WATERSHED
MANAGEMENT
ORGANIZATION

2011 watershed MANAGEMENT PLAN

for the lower mississippi river watershed management organization

AUGUST 2011

WSB
& Associates, Inc.

3RD GENERATION LOWER MISSISSIPPI RIVER WATERSHED MANAGEMENT PLAN

PREPARED FOR THE LOWER MISSISSIPPI RIVER WATERSHED MANAGEMENT ORGANIZATION

August 2011

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1.0 Executive Summary

The Lower Mississippi River Watershed Management Organization Watershed Management Plan sets the vision and guidelines for managing surface water within its boundaries. This executive summary summarizes the history, purpose, issues, goals, policies, and implementation tasks of the Watershed Management Organization (WMO).

1.1 Location and History

The Lower Mississippi River Watershed Management Organization is located in the southeast part of the Twin Cities metropolitan area, in northern Dakota County and southern Ramsey County. It abuts the south and west sides of the Mississippi River, from the Mississippi River's confluence with the Minnesota River to Rosemount. The location of the WMO is shown in **Figure 1**. Adjoining watershed management entities include Gun Club Lake WMO, Lower Minnesota River Watershed District, and the Vermillion River Watershed Joint Powers Organization. The WMO covers 35,493 acres (55.5 square miles) and is composed of seven cities partially or wholly within the organization's boundaries. The member cities include:

Dakota County	Ramsey County
City of Inver Grove Heights	City of St. Paul
City of Lilydale	
City of Mendota Heights	
City of South St. Paul	
City of Sunfish Lake	
City of West St. Paul	

A joint powers agreement was executed on October 25, 1985, which established and empowered the Lower Mississippi River Watershed Management Organization. The WMO was formed in response to the requirements of the Metropolitan Surface Water Management Act ("Chapter 509," now recodified to Minnesota Statutes 103B). The Act required, among other things, the preparation of watershed management plans in the Minneapolis-St. Paul Metropolitan area.

The WMO has provided a valuable forum for the member cities to evaluate and resolve drainage issues within the watershed. The WMO and its member cities successfully addressed the majority of the intercommunity water management issues that were identified in the past WMO plans. The cooperation of the member cities and the implementation of the WMO's joint powers agreement (JPA) were key factors in resolving the identified problems. The WMO provided the forum for the cities to systemically prioritize and address these and other intercommunity drainage issues. Refer to **Table 6-6** for a list of the completed projects and planning activities.

1.2 Watershed Management Purposes

The WMO developed the following vision statement on December 23, 2009:

> *"Water resources and related ecosystems are managed to sustain their long-term health and integrity through member city collaboration and partnerships with other water management organizations with member city citizen support and participation."*

The general purposes for the 3rd Generation Plan include the following purposes consistent with the Metropolitan Surface Water Management Act and Minnesota Statutes 103B.201.

- 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.
- Secure other benefits associated with the proper management of surface and groundwater.

In addition, the WMO has developed the following purposes:

- Assist member cities in achieving current and future water quality and water quantity regulations collaboratively, equitably, and cost-effectively for all members within the watershed.
- Identify and effectively communicate member concerns to other government jurisdictions to better align their policies and activities with those of the WMO and its members.
- Educate citizens about the use, protection, and management of water resources and engage them in WMO water management programs and decision making.

- Consider potential impacts of WMO decisions on natural resources and habitat.

- Govern the WMO with a citizen led Board and keep regulation at the local level – the WMO will not administer a permit program.

- Assist member communities with *intercommunity* runoff and water resource management issues. The WMO, at the discretion of the Board, may also work with individual member cities to address water resource issues within individual city boundaries. This may include but is not limited to monitoring of water bodies or outlets to the Mississippi River.

- Assess performance of the WMO and the member cities toward achieving the goals stated in this plan.

- Provide member cities with useful information about the WMO, its activities, and water resource management.

In an effort to achieve the purposes of the WMO; goals, strategies, and policies have been developed for water quantity, water quality, recreation, fish and wildlife habitat, wetlands, groundwater protection, erosion and sedimentation, education, and WMO administration. These goals, strategies, and policies are provided in **Section 5**.

1.3 WMO Management Structure, Powers, Duties and Agreements

The WMO Board of Managers (Board) consists of seven managers appointed by their respective municipalities. Each city appoints one manager and one alternate to serve at the pleasure of the city. Each manager has one vote, however in certain cases, the JPA provides for a weighted vote system. Regular meetings are held every month on the third Thursday at various member city facilities. The public is invited to attend the WMO Board meetings.

Each year, the Board authorizes and obtains an audit of the WMO's financial records. The Board also reviews and approves an annual budget.

The JPA between the member cities of the WMO went into effect on October 25, 1985. The authority of the WMO is established by Minnesota Statutes 103B and by the JPA. The JPA was revised and restated in 2001. The current JPA is included in **Appendix B**. The powers and duties of the WMO, as stated in the JPA, include, but are not limited to:

1. Prepare and adopt a watershed management plan meeting the requirements of Minnesota Rules Chapter 8410.

2. Review and approve local water management plans as defined in Minnesota Rules Chapter 8410.

3. Review local land use and development at the request of a municipality, in the absence of an approved local water management plan, or for projects requiring a variance from the adopted local water management plan or implementation program.

4. Conduct surveys (or use other information) and develop projects to accomplish the WMO's purposes.

5. Establish and maintain devices for acquiring and recording hydrological and water quality data.

6. Enter upon lands to make surveys and investigations to accomplish the WMO's purposes.

7. Acquire, operate, construct and maintain the drainage system improvements delineated in the capital improvement programs adopted by the WMO Board.

8. Accumulate reserve funds and invest funds not currently needed for WMO operations.

9. Collect money from the WMO members and from any other WMO-approved source.

10. Obtain an annual audit of the books and accounts of the WMO.

11. Make contracts, employ consultants, incur expenses and make expenditures.

12. Enter into contracts or cooperate with governmental agencies, private/public organizations, or individuals to accomplish the WMO's purposes.

13. Contract for or purchase insurance.

14. Adopt an annual general administrative budget.

15. Apportion/allocate costs of capital improvements (including engineering, legal and administrative costs) listed in the WMO watershed management plan, based on "allowable flow" or other cost sharing allocations determined by the WMO Board of Managers.

1.4 Plan Organization

The Lower Mississippi River WMO *Watershed Management Plan* sets the course for the WMO in managing stormwater runoff and the quality of the WMO water resources. The plan outlines the regulations involved, assesses specific and watershed-wide issues, sets goals and policies for the WMO and its resources and lists implementation tasks to achieve the goals. The plan also discusses the financial considerations of implementing the plan and other funding sources that may be available to the WMO and/or its member cities. The WMO plan is organized into the following sections:

Section 1.0 Executive Summary – states the authority and composition of the Lower Mississippi River Watershed Management Organization, the purpose of the Surface Water Management Act and the components of this watershed management plan.

Section 2.0 Land and Water Resource Inventory – presents information about the WMO's climate, precipitation, topography, soils, geology, groundwater, land use, public utilities, surface waters, natural communities and rare species, and pollutant sources. This is the basic information that describes the surface and subsurface conditions of the WMO.

Section 3.0 Agency Coordination – lists many of the agencies that have rules and regulations related to water resources within the WMO.

Section 4.0 Problems and Approaches for Addressing Problems – outlines existing and potential water resource management issues within the WMO and identifies the approaches for improvement for each issue. Approaches for improvement are included in the WMO implementation program.

Section 5.0 Goals, Strategies, and Policies – outlines the purposes of the WMO and the vision for its water resources. This section sets goals for water quantity, water quality, recreation, fish and wildlife habitat, wetlands, groundwater protection, erosion and sedimentation, education, and administration. The goals are followed by strategies and policies that provide methods for achieving goals and serve as decision making guidelines.

Section 6.0 Implementation Program – presents the programs, studies, and capital improvements proposed to address the existing and potential water resource management issues within the WMO. The cost of each implementation element, possible funding mechanism, and the anticipated year for completion is also outlined.

Section 7.0 Impact on Local Government - discusses the conformance of local governmental water resource management plans to this watershed management plan.

Section 8.0 Amendment Procedures - discusses the procedure to be followed should it be necessary to amend this plan. This procedure would be invoked only for major changes that would directly affect water resource management within the member cities.

Section 9.0 References - contains a list of all documents incorporated into this plan by reference or other documents which are referred to in this plan as containing information helpful in the management of WMO water resources.

Section 10.0 Glossary of Acronyms - contains a list and description of acronyms used in this plan.

2.0 Land and Water Resource Inventory

The Lower Mississippi River Watershed Management Organization is surrounded by valuable water and land resources. Protecting and enhancing these important resources is a high priority for the WMO and the surrounding area. Refer to **Figure 1** for a location map of the WMO. Information has been collected regarding land and water resources for the WMO from a variety of sources. This section of the plan provides a general description and summary of the climate, surficial topography, soils, geology, surface and ground water resource data, land use and public utilities, public waters and wetlands, public areas for water-based recreation, fish and wildlife habitat, unique features and scenic areas, pollutant sources, and water resource problem areas. More information can be obtained from Dakota County and Ramsey County websites.

2.1 Climate and Precipitation Data

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 108ºF, set in 1936, and the lowest temperature was -34ºF, set in 1936. The extreme conditions tell little except that temperatures range from uncomfortably hot to bitterly cold. The average annual temperature at the airport station is 44.9ºF. Average total annual precipitation at the airport is 29.0 inches (1961-2009 average). **Table 2-1** gives a 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 18.0 inches, or about 62 percent of the normal annual precipitation.

Table 2-1. Precipitation Summary – Minneapolis/St. Paul Airport Station

Averages: 1961-2009 Extremes: 1891-2009

Total Precipitation, Inches					Snow, inches		Average # Days with Precip		
Month	**Mean**	**High—Yr**	**Low—Yr**	**1-Day Max**	**Mean**	**High—Yr**	**0.1"**	**0.5"**	**1"**
January	0.95	3.63 1967	0.05 1892	1.21 24/1967	12.4	46.4 1982	3.7	0.8	0.5
February	0.81	3.25 1922	0.03 1894	1.90 24/1930	8.7	26.5 1962	3.1	1.1	0.7
March	1.88	4.75 1965	0.09 1910	1.62 1/1965	11.2	46.1 1965	4.9	1.2	0.4
April	2.50	7.00 2001	0.16 1987	2.22 27/1975	2.8	21.8 1983	6.1	1.9	0.5
May	3.40	10.92 1942	0.21 1934	3.59 29/1942	0.1	2.4 1954	7.6	2.6	1
June	4.10	9.82 1990	0.22 1988	2.91 7/1984	0	0.0 1949	7.5	3	1.2
July	3.65	17.90 1987	0.11 1936	9.15 23/1987	0	0.0 1948	6	2.7	1.1
August	3.95	9.32 2007	0.20 1925	7.28 30/1977	0	0.0 1948	6.8	3	1.8
September	2.87	7.77 1903	0.41 1940	4.96 12/1903	0	0.4 1985	6.1	2.2	1.1
October	2.33	6.42 1911	0.01 1952	2.75 19/1934	0.6	8.2 1991	4.7	1.6	0.7
November	1.56	5.29 1991	0.02 1939	2.52 11/1940	7.4	46.9 1991	3.8	1.1	0.4
December	1.03	4.27 1982	0.00 1943	1.50 14/1891	10.6	33.5 1969	3.2	0.6	0.2
Annual	29.03	41.53 2002	11.54 1910	9.15 7/23/87	53.8	101.5 1983	63.5	21.8	9.6

The annual snowfall averages about 54 inches, equivalent to about 5.4 inches of water. The heaviest monthly snowfall recorded to date at the Minneapolis/St. Paul International Airport was 46.4 inches of snow for the month of January 1982. The area averages 40 to 45 days per year when the snow depth is six inches or greater and about 20 days per year when the snow depth is more than 12 inches. Runoff from snowmelt can occur anytime during the winter, but the most 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. Refer to **Figure 2** for the 1% chance of rainfall event (100-year storm) across Minnesota and **Figure 3** for the annual normal precipitation across Minnesota.

There are recent concerns that the increase in urban development and resulting "heat island" effect is contributing to more frequent, high intensity storm events. These storm events can produce large amounts of runoff which may exceed storm sewer designs and result in flooding. Substantial increases of storm events above the 95th percentile since 1950 have been observed, however, only a few regions have enough data to assess such trends. As the average temperature has risen slightly precipitation has also increased[1]. Some Climatologists predict there will be more of an increase in extreme events than mean precipitation[2]. The National Oceanic and Atmospheric Administration (NOAA) Atlas 14 is currently being drafted and is expected to be completed in 2012. This document will take the place of TP-40 for predicting frequency and intensity of rainfall events once it is completed. NOAA Atlas 14 will use only actual rainfall data and will not use predictions to calculate rainfall frequency and intensity estimates.

Additional climatological information can be obtained from the State Climatologist website at http://www.climate.umn.edu/.

2.2 Topographic Data

The WMO topography is characterized by rolling to hilly terrain interspersed with poorly drained depressions that form many ponds and lakes. The Mississippi River bluffs and the ravines that cut through them form the main areas of steep slope. Steep slopes are also found around the ponds and depressions in the southern two-thirds of the watershed. Flat and relatively flat areas can be found along the Mississippi River flood plain and above the bluffs in south and central South St. Paul.

The bluffs, ravines, and other steep slopes are usually wooded or overgrown with underbrush. These steep-sloped areas are not suitable for development. However, they are important because of the wildlife they support and their natural beauty. Erosion can be a problem in areas of steep slope.

---

[1] Solomon, S., D. Qin, M. Manning, R.B. Alley, T. Berntsen, N.L. Bindoff, Z. Chen, A. Chidthaisong, J.M. Gregory, G.C. Hegerl, M. Heimann, B. Hewitson, B.J. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, T. Matsuno, M. Molina, N. Nicholls, J. Overpeck, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, R. Somerville, T.F. Stocker, P. Whetton, R.A. Wood and D. Wratt, 2007: Technical Summary. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[2] Hegerl, G.C., F. W. Zwiers, P. Braconnot, N.P. Gillett, Y. Luo, J.A. Marengo Orsini, N. Nicholls, J.E. Penner and P.A. Stott, 2007: Understanding and Attributing Climate Change. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Dakota County has two-foot and Ramsey County has one-foot contour interval topographic mapping available. There are also 10-foot contour interval topographic maps available from the U.S. Geological Survey. Refer to **Figure 4** for a contour map showing 10-foot contours across the WMO.

2.3 Soils Data

Soil composition, slope and land management practices determine the effect of soils on stream and lake water quality. Soil composition and slope are important factors affecting the rate and amount of storm water 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 storm water 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 is, the lower the runoff potential. Conversely, soils with low infiltration rates produce high runoff volumes and high peak discharge rates. The hydrologic soil classification map in **Figure 5** shows the estimated distribution of soils as determined by the Natural Resource Conservation Service (NRCS). The five soil classifications are defined as follows:

> **Group A -** These soils have high infiltration rates even when thoroughly wetted. These soils consist chiefly of deep, well drained to excessively drained sands and gravel. Group A soils have a high rate of water transmission, therefore resulting in a low runoff potential.
>
> **Group B -** These soils have moderate infiltration rates. Group B soils consist of deep moderately well to well drained soils with moderately fine to moderately coarse textures.
>
> **Group C -** These soils have slow infiltration rates. These soils typically consist of clayey gravel or clayey sand.
>
> **Group D -** These soils have very slow infiltration. Group D soils are typically clay soils with high swelling potential, soils with high permanent water table, soils with a clay layer at or near the surface, or shallow soils over nearly impervious material.
>
> **Urban** - These soils have been greatly affected by development and are frequently compacted, cut, and filled, resulting in variable runoff rates and a poor environment for plant growth.

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. As land is developed for urban use, much of the soil is covered with impervious surfaces, and soils in the remaining areas are significantly disturbed and altered. Development often results in consolidation of the soil and tends to reduce infiltration capacity of otherwise permeable soils, resulting in significantly greater amounts of runoff.

With the exception of the Mississippi River floodplain, the soils in the WMO generally consist of well-drained soils formed in loamy and sandy glacial till and outwash. The subsoils in the watershed are generally sand. The following is a percentage breakdown of each soil group in the WMO:

Group A – 7.8% **Group B –** 57.6%

Group C – 2.6% **Group D –** 1.0%

Urban – 31.0%

The Dakota County and Ramsey County soil surveys contain maps showing generalized and detailed soils information. The following generalized soil and land descriptions are taken from the county soil maps.

Most of the soil along the Mississippi River is "alluvium," which is either a silty, sandy, or loamy soil on nearly level floodplains or fill material on wet substratum. The mapping unit indicates soils that are nearly level to very gently sloping, generally poorly-drained and located in floodplain areas. In Ramsey County, this soil type is generally covered with fill material 2 feet thick or more. However, this soil is still considered poorly drained because of the underlying poorly drained soil and nearly level land surface.

The "urban land" designation in the City of St. Paul includes the Chetek and Mahtomedi soil groups. The soils have been disturbed and reworked by urbanization. This land can be level or very steep. The soils, generally associated with uplands, tend to be excessively drained with a moderately coarse texture.

The most prevalent general soil type in the WMO is "loamy and sandy soil," which is a combination of the Kingsley-Mahtomedi soil groups. This loamy and sandy soil is well drained and moderately coarse textured. It is found on gently sloping to very steep land, much of it urban, and is also found on uplands.

The "silty, loamy, and sandy soil" unit is the Waukegan/Wadena/Hawick group. It is a silty, loamy and sandy soil, well drained to excessively drained, found on level to very steep land on outwash plains and terraces.

Much of the watershed is urbanized, which changes the character of soil — typically resulting in decreased infiltration rates for sandy areas. Grading, plantings, and tended lawns tend to dominate the landscape in urbanized areas and may become more important factors in runoff generation than the original soil type. The topography of the watershed, characterized by numerous small depressions and steep slopes, causes the watershed to be well drained and the surficial soils to have less impact on runoff generation than would be true for flat or gently rolling terrain.

More information about soils can be obtained from the Dakota County and Ramsey County soil surveys.

2.4 Geology and Groundwater Resources

2.4.1 Geology

The geology of the WMO consists of Quaternary deposits directly overlying Cambrian or Ordovician bedrock formations. This sequence is depicted in the generalized regional stratigraphic column shown in **Appendix C**. The stratigraphic column shows the vertical relationship of the units, their approximate thickness and their water-bearing capabilities.

The subcropping bedrock units in the WMO are the Decorah shale, the Platteville and Glenwood shale, the St. Peter sandstone, the Prairie du Chien dolomite, the Jordan sandstone, and the St. Lawrence shale. Subcropping bedrock is the first bedrock encountered below the overlying soils. The youngest subcropping bedrock units, such as the Decorah shale, occur in the northern part of the WMO, while the older subcropping bedrock units, such as the Jordan Sandstone, occur in the southern part of the WMO. All of these bedrock units are sedimentary rocks deposited by shallow seas during late Cambrian and Ordovician times, approximately 500 million years ago. The bedrock formations form part of a gently sloping bowl-like structure centered under the Minneapolis-St. Paul metropolitan area, known as the Twin Cities basin. The Dakota County and Ramsey County geologic atlases contain more information about the subcropping bedrock units. Refer to **Figure 6** for a map showing the depth to bedrock throughout the watershed.

Glacial deposits of varying thickness cover most of the bedrock in the watershed area. The thickest deposit lies over the extensive buried bedrock valley located in southern Inver Grove Heights. The bedrock valley was carved during the Pleistocene era by advancing and retreating glaciers and by erosion from streams inhabiting the valley during inter-glacial periods. Later, this valley was buried under thick deposits of stream and glacial sand and gravel. The deposits that buried the bedrock valley are approximately 400 feet thick, even 500 feet thick or more in places, while the glacial deposits in the northern and eastern parts of the WMO are less than 50 feet thick, with exposed bedrock along the cliffs of the Mississippi River banks.

2.4.2 Groundwater Resources

Two types of aquifers are present in the Lower Mississippi River WMO: surficial and bedrock aquifers. The following paragraphs provide general information about the aquifers in the WMO. For more information, refer to the Dakota County and Ramsey County geologic atlases, the *Dakota County Groundwater Protection Plan*, and the *Ramsey County Ground Water Quality Protection Plan.* **Figure 7** shows the type and location of the DNR permitted groundwater appropriations sites within the WMO. Updated information on groundwater appropriations is available at http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html.

Surficial Aquifers

Surficial aquifers are water-bearing layers of sediment, usually sand and gravel, which lie close to the ground surface. 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 the WMO, the aquifer could provide sufficient water yield for some non-potable industrial uses.

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 water levels. Surficial aquifers may discharge to local lakes, streams or to the underlying bedrock.

A large number of ponds and lakes are scattered throughout the southern part of the watershed and recharge the groundwater. Many of these water bodies are landlocked and their only outlet is to the groundwater. Some of the landlocked water bodies are probably perched above the regional level of the shallow groundwater in the watershed.

Refer to **Figure 8** for an approximation of the depth to groundwater throughout the watershed. The depth to groundwater was interpolated using known land elevation data and known groundwater elevation information. A groundwater elevation raster (digital image) was created using known lake, wetland, and soil boring information. The depth to groundwater was then calculated by subtracting the groundwater elevations from ground elevations throughout the WMO. Groundwater elevations were then verified using well data from the County Well Index and water table elevation contours from the Ramsey and Dakota County Geologic Atlases. For exact groundwater information it is suggested that soil borings be performed at the desired location.

Bedrock Aquifers

Five major bedrock aquifers are available for water supply in the WMO. The major bedrock aquifers are, in order of use and development: (1) Prairie du Chien-Jordan, (2) Mount Simon-Hinckley, (3) 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.

The groundwater level in the Prairie du Chien-Jordan aquifer varies from less than 700 feet to more than 800 feet above mean sea level as shown in the county geologic atlases. The aquifer is recharged in areas where thin permeable drift overlies the limestone layers. Some recharge of this aquifer occurs locally from percolation through the overlying glacial deposits or St. Peter sandstone. However, hydrogeologic considerations suggest this recharge would be a minimal contribution to the aquifer flow. Regional recharge of the Prairie du Chien-Jordan aquifer occurs to the south, in Freeborn and Mower Counties. Groundwater movement in the aquifer is generally from south to north, toward the Minnesota and Mississippi Rivers. The drift-filled bedrock valley in the southern portion of the area cuts deeply into the Prairie du Chien-Jordan aquifer, creating a direct connection between the aquifer and the surficial groundwater in the glacial drift. Hence, any contamination percolating through the glacial drift in the bedrock valley may enter the bedrock aquifer system.

The aquifer with the highest water quality and highest possible 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 and there are limitations to its use. Minnesota statutes limit appropriations from the Mt. Simon-Hinckley aquifer to potable water uses, where there are no feasible or practical alternatives, and where a water conservation plan is incorporated with the appropriations permit. The water level of the Mt. Simon-Hinckley has been nearly constant, having a head of about 700 feet above mean sea level (artesian conditions are most likely present in areas where ground elevations are close to or less than 700 feet). 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. Groundwater movement in the aquifer is generally to the southeast. The local direction of groundwater flow in the Twin Cities area tends to be toward the western suburbs, due to pumping of the aquifer.

The City of Inver Grove Heights obtains its municipal water from the Prairie du Chien - Jordan and the Mount Simon Hinckley aquifers, and the City of South St. Paul obtains its water from the Prairie du Chien-Jordan aquifer.

2.5 Land Use and Public Utilities

Figure 9 shows existing land use in the WMO. The land use map shows most of the land use in the watershed is residential, with concentrated areas of commercial development along Robert Street, Highway 110, and Concord Avenue, business and industrial areas along the river, and large amounts of undeveloped land in Inver Grove Heights. **Figure 10** shows the anticipated future land use in the WMO. The land use maps show that most of the land use changes are projected to occur in the southern half of the WMO, in the form of new development. Smaller land use changes, mostly in the form of redevelopment, are anticipated in the remainder of the watershed.

The Cities of Lilydale, Mendota Heights, St. Paul, South St. Paul, Sunfish Lake and West St. Paul are entirely within the Metropolitan Urban Service Area (MUSA). The MUSA is the area delineated by the Metropolitan Council in their *Regional Blueprint*, where urbanization is expected to occur and where metropolitan service systems (particularly sewer and major highways/interchanges) will be provided to accommodate growth. About 44% of the land in the City of Inver Grove Heights lies within the 2010 MUSA boundary. Refer to **Figure 9** for the 2010 MUSA boundary and **Figure 10** for the projected 2030 MUSA boundary in the WMO.

The Cities of St. Paul, Lilydale (supplied by Mendota Heights), Mendota Heights, and West St. Paul obtain their municipal water through the St. Paul Regional Water Utility, which obtains most of its water from the Mississippi River. The Cities of South St. Paul and Inver Grove Heights obtain their municipal water supplies from groundwater aquifers. Areas of large lot development (outside the MUSA) within the City of Inver Grove Heights and a few areas within the City of Mendota Heights and the City of Lilydale are served by private individual wells. Although the City of Sunfish Lake is located within the MUSA, private individual wells and on-site septic systems serve the residents of Sunfish Lake. The City of Sunfish Lake has no plans to provide either public water or sanitary sewer services in the future.

2.6 Surface Water Resource Information

2.6.1 Public Waters (Lakes, Wetlands, Streams, Ditches) and Wetlands

Figure 11 shows the DNR-protected waters located in Lower Mississippi River WMO. As seen in the figure, none of the DNR-protected waters are streams, and there are no public ditches in the WMO. **Figure 12** shows the wetlands identified in the National Wetlands Inventory (NWI) and other water bodies. There may be additional wetlands (especially those smaller than 0.5 acre) in the WMO that are not included in the inventory.

