIVING WATER
LAKE ALIMAGNET SUBWATERSHED																	
LA1-A		0.63	27,425		1,015.00		1,016.58		1.58	0.47	43.5			1018.58			
LA2-A		3.31	144,191				966.16			35.10	8.8			968.16			
LA2-B		0.09	3,784				967.53			0.22	7.8			969.53			PRIVATE
LA2-C		0.18	7,741				966.57			0.21	23.6			968.57			PRIVATE
LA3-A		4.01	174,841	18	958.00		966.40		8.40	40.62	35.6	960.00	972.00	968.40	5.60	Low	
LA3-B		2.47	107,794				1,025.11			7.64	0.0			1027.11			NON CITY
LA3-C		1.04	45,261				1,030.24			4.24	73.1			1032.24			
LA3-D		0.39	17,185				1,051.09			0.93	16.9			1053.09			
LA3-E		0.27	11,844				1,053.89			0.27	0.0			1055.89			PRIVATE
LA3-F		0.02	1,022				1,037.84			0.05	7.6			1039.84			
LA3-H		0.06	2,543		1,042.50		1,042.90		0.40	1.46	0.2			1044.90			PRIVATE
LA3-I		0.30	12,881		957.00		967.22		10.22	2.84	108.2			969.22			
LA3-J		0.07	2,979				1,065.08			0.07	0.0			1067.08			
LA3-Q		0.11	4,647		1,047.40		No data			0.00	No data						PRIVATE, No available stage storage
LA3-R		0.11	4,633		1,045.50		1,040.90		-4.60	0.00	3.1			1042.90			
LA3-S		0.12	5,430		1,047.00		1,048.45		1.45	0.02	3.3			1050.45			
LA3-T		0.20	8,592		1,046.50		1,044.71		-1.79	0.01	7.4			1046.71			
LA3-U		0.08	3,422		1,047.50		1,049.96		2.46	0.05	4.1			1051.96			
LA3-V		0.04	1,959		1,047.00		1,049.43		2.42	0.10	3.2			1051.43			
LA3-W		0.02	956		1,047.45		1,048.82		1.37	0.09	15.3			1050.82			
LA3-X		0.03	1,099		1,048.00		1,046.79		-1.21	0.09	21.1			1048.79			
LA4-A	Lake Alimagnet	107.99	4,704,097	30	954.50	954.80	955.19	959.10	0.69	161.37	0.0	958.00	968.00	957.19	12.81	Low	RECEIVING WATER
LA4-B		2.53	110,214				993.49			5.99	0.0			995.49			
LA4-C		2.82	122,681				1,003.89			2.41	0.0			1005.89			RECEIVING WATER
LA4-D		0.58	25,190				1,002.57			1.40	0.0			1004.57			
LA4-E		0.28	12,142				981.02			0.30	0.0			983.02			
LA4-F		1.03	44,730				1,008.21			0.48	0.0			1010.21			RECEIVING WATER
LA4-G		0.93	40,557				1,005.87			1.70	0.0			1007.87			
LA5-A		0.33	14,583	12	1,006.00		1,011.70		5.70	1.23	0.0	1015.00		1013.70			

Table D-1 Hydrologic Summary Data for the 100-Year Design Storm

Storage Area ID	Water Body Common Name	Surface Area at NWL[1] (Acre)	Surface Area at NWL[1] (Square Feet)	Approx. Outlet Size[1] (inches)	NWL[2]	Ordinary HWL DNR[2] (NGVD 29)	100-Year Event (7.45 in Rainfall Event)					Approximate Overflow Elevation[1]	Approx. Existing Low Building Elevation (LBE)[1]	Low Building Elevation[2]	Freeboard (LBE-HWL) (ft)	Risk of Inundation	Notes[1]
							HWL[2]	BFE from FEMA (NAVD 88)	Bounce (ft)	Storage (acre-ft)	Peak Outflow Rate (cfs)						
LA6-A		1.50	65,160	15	1,010.00		1,011.14		1.14	3.48	0.4	1018.00		1013.14			
LA7-A		0.02	987	12	979.90		1,010.58		30.68	0.63	0.0	981.00		1012.58			
SP8-B		0.34	14,707	24	1,036.00		1,038.17		2.17	0.79	47.1			1040.17			
SP8-C		0.28	12,392	36	1,040.00		1,039.00		-1.00	0.09	36.3			1041.00			
LAC LAVON SUBWATERSHED																	
LL1-A	Lac Lavon	67.57	2,943,328	no outlet						0.00		948.00					
MURPHY HANREHAN SUBWATERSHED																	
MH1-A		0.10	4,499				855.75			0.36	0.0			857.75			
MH1-B		0.09	4,114		891.00		893.84		2.84	0.13	7.3			895.84			PRIVATE
MH2-A		0.17	7,456				863.86			0.25	22.0			865.86			
MH2-B		0.26	11,530				857.37			0.33	68.2			859.37			
MH3-A		2.57	111,964	CHANNEL	858.00		863.85		5.85	90.21	78.3		867.00	865.85	3.15	Moderate	
MH3-C		0.40	17,639				905.17			0.30	0.0			907.17			
MH3-D		0.05	2,391				906.00			0.00	0.0			908.00			
MH3-E		0.28	12,294				924.54			1.13	13.0			926.54			
MH3-F		0.22	9,487		911.40		914.54		3.14	0.65	19.9	913.50		916.54			
MH3-G		0.00	200				903.09			0.00	3.9			905.09			
MH3-H		0.32	13,880				924.56			1.50	0.0			926.56			
MH4-A		3.17	137,879				882.98			2.17	0.0			884.98			NO PIPE DISCHARGE
MH7-A		1.69	73,473				1001.43			2.93	0.0			1003.43			
MH7-B		0.16	6,926				1046.88			1.25	0.0			1048.88			
MH8-A		1.12	48,809				1035.34			2.58	0.0			1037.34			
MH8-B		0.36	15,750				1022.10			0.68	0.0			1024.10			NO PIPE DISCHARGE
MH8-C		0.14	6,119				1051.18			1.06	0.0			1053.18			
MH8-D		0.05	2,005				1039.97			3.69	0.0			1041.97			
MH9-A		1.31	57,154	12	940.00		943.13		3.13	7.57	0.0	946.00	950.00	945.13	6.87	Low	
MH9-B		0.23	10,068		944.00		948.38		4.38	1.17	11.5			950.38			
MH10-A		0.43	18,925	30	940.00		945.85		5.85	12.06	0.0	950.00	958.00	947.85	12.15	Low	
MH11-A		0.34	14,697	42	943.50		956.46		12.96	2.70	116.2	945.00	980.00	958.46	23.55	Low	
MH11-B		0.02	975				1007.18			0.18	7.7			1009.18			
MH13-A		0.24	10,626				992.53			5.11	0.0			994.53			
MH13-B		0.17	7,422				981.75			0.26	0.0			983.75			
MH13-C		0.21	9,302				981.41			0.12	0.0			983.41			
MH13-D		0.21	9,302				985.36			0.64	0.6			987.36			
MH14-A	Orchard Gardens Park Pond	0.62	26,918	12	981.00		1007.00		26.00	6.69	4.7	1004.00	1024.00	1009.00	17.00	Low	
MH14-B		0.01	614				1050.16			0.01	0.0			1052.16			NO PIPE DISCHARGE
MH14-C		0.07	3,127				1010.03			0.85	-6.5			1012.03			
MH15-A	Horseshoe Lake	6.13	267,056				988.13			6.98	0.0			990.13			RECEIVING WATER
MH15-B	Horseshoe Lake	5.31	231,304				987.86			4.66	0.0			989.86			RECEIVING WATER
8000008		0.00					1041.10			2.98	0.0			1043.10			S of Loop Road S
NORTHWEST SUBWATERSHED																	
NW10-A		1.53	66,440				693.38			0.62	41.7			695.38			PRIVATE
NW10-B		3.04	132,454	No Data			691.97			15.10	0.0			693.97			PRIVATE
NW10-C		1.53	66,440		733.00		697.97		-35.03	3.85	0.0			699.97			PRIVATE
NW10-D		1.53	66,440		715.00		698.15		-16.85	0.26	0.0			700.15			PRIVATE
NW11-A		0.29	12,652	No Data	723.00		716.64		-6.36	1.18	77.7			718.64			PRIVATE
NW14-A		0.23	10,020	12	729.00		736.45		7.45	0.74	2.4	736.90		738.45			
NW14-B		1.32	57,386				717.27			3.84	11.0			719.27			PRIVATE

Table D-1 Hydrologic Summary Data for the 100-Year Design Storm

Storage Area ID	Water Body Common Name	Surface Area at NWL[1] (Acre)	Surface Area at NWL[1] (Square Feet)	Approx. Outlet Size[1] (inches)	NWL[2]	Ordinary HWL DNR[2] (NGVD 29)	100-Year Event (7.45 in Rainfall Event)					Approximate Overflow Elevation[1]	Approx. Existing Low Building Elevation (LBE)[1]	Low Building Elevation[2]	Freeboard (LBE-HWL) (ft)	Risk of Inundation	Notes[1]
							HWL[2]	BFE from FEMA (NAVD 88)	Bounce (ft)	Storage (acre-ft)	Peak Outflow Rate (cfs)						
NW14-C		0.29	12,524				732.51			3.98	8.5			734.51			PRIVATE
NW14-D		0.08	3,476				729.30			0.07	7.8			731.30			
NW15-B		0.03	1,329		737.50		733.50		-4	0.00	193.6			735.50			
NW15-C		0.12	5,337		720.00		746.17		26	0.48	4.1			748.17			PRIVATE
NW15-D		0.72	31,452		820.00		720.98		-99	5.11	7.3			722.98			PRIVATE
NW15-E		0.18	7,786				740.75			0.66	4.9	744.50		742.75			PRIVATE
NW15-F		0.48	20,723		940.00		724.23		-215.77	1.72	3.7			726.23			PRIVATE
NW15-G		0.06	2,540				826.22			0.73	10.0			828.22			
NW15-H		2.90	126,400				729.91			17.23	106.7			731.91			
NW16-A		0.43	18,655	No Data			719.35			4.09	187.3			721.35			
NW17-A		0.84	36,551	No Data			716.66			5.05	190.3			718.66			
NW19-A		1.58	69,032				748.56			18.61	0.0			750.56			
NW20-A		0.87	38,003				748.56			9.57	42.1			750.56			
NW21-A		29.70	1,293,582				733.71			29.91	5.4			735.71			
RIVERHILLS SUBWATERSHED																	
RH1-A		0.29	12,609	18	797.60		801.90		4.30	0.21	10.4	801.50	808.00	803.90	6.10	Low	
RH3-A		0.30	12,999	12	748.00		755.04		7.04	4.43	8.2	763.00	764.00	757.04	8.96	High	
RH3-B		0.06	2,596	12	797.00		805.01		8.01	0.47	9.4	805.00	809.00	807.01	3.99	Low	
RH9-A	Lake Park Pond	2.66	116,080	12	873.00		878.48		5.48	18.81	35.3	877.00	880.00	880.48	1.52	Moderate	
RH9-D	Lake Park Pond	0.67	29,109	12	873.00		878.44		5.44	6.65	35.2	877.00	880.00	880.44	1.56	Moderate	
RH10-A		0.32	14,119							0.00							NO PIPE DISCHARGE
RH10-B		0.04	1,935	18	892.00		898.27		6.27	11.34	7.5	901.00	902.00	900.27	3.73	High	
RH10-C		0.08	3,564				961.46			0.22	5.6			963.46			
RH10-D		0.06	2,802				971.85			0.17	5.7			973.85			
SUNSET POND SUBWATERSHED																	
SP1-A	Sunset Pond	48.42	2,109,337	48	851.00	850.00*	850.28		-0.72	128.80	143.1	860.00	860.00	852.28	9.72	High	
SP1-B		0.21	9,054				896.73			3.33	15.4			898.73			
SP1-C		0.21	9,142				899.49			0.12	0.0			901.49			PRIVATE
SP1-D		0.04	1,829				913.07			0.05	8.1			915.07			
SP1-E		0.05	2,291				911.38			0.02	3.2			913.38			PRIVATE
SP1-F		0.06	2,770		912.00		915.19		3.2	1.05	5.5			917.19			PRIVATE
SP1-G		0.68	29,808		899.00		897.36		-1.6	0.60	52.1			899.36			PRIVATE
SP1-H		0.10	4,376		960.00		862.83		-97.2	0.33	0.8			864.83			PRIVATE
SP1-I		0.51	22,072		874.00		877.45		3.4	1.92	8.0			879.45			
SP1-J		0.03	1,259				910.13			0.02	15.9			912.13			
SP5-A	Judicial Pond	6.80	296,375	48	893.00		901.85		8.85	41.42	66.6	900.00	920.00	903.85	18.16	Low	RECEIVING WATER
SP5-B		0.63	27,383				908.87			7.36	46.4			910.87			
SP5-C		0.05	2,174				908.73			0.42	34.0			910.73			
SP5-D		0.14	6,196				909.33			0.01	0.0			911.33			PRIVATE
SP5-E		0.32	13,869				915.78			1.50	72.3			917.78			PRIVATE
SP5-G		0.04	1,685				940.18			0.09	12.7			942.18			
SP5-H		0.03	1,207				1006.11			0.00	0.4			1008.11			
SP5-I		0.02	1,013				1007.57			0.01	0.0			1009.57			
SP5-J		0.04	1,567				1018.01			0.02	0.0			1020.01			
SP6-A	Earley Lake	28.16	1,226,718	36	905.00	906.70	912.36	912.00	7.4	262.62	75.0	916.00	914.00	914.36	1.64	High	RECEIVING WATER
SP6-AD		0.12	5,380		926.00		926.24		0.2	0.06	21.1			928.24			
SP6-AE		0.08	3,421				921.52			0.00	6.7			923.52			
SP6-AF		0.04	1,760		902.50		904.06		1.56	0.02	0.0			906.06			
SP6-AG		0.16	6,818				942.29			0.06	15.1			944.29			