The City of Inver Grove Heights' *Natural Resource Inventory and Management Plan for the Northwest Expansion Area* (2004), *Stormwater Manual for the Northwest Area* (2006), and the *Draft Southwest Area Wetland Inventory and Assessment (2002)* contain an inventory and detailed information about the wetlands located in the City. The City of Inver Grove Heights' 1990 wetland inventory, completed by the Dakota Soil and Water Conservation District, identifies over 350 wetlands 0.5 acres and larger. The City of Mendota Heights' *Local Surface Water Management Plan* (2006) contains an inventory and detailed information about all wetlands in the City. The City of St. Paul completed a *Wetland Management Plan* (2008) to address the wetlands throughout the City.

The following paragraphs present information for some of the water bodies within the WMO. Increased water quality monitoring information is needed to more accurately classify many of the water bodies and to establish water quality trends. Refer to **Appendix D** for the MPCA's inventory of public waters located in the WMO. The table also classifies some of the water body types according to the MPCA's classification system.

Mississippi River

The Mississippi River borders the majority of the Lower Mississippi River WMO and is a significant resource for the area. As the water source for the City of St. Paul, a national "Heritage River", and a national park this area, the water quality of the Mississippi River is of local, regional, state, and national concern. The Mississippi River is the largest river system in the United States and provides essential benefits including but not limited to transportation, recreation, and ecology. The Lower Mississippi River WMO Board recognizes the importance of improving the quality of the stormwater runoff reaching the Mississippi River from the WMO.

There are three reaches of the Mississippi River that border the Lower Mississippi River WMO, each of which is listed as impaired by the MPCA. The first reach (AUID – 07010206-505), from the Minnesota River to the Metro Waste Water Treatment Plant (River Mile 844 to 835), is impaired due to Fecal Coliform (1996), Polychlorinated Biphenyls (PCB) in fish tissue (1998), Perfluorooctane Sulfonate (PFOS) in fish tissue (2008), Turbidity (1998), and Mercury in fish tissue and water column (1998). The second reach (AUID – 07010206-504), from the Metro Waste Water Treatment Plant to Rock Island Railroad Bridge (River Mile 835 to 830), is impaired due to PCB in fish tissue (1998), PFOS in fish tissue (2008), Turbidity (1998), and Mercury in fish tissue and water column (1998). The third reach (AUID – 07010206-502), from the Rock Island Railroad Bridge to Lock & Dam #2 (River Mile

830 to 815.2), is impaired due to PCB in fish tissue (1998), PFOS in fish tissue (2008), Turbidity (1998), and Mercury in fish tissue and water column (1998). The year in parenthesis is the year the reach was placed on the impaired waters inventory. Refer to the MPCA's website for information on individual Total Maximum Daily Loads (TMDL) start and completion dates.

Sunfish Lake (ID #19-0050-00)

Sunfish Lake, a 51-acre lake located in the City of Sunfish Lake, supports some fishing and swimming, but there is no public access or adjoining public parks. The City has no plans to provide public access or acquire adjacent land for parks. Sunfish Lake has a high overflow outlet, constructed in about 1997**,** that carries water to Friendly Marsh and Interstate Valley Creek. The outlet is located above the Ordinary High Water (OHW) elevation, so there is typically no discharge from the lake. Sunfish Lake was listed by the MPCA as impaired due to nutrients/eutrophication biological indicators in 2010 and has a TMDL target start date of 2012 and target completion date of 2014.

Water quality data (including Phosphorus, Chlorophyll, Secchi Disk, Temperature, Total Kjeldahl Nitrogen, Pheophytin-a) is available from 1973, 1984, 1985, 1986, 1991, 1994, 1995, 1997, 2006, 2007, and 2008. Not all parameters are available for each year.

Hornbean Lake (ID #19-0047-00)

Hornbean Lake is a 20-acre lake that straddles the Sunfish Lake/Inver Grove Heights border, just north of I-494. It is surrounded by land that is either currently low density residential or will be low density residential in the future. The lake receives runoff from I-494, in addition to the residential land uses. There is no public access or adjoining public parks and neither City has plans to provide future public access or acquire adjacent land for parks. Phosphorus, Chlorophyll, and Secchi disk data are available from water quality sampling conducted from 1999 to 2008.

Horseshoe Lake (ID #19-0051-00)

Horseshoe Lake is a 15-acre lake that lies in the southeast corner of the City of Sunfish Lake, adjacent to I-494 and Robert Trail. The Horseshoe Lake outlet is located at the southeast corner of the lake; water discharges under 60th Street and flows to small ponds in Inver Grove Heights. The lake is surrounded by land that is either currently low density residential or will be low density residential in the future. There is no public access or adjoining public parks and neither Sunfish Lake nor Inver Grove Heights plans to provide future public access or acquire adjacent land for parks. Phosphorus, Chlorophyll, Secchi disk, Temperature, Total Kjeldahl Nitrogen, and Pheophytin-a data are available from water quality sampling conducted in 2006, 2007, and 2008. The relatively good water quality of Horseshoe Lake indicates the lake is not a major contributor of nutrients to the downstream system.

Seidl's Pond (ID #19-0095-00)

Seidl's Pond is a 4-acre pond located in both South St. Paul and Inver Grove Heights. The lake is surrounded by parkland in both cities, which is heavily wooded with steep topography. Seidl's Pond has no surface water outlet (it is "landlocked").

Phosphorus, Chlorophyll, Secchi disk, Temperature, Total Kjeldahl Nitrogen, and Pheophytin-a data is available from 1993-2008. Not all parameters are available for each year.

Pickerel Lake (ID #19-0079-00)

Pickerel Lake, a 78-acre lake located in Lilydale and St. Paul, is in the Lilydale-Harriet Island Regional Park complex. In addition to the park, land use in the watershed is mostly low density residential. Ivy Falls Creek (and its watershed) discharges into Pickerel Lake. Pickerel Lake also receives drainage from the wetland south of the lake, in the Central Highway 13 watershed. Pickerel Lake discharges to the Mississippi River. When river levels are high enough, the Mississippi River backs up into Pickerel Lake, which can greatly affect the water quality of the lake. Pickerel Lake was listed as impaired due to mercury by the MPCA in 2010 and is part of the state-wide TMDL for mercury.

There is a public access on the lake. Improvements including fish stocking, a nature/interpretive center, a parking area, and other public improvements are proposed for completion in 2011. There is minimal water quality data available for Pickerel Lake; however, the MPCA used volunteers to assess water quality in Pickerel Lake in 2010 and 2011.

Simley Lake (ID #19-0037-00)

Simley Lake is an 11-acre lake located in Inver Grove Heights. There is a small city park, comprised of the island in the middle of the lake. Access to the park is limited to a pedestrian trail to the island. There is no public access on the lake. Land use in the watershed includes a high school, commercial, and residential land uses. Most of the watershed is developed. Phosphorus, Chlorophyll, Secchi disk, Temperature, Total Kjeldahl Nitrogen, and Pheophytin-a data is available from 1995-2002. Not all parameters are available for each year.

Dickman Lake/Loch Gregor (ID #19-0046-00)

Dickman Lake/Loch Gregor is a 20-acre lake located in northwestern Inver Grove Heights. The lake's tributary area is primarily from Inver Grove Heights but also includes a small portion of the City of Sunfish Lake, between I-494 and Robert Trail. There is no outlet from Dickman Lake/Loch Gregor. Existing land use in the watershed includes low density residential, park land, and undeveloped land. Future land use in the watershed will convert the undeveloped land to low density residential land use. There are no parks or public access on the lake. Water quality data (Phosphorus, Chlorophyll, Secchi disk, Temperature, Total Kjeldahl Nitrogen, Pheophytin-a, pH, Dissolved Oxygen, Total Suspended Solids, Turbidity) is available for this lake from 1996 and 1997, which indicates the lake is hypereutrophic. The WMO also monitored the Lake in 2010.

Thompson Lake (ID #19-0048-00)

Thompson Lake is a 7-acre lake located in the City of West St. Paul. Thompson Lake is the centerpiece for the popular Thompson County Park. The area has numerous trails, a fishing pier, a community center, and a picnic shelter. Monitoring performed by the City of West St. Paul and Dakota County has determined that lake

sediments contain concentrations of polycyclic aromatic hydrocarbons (PAHs) at levels that prevent reuse of the sediment on residential or industrial properties. A feasibility study needs to be completed to address the PAHs and help determine the upstream source of the pollution. The County and City are working to secure funding to remove the sediment with high PAH concentrations.

Rogers Lake (ID #19-0080-00)

Rogers Lake, a 107-acre lake located in Mendota Heights, formerly supported a public swimming beach and is popular among local residents for panfish fishing. Although there is no public access on this lake, there is a City park on the lake with picnic grounds, trails, and play areas that also provides opportunities for non-motorized boating. Land uses in the watershed are highway, low density residential and park land. Outflows from the lake reach Friendly Marsh and Interstate Valley Creek. Phosphorus, Chlorophyll, Secchi disk, Temperature, and Total Kjeldahl Nitrogen data is available for this lake from 2009.

Marcott Lakes (IDs #19-0042-00, #19-0041-00, #19-0040-00, #19-0039-00)

There are no public access points or adjoining park land for any of the Marcott chain of lakes in Inver Grove Heights. Land use in the watershed is currently a mixture of low density residential, highway, and undeveloped land. The undeveloped land is proposed to be low density or rural density residential in the future. Water quality data is available for Marcott (Rosenberger) Lake (DNR #19-0041), a 22-acre lake at the north end of the chain. Based on data from 1995, 1996, 1997,1998, 2000, 2001 and 2002, the lake water quality is very good. Highway runoff and slope failures have threatened the water quality of Rosenberger Lake in the past. Secchi disk transparency data is available for 27-acre Marcott Lake II (Ohman's Lake, DNR #19-0042) for 1988 and 1989 and water quality data (Phosphorus, Chlorophyll, Secchi disk, Temperature, Total Kjeldahl Nitrogen, Pheophytin-a, pH, Dissolved Oxygen, Total Suspended Solids, Turbidity) is available from 1997.

Schmitt Lake (ID #19-0052-00)

Schmitt Lake is a 57-acre lake located in northern Inver Grove Heights, near the intersection of I-494 and Robert Trail South. There is no public access on the lake. Fishing for northern pike and bluegills is popular at Schmitt Lake. Existing land use in the watershed includes commercial, low and high density residential, and undeveloped land. The WMO monitored Schmitt Lake in 2010. Phosphorus, Chlorophyll, and Secchi disk data is available from 2010.

Golf Course Pond (ID #19-0049-00)

This 14-acre pond is located in Inver Grove Heights. Southview Country Club is adjacent to the pond. Other land uses in the watershed include mostly low density residential, with a small amount of medium density residential. There is no public access on the pond. The only water quality data available are Secchi disk transparencies for 1988, which show the pond to be hypereutrophic.

Other Water Bodies: McGroarty Pond (ID #19-0035-00), Gun Club Pond (#19-0245-00), City Hall Pond (#19-0267-00)

These water bodies, located in Inver Grove Heights, are managed by the DNR's Fishing in the Neighborhood (FiN) Program. For more information on these water bodies and other water bodies managed by the Fishing in the Neighborhood Program refer to the DNR's website www.dnr.state.mn.us.

2.6.2 Water Resources Monitoring Information

Water quality monitoring data is available for: Sunfish Lake, Horseshoe Lake, Hornbean Lake, Seidl's Pond, Dickman Lake, Golf Course Pond, Pickerel Lake, Simley Lake, Marcott Lakes, and Rogers Lake. See **Figure 13** for monitoring locations throughout the WMO. Most of the data was obtained from MPCA's EQUIS Database, including Metropolitan Council's Citizen Assisted Monitoring Program (CAMP) monitoring results. The monitoring at Seidl's Pond, Simley Lake, and Marcott (Rosenberger) Lake was completed under the Metropolitan Council's CAMP. Refer to **Appendix E** for a summary of monitoring information for water bodies in the WMO. More detailed monitoring information can be found online at http://www.dnr.state.mn.us/lakefind/index.html or at the Environmental Data Access system on the MPCA website; http://www.pca.state.mn.us.

2.6.3 2010 List of Impaired Waters (Section 303d)

The MPCA prepares a list of streams and lakes that are not meeting their intended beneficial uses (impaired waters, or 303(d) list). For water bodies on the impaired waters list, the state will be establishing a total maximum daily load (TMDL). To establish a TMDL, a study must be completed that identifies the relative contribution of all point and nonpoint sources of each pollutant that contributes to the impairment of the water body, and develops an implementation plan that reduces pollutant loads so the water body meets designated uses. As of 2010, the Minnesota Pollution Control Agency lists the following water bodies within the WMO as being impaired and the nature of the impairment is shown in parenthesis:

- Sunfish Lake *(Nutrients/Eutrophication Biological Indicators)*
- Pickerel Lake *(Mercury)*
- Mississippi River from the Minnesota River to the Metro Waste Water Treatment Plant, River Mile 844 to 835 *(Fecal Coliform, PCB, PFOS, Turbidity, Mercury)*
- Mississippi River from the Metro Waste Water Treatment Plant to Rock Island Railroad Bridge, River Mile 835 to 830 *(PCB, PFOS, Turbidity, Mercury)*
- Mississippi River from the Rock Island Railroad Bridge to Lock & Dam #2, River Mile 830 to 815.2 *(PCB, PFOS, Turbidity, Mercury)*

Figure 13 shows the impaired waters and the location of monitoring sites listed on the MPCA website.

The MPCA has not monitored for all water quality parameters or all water bodies, so there may be other water bodies considered impaired once an increased monitoring effort has been completed and they are assessed.

2.6.4 Stormwater System, Hydrologic Data, and Flooding Information

Figure 14 shows the major subwatersheds in WMO and labels the subwatersheds based on outlet status to the Mississippi River and whether or not the subwatershed is within more than one member city. The watersheds are grouped as follows:

Group A – Watershed to Mississippi River outlet that encompasses more than one city. An example is the Simon's Ravine subwatershed in South St. Paul and West St. Paul.

Group B – Watershed to Mississippi River outlet that includes only one city. An example is the South St. Paul 2 subwatershed in South St. Paul.

Group C – Watershed that currently has no outlet to the Mississippi River (landlocked), and no outlet is planned for the next 10 to 20 years. An example is the Barnes Avenue subwatershed in Inver Grove Heights.

Table 2-2 lists the subwatersheds and their areas.

Table 2-2. Major Subwatersheds in Lower Mississippi River WMO

Subwatershed Name	Area, in Acres
"A" Subwatersheds – Intercommunity subwatersheds with existing outlet to the Mississippi River	
Interstate Valley Creek	4,251
Highway 13	728
Ivy Falls Creek	708
Riverview	3,493
Simons Ravine	1,426
Wentworth Street	639
South Grove	1,016
Highway 110-494	3,078
Old Village	511
"B" Subwatersheds – Non-intercommunity subwatersheds with existing outlet to the Mississippi River	
South St. Paul 1	150
South St. Paul 2	277
South St. Paul 3	1266
Skyline Village	427
Arbor Pointe	1021
Mississippi River	901
Eagan	324
Simley Lake	566
Rosemount	443
Gun Club Lake	39
"C" Subwatersheds – Non-intercommunilty subwatersheds with no outlet to the Mississippi River planned for 10-20 years (landlocked)	

Subwatershed Name	Area, in Acres
Babcock Trail	1,174
Valley Park	427
Inver Grove Trail	426
Barnes Avenue	440
South Marcott Lakes	698
Northwest	2,466
Rich Valley	1,598
Argenta Trail	101
Albavar Path	155
Jefferson Trail	33
110th Street	2,534
Pine Bend	796

Hydrologic modeling results for each member city are contained in their water management plans: Inver Grove Heights (2008), Lilydale (2008), Mendota Heights (2006), Saint Paul (2006), South St. Paul (2004), Sunfish Lake (2009), and West Saint Paul (2006). More detailed information on the drainage within each member city can be found in these plans and can be obtained by contacting the city of interest.

Hydrologic modeling results are also available for the following intercommunity studies and projects: Highway 110-494 watershed, Simon's Ravine, Ivy Falls Creek, East Lexington Avenue, Mayfield Heights Road, and Akron Avenue. These modeling results are stored electronically and are revised/updated on an as-needed basis. This hydrologic information is available from the WMO's engineer.

Flooding information can be found in the member cities' local water management plans, along with detailed information about stormwater ponds. Additional flood information is available from the Flood Insurance Studies (FIS) for some of the WMO communities. Refer to **Figure 15** for the 100-year and 500-year FEMA floodplain locations.

2.7 Public Areas for Water Based Recreation and Access

There are numerous water bodies (see **section 2.6.1**) and parks within or near the WMO which offer recreational activities such as walking, biking, fishing, and boating. A number of recreational resources and opportunities are outlined below:

Parks: Year-round, people utilize the amenities of popular area parks. Thompson County Park, Pickerel Lake Regional Park, Seidl's Lake Park, Kaposia Park, and many others throughout the watershed are visited frequently.

Fishing/Boating: Fishing and boating are popular activities throughout the watershed. Many fishing piers are located on ponds, lakes, and along the Mississippi River. Canoeing and kayaking is also a popular form of recreation and exercise at many water bodies across the watershed. There are no public facilities on any of the basins in the

WMO for launching boats, so access is limited for those who do not live adjacent to a water body.

Trail Systems: Walking, biking, and jogging are common activities on the numerous trail systems located at area parks, along the river, and throughout the watershed.

Additional information regarding recreational opportunities within the WMO is available at the member cities' web sites.

2.8 Fish and Wildlife Habitat

The WMO contains habitat for a variety of small mammals, fish, reptiles, birds, amphibians, and insects. Maintenance of habitat for wildlife species is important in maintaining ecological stability of the WMO's natural areas. Information from the DNR indicates there is a variety of unique plant and animal life within the WMO, much of which is located in or around the area water bodies.

There are many different species of fish located in the Mississippi River and area lakes. Fish sampling information can be obtained to determine the species of fish in a given river or lake. This information can be found at www.dnr.state.mn.us/lakefind/index.html. The Mississippi River is an especially popular fishery. The DNR reports there may be over 125 species present in Pool 2 (from Ford Dam in St. Paul to the Hastings Dam) and attracts many anglers fishing for walleye, sauger, catfish, and white bass.

2.9 Unique Features

2.9.1 Scenic Areas

Scenic areas include State designated Scientific and Natural Areas, designated Scenic Areas, and Historic Areas. The WMO contains many lakes and wetlands that are the centerpiece for many scenic areas and parks. It is bordered by the Mississippi River on the entire north and east boundaries. The Katherine Ordway Natural History Study Area is adjacent to the Mississippi River, in southeast Inver Grove Heights. Other important park areas include Thompson County Park in West St. Paul and Dodge Nature Center in Mendota Heights.

2.9.2 Natural Communities and Rare Species

The Minnesota DNR Natural Heritage Information System from 2011 was queried for the WMO. The Minnesota DNR conducts the Minnesota County Biological Survey (MCBS), which identifies natural communities and rare species. The Natural Heritage Information System shows the presence of rare species in WMO along the Mississippi River in Lilydale, South St. Paul, St. Paul, and Inver Grove Heights. The survey also shows the presence of rare species in the Cities of West St. Paul and Inver Grove Heights separate from the Mississippi River corridor. In addition, there are 16 native plant communities including mesic prairies, dry sand prairies, and black ash seepage swamps within the WMO boundary. These surveys are evidence of the ecological importance of the Mississippi River corridor and critical habitats within the

member cities. **Figure 16** shows the location of MCBS Native Plant Communities and Scientific and Natural Areas.

The presettlement vegetation in the WMO consisted of river bottom forest along the Mississippi River, and as a mixture of oak openings and barrens, upland deciduous forest, and brush prairie. **Figure 17** shows the presettlement vegetation.

2.9.3 Mississippi National River and Recreational Area (MNRRA) and Mississippi River Corridor Critical Area (MRCCA)

The Minnesota State Legislature enacted the Critical Areas Act in 1973 and an executive order (79-19) was signed in 1976 declaring the Mississippi River corridor a Critical Area. The executive order states the following purposes for the Critical Area designation:

1. To protect and preserve a unique and valuable state and regional resource for the benefit of the health, safety and welfare of the citizens for the state, region, and nation;
2. To prevent and mitigate irreversible damage to this state, regional and national resource;
3. To preserve and enhance its natural, aesthetic, cultural, and historical value for the public use;
4. To protect and preserve the river as an essential element in the national, state and regional transportation, sewer and water and recreational systems; and
5. To protect and preserve the biological and ecological functions of the corridor.

The MRCCA includes 72 miles of the river, extending from the Cities of Dayton and Ramsey to just south of the City of Hastings. The boundary of the MRCCA can generally be described as from the river bluff down to the river, with the corridor width varying. The Cities of Inver Grove Heights, Lilydale, Mendota Heights, St. Paul, and South St. Paul are affected by the state Critical Areas Act and the federally designated MNRRA. **Figure 18** shows the MRCCA boundary in relation to the WMO.

In 1976, four corridor districts were established, corresponding to the following different types of land use along the Mississippi River: rural open space district, urban developed district, urban open space district, and urban diversified district. Each district has its own set of guidelines. The Critical Area Act requires that each city having jurisdiction over land within the Critical Area develop a Critical Area Plan. Executive Order 79-19 includes the rules and guidelines that each city must incorporate in its Critical Area Plan.

In 1988, the U.S. Congress designated the Mississippi River corridor as the MNRRA, a unit of the national park system. The boundaries of the MNRRA corridor are the same as the Critical Area corridor. MNRRA was established to:

1. Protect, preserve, and enhance the significant values of the Mississippi River corridor through the Twin Cities metropolitan area;
2. Encourage coordination of federal, state, and local programs; and

3. Provide a management framework to assist the state of Minnesota and local governments in the development and implementation of integrated resource management programs and ensure orderly public and private development in the area.

The Mississippi River Coordinating Commission and the National Park Service adopted the MNRRA *Comprehensive Management Plan* in 1995. This plan adopts and incorporates by reference the state Critical Area Program, Shoreland Management Program, and other applicable state and regional land use management programs. The MNRRA comprehensive plan also identifies voluntary policies that are additional to the Critical Area requirements, for the purpose of protecting and enhancing river resources. The earlier Critical Area requirements are referred to as Tier 1 criteria, whereas the additional voluntary guidelines in the MNRRA comprehensive plan are referred to as Tier 2 criteria. Although city conformance with Tier 2 criteria is not mandatory, conformance to Tier 2 criteria is necessary to receive federal grants for land acquisition and development. All of the member cities within the MNRRA corridor have comprehensive plans that conform to Tier 1 criteria, but there are varying levels of conformance with Tier 2 criteria.

In 2009 the Minnesota State Legislature directed the DNR to conduct new rulemaking for the MRCCA. The boundary of the existing corridor is not anticipated to change, however the boundaries and requirements within the corridor are expected to change. The adoption of updated rules will be mandatory by the local government units (LGUs) located within corridor boundaries. New rules for the MRCCA are in the process of being drafted and are expected to be completed shortly after the adoption of this plan.

2.10 Pollutant Sources

The MPCA identified the following types and number of environmentally contaminated sites within the WMO:

1. MPCA's List of Permitted Solid Waste Facilities (SWPERM) – 16 sites
2. MPCA's 1980 Metropolitan Area Waste Disposal Site Inventory (MDI), unpermitted dumpsites – 25 sites
3. MPCA's Voluntary Investigation and Cleanup (VIC) Unit List – 95 sites
4. MPCA's Sites Delisted from Permanent List of Priorities (DPLP) – 3 sites
5. U.S. EPA's No Further Remedial Action Planned (NFRAP) Sites, removed from CERCLIS by U.S. EPA – 8 sites
6. MPCA's Closed Landfill Sites Undergoing Cleanup – 1 site

The MPCA also identified approximately 250 reported underground storage tank leaks within the WMO.

Refer to **Figure 19** for approximate location of possible pollutant sources throughout the WMO. More information can be obtained by contacting the MPCA or going to www.mpca.state.mn.us and searching "What's in my neighborhood". The MPCA should be contacted for site-specific details.

Dakota County initiated the Site Assessment and Site Response Program to inventory, identify, evaluate and restore contaminated sites. This program complements existing State and Federal programs.

The highways in the WMO (i.e. I-35E, I-494, Highway 52, and Highway 55) present potential environmental hazards. For example, a spill on Interstate 494 could result in pollution of Schmitt Lake since the lake is located immediately adjacent to the roadway. The MPCA's spill reports show that spills have occurred in the past on Interstate 494 and Highways 52 and 55 within the WMO.

Other potential pollutant sources include industrial, office, commercial, residential and other highly impervious land uses. Stormwater runoff from these land uses could carry pollutants into the stormwater system (nonpoint source pollution), especially if there are direct inlets into the storm sewer system that do not drain first into a stormwater pond. Facilities within these land use types may be covered by a NPDES General Industrial Stormwater Permit, which requires preparation of stormwater pollution prevention plans (SWPPP) to prevent nonpoint source pollution. In addition, each member city is part of the MPCA's MS4 (Municipal Separate Storm Sewer System) program. Each member city is required to have a city wide SWPPP as part of the MS4 program requirements. Refer to the MPCA's website for the most up to date information regarding these programs.

2.11 Water Resource Problem Areas

A number of water resource problem areas, issues or concerns were identified within the WMO. The problem areas were identified through information obtained from the Technical Advisory Committee (TAC) and the Citizen Advisory Committee (CAC). Each site was analyzed and potential solutions to address the problems were developed, as detailed in **Section 4**. Refer to **Figure 20** for the location of site-specific problem areas. The following is a list and brief description of some of the water resource problem areas in the WMO.

1) Stream bank erosion along the Mississippi River – Improvements are needed to stabilize erosion-prone areas and reduce sediment loading to the river.

2) Pickerel Lake Regional Park for BMPs and Improvements – Improvements are needed to enhance water quality and provide access to high quality recreational areas.

3) PAHs present in Thompson Lake Sediments – Increased modeling and source determination needs to be completed to address PAHs.

4) Impaired Waters – The MPCA has identified Sunfish Lake, Pickerel Lake, and three reaches of the Mississippi River as being impaired.

5) Debris and Floatables at Simley Lake – Source of pollution and maintenance responsibilities need to be addressed.

6) Flooding and Erosion at Marie Ave/Dodd Rd. – Improvements need to be constructed to address erosion and reduce flood potential.

7) Erosion along Ivy Falls Creek at Thompson Ave/Delaware Ave – Feasibility study and improvements are needed to address erosion problems.

8) Erosion at Golf Course Pond – Continued monitoring of the erosion problem is needed along with potential constructed improvements.

9) Water Quality in Hornbean Lake – Implementation of BMPs in the Hornbean Lake watershed is needed to minimize the impacts of upstream development.

There are most likely additional problem areas located throughout the WMO that have yet to be identified due to a lack of monitoring. These problem areas will be identified and addressed as additional monitoring occurs.

3.0 Agency Cooperation

There are a number of local, state, and federal agencies that have rules and regulations related to water resource management. The WMO recognizes the roles of these other agencies and will cooperate, coordinate, and when possible partner with these agencies.

This Plan is in conformance with but does not restate all other agency rules that are applicable to water resource management. The following agencies deal with or regulate water resources throughout the WMO:

- Minnesota Department of Health www.health.state.mn.us
- Minnesota Pollution Control Agency www.pca.state.mn.us
- Board of Water and Soil Resources www.bwsr.state.mn.us and the Wetland Conservation Act www.bwsr.state.mn.us/wetlands/wca/index.html
- Minnesota Department of Natural Resources www.dnr.state.mn.us
- US Army Corps of Engineers www.mvp.usace.army.mi
- Minnesota Department of Agriculture www.mda.state.mn.us
- US Fish and Wildlife Service www.fws.gov
- Dakota County www.co.dakota.mn.us
- Dakota County Soil and Water Conservation District www.dakotacountyswcd.org
- Ramsey County www.co.ramsey.mn.us
- Ramsey County Soil and Water Conservation District www.co.ramsey.mn.us/cd/index.htm
- Minnesota Environmental Quality Board www.eqb.state.mn.us
- Metropolitan Council www.metrocouncil.org
- National Park Service www.nps.gov

While these other agencies' rules, policies, and guidelines are not all restated in this Plan, they are applicable to projects, programs, and planning within the WMO. The MPCA Minnesota Stormwater Manual, which is a document intended to be frequently updated, is also incorporated by reference into this Plan and can be found at www.pca.state.mn.us/water/stormwater/stormwater-manual.html.

4.0 Problems and Approaches for Addressing Problems

This section contains an assessment of existing and potential water resource-related problems within the WMO. These problems have been identified from analysis of the land and water resource data collected during the preparation of this Plan, through information provided by the WMO, information from the member cities, information obtained at the public open house, and contributions from the TAC and CAC. A description of existing and potential problems within the WMO has been listed along with potential corrective actions. The WMO implementation plan containing future planning and projects is presented in **Tables 6-1, 6-2, 6-3, 6-4**, and **6-5.** Projects and studies completed by the WMO and member cities that resolved problems and issues identified in previous plans can be found in **Table 6-6**.

Refer to **Figure 20** for the location of site-specific problem areas.

4.1 Water Quality Problems and Issues

Problem 4.1.A: The following water bodies located in the WMO have been listed as impaired by the Minnesota Pollution Control Agency:

- Sunfish Lake *(Nutrients/Eutrophication Biological Indicators)*
- Pickerel Lake *(Mercury)*
- Mississippi River from the Minnesota River to the Metro Waste Water Treatment Plant, River Mile 844 to 835 *(Fecal Coliform, PCB, PFOS, Turbidity, Mercury)*
- Mississippi River from the Metro Waste Water Treatment Plant to Rock Island Railroad Bridge, River Mile 835 to 830 *(PCB, PFOS, Turbidity, Mercury)*
- Mississippi River from the Rock Island Railroad Bridge to Lock & Dam #2, River Mile 830 to 815.2 *(PCB, PFOS, Turbidity, Mercury)*

Approach for Addressing Problem 4.1.A: The WMO and affected member cities shall work with the MPCA and other relevant agencies to address impairments, develop TMDLs, and implement TMDL plans. The WMO and its member cities shall also be prepared to incorporate the provisions of the South Metro Mississippi TSS TMDL and the Upper Mississippi River Bacteria TMDL once they are completed. The WMO will be affected by both of these implementation plans that are anticipated to be completed during the ten year life-cycle of this plan.

The mercury TMDL is a statewide study that was completed by the MPCA in 2007. Over 90% of the mercury deposition in the state originates beyond the boundaries of the State of Minnesota. The federal government will be responsible for meeting its reduction goal, while the State of Minnesota needs a 93% reduction from 1990 levels by 2025 to meet its share. The MPCA will work with an Implementation Oversight Group and Minnesota entities that release mercury into the environment.

Monitoring has not been completed for all water quality parameters or all water bodies within the WMO. As a result, other water bodies may be added to the impaired waters list once an increased monitoring effort has been completed.

Problem 4.1.B: Increased water quality monitoring is needed to better classify DNR protected water bodies in the WMO and to help establish water quality trends.

Approach for Addressing Problem 4.1.B: The WMO will work with member cities to develop a monitoring program to collect water quality data for water bodies throughout the WMO. Monitoring will be determined annually and by the WMO budget. The data collected, combined with historic data will be used to classify water bodies, establish water quality trends, and determine areas where improvements are necessary to preserve and enhance resources. The WMO may conduct monitoring, require the local governments to conduct monitoring, or seek other means to complete these monitoring activities.

The WMO may also work with the MPCA to monitor water bodies as part of the MPCA's Watershed Approach Program.

Problem 4.1.C: There is not enough data to understand the quality of water reaching the Mississippi River through stormwater outfalls and streams.

Approach for Addressing Problem 4.1.C: The WMO will work with member cities to develop a monitoring program to monitor select outfalls to the Mississippi River. Monitoring will be determined annually and by the WMO budget. This monitoring effort will help identify point source locations for pollutant loadings to the river and will help establish high priority areas for water quality improvements and BMP implementation. This will also help identify the most cost-effective locations to construct water quality capital improvements.

Problem 4.1.D: The efficiency and effectiveness of many stormwater BMPs in the watershed is unknown.

Approach for Addressing Problem 4.1.D: MPCA's Minimal Impact Design Standards (MIDS) Project, once complete, should be utilized to help determine the effectiveness of BMPs within the WMO. Refer to http://www.pca.state.mn.us for more information and updates on the MIDS Project.

The WMO may also monitor certain BMPs throughout the WMO to determine their effectiveness. This may be accomplished through the use of grant funding or volunteers.

Problem 4.1.E: There are increased algae blooms due to excessive nutrients in many lakes, rivers, and ponds.

Approach for Addressing Problem 4.1.E: Stormwater BMPs shall be implemented by member cities to reduce both point source and non point source pollutants and reduce the impact of development on the water quality of water bodies in the WMO. Retrofits of existing BMPs shall also be performed where feasible and applicable during redevelopment. Increased education and public awareness of housekeeping BMPs will be a focus of the WMO and member cities to improve the quality of surface waters in the WMO.

Problem 4.1.F: Water quality in Hornbean Lake may be negatively impacted by future development in Inver Grove Heights and Sunfish Lake.

Approach for Addressing Problem 4.1.F: BMPs shall be implemented by Inver Grove Heights and Sunfish Lake as development occurs to reduce negative impacts on Hornbean Lake and other resources downstream of the development.

Problem 4.1.G: Presence of polycyclic aromatic hydrocarbons (PAHs) in Thompson Lake.

Approach for Addressing Problem 4.1.G: A feasibility study should be completed to address the PAHs and help determine the upstream source of the pollution. Dakota County and West St. Paul are working to secure funding to remove sediment having high PAH concentrations.

Problem 4.1.H: Accumulation of debris and floatables at Simley Lake.

Approach for Addressing Problem 4.1.H: The WMO will investigate the source of the pollution and will establish maintenance responsibilities of Simley Lake in effort to address the problem.

Problem 4.1.I: The ability of member cities to efficiently address requirements of new NPDES and MS4 Permits.

Approach for Addressing Problem 4.1.I: Develop education and public outreach programs that address member city NDPES and MS4 Permit requirements. Investigate the cost and efficiency of assisting member cities with MS4 Permit renewals.

4.2 Flooding and Stormwater Rate Control Concerns

Problem 4.2.A: Increased impervious areas that result from development or redevelopment and other land use practices cause increased rates and volumes of stormwater runoff which may result in downstream flooding, erosion, sedimentation, and water quality problems.

Approach for Addressing Problem 4.2.A: Strengthen the WMO's current Low Impact Development (LID) encouragement policy and rate control and volume control goals while taking into consideration development and redevelopment conditions. Focus on performance standards rather than prescriptive standards for water quality improvements.

The WMO shall also utilize the MPCA's MIDS Project, once it has been completed, to help determine appropriate and effective BMPs for certain development and redevelopment conditions.

Problem 4.2.B: The WMO has a number of landlocked basins that need to be evaluated on whether they will require an outlet or remain landlocked.

Approach for Addressing Problem 4.2.B: WMO and member cities will evaluate landlocked basins of interest. If there are no flooding concerns, no outlet will be necessary. If the area does flood or could cause flood problems in the future, the WMO and member cities will investigate the option of providing an outlet for the area which will protect adjacent land uses and not adversely impact downstream resources.

Problem 4.2.C: Establishing appropriate minimum building elevations to prevent the flooding of structures located adjacent to flood-prone areas and landlocked basins.

Approach for Addressing Problem 4.2.C: Member cities shall establish minimum building elevations above the critical 100-year flood elevation. The cities need to consider the effects of larger storms and plugged outlet conditions when they set these elevations. In situations such as landlocked basins or ponds with large tributary watersheds, additional freeboard above the 100-year flood elevation may be required. The cities also need to provide emergency overflows for ponds and inundation areas to address plugged outlet conditions and the effects of larger floods.

Problem 4.2.D: Flooding and erosion at Marie Avenue/Dodd Road.

Approach for Addressing Problem 4.2.D: Feasibility study has been completed for this problem area. Improvements need to be constructed to address the flooding and erosion problems.

Problem 4.2.E: Rate control and streambank erosion in the Interstate Valley Creek Watershed north of Marie Avenue.

Approach for Addressing Problem 4.2.E: Feasibility study and project shall be completed to address rate control issues and provide streambank stabilization north of Marie Avenue in the Interstate Valley Creek Watershed.

Problem 4.2.F: Drainage issues in Lilydale east of the intersection of Lexington Avenue and Sibley Memorial Highway (Trunk Highway 13) have resulted in flooding at the Lexington-Riverside Condominiums (1101 Sibley Memorial Highway), ongoing sedimentation and erosion problems within the highway right-of-way and on Lexington-Riverside property, and gullying and erosion problems along the Mississippi River bluffs.

Approach for Addressing Problem 4.2.F: A feasibility study to investigate this problem was completed in 2010. Recommended improvements include plugging the west culvert under Trunk Highway 13 and diverting water eastward through a ditch and culvert on the south side of Trunk Highway 13, construction of a new outlet from the Lexington-Riverside Pond, construction of a new storm sewer system to convey flows from the pond to the existing storm sewer, and addressing hillside erosion on the Overlook Condominiums Property. The Cities of Lilydale and Mendota Heights, along with MnDOT, Dakota County, and the Lexington-Riverside Condo Association are anticipated to participate in the cost share for this project. More information can be found in the *Lexington Avenue-Trunk Highway 13 Drainage and Erosion Feasibility Study* which can be found on the WMO's website.

Problem 4.2.G: Seidl's Pond, a landlocked basin in South St. Paul, experiences high water levels and periodic flooding.

Approach for Addressing Problem 4.2.G: A feasibility study to address this problem was completed in 2004. Construction of an outlet and a lift station is necessary to reduce drainage and flood potential of the area. More information can be found in the feasibility study which can be obtained by contacting the WMO.

Problem 4.2.H: The storm sewer system on Dawn Way in Inver Grove Heights is susceptible to surcharge as a result of insufficient capacity to convey storm water runoff

from the upstream drainage area. The upstream drainage area consists of the South St. Paul Airport and portions of Inver Grove Heights.

Approach for Addressing Problem 4.2.H: Hydrologic analysis and cost split analysis have been completed for potential Dawn Way storm sewer system improvements. The Cities of Inver Grove Heights and South St. Paul will construct the necessary improvements to address the existing drainage problems and provide additional capacity to the Dawn Way storm sewer system.

4.3 Impacts of Water Resource Management on Recreation

Problem 4.3.A: The WMO has limited public access to high quality lakes and park areas for recreational activities.

Approach for Addressing Problem 4.3.A: The WMO and member cities will investigate opportunities to implement access points and construct improvements to improve access to high quality water resources in the area. An example of this is the improvements currently underway at Pickerel Lake Regional Park to increase access and provide an enhanced recreation area.

4.4 Impacts of Wetland Loss on Fish and Wildlife Resources

Problem 4.4.A: Due to densely developed areas in the WMO, some member cities may have less opportunity than others to take advantage of wetland banking and restoring fish and wildlife resources.

Approach for Addressing Problem 4.4.A: The WMO will evaluate and pursue locations to conduct wetland restoration opportunities. These locations may serve as a wetland bank for member communities within the WMO and thus increase fish and wildlife resources within the WMO.

4.5 Impacts of Erosion and Sedimentation on Water Resources

Soil erosion can be a significant sediment source to water resources throughout the WMO, resulting in decreased water depth and degraded water quality. Erosion also impacts stormwater rates and volumes. As soil erodes, vegetation is removed from the ground surface, which results in increased rates of stormwater runoff. Erosion also results in channelization of stormwater flow, increasing the rate of stormwater runoff.

Problem 4.5.A: There are many areas along the Mississippi River, within the boundary of the WMO, that are experiencing stream bank erosion. This erosion results in a large sediment load to the river.

Approach for Addressing Problem 4.5.A: The WMO will work with the U.S. Army Corps of Engineers to identify the exact location and extent of the erosion problems. The WMO will reference the DNR's *River Restoration Guidelines*, once completed, when developing improvement options. Improvements will then need to be constructed to stabilize erosion-prone areas and reduce sedimentation of the river.

Problem 4.5.B: The need for consistency in erosion control inspection and design requirements.

Approach for Addressing Problem 4.5.B: Conduct and/or facilitate joint certification training for member city staff on designing and inspecting erosion control plans and erosion control measures.

Problem 4.5.C: Erosion along Ivy Falls Creek at the intersection of Thompson Avenue and Delaware Avenue.

Approach for Addressing Problem 4.5.C: Feasibility study and project need to be completed to address erosion problems along Ivy Falls Creek.

Problem 4.5.D: Sedimentation of stormwater ponds reduces storage volume capacity, decreases stormwater treatment ability, and can result in flooding.

Approach for Addressing Problem 4.5.D: WMO and member cities shall develop a maintenance program for pond maintenance and maintenance of all BMPs to avoid these potential issues. Determination of excess sources of sediment or other loadings will be a component of this maintenance program.

Problem 4.5.E: Golf Course Pond, in northern Inver Grove Heights, has severe erosion around the entire shore of the pond, but the erosion may be the result of a high water table, and not the result of wave action or runoff.

Approach for Addressing Problem 4.5.E: The WMO and City of Inver Grove Heights will need to monitor the problem and determine if action is required.

Problem 4.5.F: There are shoreland vegetation and erosion problems on various water bodies in the WMO.

Approach for Addressing Problem 4.5.F: Evaluate DNR protected water bodies with potential or known problems within the WMO and pursue shoreland restoration projects where needed.

4.6 Impact of Land Use Practices and Development on Water Resources

Problem 4.6.A: There is a need for groundwater management and protection in the WMO.

Approach for Addressing Problem 4.6.A: The WMO and member cities shall encourage infiltration in suitable areas to provide groundwater recharge and stormwater volume control. Infiltration shall not be allowed in areas with potential contamination, drinking water supply management areas, and wellhead protection areas. Infiltration will not be encouraged where soils are not suitable for infiltration or where there is less than three feet of separation between the bottom of the infiltration system and the groundwater or bedrock.

4.7 Public Education

Problem 4.7.A: The public needs more education on issues facing the water resources in their community and how they impact water quality.

The current WMO education program consists of the annual WMO newsletter, which the member cities distribute, and the annual activity report, which is submitted to BWSR and is available to residents upon request.

The cities use a variety of methods to educate their residents about stormwater management issues. Some of these methods include: storm drain stenciling, door hangers, newsletters, and newspapers and other media to distribute water resource and stormwater management information. Member cities are also involved in Dakota County's Wetland Health Evaluation Program (WHEP) which uses volunteers to assess the biological health of wetlands.

Approach for Addressing Problem 4.7.A: Expand the WMO's education and public involvement efforts to provide more assistance to the member cities. The WMO shall implement a marketing strategy throughout the WMO that helps change social behavior in regards to stormwater and water quality. The WMO will also investigate the creation of a committee to focus on education and public outreach. Refer to **Section 5.8** for details regarding the new components of the WMO education program.

4.8 Administrative Issues

Problem 4.8.A: Some grants and funding is only available to watersheds or similar organizations.

Approach for Addressing Problem 4.8.A: Assist member cities in pursuing/securing grants to assist in implementation of their Local Water Resource Management Plans.

Problem 4.8.B: Implementation of the evaluation criteria contained in the BWSR performance standards.

Approach for Addressing Problem 4.8.B: Redirect administrative resources to address BWSR performance standards such as data practices policy, project and program expenditures, Board training, operational guidelines, water quality and watershed yield trends, and public information and education outcomes.

Problem 4.8.C: Need to improve collaboration of WMO/WD and County ideas and programs to maximize efficiency throughout the WMO.

Approach for Addressing Problem 4.8.C: Explore opportunities to partner with other WMO/WD programs and County programs.

Problem 4.8.D: The WMO is required to have a Board that contains all citizen members.

Approach for Addressing Problem 4.8.D: The WMO will pursue the transition of its Board to an all citizen member Board.

Problem 4.8.E: Expansion of Technical Advisory Committee (TAC) membership and participation.

Approach for Addressing Problem 4.8.E: Revise JPA to broaden membership of formal TAC beyond county and SWCD staff to include member city staff and others.

Problem 4.8.F: There are concerns that the current electronic and GIS boundary of the WMO does not reflect the existing Joint Powers Agreement watershed boundary.

Approach for Addressing Problem 4.8.F: The WMO will compare legal documents from the Joint Powers Agreement and the existing GIS watershed boundary to verify the appropriate limits of the WMO.

Problem 4.8.G: Lack of citizen involvement and participation in dealing with processes, education, and issues throughout the WMO.

Approach for Addressing Problem 4.8.G: The Board will investigate implementation of a permanent CAC. The CAC would be utilized as an advisory group to the Board and would provide watershed-wide input on items such as water resource problems and strategies to improve education.

4.9 Adequacy of Existing Programs

Problem 4.9.A: The water body classification system (Categories I-V) used by the WMO since their Second Generation Plan (2001) does not align with the MPCA's water body classification system and water quality monitoring protocol.

Refer to **Appendix F** for a description of the former classification categories along with the water bodies that were classified by the WMO and the member cities.

Approach for Addressing Problem 4.9.A: The WMO will use a similar water body classification system to that of the MPCA. Refer to **Table 5-1** located in **Section 5.3.2.I** for the table that will be used to help classify water bodies as deep lakes, shallow lakes, wetlands, and ponds. The pond column has been added to the MPCA's table by the WMO to provide a classification for water bodies that may be considered ponds.

The classification system determines whether a water body should be managed as a deep lake, shallow lake, wetland, or pond. For water bodies classified as wetlands, member cities must use a wetland management classification system that takes into account the susceptibility of the wetlands to degradation by stormwater. The WMO requires the member cities use a wetland classification system that ranks the wetlands and sets wetland management standards based on the rank and desired level of protection. **Table 5-2** in **Section 5.3.2.I** shows the WMO's water quality goals based on classification.

Problem 4.9.B: The WMO does not currently have a uniform water quality cost allocation formula for inter community projects.

The WMO does have "allowable flow" which is the flowrate that an upstream community can discharge to a downstream community without incurring financial obligation for the stormwater management system in the downstream community. The allowable flow is intended to represent the flows from the tributary watershed under natural/pre-development conditions. Discharges from the upstream community in excess of the allowable flow obligate the upstream community to share in the cost of the stormwater management system, in accordance with the formulas in the joint powers agreement. The September 1985 Joint Powers Agreement sets forth the method for calculating allowable flow. **Appendix B** includes a copy of the joint powers agreement and memoranda regarding allowable flow.

Approach for Addressing Problem 4.9.B: The WMO will attempt to develop a water quality cost allocation formula. The WMO will also review the current allowable flow methodology and verify that no revisions are necessary.

Problem 4.9.C: Maintenance of Stormwater System - The stormwater system within the WMO includes pipes, constructed ponds, lakes, wetlands, ditches, swales and other drainageways. Proper maintenance of the stormwater system will ensure that the system provides the necessary flood control and water quality treatment. Many units of government are responsible for maintaining the stormwater systems within the WMO and need to perform this maintenance on a regular basis. For example:

- MnDOT is responsible for maintaining the storm sewers, ponds, culverts, etc. located along I-494, I-35E, Highway 55, Highway 52, Highway 156, Highway 110, and Highway 3.

- Dakota County is responsible for maintaining only the "mainline" culvert crossings in their county roads; member cities are currently responsible for maintaining storm sewer catch basins and leads in the county roads (e.g. County Road 73-"Babcock Trail", County Road 75-"Cahill Avenue", and County Road 26-"70th Street").

- Ramsey County is responsible for maintaining storm sewer catch basins and leads in the county roads (e.g. County Road 63-"Delaware Avenue").

- Member cities are responsible for maintaining their stormwater system in accordance with the requirements of the MPCA SWPPP Program.

- Owners of private stormwater facilities are responsible for maintaining their facilities in proper condition, consistent with the original performance design standards.

For stormwater systems constructed using WMO cost share monies, member cities may request reimbursement from the WMO for maintenance activities, according to the WMO cost share formula since the new JPA has other cost share methods.

Approach for Addressing Problem 4.9.C: Maintenance responsibilities shall be carried out by the appropriate organizations listed above. Member cities are to fulfill their requirements and notify the WMO or other regulatory agencies should they know of maintenance deficiencies.

4.10 Availability and Adequacy of Existing Information to Manage Water Resources

Problem 4.10.A: Several intercommunity drainage issues had persisted unresolved for decades prior to the establishment of the WMO. The WMO and its member cities successfully addressed the majority of the intercommunity water management issues identified in past plans. The cooperation of the member cities and the implementation of the WMO's Joint Powers Agreement (JPA) were key factors in resolving many of the identified problems.

Approach for Addressing Problem 4.10.A: The WMO will continue to update the implementation plan and prioritize and address water resource issues as they arise.

5.0 Goals, Strategies, and Policies

The WMO has developed a number of purposes for the management of the watershed and its water resources. These purposes have been developed to be consistent with the vision of the WMO, as well as, to meet the requirements of the Metropolitan Surface Water Management Act. In addition, many goals, strategies, and policies have been outlined to help achieve the purposes of the 3rd Generation Watershed Management Plan.

5.1 Watershed Management Purposes

5.1.1 Lower Mississippi River WMO Purposes (3rd Generation)

The WMO developed the following vision statement on December 23, 2009:

> *"Water resources and related ecosystems are managed to sustain their long-term health and integrity through member city collaboration and partnerships with other water management organizations with member city citizen support and participation."*

The general purposes for the 3rd Generation Plan include the following purposes consistent with the Metropolitan Surface Water Management Act and Minnesota Statutes 103B.201.

- 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 water 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.
- Secure other benefits associated with the proper management of surface water and groundwater.

In addition, the WMO has developed the following purposes:

- Assist member cities in achieving current and future water quality and water quantity regulations collaboratively, equitably, and cost-effectively for all members within the watershed.

- Identify and effectively communicate member concerns to other government jurisdictions to better align their policies and activities with those of the WMO and its members.

- Educate citizens about the use, protection, and management of water resources and engage them in WMO water management programs and decision making.

- Consider potential impacts of WMO decisions on natural resources and habitat.

- Govern the WMO with a citizen-led Board and keep regulation at the local level – the WMO will not administer a permit program.

- Assist member communities with *intercommunity* runoff and water resource management issues. The WMO, at the discretion of the Board, may also work with individual member cities to address water resource issues within individual city boundaries. This may include, but is not limited to, monitoring of water bodies or outlets to the Mississippi River.

- Assess performance of the WMO and the member cities toward achieving the goals stated in this plan.

- Provide member cities with useful information about the WMO, its activities, and water resource management.

To achieve the purposes of the WMO, the following goals, strategies, and policies have been developed for water quantity, water quality, recreation, fish and wildlife habitat, wetlands, groundwater protection, erosion and sedimentation, education, and administration.

WMO Goals: Desired outcomes to help achieve the vision of the WMO and the purposes of this plan.

WMO Strategies: Activities the WMO will undertake to help achieve their goals.

WMO Policies: Standards that have been developed that require specific action of the member cities to help achieve the goals of the WMO.

These goals, strategies, and policies have been developed to complement member city, county, regional, and state goals and policies. Pursuant to State Statute, member cities shall update their local plans (if necessary) within two years of WMO adoption of this plan.

An implementation plan has been developed that outlines the estimated completion dates and timelines of the WMO's measurable outcomes and activities. The implementation plan is located in **Section 6**.

5.2 Water Quantity

The WMO recognizes the importance of minimizing effects of development and redevelopment to reduce existing and avoid future water resource problems. The following goals and policies have been developed to address volume control, rate control, flooding, and other water quantity related issues.