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Storage Area ID	Water Body Common Name	Surface Area at NWL[1] (Acre)	Surface Area at NWL[1] (Square Feet)	Approx. Outlet Size[1] (inches)	NWL[2]	Ordinary HWL DNR[2] (NGVD 29)	100-Year Event (7.45 in Rainfall Event)					Approximate Overflow Elevation[1]	Approx. Existing Low Building Elevation (LBE)[1]	Low Building Elevation[2]	Freeboard (LBE-HWL) (ft)	Risk of Inundation	Notes[1]
							HWL[2]	BFE from FEMA (NAVD 88)	Bounce (ft)	Storage (acre-ft)	Peak Outflow Rate (cfs)						
SP6-AH	Toyota Regional Pond	0.83	36,343				928.67			1.90	27.9			930.67			
SP6-AJ		0.05	2,141		938.00		940.25		2.25	0.07	27.8			942.25			
SP6-AL		0.09	3,913				998.35			0.14	0.0			1000.35			
SP6-AM		0.19	8,369		965.00		964.40		-0.60	0.28	24.3			966.40			
SP6-B		0.30	13,048		911.00		915.44		4.44	1.17	9.6			917.44			
SP6-C		0.14	5,970				919.81			0.24	36.5			921.81			
SP6-D		0.15	6,400		918.00		913.54		-4.46	0.28	78.2	924.80		915.54			
SP6-E	Summit Shores Pond	0.37	16,090				912.36			1.22	42.3			914.36			
SP6-F		0.33	14,177				991.63			0.01	2.7			993.63			PRIVATE
SP6-G		0.26	11,468				954.37			1.14	103.0			956.37			
SP6-H		0.29	12,773				958.28			0.26	23.5			960.28			PRIVATE
SP6-I		0.14	5,944				972.20			0.15	0.0			974.20			PRIVATE
SP6-J		0.07	3,103				958.42			0.37	106.9			960.42			PRIVATE
SP6-L		0.35	15,042				916.55			0.63	35.7			918.55			
SP6-M		0.05	2,293				1003.79			0.26	9.6			1005.79			PRIVATE
SP6-N		0.05	2,100				1002.37			0.39	13.5			1004.37			PRIVATE
SP6-O		0.04	1,717				1009.86			0.82	17.2			1011.86			PRIVATE
SP6-P		0.09	4,109		1064.00		1065.07		1.07	0.04	0.0			1067.07			PRIVATE
SP6-Q		0.13	5,775		1004.00		1009.07		5.07	0.39	5.9			1011.07			PRIVATE
SP6-R		0.10	4,185		966.00		969.34		3.34	0.31	24.1			971.34			PRIVATE
SP6-S		0.10	4,464		1035.00		1034.73		-0.27	1.25	0.7			1036.73			PRIVATE
SP6-T		0.05	2,108		1027.00		1025.34		-1.66	0.01	9.0			1027.34			PRIVATE
SP6-U		0.06	2,635		1018.00		1020.76		2.76	0.34	10.3			1022.76			PRIVATE
SP6-V		0.82	35,540		922.50		927.10		4.60	1.82	53.4	927.00		929.10			
SP6-W		0.20	8,839		996.00		998.33		2.33	0.61	0.0			1000.33			PRIVATE
SP6-X		0.08	3,630	12	993.00		998.25		5.25	0.23	5.3			1000.25			PRIVATE
SP6-Y		0.11	4,826		920.50		922.11		1.61	0.65	13.2			924.11			
SP6-Z		0.02	1,061				1004.43			0.43	10.0			1006.43			
SP7-A		0.12	5,294				1044.35			0.09	9.0			1046.35			PRIVATE
SP7-C		0.18	7,790				1006.16			0.25	18.5			1008.16			PRIVATE
SP8-A	Wood Park Pond	13.55	590,445	18	1001.00	998.80	1000.02		-0.98	32.35	0.0	1012.00	1010.00	1002.02	9.98	High	RECEIVING WATER
SP8-D		0.27	11,881		1018.90		1021.58		2.68	0.75	10.3			1023.58			
SP9-A		0.70	30,641	12	1009.00		1016.60		7.60	8.98	5.6	1011.00	1018.00	1018.60	1.40	Moderate	
SP9-B		0.14	6,209	18	1043.00		1046.17		3.17	0.03	11.0			1048.17			
SP9-C		0.08	3,678	12	1052.00		1053.05		1.05	0.24	4.8			1055.05			
SP10-A	North Twin Lake	5.67	247,077	36	914.50		922.36	923.90	7.86	33.17	29.3	926.00	930.00	924.36	7.64	Low	RECEIVING WATER
SP10-B		1.44	62,570				929.65			19.99	63.6			931.65			
SP11-A	South Twin Lake	10.47	456,125	36	914.50		921.42	923.60	6.92	49.81	37.2	926.00	926.00	923.42	4.58	High	RECEIVING WATER
SP12-A		0.24	10,342	27	932.70		936.91		4.21	1.82	39.4	936.00	946.00	938.91	9.09	Low	
4535SP		0.00					888.82			0.13	12.7			890.82			Pond at Cross Fit South Metro
WEST SUBWATERSHED																	
W1-A		0.20	8,529		792.00		793.36		1.36	0.41	3.6			795.36			PRIVATE
W1-B		0.06	2,703		785.50		788.13		2.63	0.03	5.3			790.13			PRIVATE
W2-A		1.53	66,859	36	867.70		871.36		3.66	7.00	78.1	877.00	878.00	873.36	6.64	High	
W3-A	Cherokee Pond	2.17	94,725	21	882.00		891.62		9.62	21.95	9.5	890.00	891.00	893.62	-0.62	High	
W4-A	Neill Pond	4.95	215,634	21	882.00		893.34		11.34	64.34	19.0	890.00		895.34			RECEIVING WATER
W4-B		0.09	3,836		886.00		893.16		7.16	0.01	0.8			895.16			

Table D-1 Hydrologic Summary Data for the 100-Year Design Storm

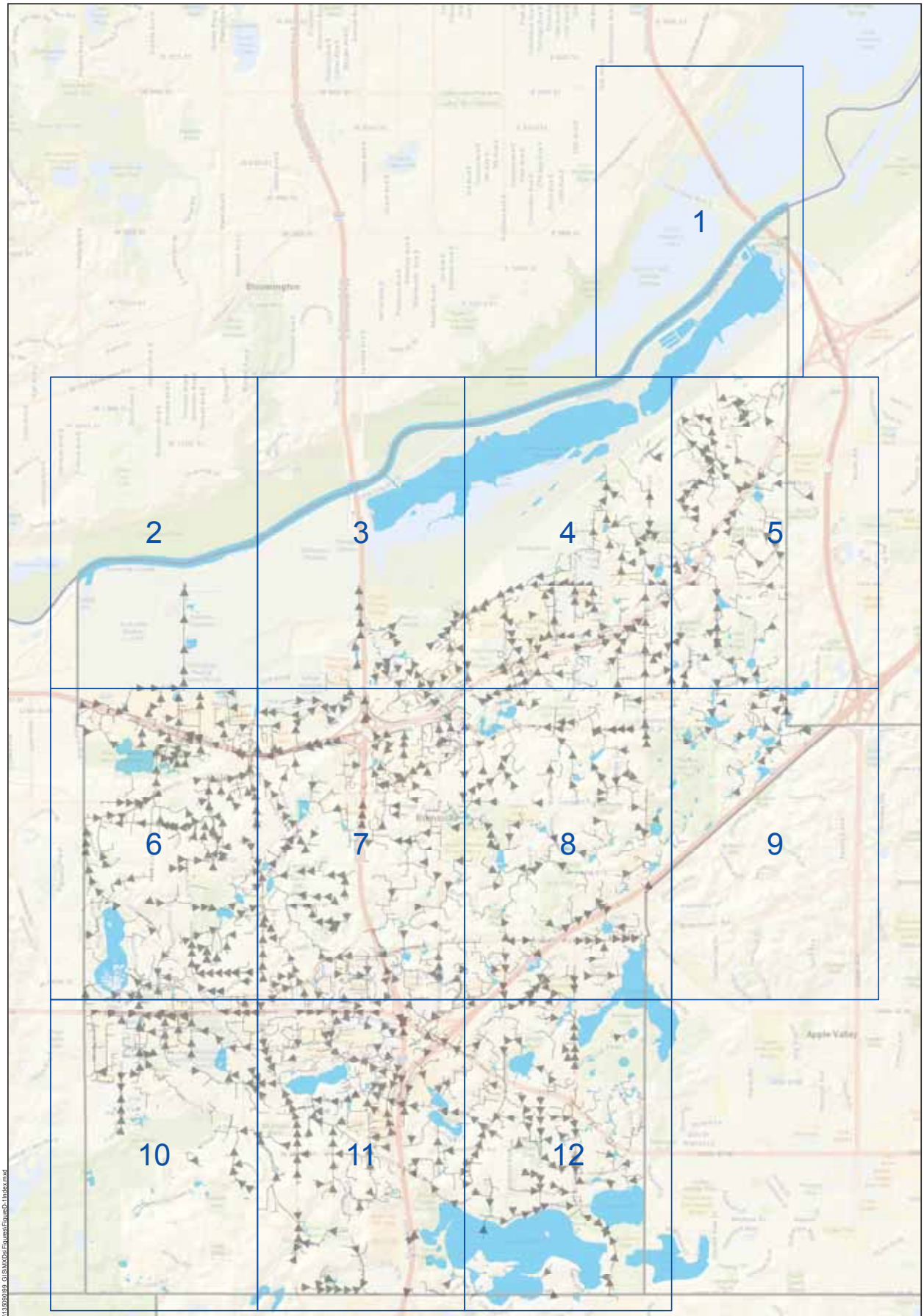
Storage Area ID	Water Body Common Name	Surface Area at NWL[1] (Acre)	Surface Area at NWL[1] (Square Feet)	Approx. Outlet Size[1] (inches)	NWL[2]	Ordinary HWL DNR[2] (NGVD 29)	100-Year Event (7.45 in Rainfall Event)					Approximate Overflow Elevation[1]	Approx. Existing Low Building Elevation (LBE)[1]	Low Building Elevation[2]	Freeboard (LBE-HWL) (ft)	Risk of Inundation	Notes[1]
							HWL[2]	BFE from FEMA (NAVD 88)	Bounce (ft)	Storage (acre-ft)	Peak Outflow Rate (cfs)						
W4-C		0.13	5,512		886.00		893.16		7.16	0.36	10.0			895.16			
W5-A	Vista View Park Pond	4.78	208,268				850.89			28.26	0.0			852.89			
W5-B		1.16	50,566	12	887.88		896.15		8.27	11.96	5.0			898.15			
W5-C		2.58	112,472	60	845.30		876.25		30.95	49.22	0.0	855.00	854.00	878.25	-22.25	High	
W5-D		0.20	8,587		1006.40		1010.89		4.49	1.40	5.6			1012.89			PRIVATE
W5-E		0.10	4,153				1014.14			0.13	4.2			1016.14			PRIVATE
W5-F		0.04	1,783				1013.25			0.05	0.0			1015.25			PRIVATE
W5-H		0.11	4,907				1009.95			0.21	10.0			1011.95			
W6-B		0.02	947				1010.34			0.04	10.6			1012.34			
W6-C		0.32	14,041		980.00		983.89		3.89	1.52	19.3			985.89			
W7-A	Krestwood Park Pond	0.69	29,995	12	979.50		985.21		5.71	6.21	-4.5	986.00	990.00	987.21	4.79	Low	
W8-A		0.40	17,548	30"" force main	945.60		959.15		13.55	14.47	-64.1	954.00	958.00	961.15	-1.15	Moderate	
W8-B		0.54	23,709	30"" force main	940.00		960.59		20.59	20.06	0.0	954.00	960.00	962.59	-0.59	Moderate	
W8-C		0.69	29,929				1001.42			0.57	0.0			1003.42			
W9-A		2.03	88,371	30	948.00		963.80		15.80	27.09	-0.6	976.00	990.00	965.80	26.20	Low	
W10-A		0.77	33,641	21	969.00		983.37		14.37	29.68	27.1	978.00	996.00	985.37	12.63	Low	
W10-B		0.08	3,540		1007.00		1007.08		0.08	0.09	13.8			1009.08			PRIVATE
W11-A		0.48	20,740	30	1009.20		1012.56		3.36	1.28	40.9	1012.00		1014.56			
W12-A		0.54	23,404	18	1035.00		1040.65		5.65	1.04	13.5	1042.00	1051.00	1042.65	10.35	Low	
W13-A		0.34	14,665	24	1017.00		1021.42		4.42	1.77	37.5	1023.00	1046.00	1023.42	24.58	Low	
W13-B		0.04	1,682		1036.75		1037.18		0.43	0.05	0.0			1039.18			

[1]Data obtained from City GIS data.

[2]All elevation data in City GIS is noted as NAVD 88 datum. OHWL from DNR is in NGVD 29 datum. Users should recognize that low building elevations may have been taken from as-builts in other datums and should be verified for site specific analyses.

The data in Table D-1 included ponds in the City inventory that had complete storm sewer data. Ponds in the inventory that do not appear in the table were any of the following:

- Underground Systems
- Infiltration/Filtration Systems



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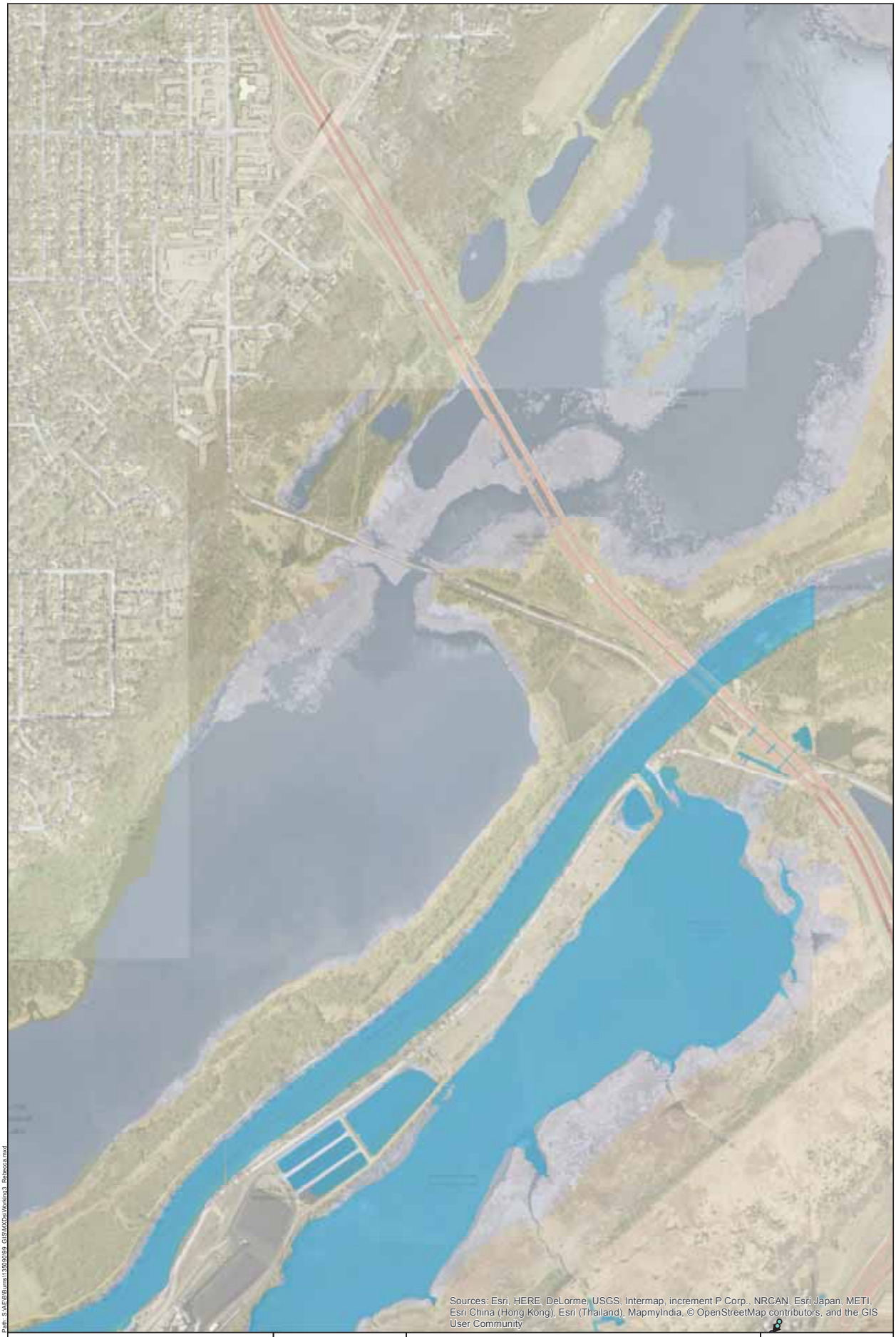
Source:

DRAINAGE SYSTEM INDEX MAP

WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure
D-1.I



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WATER RESOURCES MANAGEMENT PLAN
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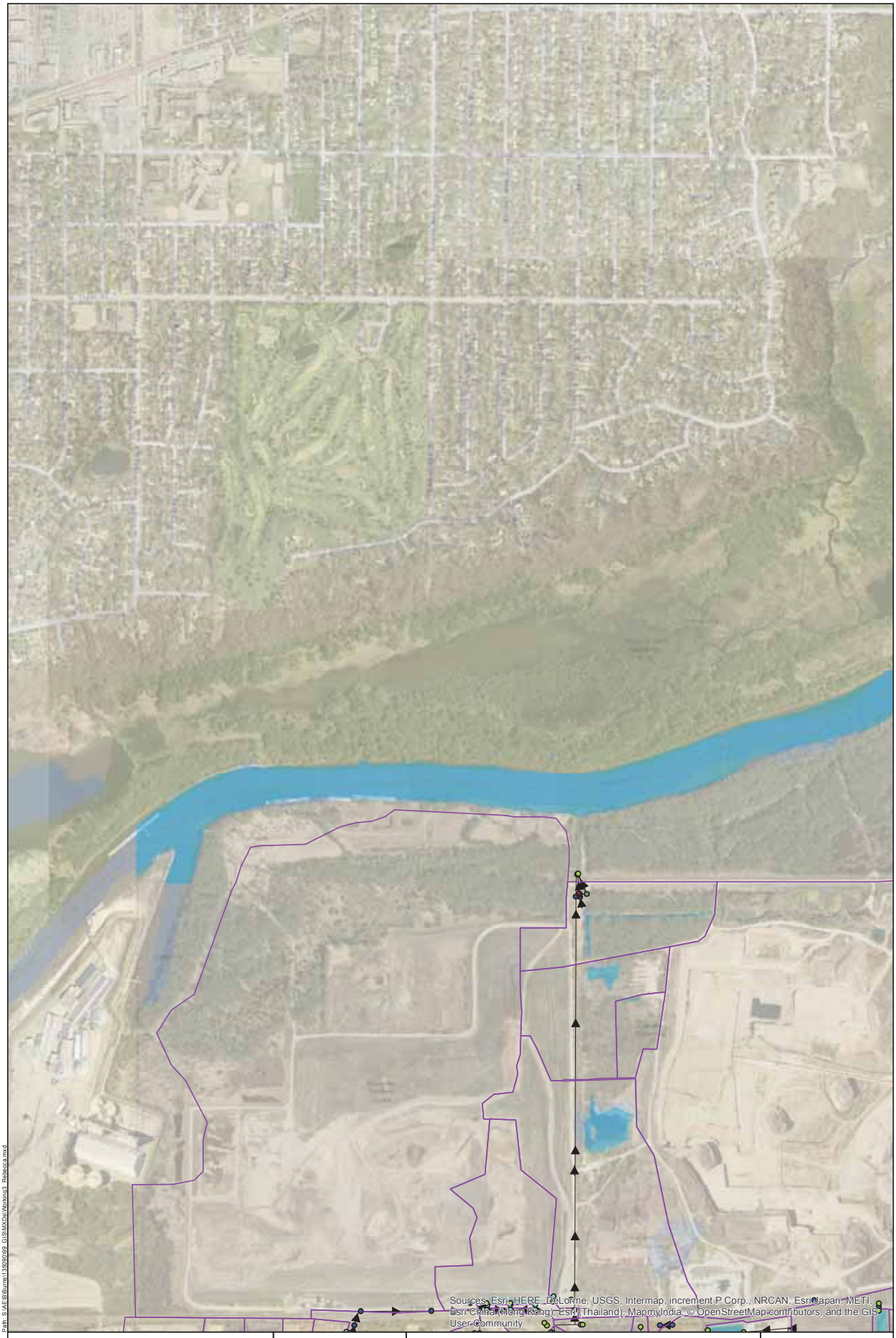
Figure
D-1.1



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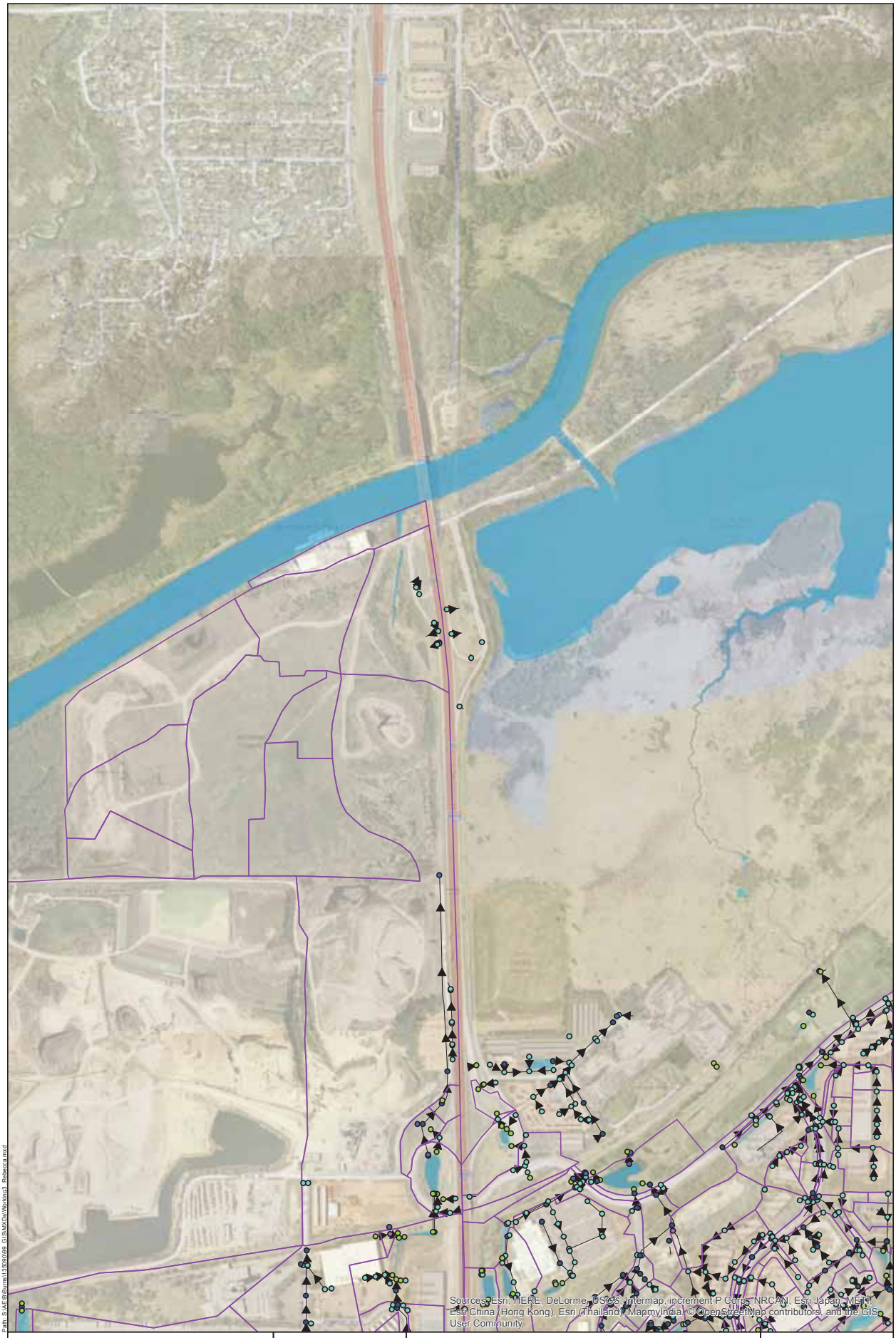
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure
D-1.2



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WATER RESOURCES MANAGEMENT PLAN
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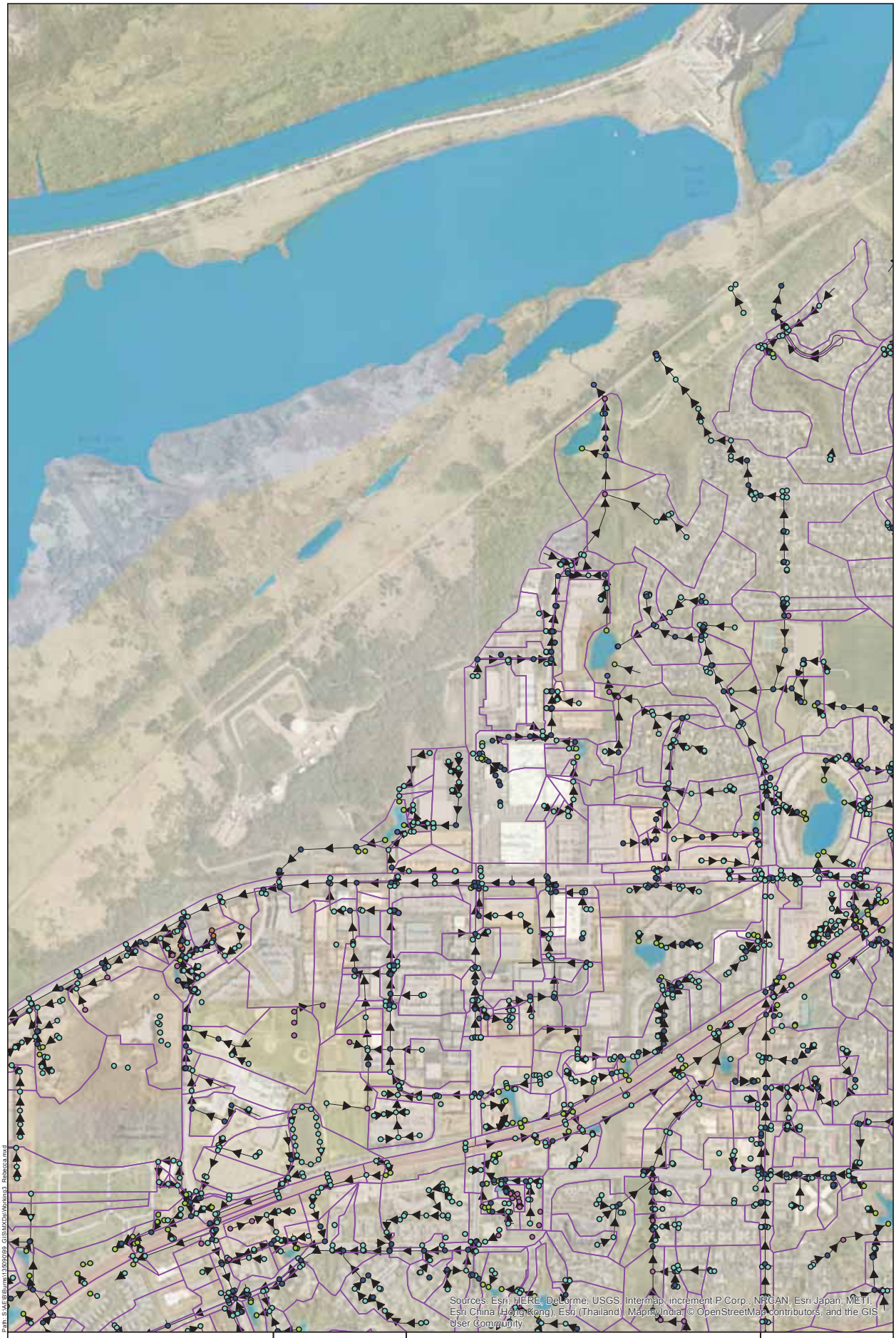
Figure
D-1.3



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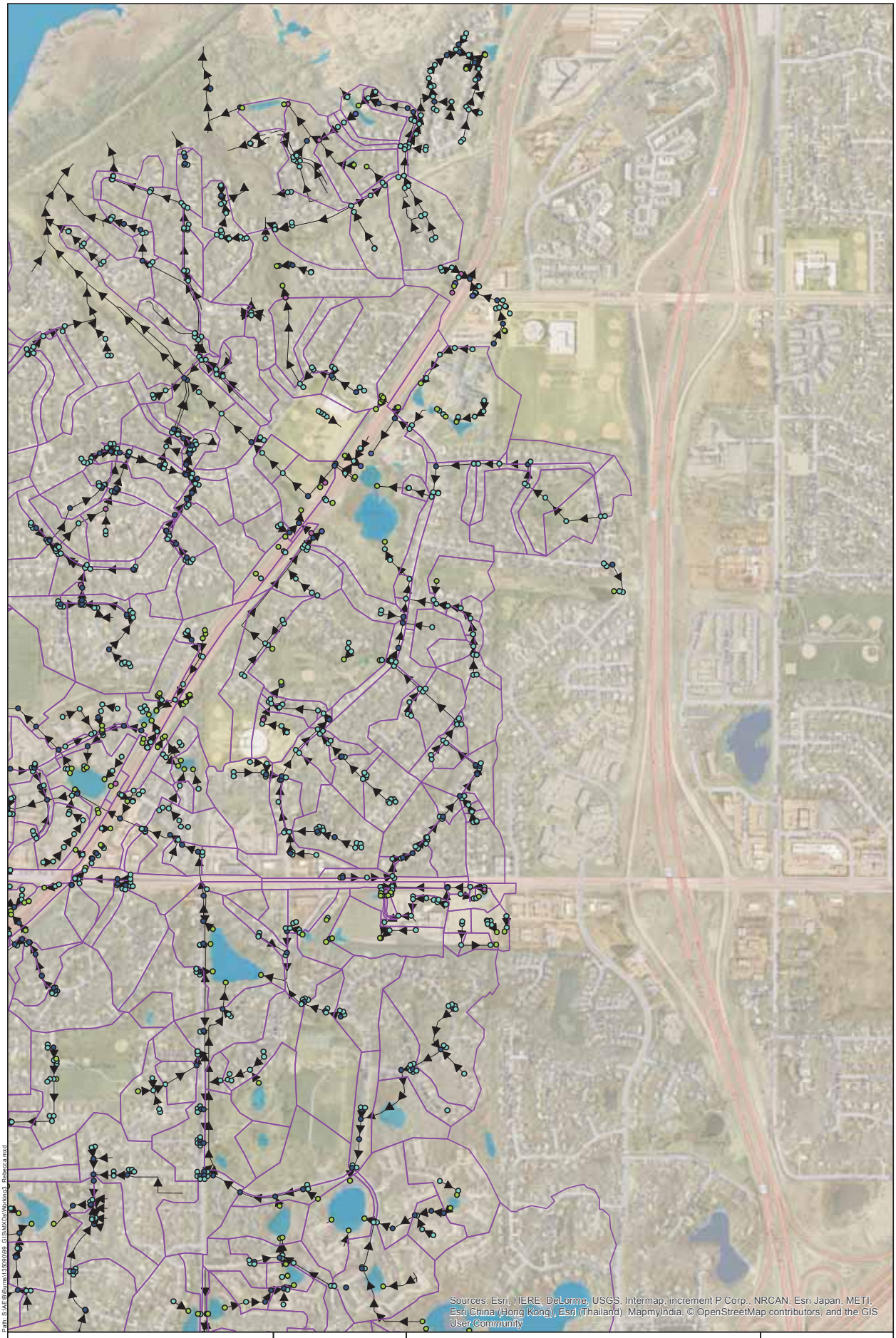
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure
D-1.4



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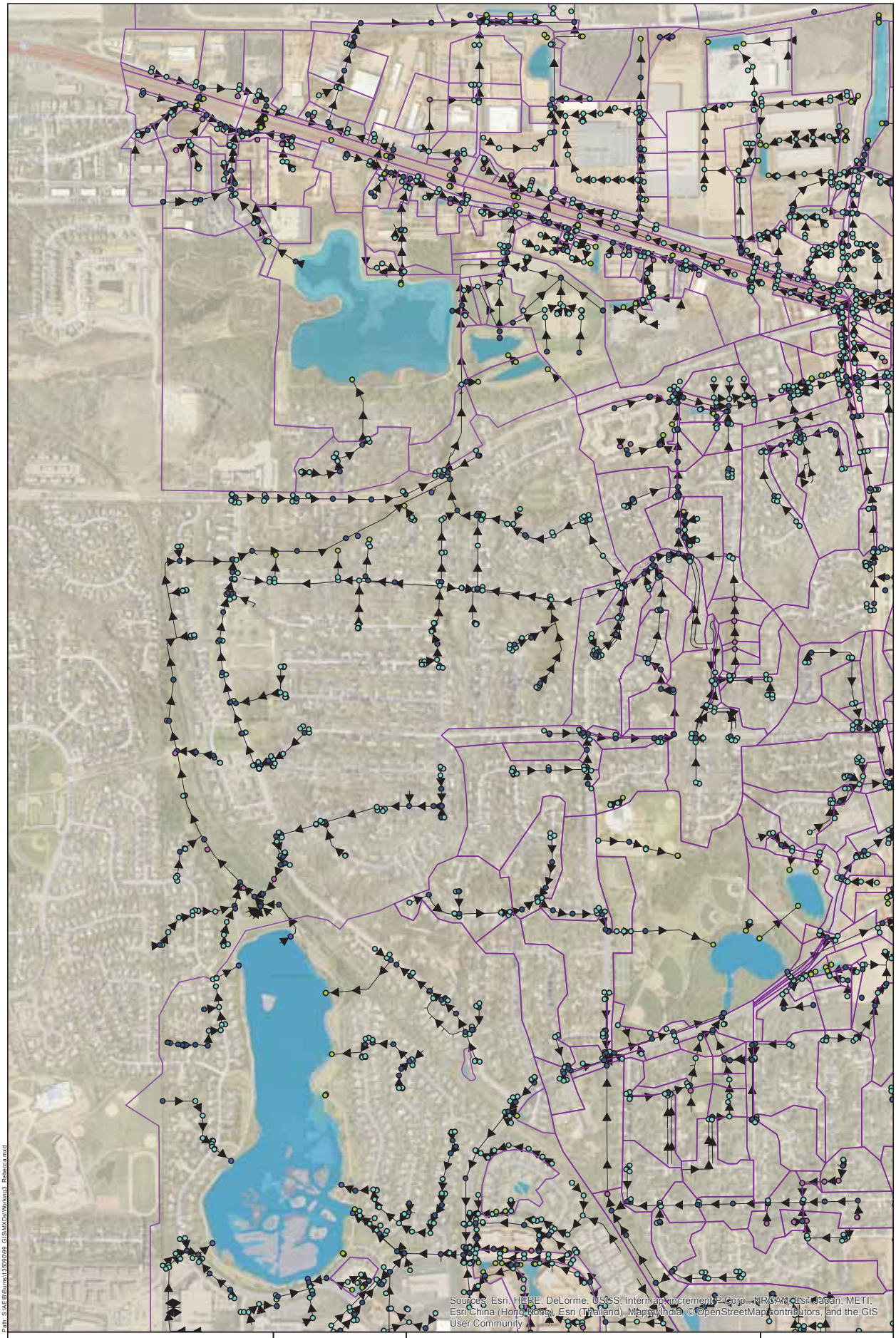
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure
D-1.5