5.2.1 WMO Goals

A. Reduce stormwater runoff volumes by increasing infiltration and ground water recharge.

B. Reduce existing flood occurrences and minimize future flood potential throughout the WMO.

5.2.2 WMO Strategies

A. The WMO will establish stormwater volume reduction requirements taking into consideration variable development and redevelopment conditions. This may include establishing LID policies to provide increased volume control for development and redevelopment projects. (Goal 5.2.1 A, Goal 5.2.1 B)

B. The WMO will continue to use the previously established intercommunity "design flows" (stormwater flow rates that the stormwater management system is expected to convey with fully developed conditions in the watershed) as the design parameters for downstream improvements. The WMO will also continue to use the previously established "allowable flows" (stormwater flow rate that an upstream community can discharge to a downstream community without incurring financial obligation for the stormwater system in the downstream community) as the basis for determining the financial obligation of member cities for intercommunity flooding and erosion control projects. Refer to **Appendix B** for the joint powers agreement and memoranda regarding established intercommunity design flow (allowable flow). (General Water Quantity)

C. The WMO will coordinate intercommunity stormwater runoff design and planning with the member communities by:

- Reviewing the member cities' local watershed management plans for consistency with WMO goals and consistency with intercommunity planning.
- Calculating the cost apportionment between cities for water resources projects with intercommunity participation. (General Water Quantity)

D. The WMO will consider practicable solutions when involved with intercommunity water resources planning activities.

- All drainage studies or feasibility studies (whether by the WMO or a city) for projects in a subwatershed with intercommunity drainage, shall consider the impact of the project and the total intercommunity project cost.
- Any projects with intercommunity drainage issues shall not be implemented without prior completion of a feasibility study outlining improvement options and adoption of a preferred option by the WMO, except in emergencies. (General Water Quantity)

5.2.3 WMO Policies

A. Member cities are to reduce the amount of impervious surfaces through the use of Low Impact Development (LID) techniques to the greatest extent reasonable for new development and redevelopment projects, taking into consideration land use, zoning, topography, previous site uses, and site constraints. LID techniques may include, but are not limited to, those presented on the MPCA-Low Impact Development website, http://www.pca.state.mn.us/water/stormwater/stormwater-lid.html. (Goal 5.2.1 A, Goal 5.2.1 B)

B. Member cities will not be allowed to use infiltration as a stormwater BMP in areas where there are known contaminants or in drinking water supply management areas/wellhead protection areas. In addition, infiltration will not be encouraged where the soils are not suitable for infiltration or in areas where there is less than three feet of separation between the bottom of the infiltration system and the groundwater or bedrock. In-situ field tests shall be required to verify the infiltration rates of on-site soils prior to the construction of infiltration BMPs. (Goal 5.2.1 A, Goal 5.6.1 A)

C. Member cities are to provide pretreatment of stormwater prior to discharge to any new infiltration system to protect the functionality of the system. Pretreatment shall collect sediment, skim floatables, and be easily accessed for inspection and maintenance. (Goal 5.2.1 A, Goal 5.6.1 A)

D. The level of protection along all trunk conveyors, streams, and channels and around all wetlands, ponds, detention basins, and lakes shall be based on the critical duration 100-year event, which shall be defined as the 100-year, 24-hour rainfall or the 100-year, 10-day runoff event; whichever is greater. (Goal 5.2.1 B)

E. Design of new trunk stormwater systems should provide discharge capacity for the critical-duration runoff event that is not less than a 10-year frequency event. For open channel conveyance construction, the design criteria shall be for the critical 100-year event. Variances to this standard may apply in areas where in-place storm sewers are designed for a 5-year frequency event. (Goal 5.2.1 B)

F. Design of new non-trunk stormwater systems should provide discharge capacity for the critical-duration runoff event that is not less than a 5-year frequency event, preferably a 10-year frequency event (level of service). Where the planned level of service would cause hardship in operation of a downstream system, the owner may design for a lesser level of service if the following circumstances are present:

- The proposed new or replacement system will not have a longer life than that of the existing downstream system.
- It is not practical to incorporate temporary measures into the new system to mitigate the effects of the new system on the downstream system. (Goal 5.2.1 B)

G. Member cities are to ensure that proposed development, redevelopment, and/or infrastructure projects will not exceed the capacity of the existing downstream stormwater drainage system. (Goal 5.2.1 B)

H. Member cities are to incorporate emergency overflow structures (e.g. swales, spillways), where feasible, into pond outlet structure designs to prevent undesired flooding resulting from storms larger than the 100-year (one percent) event or plugged outlet conditions. (Goal 5.2.1 B)

I. Member cities are to maintain ordinances or policies that allow the cities to secure easements over floodplains, detention areas, wetlands, ditches, and all other parts of the stormwater system as areas develop or redevelop. (Goal 5.2.1 B)

J. Member cities are to incorporate multi-stage outlets into their pond designs to control flows from smaller, less frequent storms and help maintain base flows in downstream open channels, where practicable. (Goal 5.2.1 B)

K. Member cities are to maintain ordinances or policies that set minimum building elevations at least one foot above the critical 100-year flood elevation for structures adjacent to inundation areas. The cities should consider the effects of events larger than the 100-year flood when setting minimum building elevations. Higher minimum building elevations should be considered for structures adjacent to ponding areas with large tributary watersheds and for structures adjacent to landlocked basins. (Goal 5.2.1 B)

L. The WMO establishes the following policies regarding landlocked basins:

- The flood levels established in local (city) watershed management plans shall take into consideration the effects of water level fluctuations on trees, vegetation, erosion and property values. Steeply sloped shorelines that are subject to slope failure and shoreline damage should not be in contact with flood water for extended periods of time. (Goal 5.2.1 B)

- Only the existing tributary area may discharge to a landlocked basin, unless provision has been made for an outlet from the basin, or hydrologic analysis has been completed showing additional discharge to basin is acceptable. The form of outlet may range from temporary pumps to gravity storm sewers. The outlet is to be in place before increased water levels are likely to affect vegetation, slope stability and adjacent properties. (Goal 5.2.1 B)

- If outlets from landlocked basins are needed, member cities are encouraged, where practicable, to keep outflow rates low enough to allow for as much infiltration as possible. Drawdown time to within one foot of the normal water level should not exceed 48 hours to reduce damage to upland vegetation. (Goal 5.2.1 B)

- When member cities establish high water elevations and whether outlets are needed for landlocked basins, member cities are encouraged, where practicable, to account for long duration events, such as multiple-year wet cycles and high runoff volume events (e.g. snowmelt events that last for many weeks). (Goal 5.2.1 B)

- Member cities need to consider both the water quality and flooding impacts of proposed outlets from landlocked basins on downstream water resources. (Goal 5.2.1 B)

M. Member cities are to require developers to provide Runoff Control Plans prepared by a licensed professional engineer for projects that disturb one or more acres of land. The Runoff Control Plan shall incorporate best management practices (BMPs) and shall conform to approved local water management plans.

Runoff Control Plans shall include the following:

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 streambank and shoreland vegetation should be avoided. The plan shall address how unavoidable disturbances to this vegetation will be mitigated.

e. Existing and proposed normal, 5-year (or 10-year) and 100-year water elevations on-site.

f. Existing and proposed site contour elevations related to the North American Vertical Datum (NAVD) of 1988.

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 quantity and quality management facilities.

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. Documentation indicating conformance with the city's existing local water management plan.

m. Inlets to detention basins, wetlands, etc. shown at or below the normal water level.

n. Identification of receiving water body.

Runoff Control Plans shall meet the following criteria:

- The peak rate of stormwater runoff from the developed subwatershed of the site shall not exceed the existing peak rate of runoff for the 5-year (or 10-year) and the 100-year return frequency critical duration storm events (encouraged to maintain the runoff rate for the 2-year storm event as well). For the purposes of this criteria, "subwatershed" may be the project site, or may be an area of greater size for which an approved local water management plan meets this criteria (e.g. regional detention basins).

- A hydrograph method based on sound hydrologic theory shall be used to analyze stormwater runoff for the design or analysis of flows in conveyors, streams, and channels and flows to ponds and wetlands.

- Reservoir routing procedures and critical duration 100-year runoff events shall be used for design of detention basins and outlets. (Goal 5.2.1 B)

5.3 Water Quality

There are many water bodies throughout the WMO that are valuable resources to the people of the area. The following goals and policies have been developed to maintain or improve water quality in surface waters throughout the WMO.

5.3.1 WMO Goals

A. Evaluate and track water quality trends within the WMO.

B. Improve intergovernmental coordination regarding water quality management within the WMO.

C. Improve water quality within the WMO.

5.3.2 WMO Strategies

A. The WMO will assist member cities in creating an equitable and cost-effective method to address the requirements of the South Metro Mississippi TMDL study and implementation plan and other TMDLs as they are completed. (Goal 5.3.1 B)

B. The WMO will continue to focus on the water quality of intercommunity water bodies. The WMO, at the discretion of the Board, may also work with individual member cities to address water quality issues within individual city boundaries. (Goal 5.3.1 C)

C. The WMO will investigate the possibility of coordinating joint member contracts for maintenance to achieve economies of scale. Post construction stormwater management and good housekeeping practices for MS4 stormwater facilities shall comply with MPCA/MS4 requirements. (Goal 5.3.1 B)

D. The WMO will monitor DNR protected water bodies. Prioritization of water bodies for monitoring will be determined annually and by the WMO budget. Monitoring data

from CAMP (Citizen Assisted Monitoring Program), WHEP (Wetland Health Evaluation Program), and CSMP (Citizen Stream Monitoring Program) should be taken into consideration so monitoring information is not being duplicated. (Goal 5.3.1 A)

E. The WMO will monitor select storm sewers and streams that outlet to the Mississippi River. Prioritization of storm sewers and streams will be determined annually and by the WMO budget. Monitoring parameters should be consistent with downstream impairments and may be modified at the discretion of the Board. Possible parameters include: Total Phosphorus, PCBs (Polychlorinated biphenyls), PFOS (Perfluorooctane sulfonate), Fecal Coliform, Turbidity, and Dissolved Oxygen. (Goal 5.3.1 A)

F. The WMO shall attempt to develop a water quality cost allocation formula for intercommunity projects by the year 2015. In the interim, the WMO will address each project individually. (Goal 5.3.1 B)

G. The WMO requires MnDOT, Ramsey County, Dakota County, and other governmental agencies to meet the water quality treatment requirements outlined in this plan for runoff leaving their right-of-way, facilities, or easements. Regular maintenance of their stormwater facilities shall also be performed. (Goal 5.3.1 B)

H. The WMO will recruit volunteers, through the use of its CAC, and encourage member cities to recruit volunteers to participate in the WMO's monitoring activities. Where necessary, volunteers would be provided training on MPCA-accepted protocol to ensure that the data is acceptable for the MCPA EQUIS Database. (Goal 5.3.1 A)

I. The WMO will use a similar water body classification system to that of the MPCA. **Table 5-1** will be used to help classify water bodies as deep lakes, shallow lakes, wetlands, and ponds. The pond column has been added to the MPCA's table by the WMO to provide a classification for water bodies that may be considered ponds.

The classification system determines whether a water body should be managed as a deep lake, shallow lake, wetland, or pond. For water bodies classified as wetlands, member cities must use a wetland management classification system that takes into account the susceptibility of the wetlands to degradation by stormwater. The WMO requires the member cities use a wetland classification system that ranks the wetlands and sets wetland management standards based on the rank and desired level of protection. (Goal 5.3.1 A, Goal 5.3.1 C)

Table 5-1: Factors Used to Classify Deep Lakes, Shallow Lakes, Wetlands, and Ponds

Factor	Deep Lakes	Shallow Lakes	Wetlands	Ponds
Public Waters Inventory Code	Typically coded as "L or LP" in PWI	May be coded as either "L, LP or LW" in PWI	Typically coded as "LW" in PWI	May be coded as either "L, LP or LW" in PWI
Depth, max.	Typically > 15 feet	Typically < 15 feet	Typically <7 feet	Typically <10 feet
Littoral area	Typically < 80%	Typically >80%	Typically 100%	Typically 100%

Factor	Deep Lakes	Shallow Lakes	Wetlands	Ponds
Area (min.)	> 10 acres (Bulletin 25)	> 10 acres (Bulletin 25)	No minimum	No minimum
Thermal stratification (summer)	Stratification common but dependent upon depth	Typically do not stratify	Typically do not stratify	Typically do not stratify
Fetch	Significant fetch depending on size & shape	Fetch is variable depending on size & shape	Rarely has a significant fetch	Rarely has a significant fetch
Substrate	Consolidated sand/silt/gravel	Consolidated to mucky	Mucky to unconsolidated	Variable
Shoreline features	Generally wave formed, often sand, gravel or rock	Generally wave formed, often sand, gravel or rock	Generally dominated by emergents	Generally dominated by emergents
Emergent vegetation & relative amount of open water	Shoreline may have ring of emergents; vast majority of basin open water	Emergents common, may cover much of fringe of lake; basin often has high percentage of open water	Emergents often dominate much of basin; often minimal open water	Emergents common, may cover much of fringe of pond; basin often has high percentage of open water
Submergent vegetation	Common in littoral fringe, extent dependant on transparency	Abundant in clear lakes; however may be lacking in algal-dominated turbid lakes	Common unless dominated by an emergent like cattail	Common unless dominated by an emergent like cattail
Dissolved Oxygen	Aerobic epilimnion; hypolimnion often anoxic by midsummer	Aerobic epilimnion but wide diurnal flux possible	Diurnal flux & anaerobic conditions common	Variable
Fishery	Typically managed for a sport/game fishery. May be stocked. DNR fishery assessments typically available	May or may not be managed for a sport fishery. If so, fishery assessment should be available. Winter aeration often used to minimize winterkill potential	Typically not managed for a sport fishery. Little or no DNR fishery information. Seldom aerated. May be managed to remove fish & promote waterfowl	Typically not managed for a sport fishery
Uses	Wide range of uses including boating, swimming, skiing, fishing; boat ramps & beaches common	Boating, fishing, waterfowl production, hunting, aesthetics; limited swimming; may have boat ramp, beaches uncommon	Waterfowl & wildlife production, hunting, aesthetics. Unimproved boat ramp if any. No beaches	Typically manmade basins. Important for flood protection and runoff pollutant removal. May provide passive recreational opportunities

Note: This table was developed by the MPCA and is located in the *Guidance Manual for Assessing the Quality of Minnesota Surface Waters.* The "Ponds" column was added by the WMO for the purposes of this Plan. It is important to note that the MPCA does not have a pond classification.

Table 5-2 shows the WMO's water quality goals based on classification.

Table 5-2: Water Quality Goals for Classified Water Bodies in the WMO

Classification	TP (ppb)	Chi-a (ppb)	Secchi (meters)
Deep Lakes	≤ 40	≤ 14	≥ 1.4
Shallow Lakes	≤ 60	≤ 20	≥ 1.0
Wetlands	NA	NA	NA
Ponds	NA	NA	NA

Note: The water quality goals shown in this table are consistent with the goals shown in the MPCA's *Guidance Manual for Assessing the Quality of Minnesota Surface Waters.*

5.3.3 WMO Policies

A. Member cities shall require a 50% total phosphorus removal from runoff leaving new development and redevelopment projects that exceed one acre of land disturbance (for this policy, mill and overlay and pavement rehabilitation projects are not considered land disturbance). For areas that discharge directly to the Mississippi River or to an impaired water body for which a TMDL has been completed, the findings of the TMDL will replace this requirement (whether more or less stringent). The required reduction of total phosphorus may be accomplished through the use of regional or on-site stormwater BMPs such as: ponds, NURP (National Urban Runoff Program) basins, infiltration basins, biofiltration, vegetated swales, mechanical devices, porous pavements, or any other techniques effective at phosphorus reduction. (Goal 5.3.1 C)

B. Linear construction projects should meet policy 5.3.3A where possible and feasible. Linear projects will be required to meet NPDES Construction Permit requirements. (Goal 5.3.1 C)

C. For stormwater discharge points/outfalls that did not exist prior to the adoption of this plan: member cities are to provide pretreatment of stormwater prior to its discharge to wetlands and other water resources. Pretreatment shall collect sediment, skim floatables, and be easily accessed for inspection and maintenance. (General Water Quality)

D. For replacement discharge points/outfalls or existing stormwater discharge points/outfalls: the WMO encourages member cities to provide pretreatment of stormwater prior to its discharge to wetlands and water resources. (General Water Quality)

5.4 Recreation, Fish and Wildlife Habitat

The WMO has many natural areas that are popular recreation sites and provide excellent fish and wildlife habitat. The following goals and policies have been developed to enhance water

based recreational opportunities and protect and improve fish and wildlife habitat. In addition, many of the other goals, strategies, and policies outlined throughout **Section 5** will result in improved recreational opportunities and fish and wildlife habitat.

5.4.1 WMO Goals

A. Protect and enhance fish and wildlife habitat and recreation opportunities, and maintain shoreland integrity.

5.4.2 WMO Strategies

A. The WMO will promote and encourage protection of non-disturbed natural shoreland areas and restoration of disturbed shorelines and streambanks to their natural state through participation in Blue Thumb or other educational programs. (Goal 5.4.1 A)

B. The WMO supports water quality improvements in order to maintain or improve water quality and the habitat consistent with intended use and classifications of lakes, streams, wetlands, and ponds. (Goal 5.4.1 A, Goal 5.5.1 A)

C. The WMO will encourage the appropriate development of access to water bodies for recreation and education. (Goal 5.4.1 A)

5.4.3 WMO Policies

A. The WMO requires member cities to consider landscape designs for projects located in close proximity to natural areas or greenways to:

1) increase beneficial habitat, wildlife and recreational uses; promote infiltration and vegetative water use; and

2) decrease detrimental wildlife uses (such as beaver dams, goose overabundance) that damage water control facilities, shoreline vegetation, water quality or recreational facilities. (Goal 5.4.1 A, Goal 5.5.1 A)

B. The WMO requires member cities to prioritize shoreland areas for restoration. Shoreland areas include streambanks and lakeshore areas. The cities will be required to address this issue in their local watershed management plans. (Goal 5.4.1 A)

C. Member cities are required to maintain a shoreland ordinance that is, at a minimum, in conformance with the requirements of the Minnesota DNR. (Goal 5.4.1 A)

D. The WMO requires member cities within the Mississippi River Critical Corridor Area/Mississippi National River Recreation Area (MRCCA/MNRRA) to conform to the current rules for areas within the MRCCA/MNRRA. (Goal 5.4.1 A)

5.5 Wetlands

There are many wetlands located throughout the WMO that provide wildlife habitat and offer a natural method of conveying and storing stormwater. The following goals and policies have been developed to manage existing wetlands and restore drained wetlands where possible.

5.5.1 WMO Goals

A. Enhance or protect wetlands from the adverse impacts of development and redevelopment.

5.5.2 WMO Strategies

A. The WMO will continue to support member city management efforts to improve wildlife habitat, aesthetic enjoyment, and other public uses of wetlands adjacent to parks. (Goal 5.5.1 A, Goal 5.4.1 A)

B. The WMO will continue in the support of wetlands for inclusion in Wetland Health Evaluation Program (WHEP).(Goal 5.5.1 A)

5.5.3 WMO Policies

A. Member cities are the local governmental units (LGUs) responsible for administering the Wetland Conservation Act (WCA). MnDOT is the LGU for the WCA on its rights-of-way. (Goal 5.5.1 A)

B. An average 15 foot buffer of natural vegetation above the 100-year High Water Level (if established) or wetted boundary is required by the WMO around lakes, streams, and wetlands, upon new or redevelopment projects that exceed one acre in land disturbance (for this policy, mill and overlay and pavement rehabilitation projects are not considered land disturbance). (Goal 5.5.1 A, Goal 5.4.1 A)

C. Member cities are to inventory, classify and determine the functions and values of wetlands, either through a comprehensive wetland management plan or for development or redevelopment projects that exceed one acre. For cities facing significant development or redevelopment, the WMO recommends that they complete comprehensive wetland management plans. The cities could complete the plans in phases, focusing on the areas where the information is most needed, such as areas within the 2030 MUSA. They should do this either as part of their local watershed planning process or as an implementation task identified in the local plan. Member cities shall submit their comprehensive wetland management plans to the WMO for review and comment. (Goal 5.5.1 A, Goal 5.4.1 A)

D. The WMO requires that member cities use a wetland classification system that ranks the wetlands and sets wetland management standards based on the rank and desired level of protection (e.g. highest to lowest protection). The wetland management standards should include buffer strip width, structural setback distance from buffer strip, amount of pretreatment required for phosphorus removal, storm bounce restrictions, and susceptibility of the wetlands to degradation by stormwater inputs. (Goal 5.5.1 A)

5.6 Groundwater Protection

The WMO recognizes the importance of groundwater on its drinking water sources and the overall hydrology of the area. The following goals and policies have been developed to protect groundwater quality and supply throughout the WMO.

5.6.1 WMO Goals

A. Protect groundwater resources within the WMO.

5.6.2 WMO Strategies

A. The WMO will work to improve the quality and availability of groundwater data. In addition, the WMO will coordinate with other agencies to identify sources or potential sources of groundwater pollution. (Goal 5.6.1 A)

B. The WMO will advocate for larger scale State monitoring and evaluation of LID (Low Impact Development) techniques on groundwater. (Goal 5.6.1 A)

C. The WMO will support the policies in the Dakota County and Ramsey County groundwater plans. (Goal 5.6.1 A)

5.6.3 WMO Policies

A. Member cities are to encourage groundwater recharge and are required to protect recharge areas from potential sources of contamination. The cities should also provide increased green space, native vegetation, and pond “dead” storage, wherever possible and appropriate, to allow for the infiltration of stormwater runoff and promote groundwater recharge. (Goal 5.6.1 A, Goal 5.2.1 A)

B. Member cities responsible for wellhead protection plans should follow the requirements outlined in those plans for managing groundwater within wellhead protection areas. (Goal 5.6.1 A)

C. The WMO encourages its member cities to use stormwater BMPs (such as grassed waterways, biofiltration, porous pavements, etc.) to maximize infiltration, where feasible and not detrimental to groundwater supplies. (Goal 5.6.1 A, Goal 5.2.1 A)

D. Each WMO member city is to maintain updated records of all known on-site septic systems, and prohibit installation of new individual sewer systems or alteration, repair or extension of existing systems when connection can be made to the city sanitary sewer system. The cities are to notify property owners with on-site septic systems that they are required to connect to the cities’ sanitary sewer, if available. The cities are to also develop management programs and ordinances for subsurface sewage treatment systems (SSTS) that are consistent with MPCA standards and Minnesota Rules 7080 to 7083. (Goal 5.6.1 A)

E. Member cities should work with their counties in effort to promote awareness of groundwater resource issues through public education and information programs. (Goal 5.6.1 A, Goal 5.8.1 B)

F. Member cities are to support the policies in the Dakota County and Ramsey County groundwater plans.

5.7 Erosion and Sedimentation

Erosion and sedimentation causes surface water quality degradation, habitat damage, and other water resource issues. The following goals and policies have been developed to prevent and minimize sedimentation from areas prone to erosion.

5.7.1 WMO Goals

A. Minimize erosion, sedimentation, stream degradation, and related issues within the watershed.

5.7.2 WMO Strategies

A. The WMO shall address intercommunity erosion and sediment control issues. (Goal 5.7.1 A)

B. The WMO will facilitate joint certification training for member city staff on designing and inspecting erosion control plans and inspecting erosion control measures. (Goal 5.7.1 A, Goal 5.8.1 A)

C. The WMO will coordinate/conduct non-certification training for “other” city staff (streets, parks, building inspections) to address items in MS4 permit (e.g. mowing and erosion control). (Goal 5.7.1 A, Goal 5.8.1 A)

5.7.3 WMO Policies

A. Member cities must adopt, administer, implement and enforce ordinances addressing erosion and sediment control, including the permitting and inspection of such controls. The ordinance must be in conformance with the NPDES standards, at a minimum. The WMO suggests that the cities use the MPCA’s model ordinance, which covers overall stormwater management. (Goal 5.7.1 A)

B. Member cities are to require erosion control plans for land development and construction work that will disturb one or more acres of land. Local watershed management plans and city ordinances are to include the requirements and procedures for reviewing, approving and enforcing the erosion control plans. Erosion Control Plans shall be prepared by a qualified individual, and shall conform to the MPCA’s NPDES General Permit to Discharge Stormwater from Construction Sites. The erosion control plan shall also conform to all future NPDES stormwater regulations that apply to erosion control. (Goal 5.7.1 A)

C. Acceptable erosion in drainageways is limited to that which causes no net degradation of the watercourse or destruction of properties adjacent to the watercourse.

- Measures to alter the natural course and meandering of streams will be discouraged, except when foreseeable erosion threatens to damage structures, utilities or natural amenities, or impair the drainage system.

- Land use adjacent to watercourses shall be regulated to allow for the reasonably expected natural behavior of streams. (Goal 5.7.1 A)

D. Design of stream bank stabilization and streambed control measures should consider unique or special site conditions, energy dissipation potential, adverse effects, preservation of natural processes and habitat, and aesthetics, in addition to standard engineering and economic criteria. (Goal 5.7.1 A)

5.8 Public Participation and Education

The WMO desires to foster responsible water quality management practices by educating residents, business owners, member city staff, elected officials, and developers about proper water resource management. It is important for these audiences to recognize their role in responsible water resource management in their homes, businesses, and practices, to help preserve and improve the resources present within the WMO. The following goals and policies have been developed to increased public participation and provide improved awareness on water resource issues throughout the WMO.

5.8.1 WMO Goals

A. Expand the WMO's education and public involvement efforts to provide more assistance to the member cities.

B. Increase public awareness of human impacts on water quality and habitat and explore ways to increase active citizen involvement.

5.8.2 WMO Strategies

A. The WMO will develop and use email lists to communicate WMO activities, information, and announcements. (Goal 5.8.1 A, Goal 5.8.1 B)

B. The WMO will develop appropriate, targeted educational content regarding water resource issues to be used by member cities for distribution to and use by various citizen groups such as: homeowners and renters; youth groups; and community groups such as Rotary, Lions, Kiwanis, ROMA (Responsible Owners and Managers Organization), WSCO (West Side Citizens Organization), All Around the Neighborhood, Chamber of Commerce, etc. The WMO will also utilize water resource materials to educate the public at community events and festivals throughout the WMO. (Goal 5.8.1 A, Goal 5.8.1 B)

C. The WMO will maintain the WMO website to communicate watershed news, events, and other water resource information. WMO website address shall be included on all distributed material and will be updated regularly to serve as an additional source for watershed information(Goal 5.8.1 A, Goal 5.8.1 B)

D. The WMO shall seek citizen involvement to assist in the monitoring of water bodies or outlets (storm sewer or streams) to the Mississippi River. CAMP, WHEP, and CSMP are three programs that currently monitor water bodies in the WMO. The WMO shall solicit citizens (starting with the 3rd Generation Plan CAC) to either join these programs or start a new program for monitoring its water bodies. (Goal 5.8.1 B, Goal 5.3.1 A)

E. The WMO will continue to participate in the Blue Thumb Program or other similar programs. (Goal 5.8.1 B)

F. The WMO will continue to support Clean Water Minnesota Media Campaign or develop "catchy" educational information, possibly through the use of an ad agency, focusing on water quality within the community. The ad agency may provide varying media techniques depending on the audience being targeted. Educational components shall be updated to avoid redundancy. (Goal 5.8.1 A, Goal 5.8.1 B)

5.8.3 WMO Policies

A. Member cities' City Engineers and Public Works Officials are encouraged to attend Board Meetings to provide technical advice and information to the Board. (General Public Participation and Education)

B. Member cities are to make information available to active community groups such as Rotary, Lions, Kiwanis, ROMA (Responsible Owners and Managers Organization), WSCO (West Side Citizens Organization), All Around the Neighborhood, and Chamber of Commerce to educate and increase awareness of water resource issues throughout the WMO. (Goal 5.8.1 A, Goal 5.8.1 B)

5.9 Administration

The WMO's administration can have a significant impact on the success of the 3rd Generation Watershed Management Plan. The following goals and policies are aimed at operational activities associated with water resource management within the WMO.

5.9.1 WMO Goals

A. Meet the requirements set forth in the Metropolitan Surface Water Management Act regarding the management of a watershed management organization.

B. Increase efficiency of programs throughout the WMO and provide increased economic opportunities for the WMO and its member cities.

5.9.2 WMO Strategies

A. The WMO will explore opportunities to partner with other WMO/WD programs and County programs. The updates of neighboring WMO/WD plans may be an opportunity to explore these partnerships. (Goal 5.9.1 A, Goal 5.9.1 B)

B. The WMO will continue to publish an annual newsletter summarizing its activities for public distribution. (Goal 5.8.1 A, Goal 5.8.1 B)

C. The WMO will assist member cities (including being the applicant) in pursuing/securing grants for projects contained within an individual city and those that cross city boundaries. (Goal 5.9.1 A, Goal 5.9.1 B)

D. The WMO will adhere to BWSR administrative performance standards (e.g. data practices policy, project and program expenditures, Board training, operational guidelines, water quality and watershed yield trends, and public information and education outcomes). (Goal 5.9.1 A)

E. The WMO will utilize ad hoc subcommittees for special projects. (Goal 5.9.1 A, Goal 5.8.1 B)

F. The WMO will initiate the development of an eight to twelve member permanent CAC to serve as an ongoing advisory group. Citizens will be solicited as needed until the desired number is met. (Goal 5.9.1 A, Goal 5.8.1 B)

G. The WMO will continue to transition to an all citizen Board. (Goal 5.9.1 A, Goal 5.8.1 B)

H. The WMO will fund updating and maintenance of its web site (for posting data, the watershed management plan, etc.) through the WMO dues. (Goal 5.9.1 A)

I. The WMO will revise its joint powers agreement to reflect the 3rd Generation Watershed Management Plan. (Goal 5.9.1 A, Goal 5.3.1 C)

J. The WMO's cost allocation for intercommunity flooding and erosion control studies and construction projects will continue to be based on allowable flow. (Goal 5.9.1 A)

K. The WMO will provide technical review of projects, if requested, as a service to the member cities. Costs to complete these reviews may be charged back to member cities. (Goal 5.9.1 A)

L. The WMO will finance the implementation program elements through either the WMO dues (the annual contributions of its member cities) or some form of cost sharing in accordance with the joint powers agreement. The WMO and cities will also seek grants and other funding opportunities to help offset the costs of the implementation tasks. (Goal 5.9.1 A, Goal 5.9.1 B)

M. The operation and maintenance costs associated with a WMO improvement project will be apportioned according to the WMO joint powers agreement, as revised. (Goal 5.9.1 A)

N. Although the WMO will not be administering a permit program, the WMO will:

- Review projects for consistency with the WMO plan, as requested by member cities or other governmental agencies.

- Review and approve any proposed changes to the intercommunity stormwater system that are inconsistent with an approved local watershed management plan

- Review and approve any changes to the approved local plan that would cause the local plan to be inconsistent with the WMO plan.

- Review member city local plan updates for consistency with WMO Plan.

- Review annual progress reports from the member cities and provide areas that need to be addressed to keep in compliance with the WMO plan.

- Review member city comprehensive plan changes when revisions to their comprehensive plans affect water resource management. Stormwater management elements of the city comprehensive plans are to conform to the WMO plan. (Goal 5.9.1 A)

5.9.3 WMO Policies

A. Member cities are to adopt new ordinances or revise existing ordinances that meet the WMO policies listed in this plan. (Goal 5.9.1 A)

B. Member cities are to report their annual progress to the WMO. This may consist of each member city submitting an implementation plan progress update from their local water management plan. (Goal 5.9.1 A)

6.0 Implementation Program

Table 6-1, 6-2, and 6-3 contain a comprehensive list of the projects, programs, and studies that comprise the WMO implementation program. The WMO developed these activities through reviewing existing information (**Section 2**) and agency coordination (**Section 3**), identifying potential and existing problems (**Section 4**), developing goals, strategies, and policies (**Section 5**), and then assessing the need for programs, studies or projects. Each table shows estimated cost, proposed year of implementation, and proposed financing method for each element of the implementation program. The implementation program identifies special projects and ongoing implementation components through 2020. The proposed dates listed to complete the projects, programs, and studies are estimates and are highly dependent upon available funding. The implementation plan will be reviewed annually and updated as necessary based on past progress, new issues arising, and available funding.

Many of the activities listed in **Table 6-1, 6-2, and 6-3** are to be incorporated into each city's local watershed management plan and Capital Improvement Program. Capital improvements identified in the approved City local plans will be the responsibility of the local government units. The programs and studies identified in this section of the plan may be entirely or partially completed by the WMO, the local government unit, or joint effort between multiple entities.

Table 6-4 provides a cost summary of the implementation program. **Table 6-5** provides the estimated annual plan implementation cost for each member city. **Table 6-6** lists the projects and planning activities completed by the WMO.

TABLE 6-6				
COMPLETED PLANNING AND PROJECTS				
No.	**Planning/Project**	**Description**	**Issue**	**Status**
1	Project	Flooding on Akron Avenue between Mendota Road and Highway 110. Watershed includes Inver Grove Heights and West St. Paul.	Flooding	Drainage system improvements were completed in 1991.
2	Project	Flooding from East Lexington Avenue to Mayfield Heights Road near Highway 13. Watershed includes Mendota Heights and Lilydale.	Flooding	Drainage system improvements were completed in 1994 and 1996.
3	Planning	Watershed draining east along Highways 110 and 494. Watershed includes West St. Paul, Sunfish Lake, Inver Grove Heights, and South St. Paul.	Planning	Study was completed in 1989.
4	Planning	Hornbean Lake, Horseshoe Lake, and Sunfish Lake along Highway 494 in Sunfish Lake and Inver Grove Heights.	Planning	Study was incorporated into Sunfish Lake Water Resource Management Plan, approved 1991.
5	Planning	Seidls Lake Water Quality Study	Water Quality	Study was completed in 1991.
6	Project	Flooding and erosion along Ivy Falls Creek in Mendota Heights and West St. Paul (West of Delaware Avenue).	Flooding and Erosion	Three projects completed: 1) Ruby Drive Outfall (1990), 2) Ivy Falls Creek Stabilization (1994), 3) Thompson Avenue Drainage Diversion.
7	Planning	Water Quality Study for Simley Lake.	Water Quality	Study was completed in 1993 for the City of Inver Grove Heights.
8	Planning	Water Quality Monitoring Report for Horseshoe Lake, Hornbean Lake, and Sunfish Lake.	Water Quality	Monitoring report was completed in 1994 for the City of Sunfish Lake.
9	Project	Flooding and erosion in Simon's Ravine between Wentworth Avenue and Butler Avenue, from Robert Street to Concord Street.	Flooding and Erosion	West St. Paul pond expansions and storm sewer improvements completed 1993. Additional ponding constructed 1995. South St. Paul storm sewer improvements completed to Kaposia Dam (19th Avenue) with projects in 1990, 1993, 1994, 1999, and 2009.
10	Planning	Revise Joint Powers Agreement.	Administrative	Agreement completed in 2001, signatures completed in 2002
11	Project	Erosion, flooding, and safety at Simon's Ravine and Kaposia Dam in South St. Paul between Butler Avenue and Bromley Street.	Flooding, erosion, safety	System from Kaposia Dam to Concord completed in 2002, system from Concord to Mississippi River completed in 2006.
12	Project	Potential flooding on Babcock Trail south of Southview Boulevard. Watershed includes South St. Paul, Inver Grove Heights, and West St. Paul.	Potential Flooding	Drainage system improvements were completed in conjunction with Co. Road 14 improvements (2002).
13	Planning	Water Quality Modeling Study for Ivy Falls Creek, Interstate Valley Creek, and Highway 13 Subwatersheds	Water Quality	Modeling study was completed in 2003.

TABLE 6-6				
COMPLETED PLANNING AND PROJECTS				
No.	**Planning/Project**	**Description**	**Issue**	**Status**
14	Planning	Water Quality Feasibility Study for Ivy Falls Creek, Interstate Valley Creek, and Highway 13 Subwatersheds	Water Quality	Feasibility study was completed in 2004.
15	Planning	Seidls Pond/Lake lift station. Watershed includes South St. Paul, Inver Grove Heights, and West St. Paul.	Flooding/Drainage	Feasibility study completed in 2004.
16	Project	Diversion of Thompson Avenue drainage into Ivy Falls Creek subwatershed.	Flooding	Project was completed in 2006.
17	Planning	Flooding and erosion at Marie Avenue and Dodd Road. Watershed includes Inver Grove Heights, Sunfish Lake, Mendota Heights, and West St. Paul.	Flooding and Erosion	Feasibility Study Completed (2006).
18	Project	Bank Stabilization on Marie Creek in Mendota Heights north of Marie Avenue.	Erosion	Project was completed (2007,2008).
19	Planning	Allowable Flow Cost Apportionment for Dawn Way Storm Sewer Improvement Project. Watershed includes Inver Grove Heights and South St. Paul	Drainage	Hydrologic analysis and cost split analysis was completed in 2008.
20	Planning/Project	Water quality improvements for Anderson Pond in South St. Paul and Southview Pond in West St. Paul.	Flooding and Erosion	Feasibility Study was completed in 2005. Construction of improvements was completed in 2008-2009.
21	Planning	Create internet website.	Administrative	Worked with Dakota County SWCD to complete website in 2009.
22	Planning	Lexington Avenue-Trunk Highway 13 Drainage and Erosion Feasibility Study.	Flooding and Erosion	Feasibility Study was completed in 2010.

7.0 Impact on Local Governments

The WMO's intention is to limit additional requirements imposed upon local units of government. Most of the WMO plan's implementation program elements will be implemented by the member cities and many of the implementation tasks will be funded by WMO cost sharing. Some of the implementation program elements reflect the goals, policies and requirements of state and regional units of government that local units of government would need to address regardless. **Table 7-1** shows member city conformance with many of the policies contained in the 3rd Generation Watershed Management Plan.

Table 7-1: Member City Conformance with 3rd Generation WMO Policies

Policy	Inver Grove Heights	Lilydale	Mendota Heights	St. Paul	South St. Paul	Sunfish Lake	West St. Paul
Minimum Building Elevations (5.2.3 K)	Y	Y	Y	Y	Y	Y	Y
Rate Control (5.2.3 M)	Y	Y	Y	Y	Y	Y	Y
Storm Sewer Design (5.2.3 D-F)	Y	Y	Y	Y	Y	Y	Y
Runoff Control Plans (5.2.3 M)	N	Y	N	N	Y	N	N
50% Phosphorus Removal Policy (5.3.3 A)	N*	N*	N*	N*	N*	N*	N*
Pretreatment Prior to Infiltration (5.2.3 C)	N	N	N	N	N	N	N
Stormwater Easements (5.2.3 I)	Y	Y	Y	Y	Y	Y	Y
Erosion and Sediment Control (5.7.3 A-B)	Y	Y	Y	Y	Y	Y	Y
Wetland Buffer (5.5.3 B)	N (except in NW area)	N	N	N	N	Y	N
Shoreland Ordinance (5.4.3 D)	Y	N	Y	Y	Y	Y	Y
Prioritize shoreland areas for restoration (5.4.3 C)	N	N	N	N	N	N	N
Inventory and classify wetlands (5.5.3 C)	Y	N	Y	Y	Y	Y	Y

*Member city policy requires similar phosphorus removal as WMO policy 5.3.3 A. Member city policy should be amended to provide consistent language unless member city desires a more stringent policy.

7.1 WMO Responsibilities

The Lower Mississippi River Watershed Management Organization is not a permitting agency. As a result, the WMO's major responsibilities are to 1) ensure that the

policies and standards in the WMO plan are adopted and implemented by the member cities; 2) manage and assist member communities with intercommunity runoff, water quality, and water management issues; and 3) assess the performance of the WMO and the member cities toward achieving the goals stated in the WMO plan.

Member cities are responsible for primary management of stormwater and water resources within their boundaries. Member cities will continue as the local government units (LGUs) responsible for administering the Wetland Conservation Act within their boundaries, and will continue to implement and enforce their existing ordinances related to water resource management. The cities, other government organizations, and private parties are responsible for maintaining their stormwater systems.

7.2 Local Planning

According to MN Rules 8410.0160, the cities are to adopt local watershed management plans within two years of the BWSR's approval of the last watershed management organization plan that affects the unit of government.

It is anticipated that all of the member cities will need to revise their local plans to bring them into conformance with WMO's revised plan and MN Rules 8410. The following local units of government will be required to revise or prepare local plans that conform to the WMO plan, MN Statutes 103B and to MN Rules 8410:

Dakota County:	Ramsey County:
Inver Grove Heights	St. Paul
Lilydale	
Mendota Heights	
South St. Paul	
Sunfish Lake	
West St. Paul	

Within 30 days of the WMO Board's adoption of the WMO plan, the WMO will notify each city of these requirements pertaining to local plan revision and adoption.

A local governmental unit can assume as much management control as it wishes through its approved local water management plan. The WMO assumes that the member cities will continue to be the permitting authority for all land alteration activities. To continue as the permitting authority, the local government must outline its permitting process in its local water management plan, including the preliminary and final platting process. The WMO may appeal the local government's approval of a project if the WMO believes the project is not consistent with the local plan.

The WMO will review proposed changes to an intercommunity stormwater system that are inconsistent with a city's approved plan, and/or changes to an approved city plan that would cause the plan to be inconsistent with the WMO plan.

7.2.1 Requirements for Local Watershed Management Plans

Local water management plans are required to conform to MS 103B.235, MN Rules 8410.0160, MN Rules 8410.0170 and the WMO plan. MN Rules 8410.0160 requires (in part) that:

> "Each local plan must include sections containing a table of contents; executive summary; land and water resource inventory; establishment of goals and policies; relation of goals and policies to local, regional, state, and federal plans, goals, and programs; assessment of problems; corrective actions; financial considerations; implementation priorities; amendment procedures; implementation program; and an appendix. Each community should consider including its local plan as a chapter of its local comprehensive plan."

MN Rules 8410.0170 explains in more detail the general requirements given above.

The policies and goals established in each city's watershed management plan must be consistent with the WMO plan. The section of the local plan covering assessment of problems must include those problems identified in the WMO plan that affect the city. The approaches for improvement proposed must be limited to those actions that can be carried out at the local government level and must be consistent with the WMO plan. A city may use all or part of the WMO plan when developing its local plan.

Local watershed management plans must clearly identify when the management programs will go into effect. All local plan controls and programs must be developed and in effect within two years of adoption of the last WMO plan in the local governmental unit.

7.2.2 Lower Mississippi River WMO Review of Local Watershed Management Plans

Before a member city adopts its local watershed management plan, the plan must be submitted to all of the affected WMOs for review. The city must also submit its plan to the Metropolitan Council, and to any counties with adopted groundwater plans, for a 45-day review. Within 60 days of receipt of the local plan, the WMO will review the local plan for conformance with the WMO plan. As part of its review, the WMO will take into consideration any comments received from the Metropolitan Council and the counties. The WMO will approve or disapprove all or part of the local plan within the 60-day time frame, unless the city agrees to an extension. If the WMO does not complete its review, or fails to approve/disapprove the plan within the allotted time, and the city has not given an extension, the local plan will be considered approved (MN Rules 8410.0170, Subp. 12 and MN Statutes 103B.235, Subd. 3 and 3a).

Once the WMO approves the local plan, the local government must adopt and implement its plan within 120 days and amend its official controls within 180 days of plan approval. Each member city must notify the WMO (and the other affected WMOs) within 30 days of plan adoption and implementation, and adoption of necessary official controls.

Any amendments to the local plan must be submitted to the WMO for review and approval prior to their adoption by the member city. The WMO review process is the same as for the original local plan.

7.3 Review of WMO Plan

This watershed management plan was submitted to the member cities, the Board of Water and Soil Resources, the Minnesota Pollution Control Agency, the Minnesota Department of Natural Resources, the Minnesota Department of Agriculture, the Minnesota Department of Health, the Minnesota Department of Transportation, the Metropolitan Council, the counties, the Dakota Soil and Water Conservation District, the Ramsey Soil and Water Conservation District, the National Park Service, and Friends of the Mississippi River for formal review, in accordance with Minnesota statutes.

8.0 Plan Revision and Amendments

8.1 Plan Revision and Amendments

This plan remains in effect for ten (10) years from the year it was approved and adopted, unless it is superseded by adoption and approval of a succeeding plan. All amendments to this plan must follow the procedures set forth in this section, or as required by revised laws and rules. Plan amendments may be proposed by any person to the LMRWMO Board, but only the LMRWMO may initiate the amendment process. The LMRWMO may amend its plan in the interim (interim plan amendment) if either minor changes are required or if problems arise that are not addressed in the plan.

In accordance with Minnesota Statutes 103B.231, Subd. 3a, BWSR developed (and occasionally revises) a priority schedule for the revision of water management plans. BWSR uses the schedule to inform WMOs of when they will be required to revise their plans. Minnesota Statutes 103B.231, Subd. 3a also states that once a WMO is notified by BWSR that a plan revision is required, the WMO has 24 months from the date of notification to submit a revised plan for review. If BWSR does not notify the LMRWMO that a plan revision is required and the plan expires, Minnesota Statutes 103B.231, Subd. 3a states that the existing plan, authorities, and official controls of the LMRWMO remain in full force and effect until a revision is approved. The same statute also allows the LMRWMO to submit a draft plan revision for review prior to BWSR's scheduled date. If BWSR fails to begin review of the submitted plan within 45 days of plan submittal, the LMRWMO may adopt and implement the plan without formal BWSR approval.

8.2 General Amendment Procedure

Minnesota Rules 8410.0140, Subp. 2, requires that all plan amendments must adhere to the review process listed in MN Statutes 103B.231, Subd. 11, except when the proposed amendments constitute minor amendments and:

1. The LMRWMO held a public meeting to explain the amendments and published a legal notice of the meeting twice, at least seven days and fourteen days before the date of the meeting;

2. The LMRWMO sent copies of the amendments to the affected local units of government, the Metropolitan Council, and the state review agencies for review and comment; and

3. BWSR either agreed that the amendments are minor or failed to act within 45 days of receipt of the amendments.

The review process for minor plan amendments is more streamlined than the general plan amendment review process. The LMRWMO will also consider sending drafts of proposed amendments to all plan review authorities to receive input before establishing a hearing date or beginning the formal review process.

8.3 Minor Plan Amendments

MN Rules 8410.0140, Subp.3 considers amendments to the approved capital improvement program to be minor plan amendments if the following conditions are met:

1. The original plan set forth the capital improvements but not to the degree needed to meet the definition of "capital improvement program" as provided in Minnesota Statutes, section 103B.205, subdivision 3; and

2. The affected county or counties approve the capital improvement in its revised, more detailed form.

The following examples of other minor plan amendments are given in Minnesota Rules 8410.0020, Subp. 10:

> "...recodification of the plan, revision of a procedure meant to streamline administration of the plan, clarification of the intent of a policy, the inclusion of additional data not requiring interpretation, or any other action that will not adversely affect a local unit of government or diminish a water management organization's ability to achieve its plan's goals or implementation program."

Prior to sending a proposed minor plan amendment out for review, the LMRWMO Board will obtain BWSR's concurrence that the proposed amendment is a minor plan amendment.

8.4 Amendment Format

Upon completion of the plan amendment, the LMRWMO will submit the plan amendment to the appropriate review authorities in a format consistent with Minnesota Rules 8410.0140, Subp. 4. The rule requires that, unless the entire document is reprinted, all amendments adopted must be printed in the form of replacement pages for the plan, each page of which must:

1. Show deleted text as stricken and new text as underlined (for draft amendments under consideration):

2. Be renumbered as appropriate; and

3. Include the effective date of the amendment.

8.5 Distribution of Amendments

The LMRWMO will maintain a distribution list of everyone who receives a copy of the plan. Within 30 days of adopting an amendment, the LMRWMO will distribute copies of the amendment to everyone on the distribution list. The LMRWMO will also consider sending drafts of proposed amendments to all plan review authorities to receive input before establishing a hearing date or beginning the formal review process.

9.0 References

Portions of the *Lower Mississippi River Watershed Management Organization Watershed Management Plan, 2001 (Barr Engineering)* were unchanged and reused in this document. The following documents have been referenced within the text of the Plan and are available within the Appendices of the Plan, from LMRWMO Board, or from member city staff.

1. Minnesota Board of Water and Soil Resources. *Minnesota Rules Chapter 8410. Metropolitan Area Local Water Management*.

2. Barr Engineering. 2001. *Lower Mississippi River Watershed Management Organization Watershed Management Plan*.

3. Barr Engineering. 2009. *Gaps Analysis and Visioning Project for the Lower Mississippi River Watershed Management Organization*.