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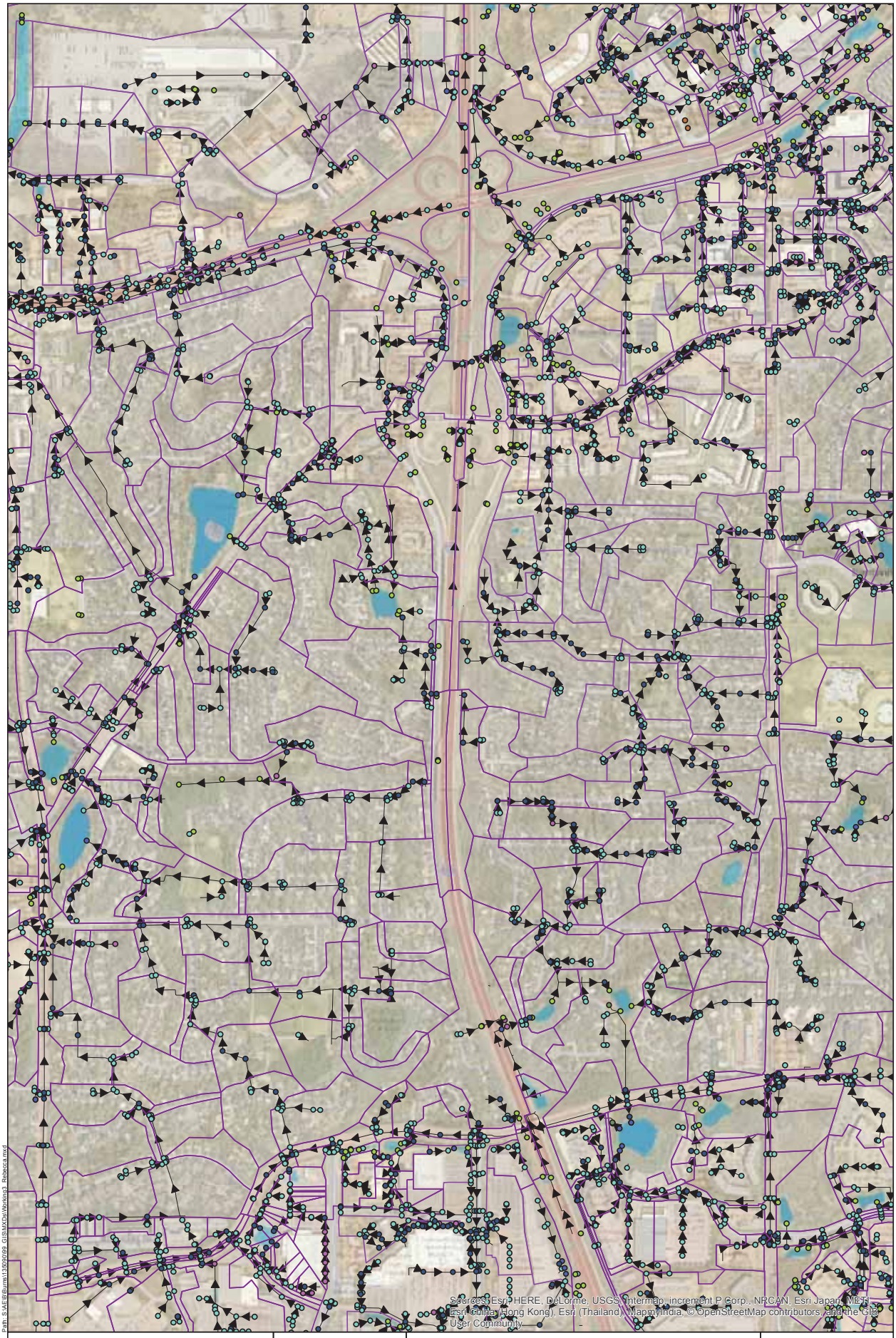
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure
D-1.6



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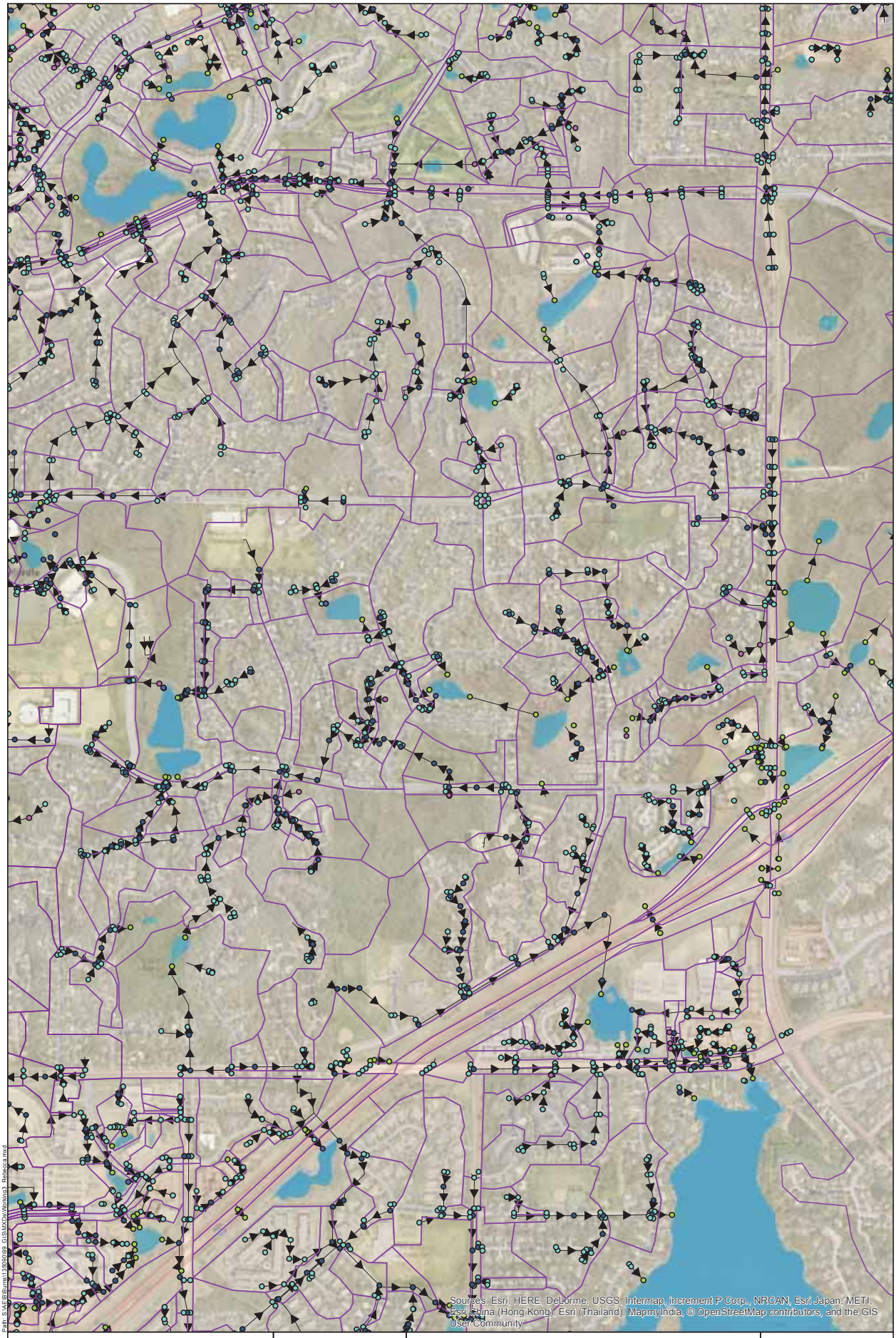
WATER RESOURCES MANAGEMENT PLAN
Burnsville, Minnesota

Figure
D-1.7



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WATER RESOURCES MANAGEMENT PLAN
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Figure
D-1.8

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Burnsville, Minnesota

Figure
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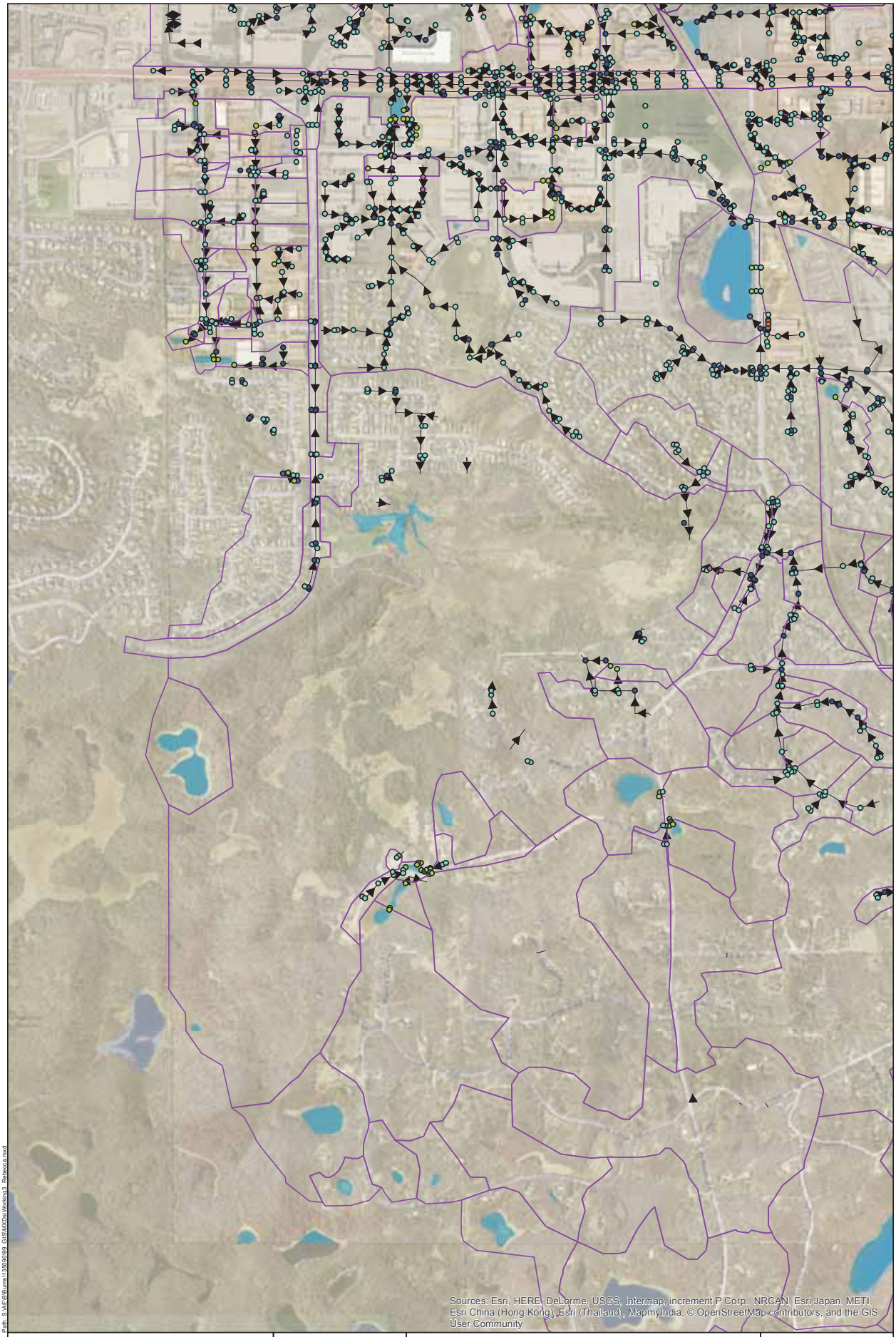