4. Barr Engineering. 2008. *Water Resource Management Plan for the City of Lilydale.*

5. Barr Engineering. 2008. *City of Inver Grove Heights 2nd Generation Water Resources Management Plan.*

6. Bonestroo. 2006. *Local Surface Water Management Plan for the City of Mendota Heights.*

7. Bonestroo. 2006. *Local Surface Water Management Plan for the City of West Saint Paul.*

8. Emmons and Olivier Resources. 2006. *City of Inver Grove Heights Stormwater Manual – Northwest Area.*

9. MPCA. 2009. *Manual for Assessing the Quality of Minnesota Surface Waters.*

10. WSB & Associates. 2006. *St. Paul Local Surface Water Management Plan.*

11. WSB & Associates. 2004. *Comprehensive Storm Water Management Plan for the City of South St. Paul.*

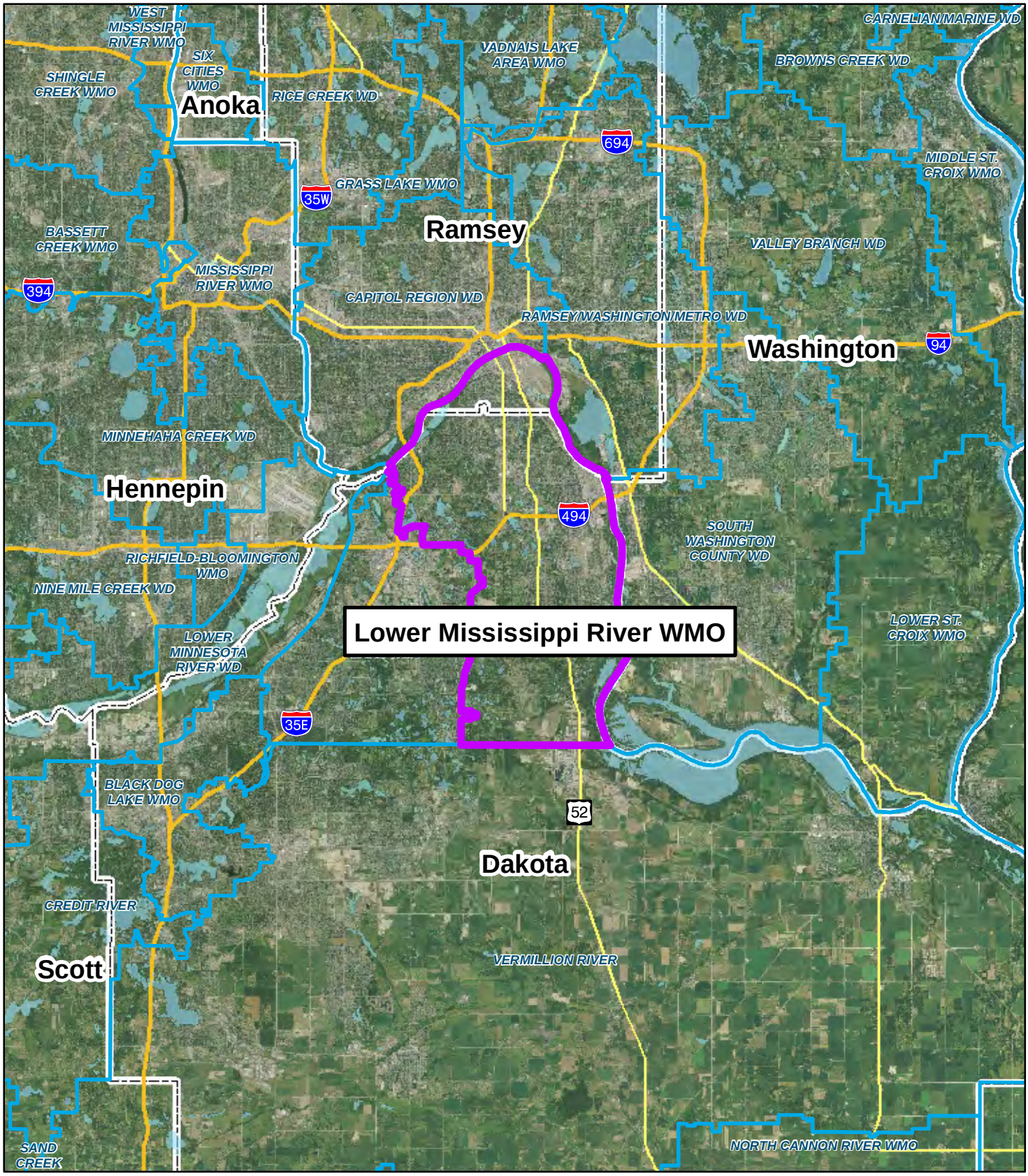
12. WSB & Associates. 2009. *Comprehensive Stormwater Management Plan for the City of Sunfish Lake.*

10.0 Glossary of Acronyms

BMP	Best Management Practice
BWSR	Board of Water and Soil Resources
CAC	Citizen Advisory Committee
CAMP	Citizen Assisted Monitoring Program – MCES
CIP	Capital Improvement Project
CSMP	Citizen Stream Monitoring Program - MPCA
DNR	Minnesota Department of Natural Resources
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
GIS	Geographic Information System
HWL	High Water Level
IDDE	Illicit Discharge Detection and Elimination
JPA	Joint Powers Agreement
LGU	Local Governing Unit
LID	Low Impact Development
LMC	League of Minnesota Cities
LMRWMO	Lower Mississippi River Watershed Management Organization
MCES	Metropolitan Council Environmental Services
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MIDS	Minimal Impact Design Standards
MNDOT	Minnesota Department of Transportation
MNRAM	Minnesota Routine Assessment Method for Wetlands
MPCA	Minnesota Pollution Control Agency
MS4	Municipal Separate Storm Sewer System
MUSA	Metropolitan Urban Service Area
NEMO	Nonpoint Source Education for Municipal Officials
NPDES	National Pollutant Discharge Elimination System
NURP	National Urban Runoff Program
NRCS	Natural Resource Conservation Service
NWL	Normal Water Level
OHW	Ordinary High Water Elevation
PAHs	Polycyclic Aromatic Hydrocarbons
P8	Program for Predicting Pollutant Particle Passage through Pits, Puddles, and Ponds
SWCD	Soil and Water Conservation District
SWPPP	Storm Water Pollution Prevention Plan
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WCA	Wetland Conservation Act
WD	Watershed District
WHEP	Wetland Health Evaluation Program
WMO	Watershed Management Organization

APPENDIX A

FIGURES



Source: Minnesota Department of Natural Resources, 2003

Legend

- Lower Mississippi River WMO
- Watersheds
- Interstate Highways
- US Highways
- County Boundaries

0 4 8 Miles

Lower Mississippi River WMO
Watershed Management Plan

Location Map

Figure 1

N
S

WSB & Associates, Inc.

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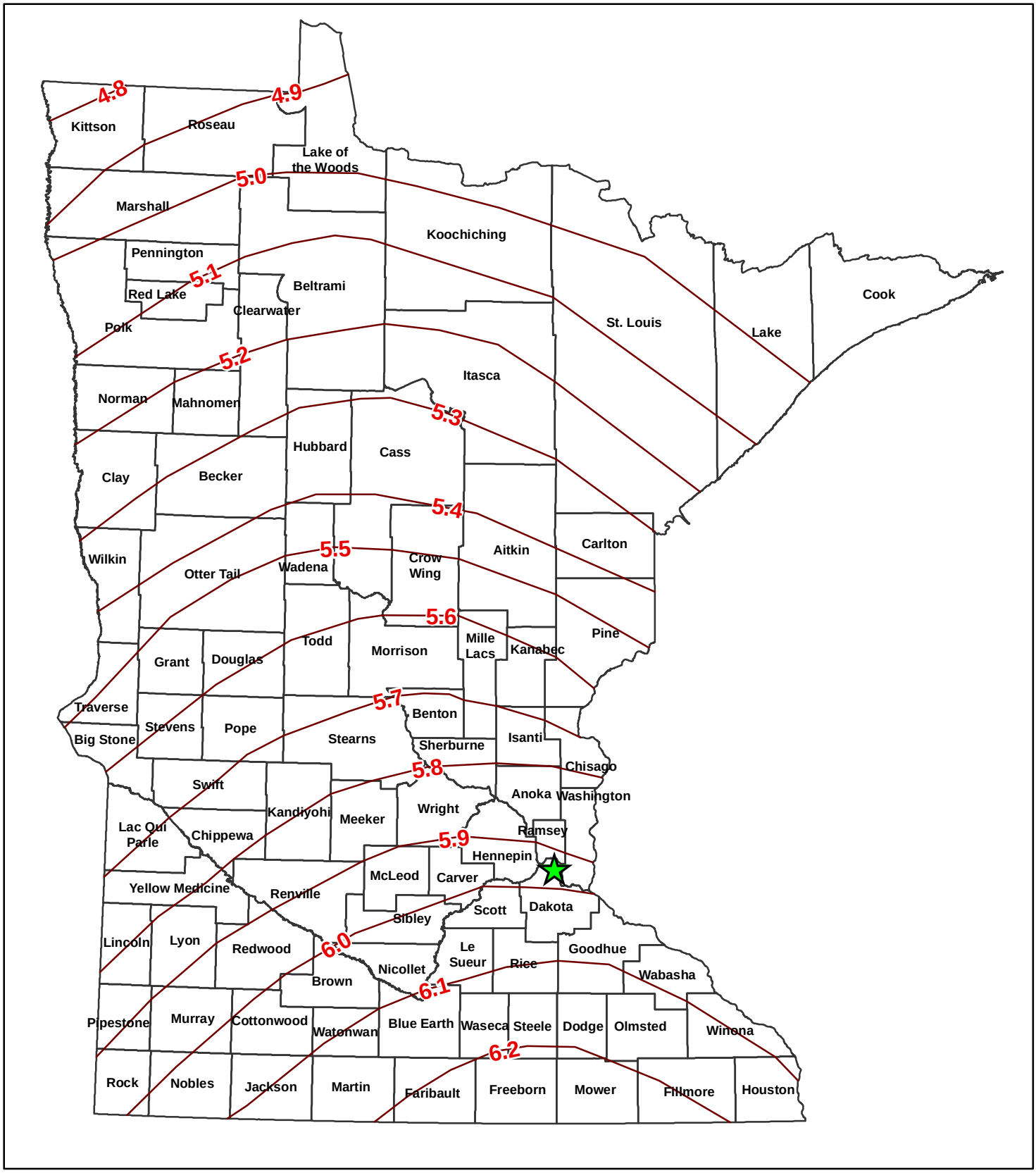

Lower Mississippi River WMO

Lower Mississippi River WMO Watershed Management Plan

Source: National Oceanic and Atmospheric Administration, Natural Resources Conservation Service, U.S. Department of Agriculture, 2003

1% Chance Rainfall Event in 24-hours

Values in Inches

Figure 2

0 50 100 Miles

N S

WSB & Associates, Inc.

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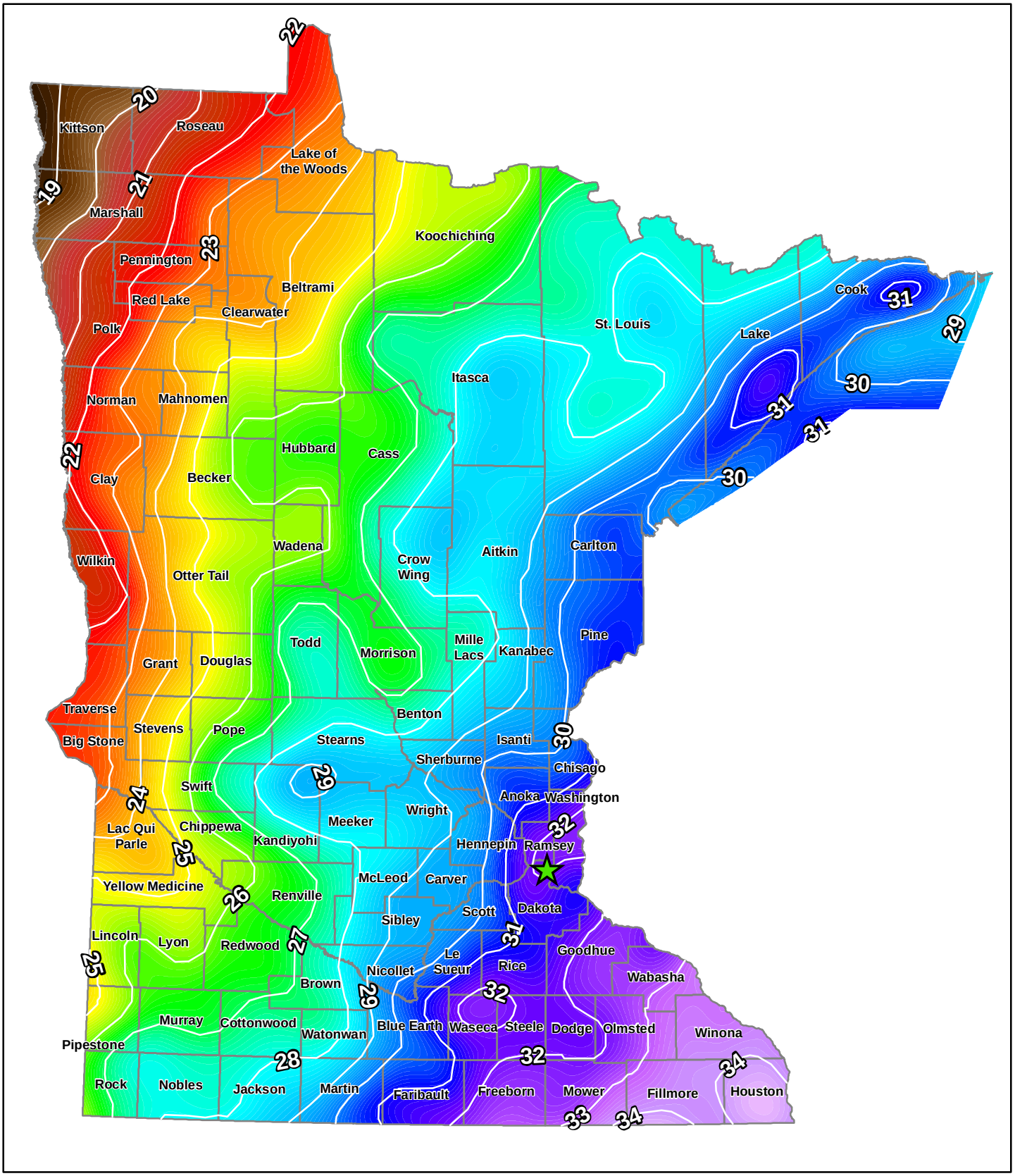

Lower Mississippi River WMO

Lower Mississippi River WMO Watershed Management Plan

Source: National Oceanic and Atmospheric Administration, Natural Resources Conservation Service, U.S. Department of Agriculture, 2003

Annual Normal Precipitation

Values in Inches

Figure 3

0 50 100 Miles

N S

WSB & Associates, Inc.

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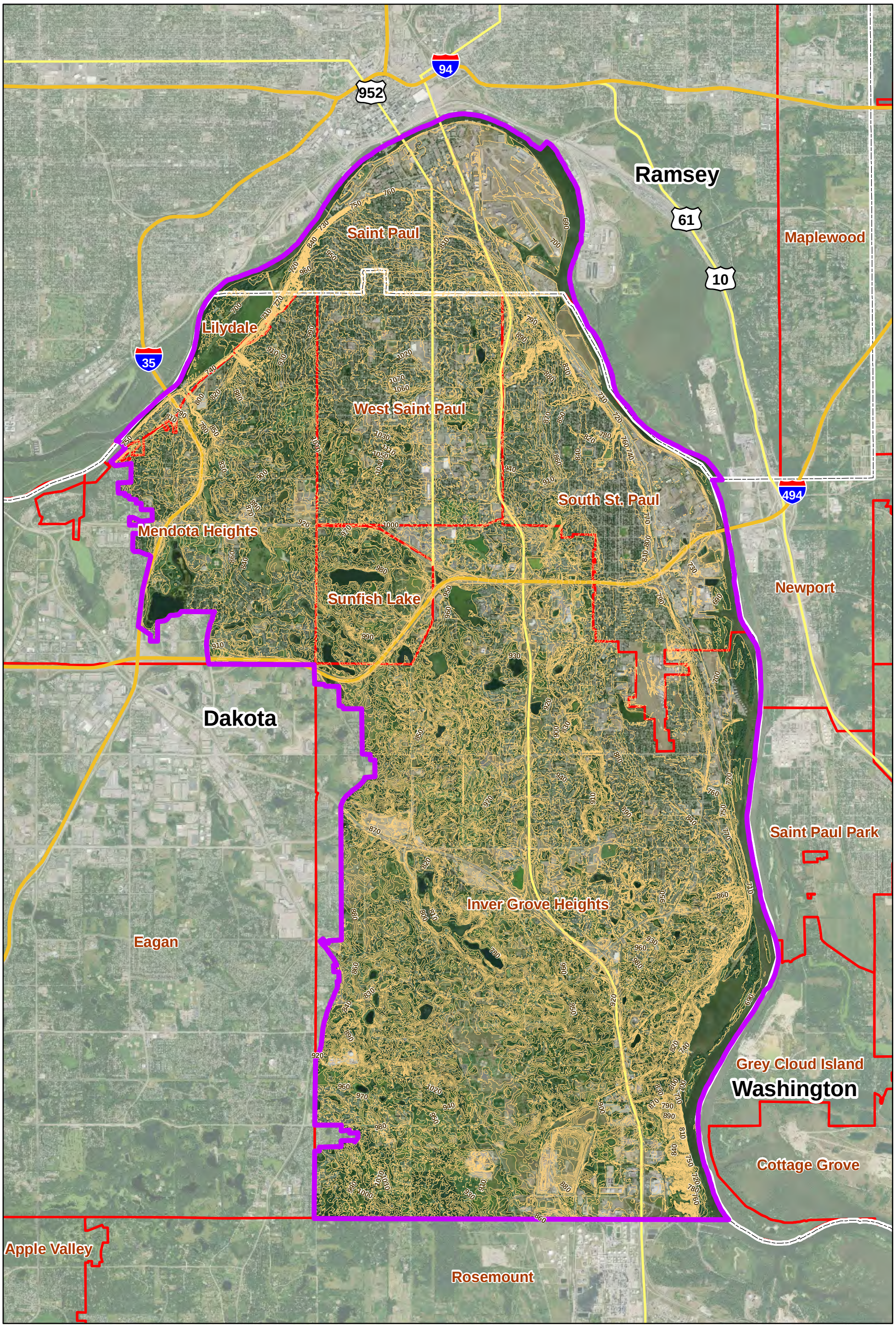

Legend

- 10-ft Contours
- Lower Mississippi River WMO
- Municipal Boundaries

Lower Mississippi River WMO
Watershed Management Plan

Contours

Figure 4

N
S
0 5,000 Feet

Source: Dakota County, 2004
Ramsey County, 2006

WSB & Associates, Inc.

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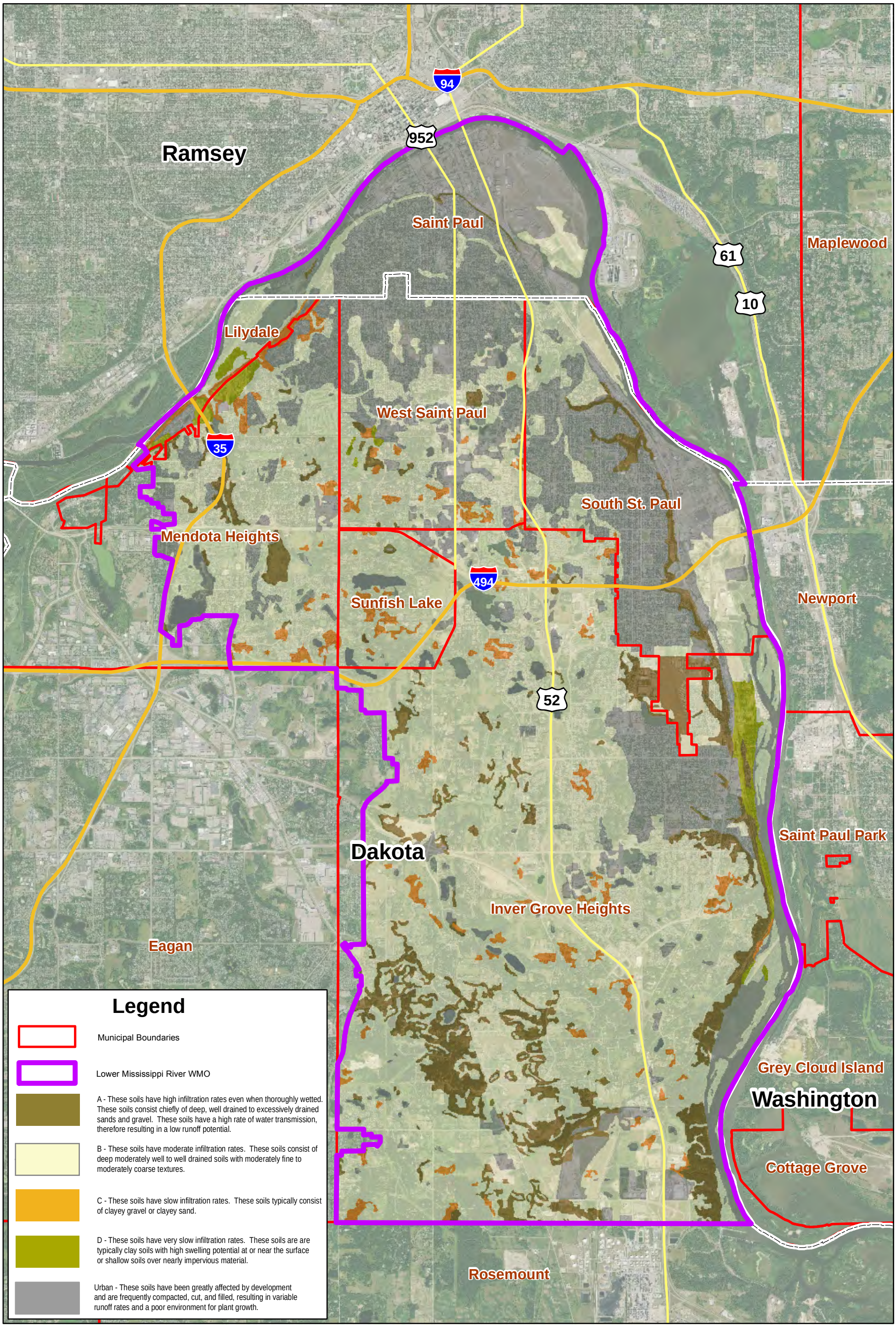

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LMRWMO Soil Breakdown:

Group A – 7.8%
Group B – 57.6%
Group C – 2.6%
Group D – 1.0%
Urban – 31.0%

Note As a result of continued development, there are likely more Urban soils than are shown on this map.

Lower Mississippi River WMO Watershed Management Plan

Hydrologic Soils Classification

Figure 5

Source: Natural Resources Conservation Service, 2008

N
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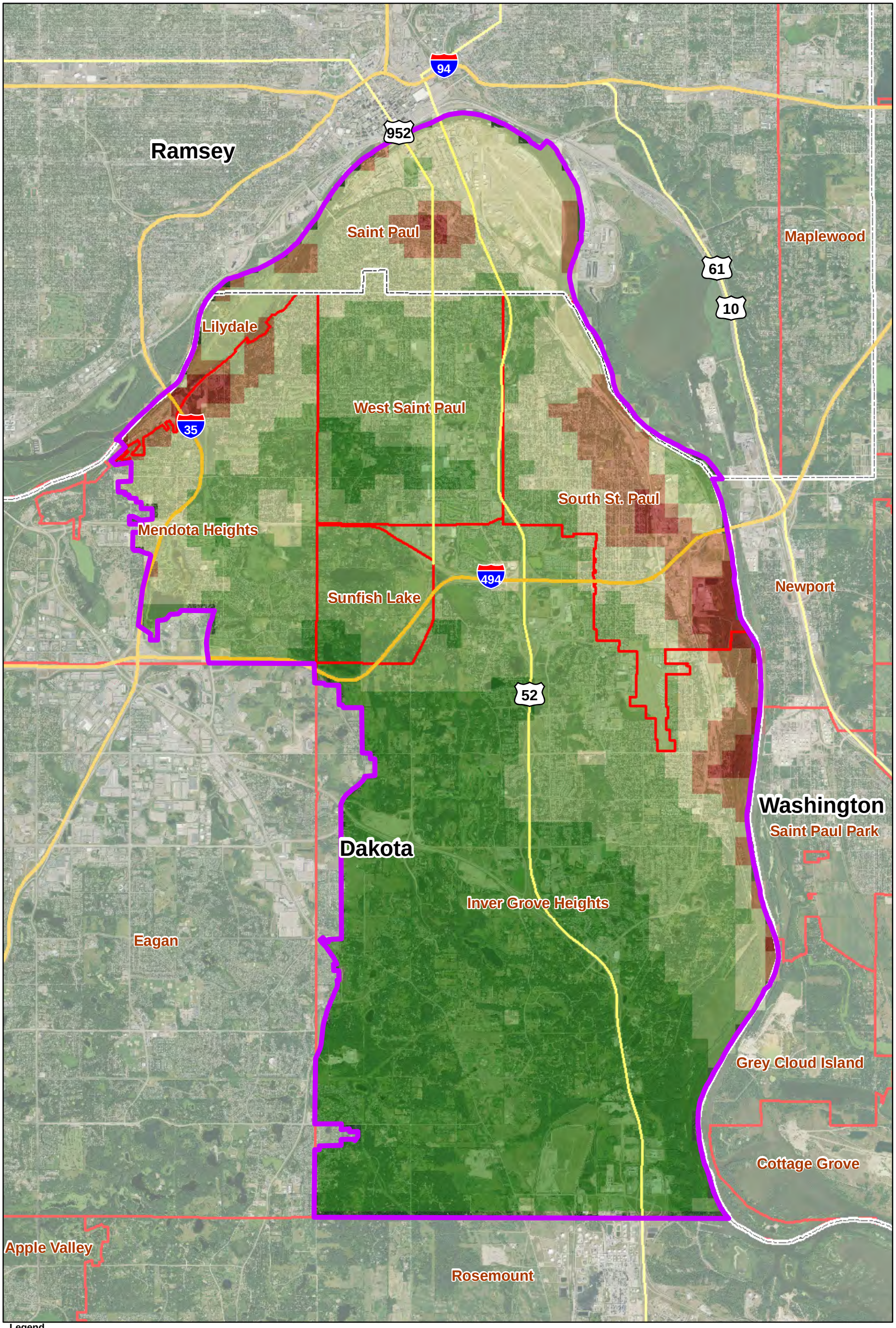
0 5,000 Feet

WSB & Associates, Inc.



Legend

- Municipal Boundaries
- Lower Mississippi River WMO

Depth to Bedrock (ft)

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- Over 200

Lower Mississippi River WMO
Watershed Management Plan

Depth to Bedrock

Figure 6

Source: Minnesota Geologic Survey, 2006

N
S

0 5,000 Feet

WSB & Associates, Inc.