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Figure
D-1.10

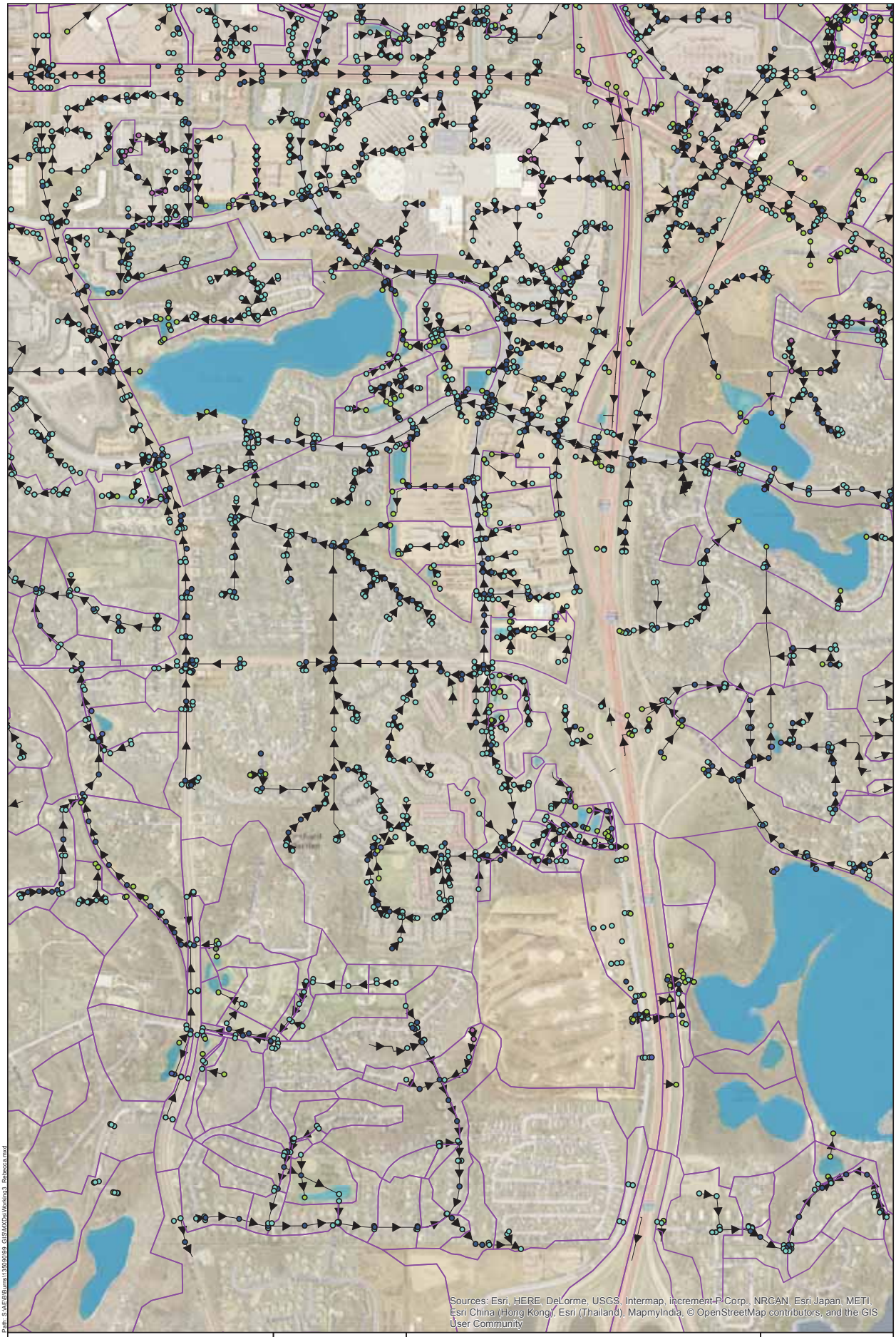

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Figure
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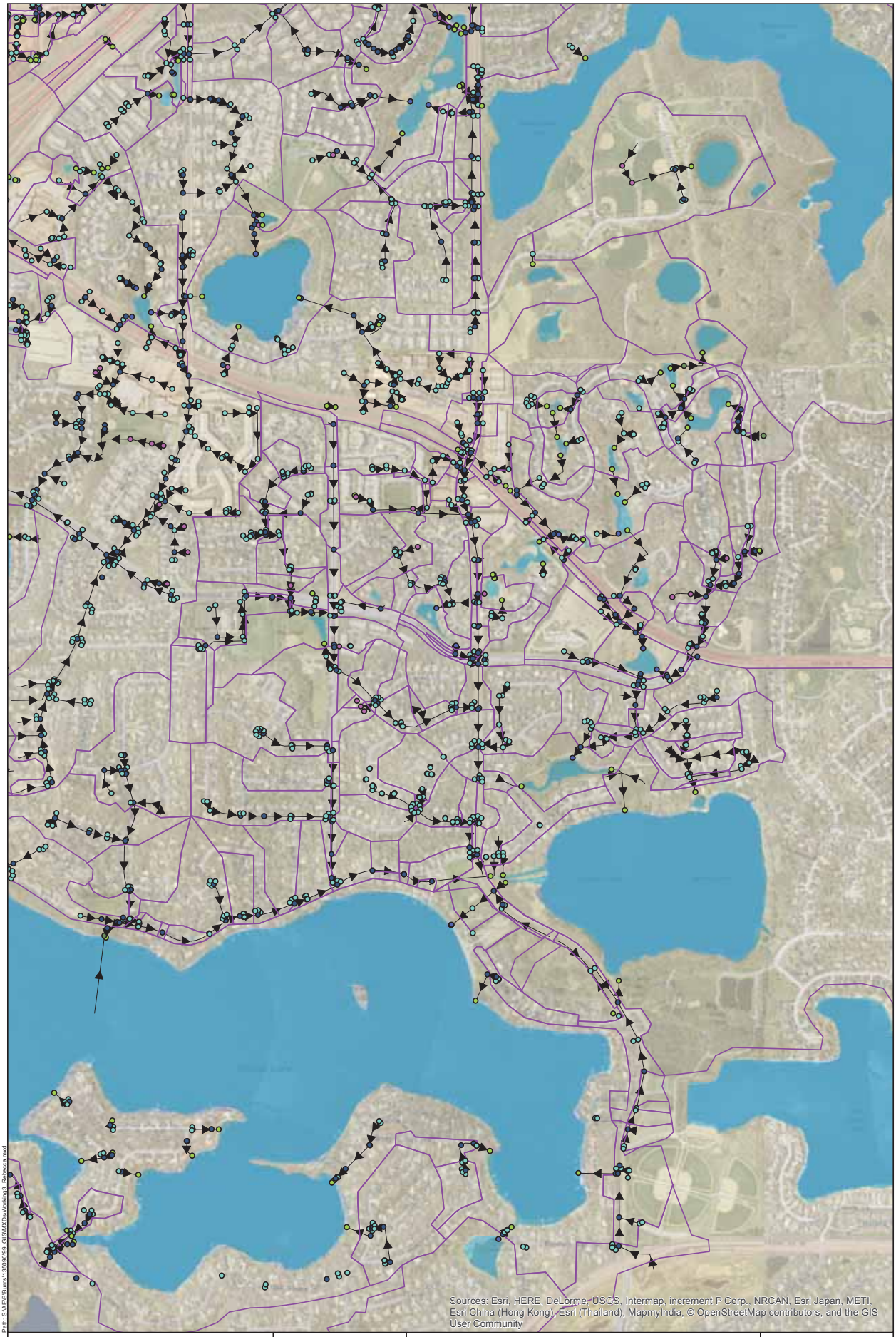

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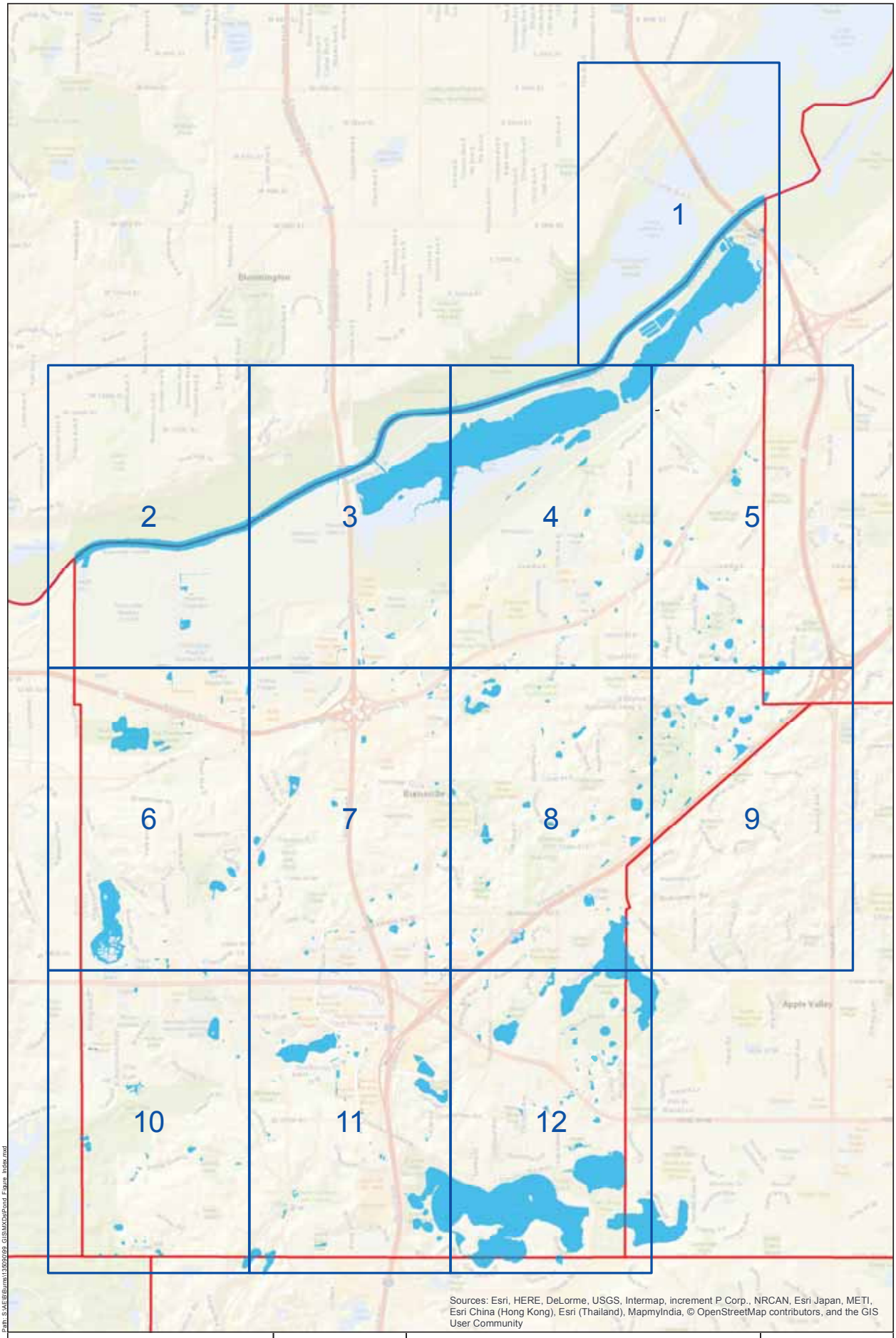
Figure
D-1.12



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Pond Inventory Index Map

City of Burnsville, Minnesota

Figure
D - 2.I

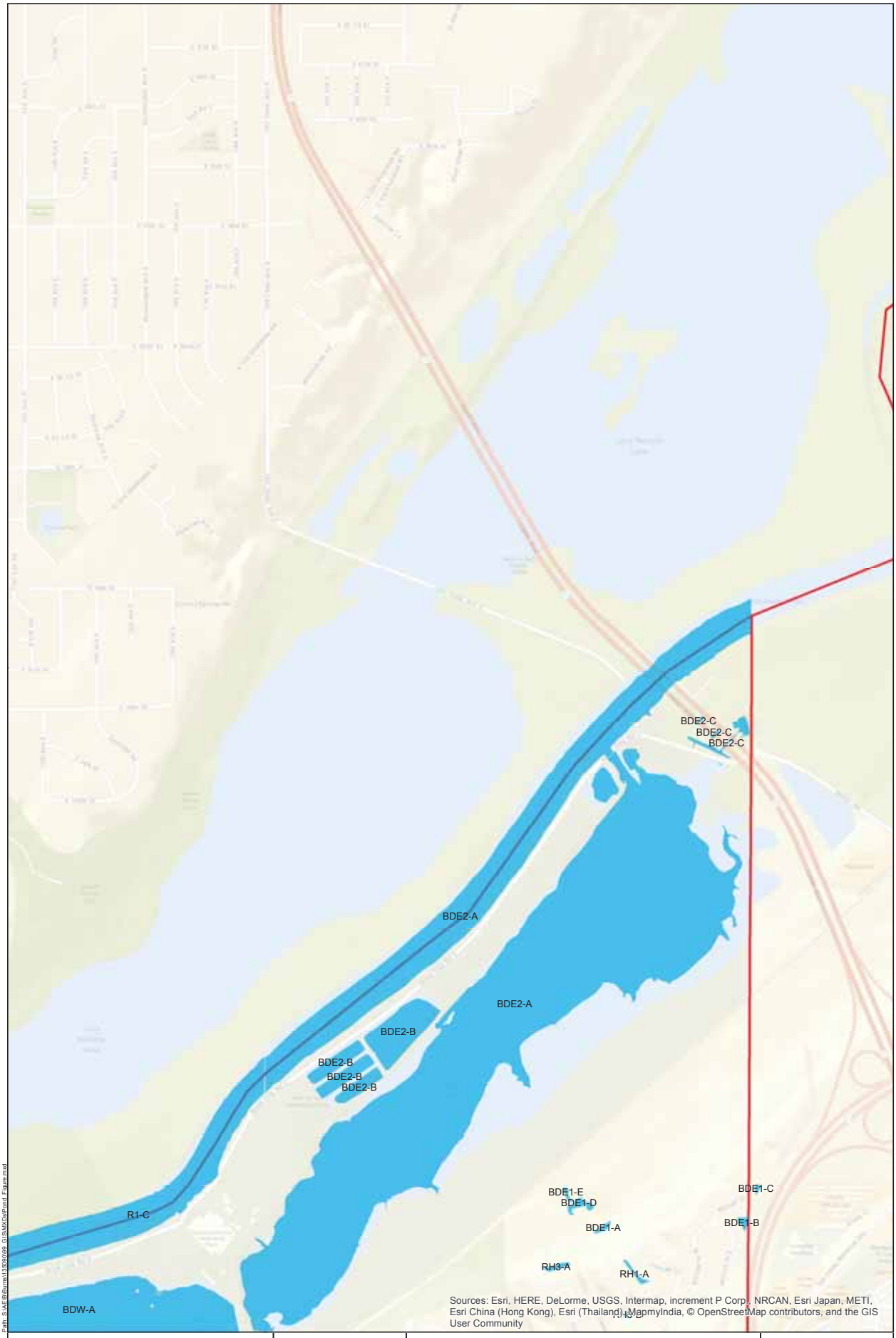

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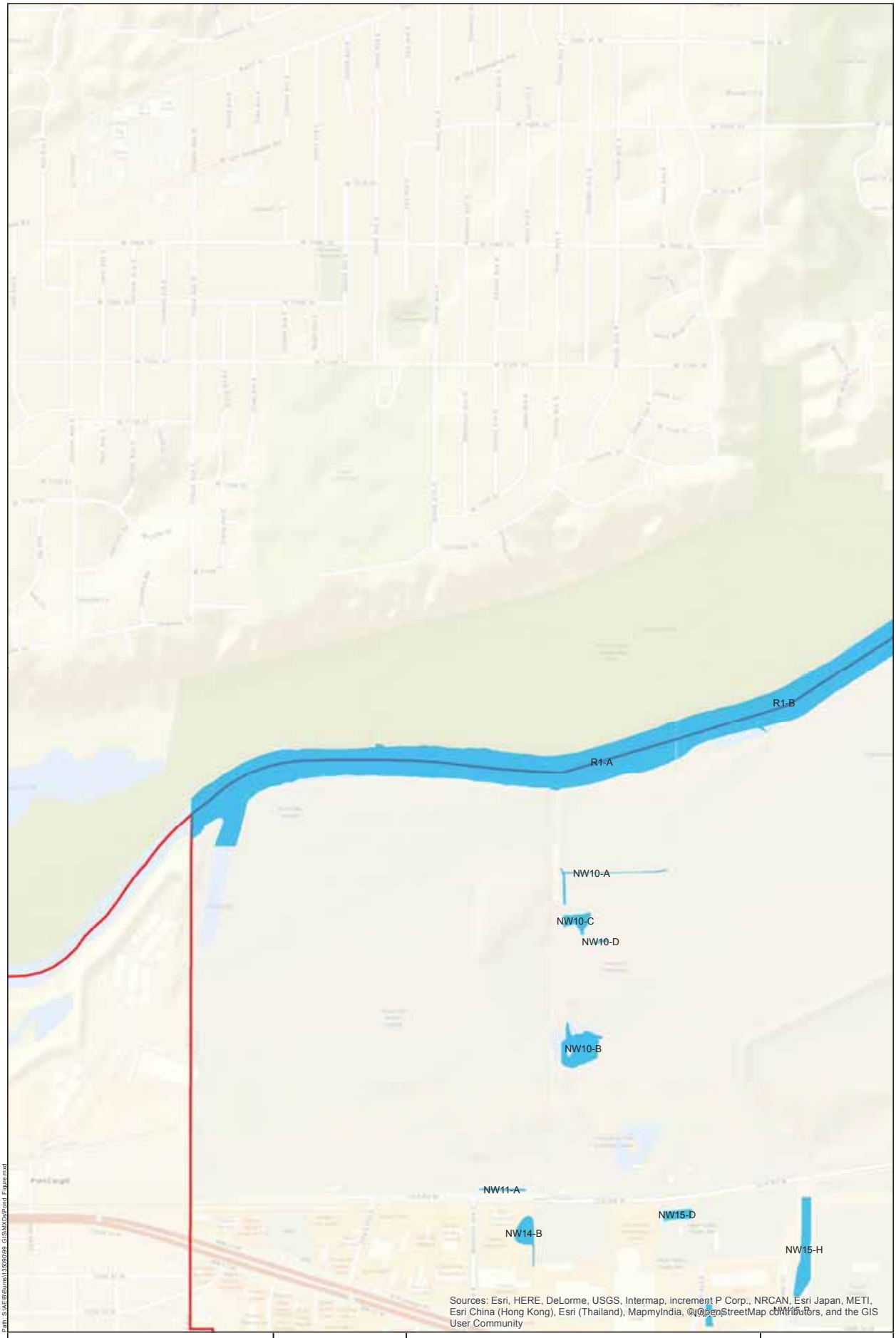
Figure
D - 2.1



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Projection:
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Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.2