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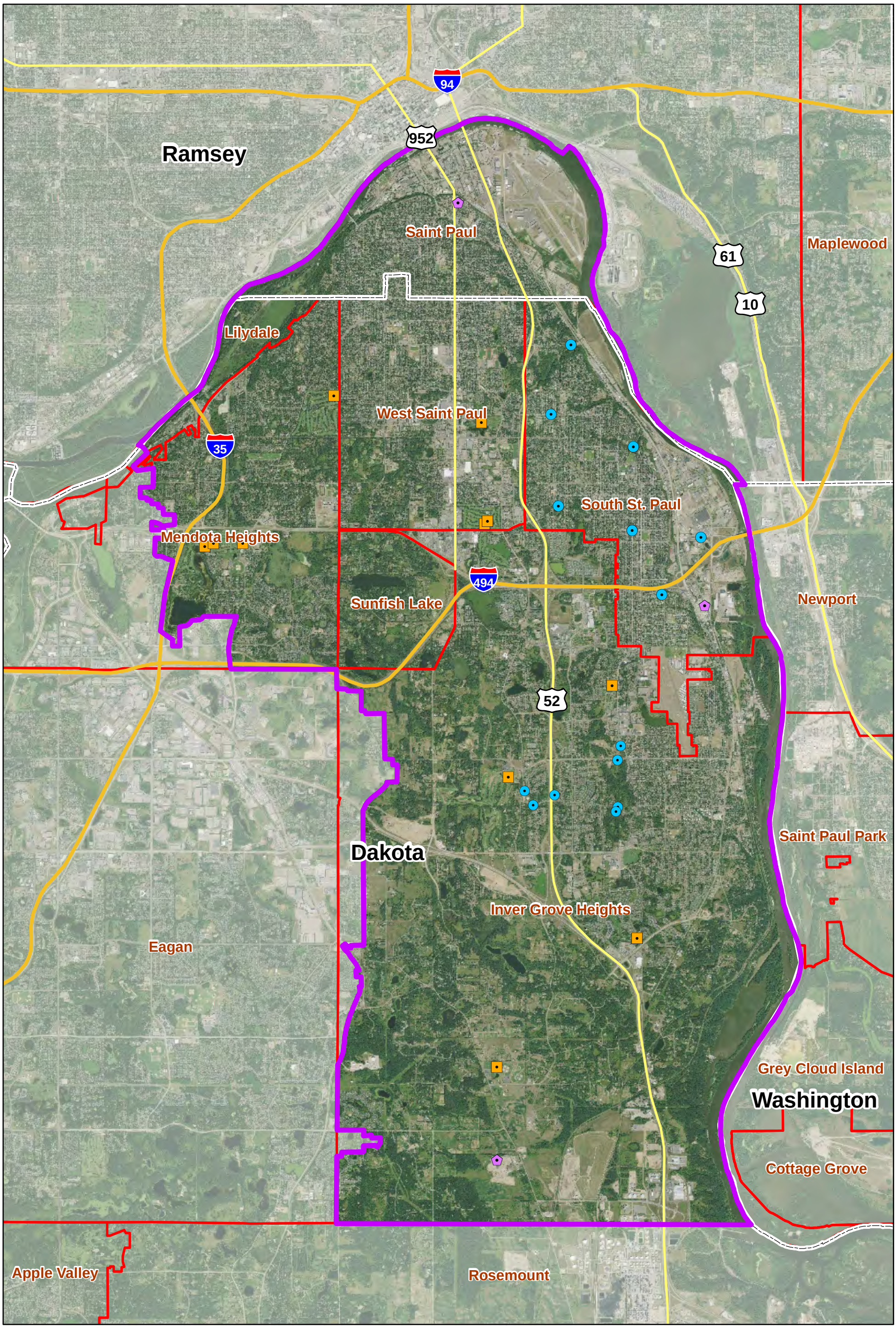

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Legend

- Lower Mississippi River WMO
- Municipal Boundaries
- Industrial Processing
- Non-Crop Irrigation
- Waterworks (Wells)

Lower Mississippi River WMO
Watershed Management Plan

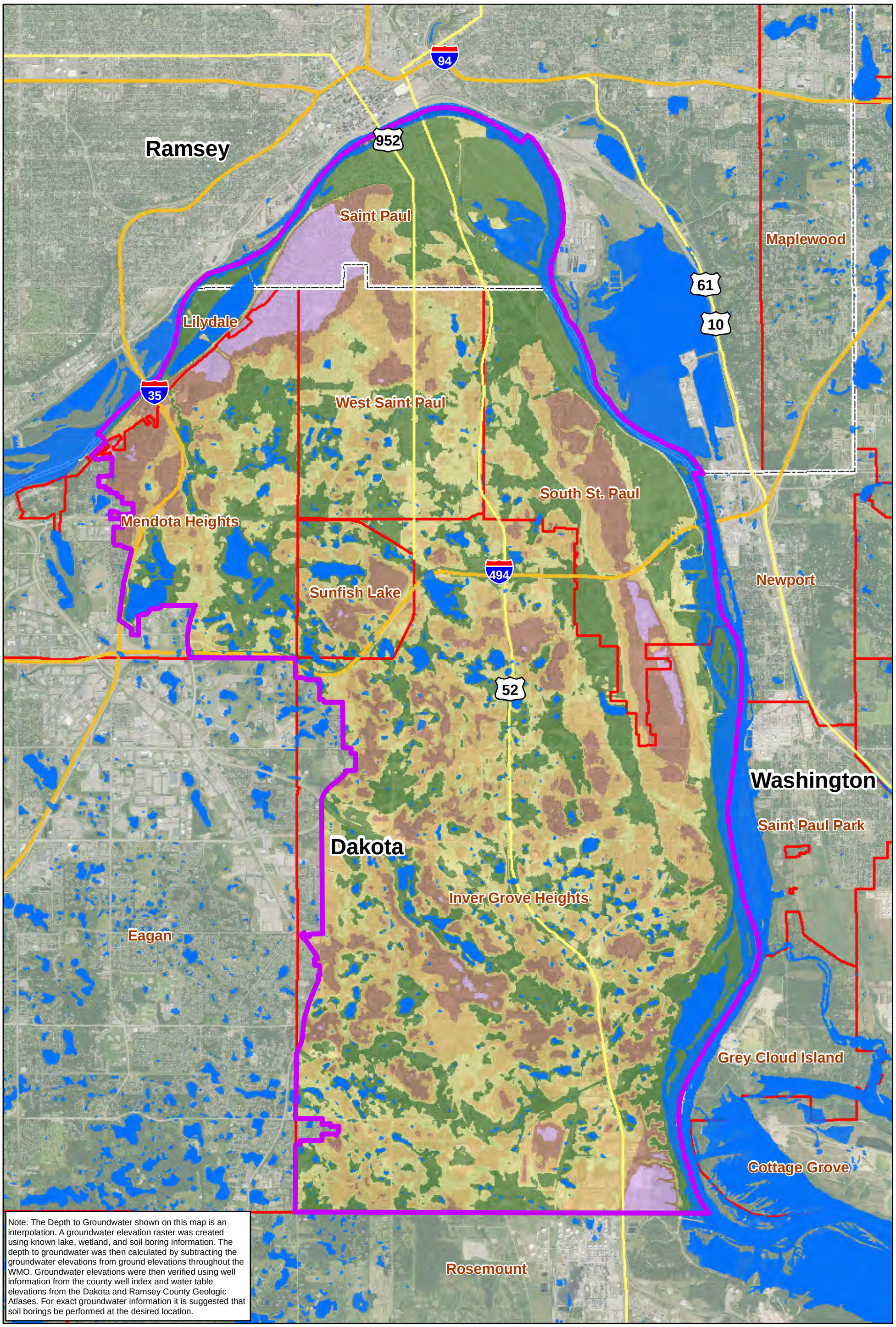
Groundwater Appropriations

Figure 7

Source: Minnesota Department of Natural Resources, 2010, City of Inver Grove Heights, 2011, City of South St. Paul, 2011

N
S
0 5,000 Feet

WSB & Associates, Inc.



Lower Mississippi River WMO
Open Water Surface

Depth to Groundwater (ft)

0 - 10
10 - 25
25 - 50
50 - 100
100+
Municipal Boundaries

Lower Mississippi River WMO
Watershed Management Plan

Depth (ft) to Groundwater

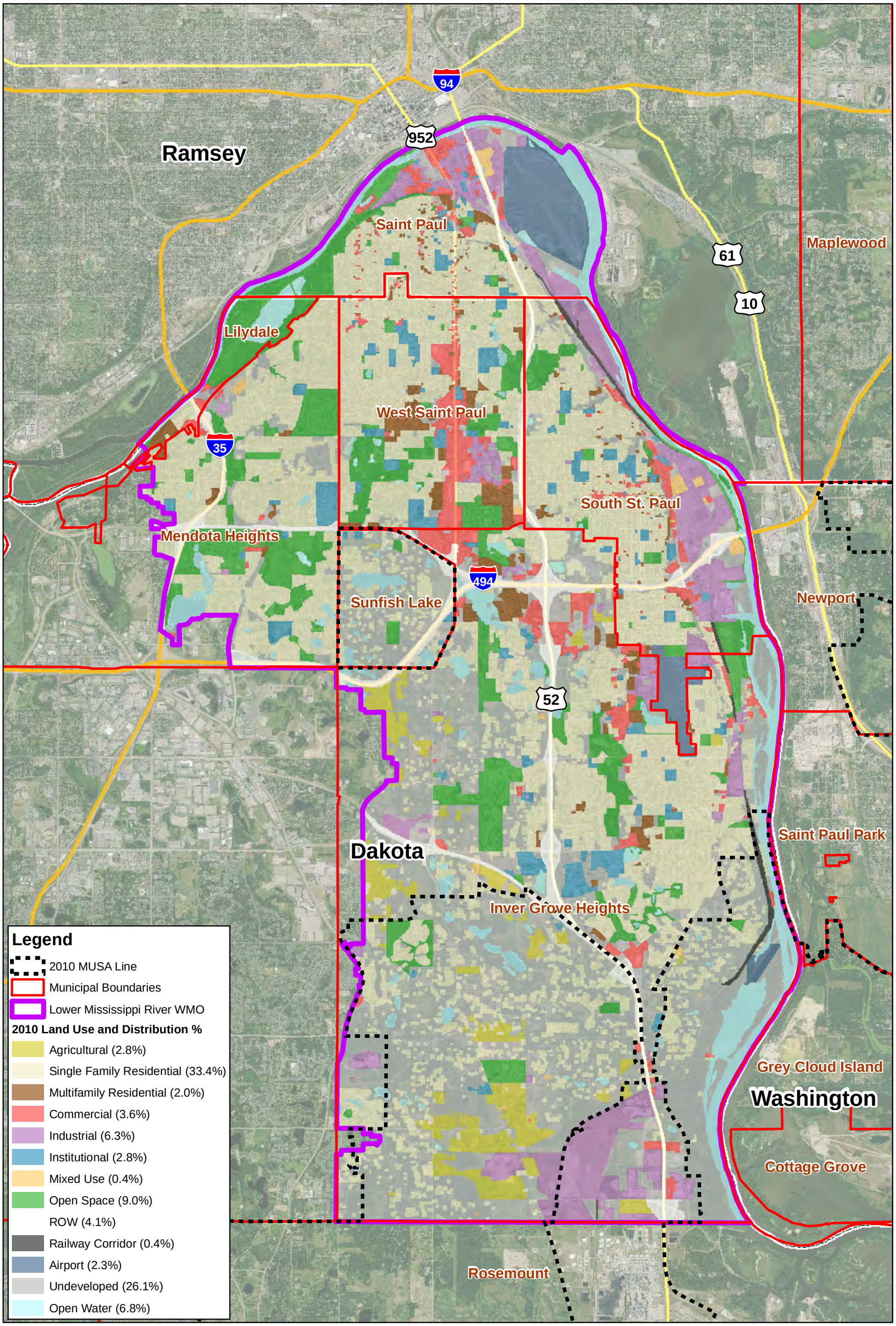
Figure 8

N
S
0 5,000 Feet

Source: WSB & Associates, 2010

WSB & Associates, Inc.

File: K:\01721-02\GIS\Maps\Figures\Figure8_DepthtoGroundwater.mxd, Aug 30, 2010 3:07:35 PM



File: K:\01721-02\GIS\Maps\Figures\Figure9_ExistingLanduse.mxd, Aug 30, 2010 3:22:50 PM

Lower Mississippi River WMO
Watershed Management Plan

Source: Metropolitan Council, 2010
City of Inver Grove Heights, 2010

N
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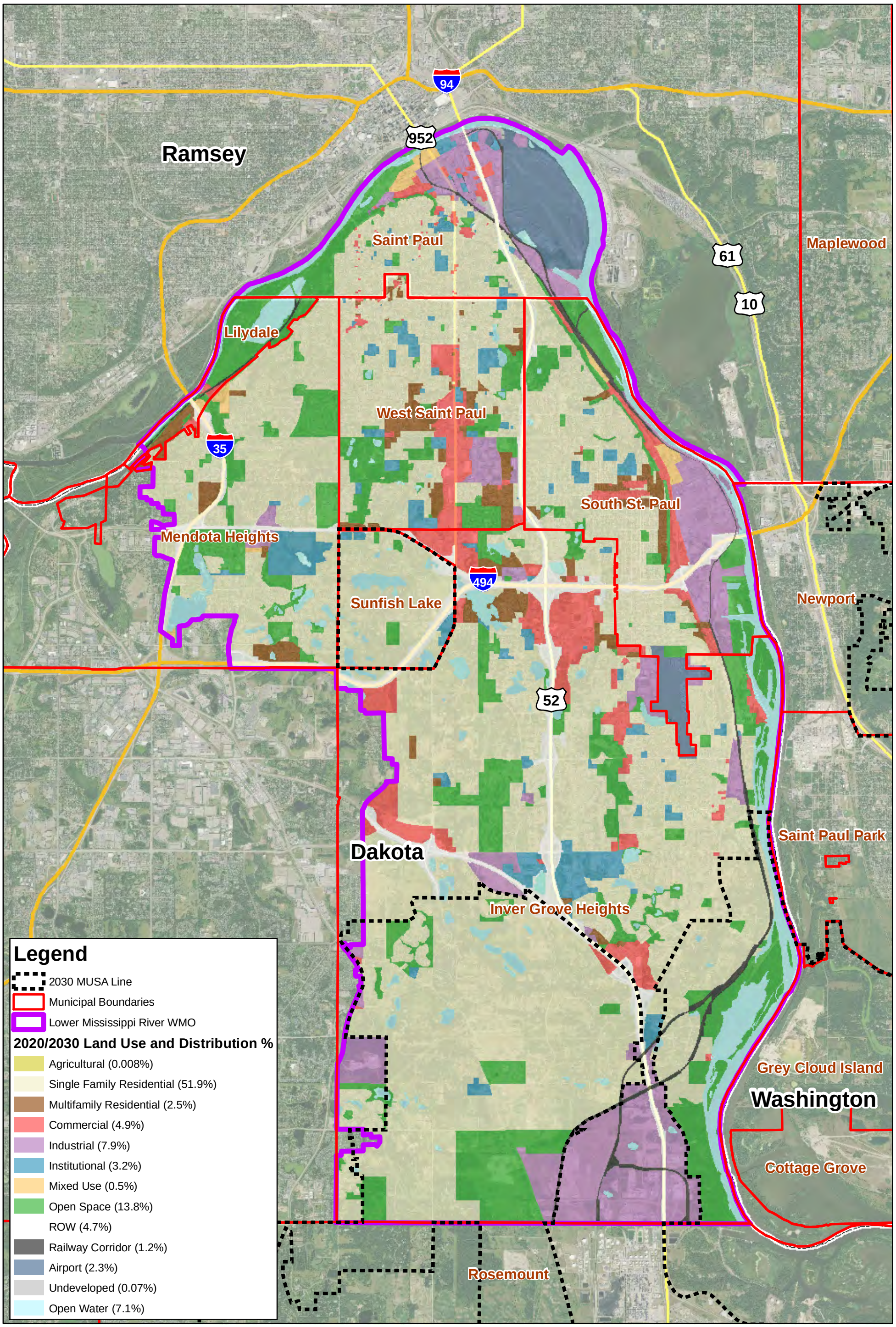
0 5,000 Feet

WSB & Associates, Inc.

2010 Land Use

Figure 9



File: K:\01721-02\GIS\Maps\Figures\Figure10_FutureLanduse.mxd, Aug 30, 2010 3:23:35 PM

**NOTE* The following Cities Land Use Plan is for 2030:*
Inver Grove Heights, Lilydale, Sunfish Lake, and West St. Paul

The following Cities Land Use Plan is for 2020:
Mendota Heights, South St. Paul, and St. Paul

Lower Mississippi River WMO
Watershed Management Plan

2020/2030 Land Use

Figure 10

Source: Metropolitan Council, 2010
City of Inver Grove Heights, 2010

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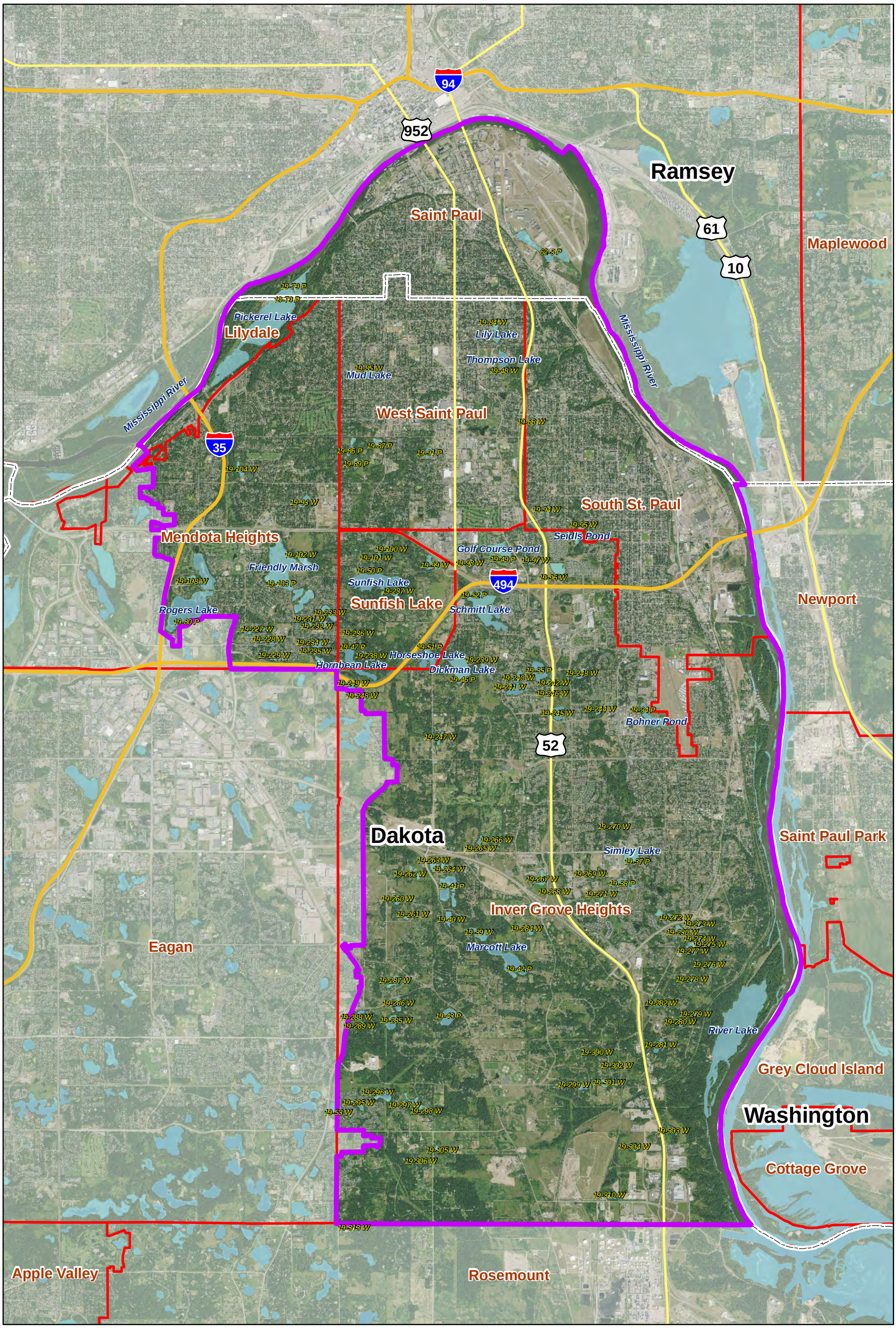
0 5,000 Feet

WSB & Associates, Inc.



Legend

- Municipal Boundaries
- Lower Mississippi River WMO
- DNR Public Water Inventory (PWI)

Lower Mississippi River WMO
Watershed Management Plan

DNR Public Water Inventory (PWI) Map

Figure 11

Source: Minnesota Department of Natural Resources, 2008

N

0 5,000 Feet

WSB & Associates, Inc.

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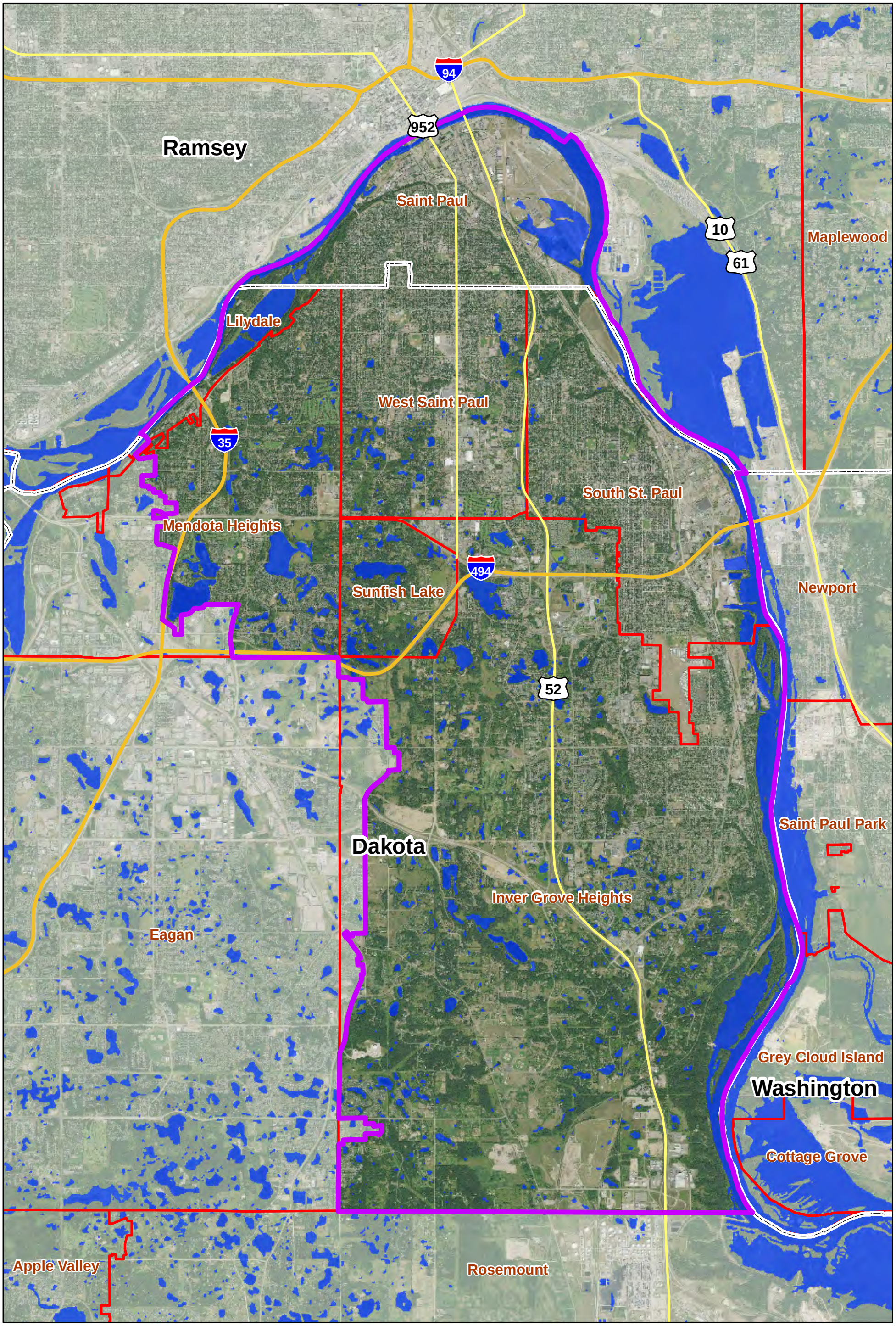

Legend

- Municipal Boundaries
- Lower Mississippi River WMO
- National Wetlands Inventory

Lower Mississippi River WMO
Watershed Management Plan

National Wetlands Inventory Map

Figure 12

Source: U.S. Fish and Wildlife Service, 2010

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0 5,000 Feet

WSB & Associates, Inc.