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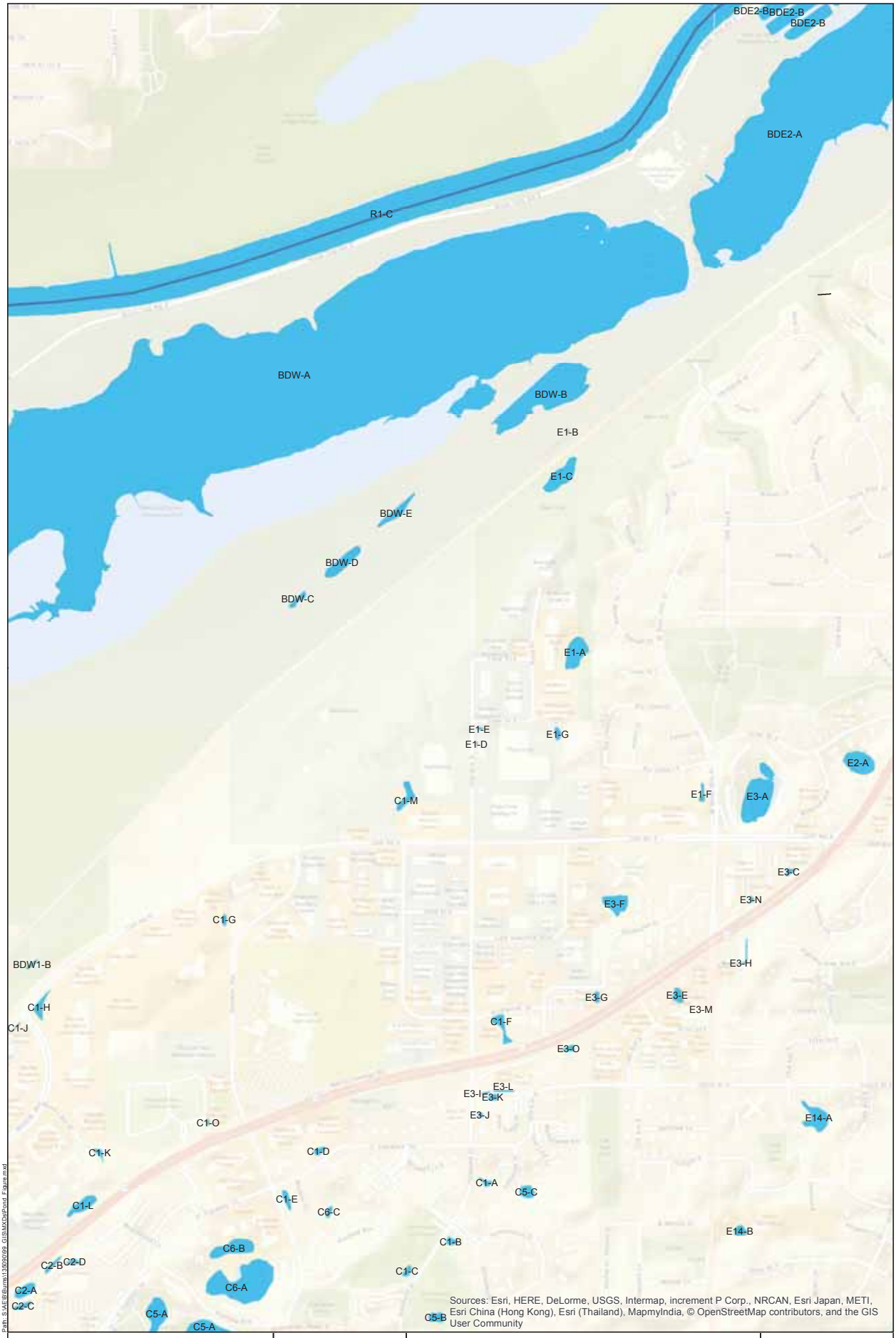
City of Burnsville, Minnesota

Figure
D - 2.3



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Projection:
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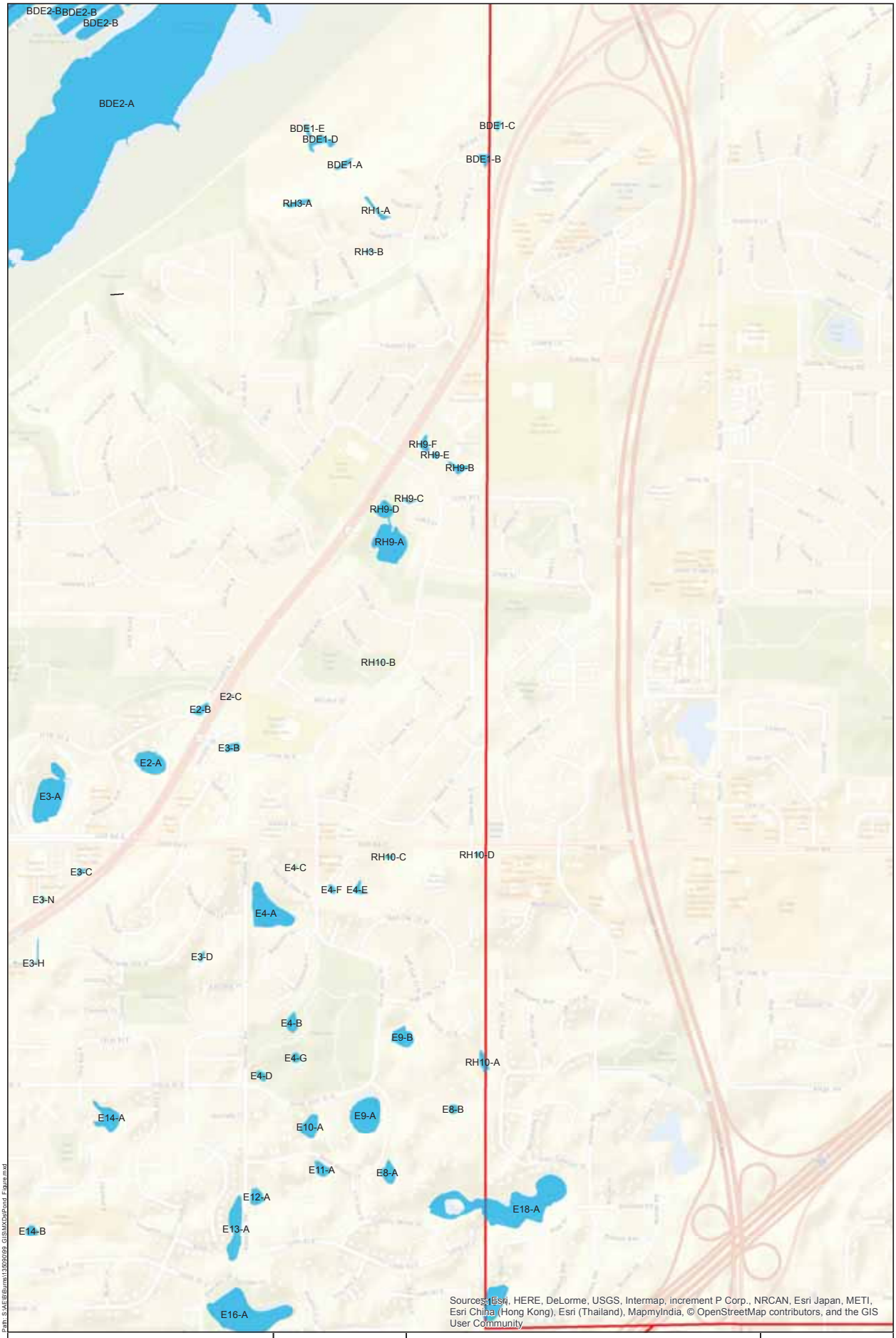
Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.4



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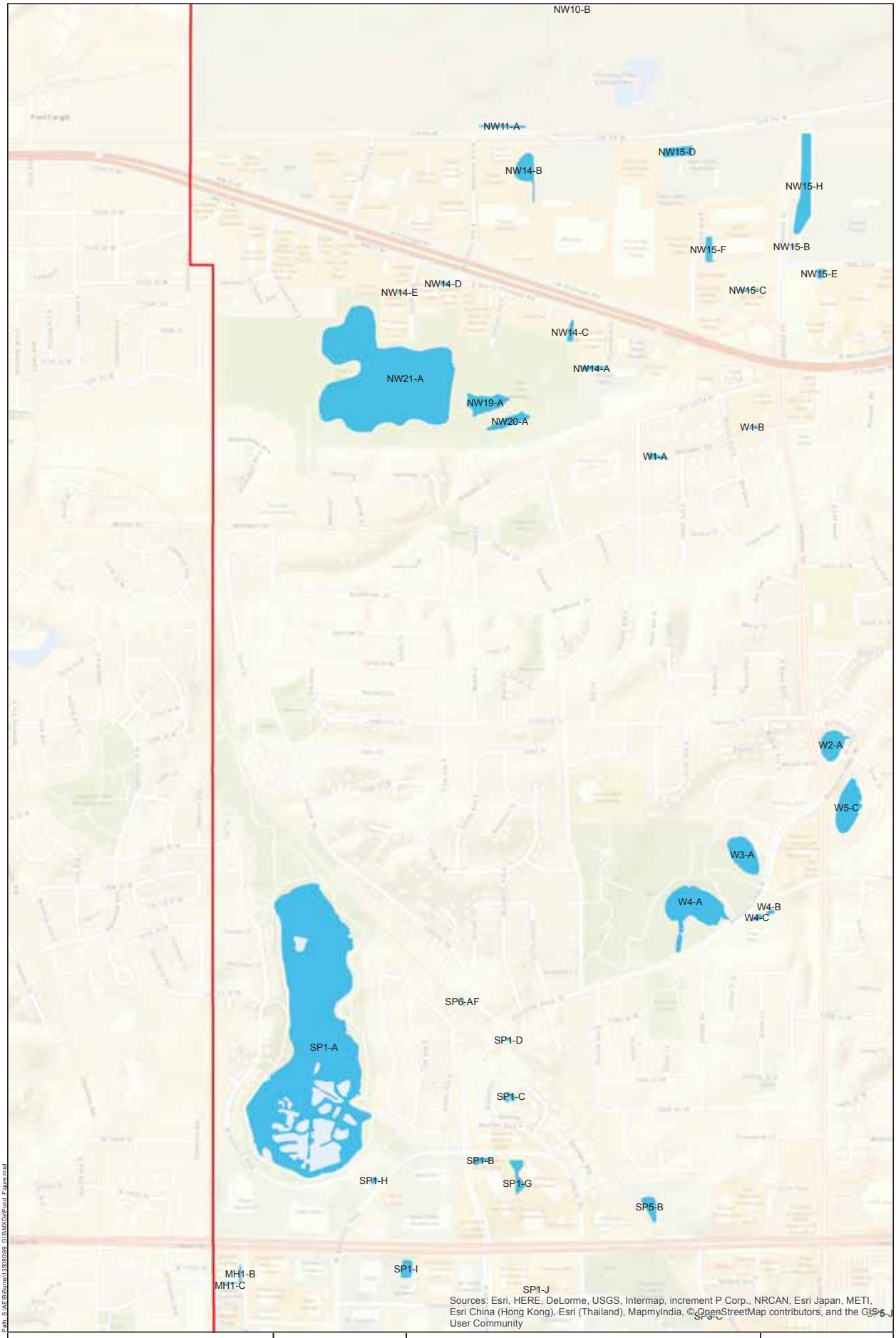
Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.5



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SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (888) 908-8166
TF: (800) 325-2055
www.sehinc.com

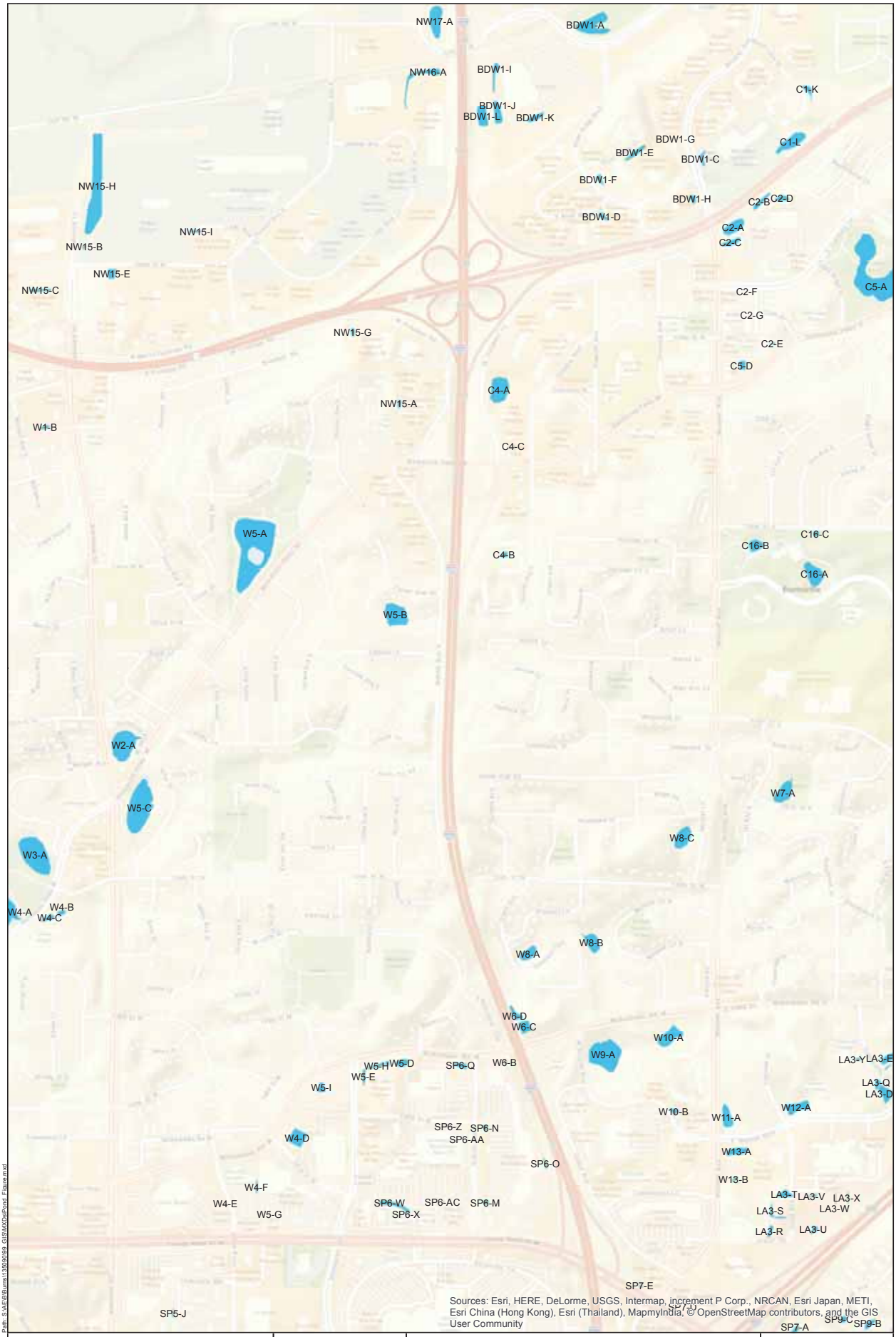
Project: BURNS 135090
Print Date: 1/11/2017

Map by: eerdahl
Projection:
Source:

Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.6



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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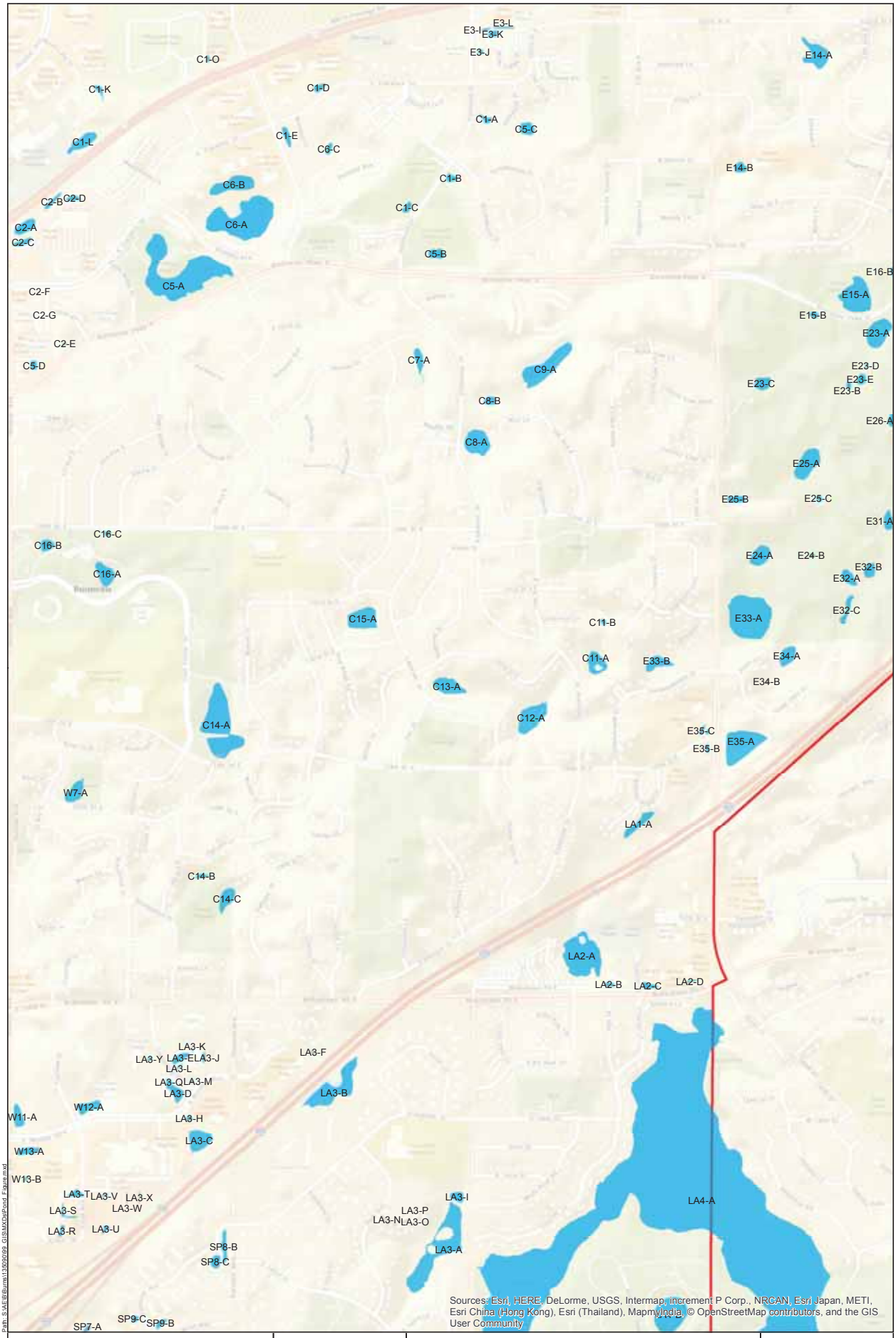
Project: BURNS 135090
Print Date: 1/11/2017

Map by: eerdahl
Projection:
Source:

Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.7



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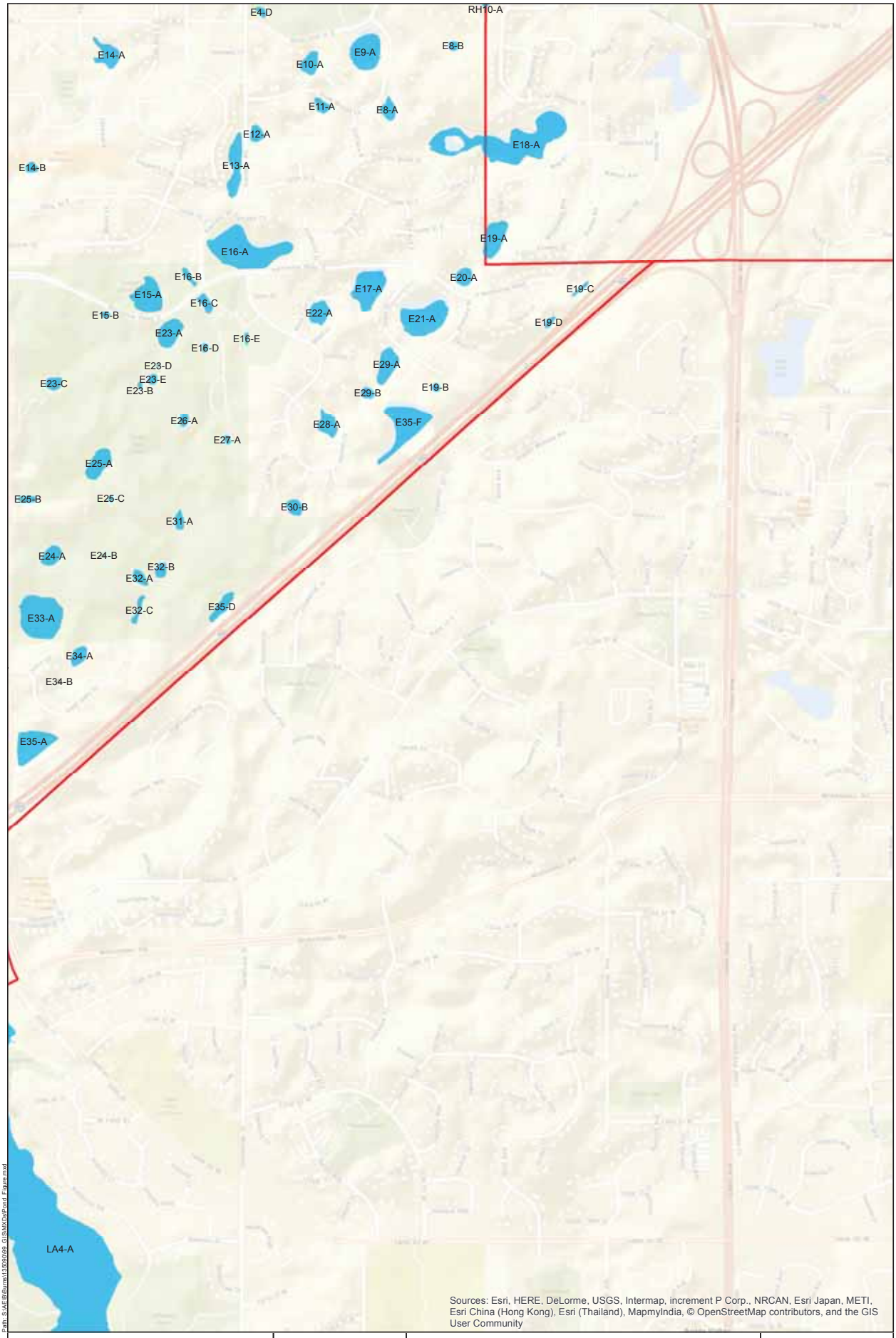
Project: BURNS 135090
Print Date: 1/11/2017

Map by: eerdahl
Projection:
Source:

Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.8



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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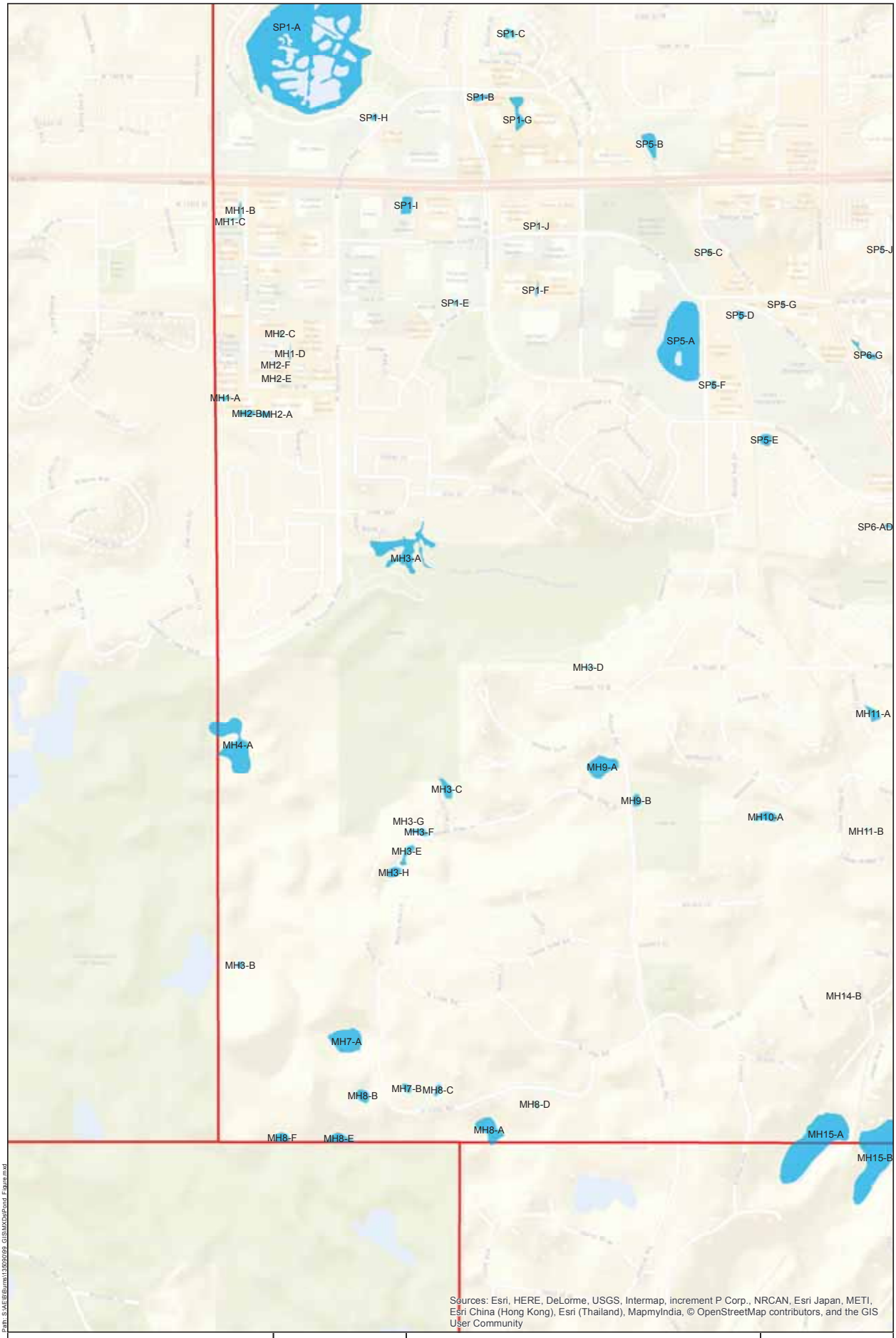
Print Date: 1/11/2017

Map by: eerdahl
Projection:
Source:

Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.9



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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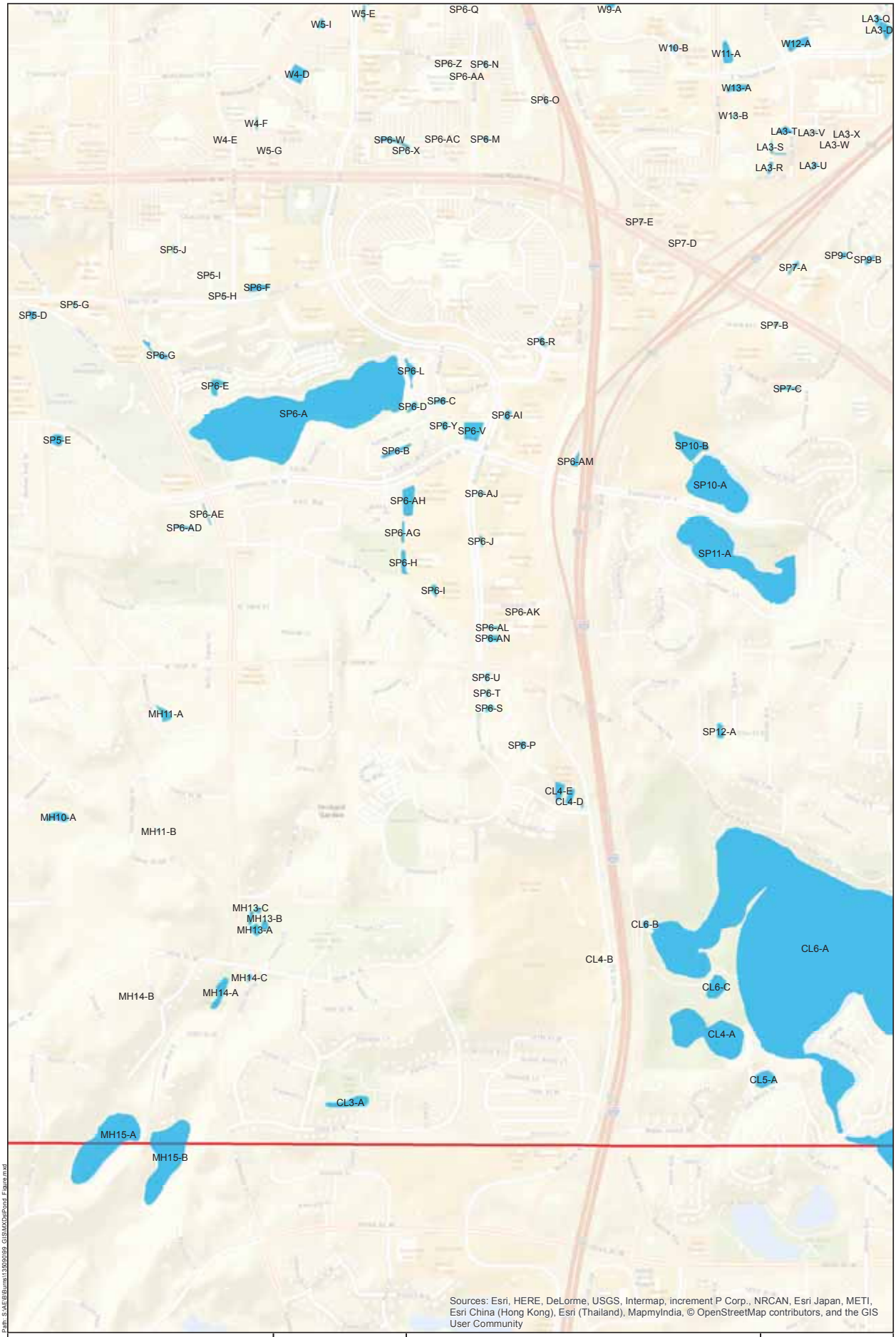
Project: BURNS 135090
Print Date: 1/11/2017

Map by: eerdahl
Projection:
Source:

Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.10



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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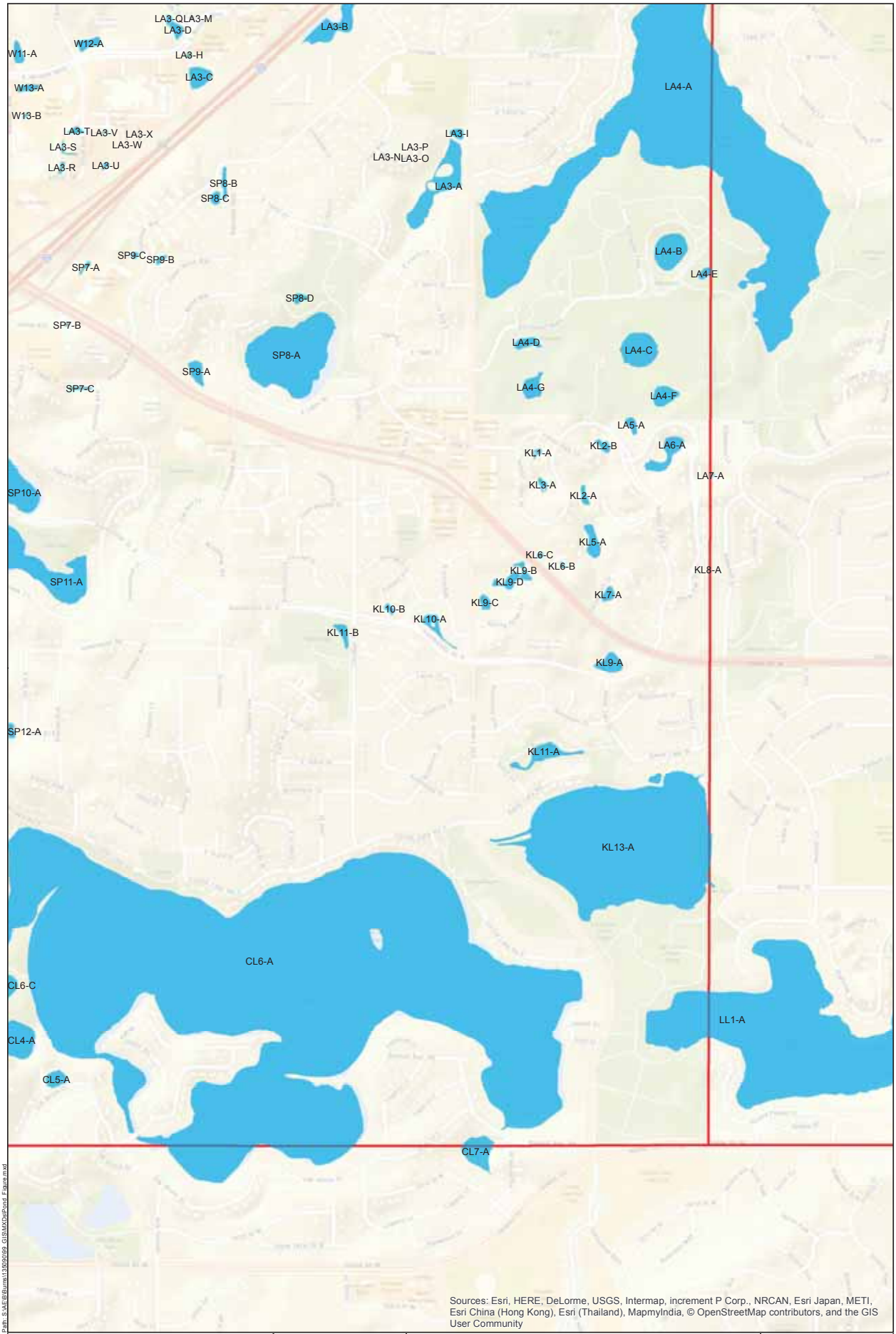
Project: BURNS 135090
Print Date: 1/11/2017

Map by: eerdahl
Projection:
Source:

Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.11



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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Project: BURNS 135090
Print Date: 1/11/2017

Map by: eerdahl
Projection:
Source:

Pond Inventory Map

City of Burnsville, Minnesota

Figure
D - 2.12

Appendix E

Water Resource Related Agreements

Appendix E – Water Resource Related Agreements

The City of Burnsville has entered into a number of water resource related agreements that govern in part how the City of Burnsville must manage its water resources. These agreements include joint powers agreements between the City and Watershed Management Organizations having jurisdiction within its boundaries, agreements between the City and adjoining communities, or agreements it may have with other governmental units or private parties. A description of the water resources related agreements which the City has entered into are described below.

1. Joint Powers Agreement with the Black Dog Watershed Management Organization.
2. Joint Powers Agreement with Credit River Watershed Management Organization.
3. Joint Powers Agreement with the Vermillion River Watershed Management Organization.
4. Joint Powers Agreement with the City of Savage, dated May 21, 1990 – City Project 90LD-3 – relates to billing and construction of Chowen Avenue storm sewer.
5. Joint Powers Agreement with the City of Savage, dated June 6, City Project Nos. 83LD-1A, B & C – relates to the Sunset Pond area.
6. Joint Powers Agreement with the City of Lakeville, dated March 17, 1980 – relates to Crystal Lake Overflow System
7. Joint Powers Agreement with the City of Lakeville, dated September 6, 1983 – relates to storm controls in an area adjacent to a common border between the cities of Lakeville and Burnsville in the vicinity of 35W North and 160th Street.
8. Joint Powers Agreement with the City of Apple Valley, dated March 15, 1982 – relates to City Project No. 81LD-7, and relates to Pond D, called out by Mn/DOT which is located in Burnsville in the SE Quarter of the NW Quarter of Section 16, Township 115, Range 20W.
9. Joint Powers agreement with the City of Apple Valley, dated December 18, 1978 – relates to Alimagnet Lake Lift Station to control lake level from stormwater runoff.
10. Joint Powers Agreement with the City of Eagan, dated March 15, 1992 – relates to land in Eagan in the SW ¼ of Section 31, Township 27, North Range 23, draining into the City of Burnsville.
11. Joint Powers Agreement with the City of Eagan, dated July 15, 1974 – relates to sanitary sewer, water lines and storm sewer improvements in River Hills 9th Addition, SW Quarter of the NW Quarter of Section 30, Township 27, North Range 23 West.
12. Joint Powers Agreement with the City of Savage, dated January 30, 1991 – relates to City Project 83LD-1A.
13. Joint Powers Agreement with the City of Savage, dated May 3, 1982 – relates to billing fees for properties in savage that are connected to the Burnsville Water System.
14. Joint Powers Agreement with the City of Lakeville, dated January 3, 1992 – relates to three issues;
    a. Quarterly Potable Water Usage

b. Maple Island Sanitary Sewer Lift Station Charges
c. Payment for the Crystal Lake Outlet Construction.

15. Joint Powers Agreement with the City of Apple Valley, dated November 2, 1981 and amended March 7, 1983 – relates to Cobblestone Manor sewer Service Agreement.

16. Joint Powers Agreement with the City of Eagan, dated March 15, 1982 – relates to Subject 81LD-7 and Pond "E" Agreement further relates to Eagan reimbursing the City of Burnsville for appropriate trunk area storm sewer assessments when area is platted or building permits are issued.

17. Joint Powers Agreement with the City of Eagan, dated July 15, 1974. Agreement outlines Burnsville and Eagan responsibilities toward providing storm sewer, sanitary sewer and water service to properties in the River Hills 9th Addition.

18. Rose Bluff Development Agreement for Potable Water, Sanitary Sewer and Storm Water, 2016.

19. Maintenance Agreement with Dakota County dated October 22, 2013. Agreement outlines the maintenance responsibilities and cost sharing percentages for storm sewer system repair and maintenance activities in Dakota County road right of ways.

Stormwater Best Management Practice (BMP) Maintenance Agreement

The BMP Maintenance Agreement is taken from the City NPDES MS4 Policy Document as of February 2017. The agreement can be modified, with input from the City Engineer, to apply to a wide range of storm water BMPs.

(Reserved for Recording Data)

STORMWATER BEST MANAGEMENT PRACTICE (BMP) MANAGEMENT AGREEMENT

This AGREEMENT made this __ day of _____, 20__, by and between the **CITY OF BURNSVILLE**, a Minnesota municipal corporation (hereinafter referred to as the "City") and _____, a _____, (hereinafter referred to as the "Developer").

WHEREAS, the Developer is the fee owner of certain real property situated in the City of Burnsville, County of Dakota, State of Minnesota legally described on the attached Exhibit "A" (hereinafter referred to as the "Subject Property") which the Developer has obtained the approval of the City for the development thereof; and

WHEREAS, the City has required that the Developer make provision for the construction, maintenance and repair of one or more Stormwater Best Management Practices (BMPs) located within the boundaries of the Subject Property as shown on Exhibit "B" attached hereto, as the same is described and depicted in those certain construction plans drawn by _____, ("Plans"). BMPs are physical devices or structures (e.g., wet ponds, rain gardens, infiltration basins, filtration basins, porous pavement) within the site that are necessary to convey and/or treat stormwater.

WHEREAS, the City and Developer desire to set forth their understanding with respect to the construction, repair and maintenance of the BMPs and the responsibility relating to the costs of the repair and maintenance of the BMP.

NOW THEREFORE, in consideration of the foregoing facts and circumstances, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereto hereby agree as follows:

1. Construction and Maintenance of BMP. The Developer agrees to construct the BMPs according to the Plans and repair and maintain the BMP at its sole cost and expense. Maintenance of the BMP shall mean (i) monthly inspections and, if necessary, removal of all litter and debris, and replacement of mulch, vegetation, and eroded areas to ensure establishment of healthy functioning plant life therein; and (ii) an annual inspection, and

certification, by a qualified individual or company acceptable to the City that the BMP is functioning in accordance with the approved plans and have maintained the proper operation of the BMP according to the City Standards. If, as a result of an inspection by a qualified individual or company acceptable to the City or City staff, it is determined that the BMP (1) has not been maintained; or (2) is not functioning as originally designed and intended; or (3) is in need of repair, the Developer agrees to restore the BMP so that it functions as it was designed and intended. The Developer further agrees that they will not use the BMP for snow storage and will inform its snow removal contractors of this provision of the Agreement.

Subject to Section 4 below, Developer shall be solely responsible for the repair and maintenance of the Stormwater Pond.

2. Developer's Default. In the event of default by the Developer as to any of the work to be performed by it hereunder, following at least thirty (30) days prior written notice and Developer's failure to cure such default within such time-frame, except in an emergency as determined by the City, the City may, at its option, perform the work and the Developer shall promptly, following receipt of an invoice and reasonable substantiation of such costs, reimburse the City for any reasonable out-of-pocket expense incurred by the City. This Agreement is a license for the City to act when so authorized under this Agreement, and it shall not be necessary for the City to seek a Court order for permission to enter the Subject Property. When the City does any such work, the City may, in addition to its other remedies, assess the reasonable out-of-pocket cost in whole or in part.

3. Future City Policy. Notwithstanding anything contained in this Agreement to the contrary, in the event the City shall in the future establish a policy for repair and maintenance by the City of stormwater ponds owned by private parties located elsewhere in the City under which policy the costs of such repair and maintenance are to be paid either out of general City revenues or by collection of utility or service fees or charges, then any owner of any portion of the Subject Property shall be entitled to petition the City for the inclusion of the Stormwater Pond under such repair and maintenance program. The recording of a certified copy of the Resolution of the City Council of the City which sets forth the consent and authorization described in the foregoing sentence shall serve to terminate this Agreement, without further action on the part of any party hereto.

4. Terms and Conditions. This Agreement shall run with the land and shall be binding upon Developer's successors and assigns with respect to the Subject Property. The terms and conditions of this Agreement shall be binding upon, and shall insure to the benefit of, the parties hereto and their respective successors and assigns.

IN WITNESS WHEREOF, the parties hereto have caused this document to be executed as of the day and year first above written.

CITY OF BURNSVILLE

BY:_____
Elizabeth B. Kautz, Mayor

(SEAL)

AND _____
Heather A. Johnston, City Manager

STATE OF MINNESOTA)
(ss.
COUNTY OF DAKOTA)

The foregoing instrument was acknowledged before me this _th day of _____, 20____, by Elizabeth B. Kautz and by Heather Johnston, the Mayor and City Manager of the City of Burnsville, a Minnesota municipal corporation, on behalf of the corporation and pursuant to the authority granted by its City Council.

_____
NOTARY PUBLIC

Appendix F

Local Permitting Process

Appendix F – Development Review Procedures

The City's process for water resource related permitting is a significant aspect of the overall City development review and permitting program. The key steps in the permitting process are outlined in the City's NPDES MS4 Policy Number 5.155.

The City's Standard Operating Procedure for Development Review and Review Checklist from the Policy as of February 2017 are included in the following pages.

	City of Burnsville	**SOP - Site Plan Review Procedures**

MCM 5 - SITE PLAN REVIEW PROCEDURES

Upon receipt of a proposed site plan submittal package to the City of Burnsville the following procedures shall be followed:

1) Proposed site plan submittal information shall be directed to the City Engineer.

2) The City Engineer shall take the following actions:
   a. Forward the information to the appropriate entities for review and approval. This may include, but not limited to one or all of the following reviewers:
      i. City Engineering Consultant
      ii. Review by the City's Engineering Specialist
      iii. Other City Departments as needed (Natural Resources, Planning, etc.)
   b. Oversee the review process and compile comments.
   c. Notify owner of approval, disapproval, or required resubmittal of site plan information based on the comments.
   d. Ensure appropriate City permits are obtained or applied for prior to final approval.
   e. If applicable, notify the applicant of the need to apply for and obtain coverage under the MPCA NPDES Construction Stormwater Permit.

3) The reviewing entities shall complete the following actions:
   a. Review submitted information against the City's Site Plan Review Checklist which reflects concurrence with current ordinances, policies and design standards.
   b. Provide written comments and recommendations of approval, disapproval and/or required resubmittal of site plan information. City Engineer or designee shall ensure delivery to plan submitter.
   c. Utilize site plan review checklist/form and a comment letter describing compliance or non-compliance. The City's Engineering Consultants may use the form and/or provide a review memorandum addressed to the City Engineer that addresses the items noted in the form.
   d. Repeat process until the plan is approved and permits can be approved.

	City of Burnsville	**FORM – SITE PLAN REVIEW CHECKLIST**

Project / Site Information

Project Name / Owner:	
Project Location:	
Disturbed Acres: Existing Impervious: Proposed Impervious: Net Increase / (Decrease):	
City Project Number:	

Review Tracking

Initial Submittal Date:	Reviewed By / Date:

Review Comments / Findings:	Notified Owner:

Re-Submittal Date:	Reviewed By / Date:

Review Comments / Findings:	Notified Owner:

Construction Site – Erosion/Sediment Control (All projects)

Site plans and project documentation must incorporate erosion and sediment controls and waste controls.

Incorporated			Comments:
Yes	No	NA	
☐	☐	☐	Do the plans include provisions in accordance with Appendix C – Part 9: • Perimeter controls, construction entrance/exit, inlet protection • Sediment Tracking Cleanup, Waste Controls • Temporary Sediment Basins – Water Quality Treatment (if required) • Dewatering • Final stabilization • Maintenance of BMPs and Site Inspections/Rainfall record keeping

SWPPP Submittal (Required for projects disturbing 1 acre or more)

Incorporated			Comments:
Yes	No	NA	
☐	☐	☐	Has a Stormwater Pollution Prevention Plan (SWPPP) been prepared/Included?
☐	☐	☐	Has the City notified the owner of the NPDES Permit Requirements?

Post-Construction Stormwater Management Requirements

Refer to Water Resources Management Plan – Appendix C and/or other documents noted.
General Provisions – From WRMP Appendix C

- Water quality treatment, volume control, water quantity and rate control requirements apply to any project which results in one-half acre or more of disturbed area or 5,000 square feet or more of new impervious area.
- Additional requirements applicable to projects in Shoreland Areas are defined in City Code Section 10-8-10.
- Any project within a floodplain area requires a permit from the City and/or FEMA.
- Additional requirements applicable to the City's Wellhead Protection Overlay District

Incorporated			
Yes	No	NA	
☐	☐	☐	Do the plans address the water quality treatment in accordance with the provisions in Appendix C – Part 2?
☐	☐	☐	Do the volume control / infiltration/filtration practices meet the provisions of Appendix C – Part 3?
☐	☐	☐	Does the project meet the Water Quantity/Flood Control requirements of Appendix C – Part 4?
☐	☐	☐	Does the project meet the rate control provisions in Appendix C – Part 5?
☐	☐	☐	Do the plans address the Special waters and Wetland provisions in Appendix C – Part 6?
☐	☐	☐	Do the plans and supporting documentation include Design Computations consistent with Appendix C – Part 7?
☐	☐	☐	Do the plans address the Additional Pond and Infiltration System Design Criteria in Appendix C – Part 8?
☐	☐	☐	Do the plans include the Storm Water Plan Submittals in Appendix C – Part 10?
☐	☐	☐	Do the plans include provisions of the City's Wellhead Protection Plans (including but not limited to) Appendix C – Parts 3a and 3b?

Additional Review Comments / Findings:	

	City of Burnsville	**SOP - Site Plan Mitigation Procedures**

MCM 5 - SITE PLAN MITIGATION PROCEDURES

The MS4 Permit requires the City to establish mitigation provisions for circumstances where the City or other owners and operators of a construction activity cannot cost effectively meet the conditions for post- construction stormwater management (volume control requirements or TSS and/or TP requirements) established in the City's WRMP on the site of the original construction activity. If during the development review process, the City determines that this is the case, the City may require the owner to identify locations where mitigation projects can be completed.

Mitigation project areas will be evaluated and selected in the following order of preference:

1) Locations that yield benefits to the same receiving water that receives runoff from the original construction activity.
2) Locations within the same Department of Natural Resource (DNR) catchment area as the original construction activity.
3) Locations in the next adjacent DNR catchment area up-stream.
4) Locations anywhere within the City of Burnsville.

Mitigation projects must involve the creation of new structural stormwater BMPs or the retrofit of existing structural stormwater BMPs, or the use of a properly designed regional structural stormwater BMP. Routine maintenance of structural stormwater BMPs already required by the NPDES permit cannot be used to meet mitigation requirements. Mitigation projects shall be completed within 24 months after the start of the original construction activity.

The City will determine, and document, who is responsible for long-term maintenance on all mitigation projects. The City will not accept payment from the owner and/or operator of a construction activity for mitigation purposes in lieu of the owner or operator of that construction activity meeting the City Standards for post-construction stormwater management.