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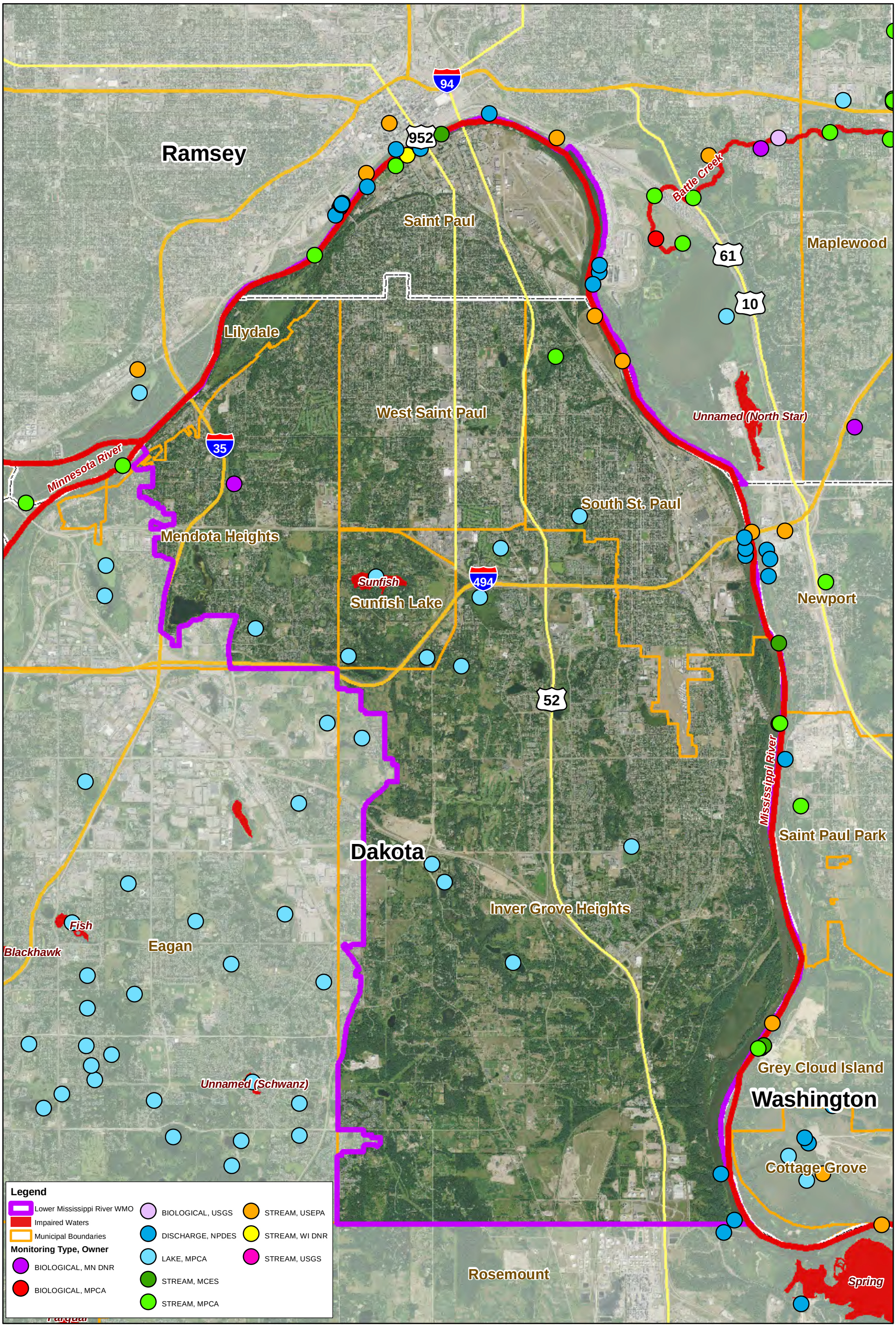


Source: Minnesota Pollution Control Agency, 2006

Lower Mississippi River WMO
Watershed Management Plan

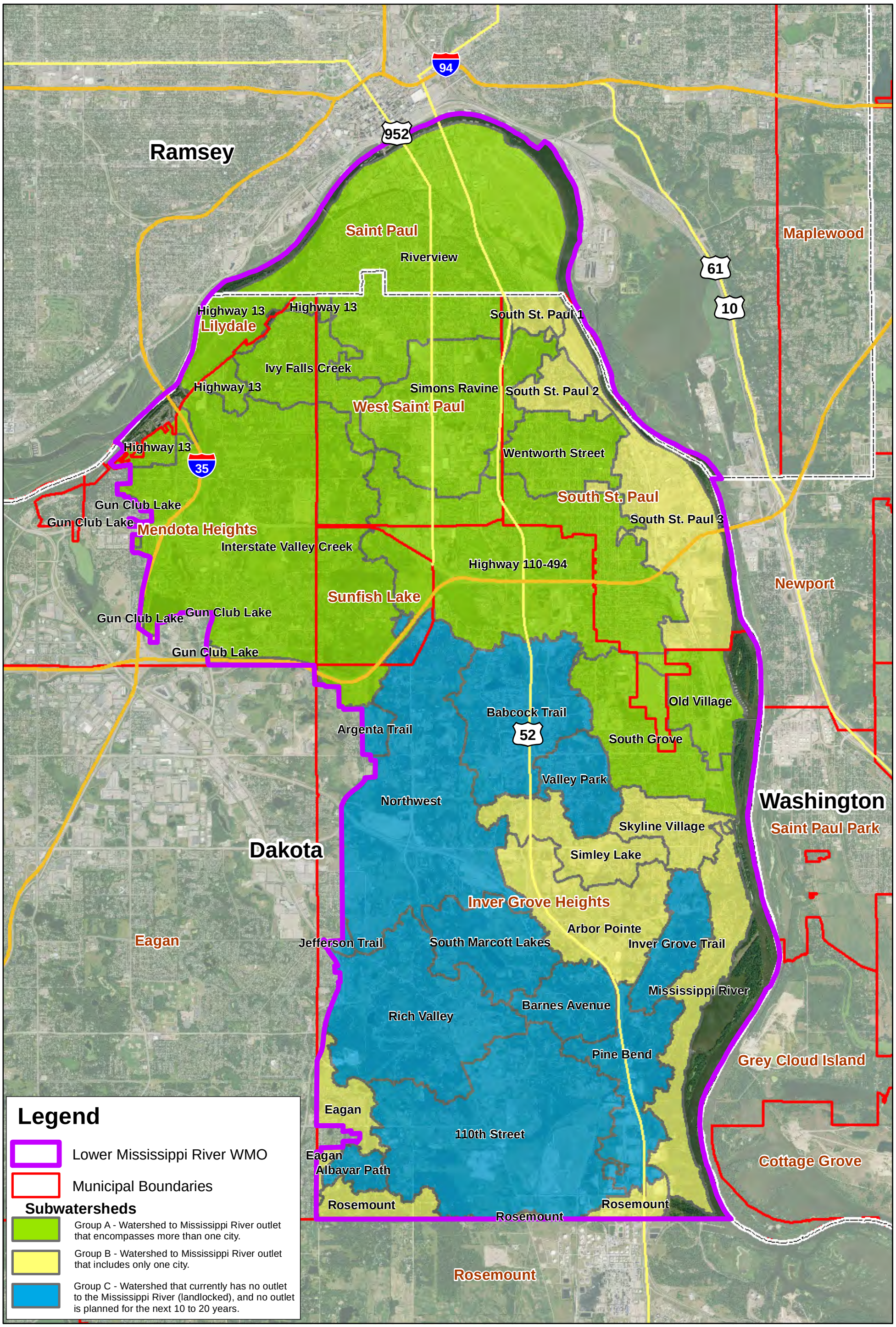
Water Quality Monitoring Locations

Figure 13

N
S
0 5,000 Feet

WSB & Associates, Inc.

File: K:\01721-02\GIS\Maps\Figures\Figure13_MonitoringLocations.mxd, Aug 30, 2010 3:43:31 PM



Lower Mississippi River WMO
Watershed Management Plan

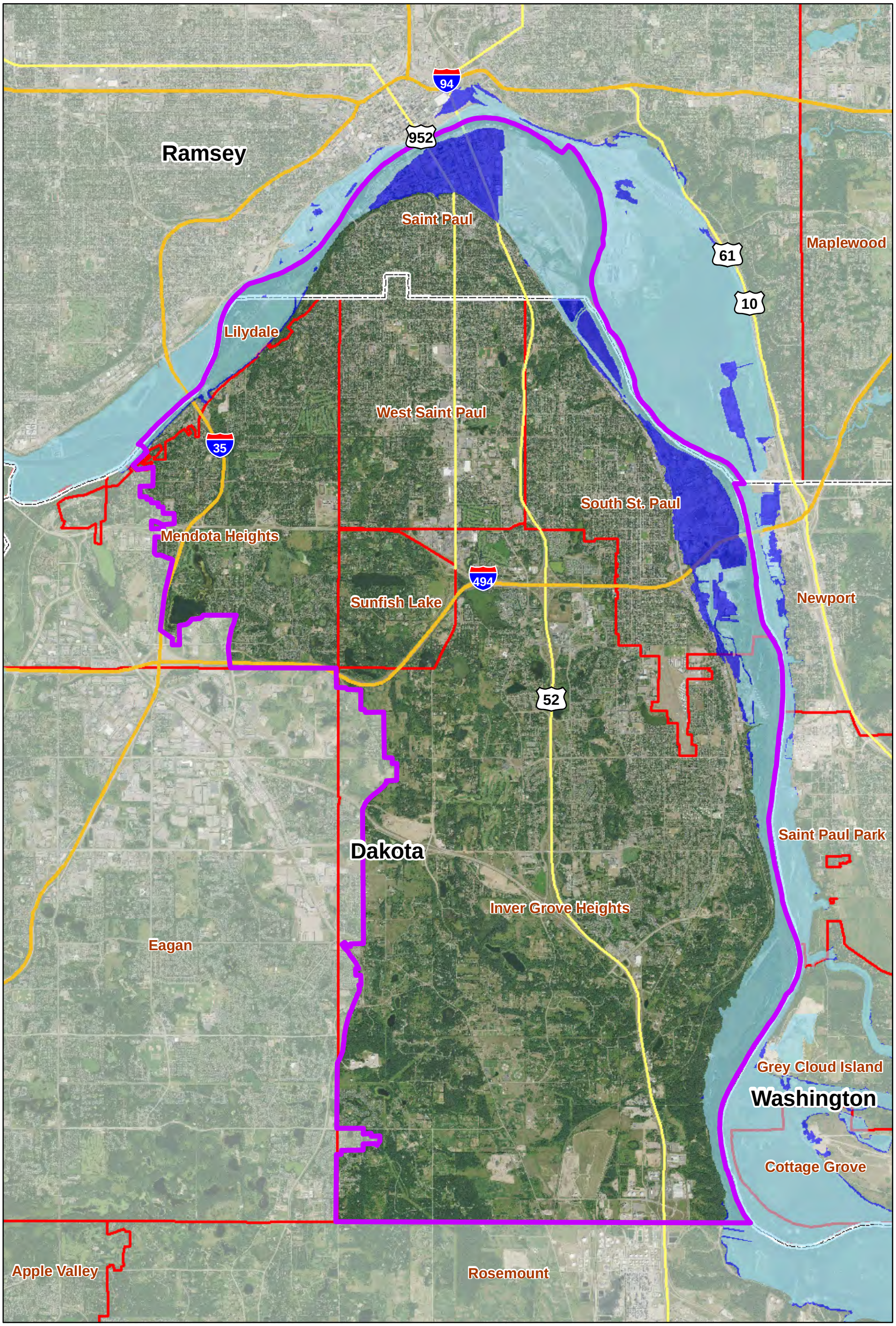
Subwatersheds

Figure 14

Source: Member City Water Management Plans: Inver Grove Heights (2008), Lilydale (2008), Mendota Heights (2006), Saint Paul (2006), South St. Paul (2004), Sunfish Lake (2009), West Saint Paul (2006)

WSB & Associates, Inc.

File: K:\01721-02\GIS\Maps\Figures\Figure14_Subwatersheds.mxd, Aug 27, 2010 10:19:55 AM



File: K:\01721-02\GIS\Maps\Figures\Figure15_Floodplain.mxd, Aug 30, 2010 3:40:05 PM

Legend

- Municipal Boundaries
- Lower Mississippi River WMO
- 100-Year Floodplain
- 500-Year Floodplain

Lower Mississippi River WMO
Watershed Management Plan

Floodplain Boundary Map

Figure 15

Source: Federal Emergency Management Agency, 2003

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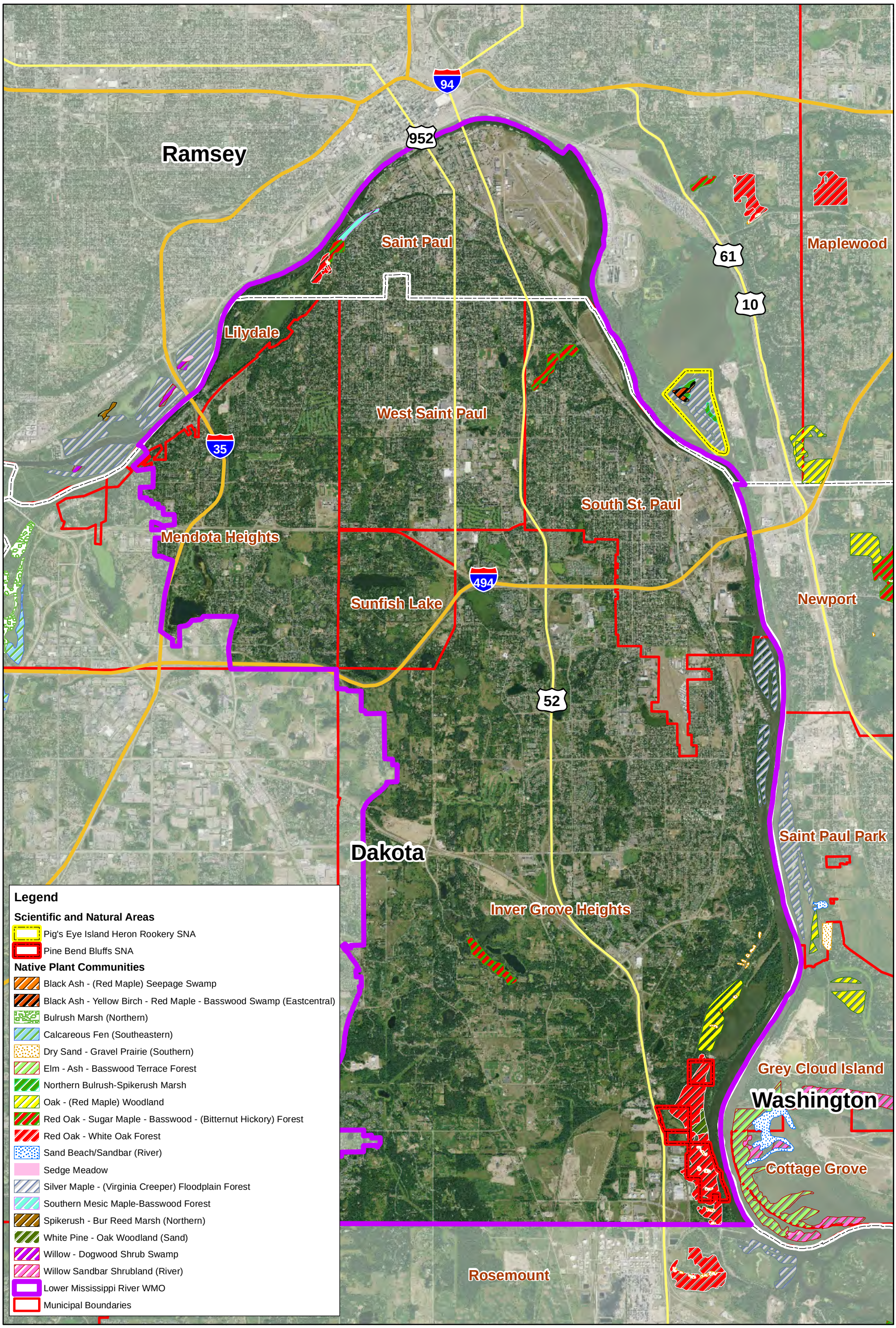
WSB & Associates, Inc.



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Lower Mississippi River WMO
Watershed Management Plan

Native Plant Communities and Scientific and Natural Areas

Figure 16

Source: Minnesota Department of Natural Resources, 2010

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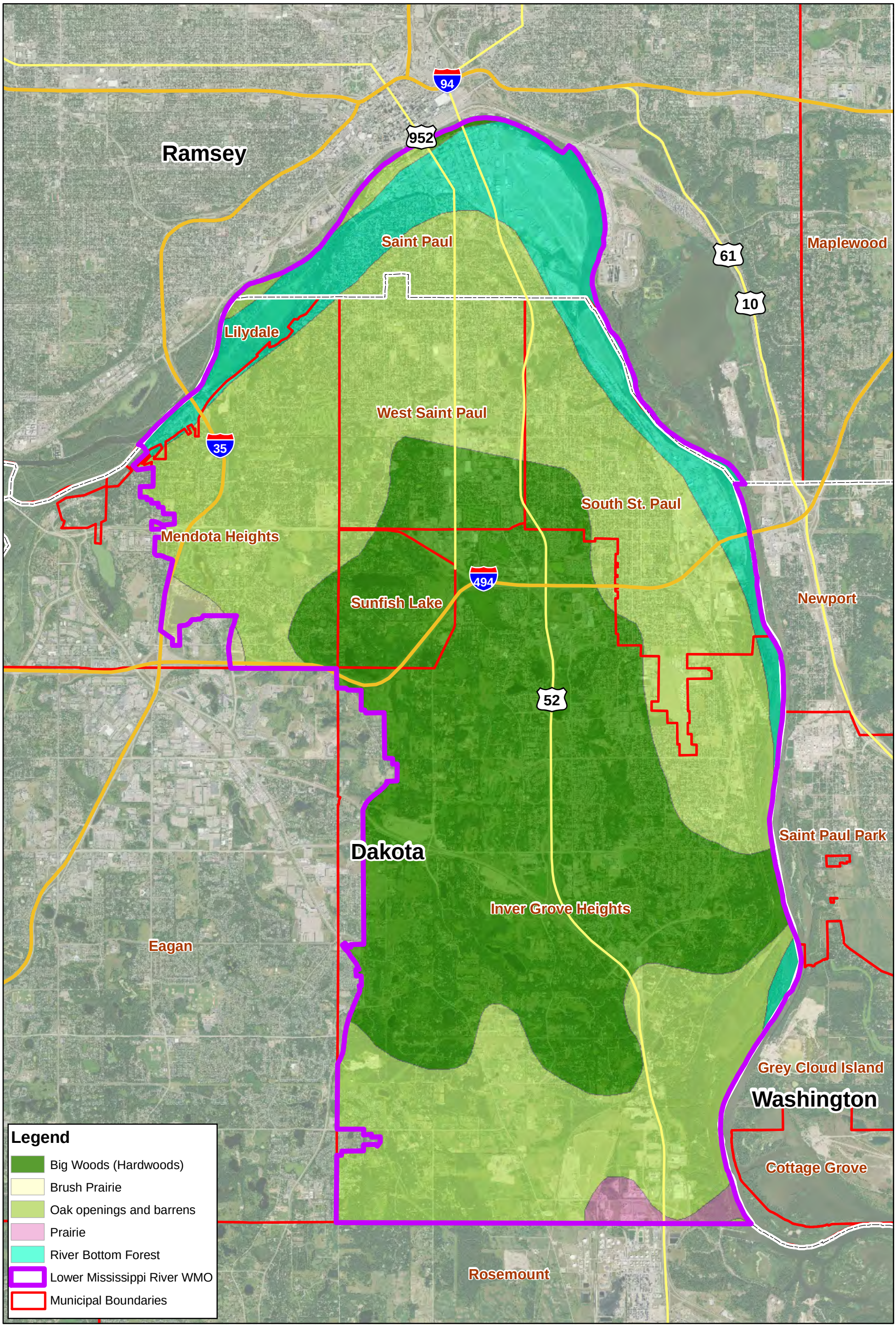
WSB & Associates, Inc.



Source: Minnesota Department of Natural Resources, 1994

Lower Mississippi River WMO
Watershed Management Plan

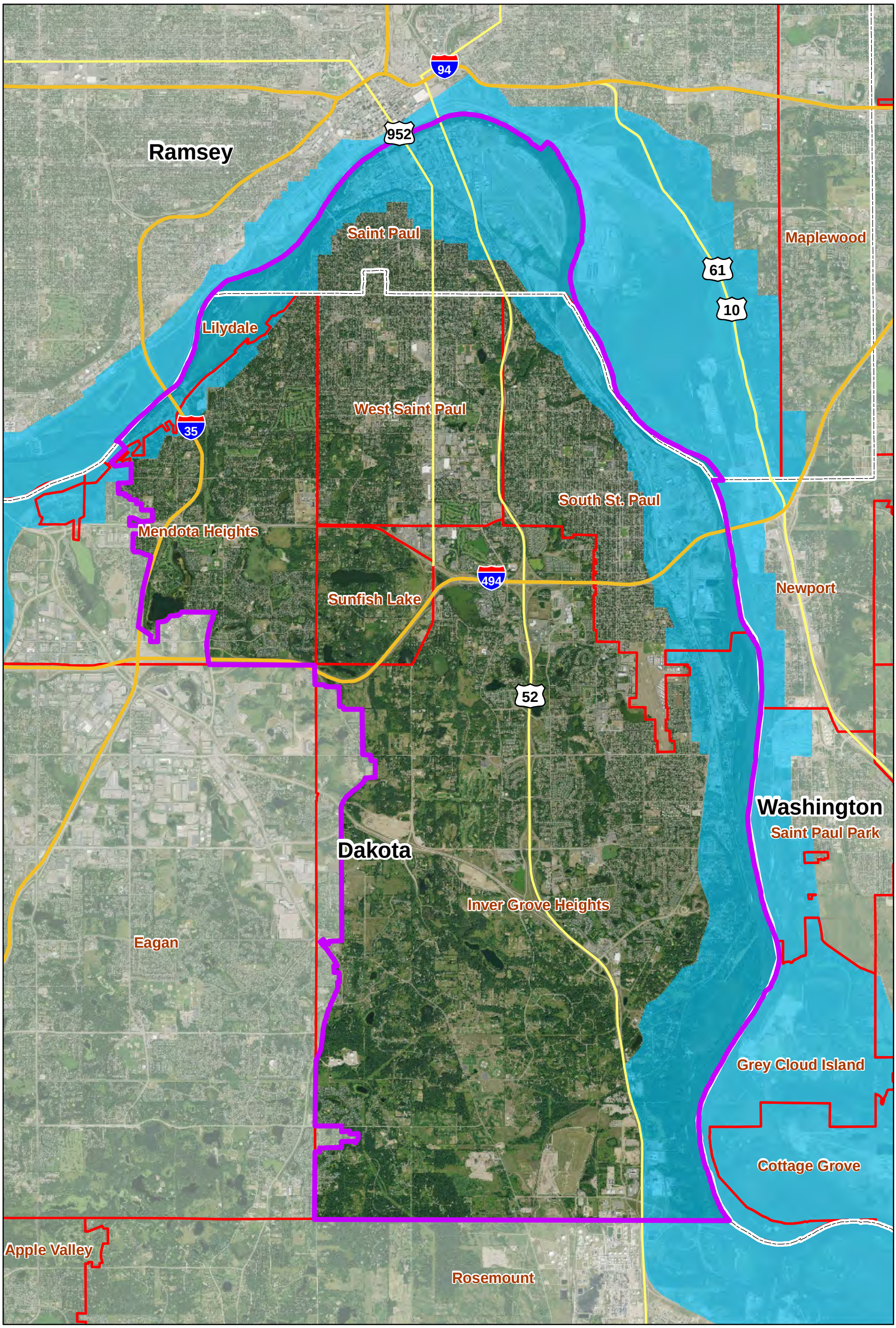
Presettlement Vegetation

Figure 17

N
S
0
5,000
Feet

WSB & Associates, Inc.

File: K:\01721-02\GIS\Maps\Figures\Figure17_PresettlementVegetation.mxd, Sep 07, 2010 2:42:48 PM



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Legend

- Municipal Boundaries
- Lower Mississippi River WMO
- Mississippi River Corridor Critical Area

Lower Mississippi River WMO
Watershed Management Plan

Mississippi River Corridor Critical Area

Figure 18

Source: Minnesota Department of Natural Resources, 2000

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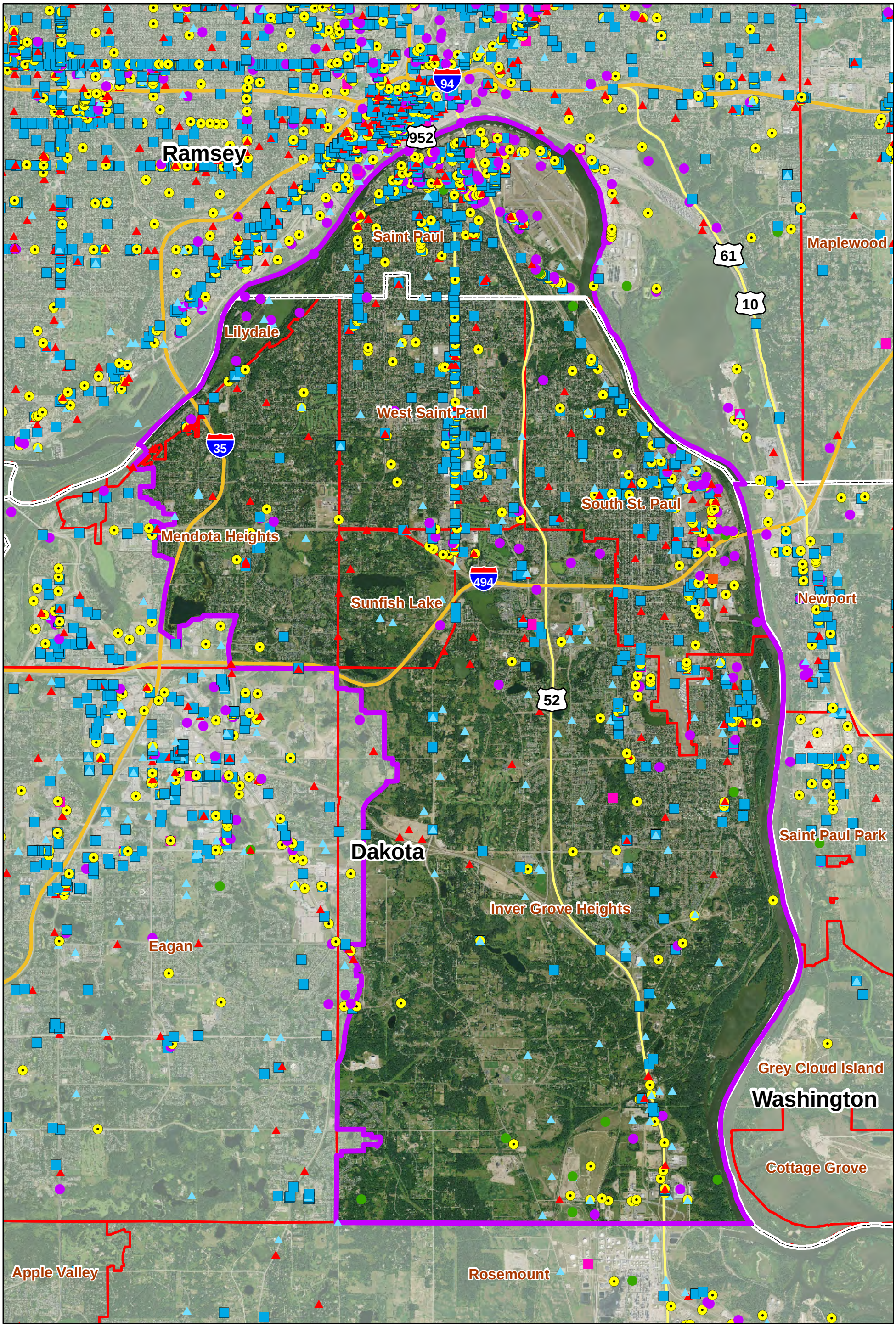
0 5,000 Feet

WSB & Associates, Inc.



File: K:\01721-02\GIS\Maps\Figures\Figure19_PollutantSources.mxd, Aug 30, 2010 4:08:27 PM

Legend

- Lower Mississippi River WMO
- Municipal Boundaries
- Air
- Investigation and Cleanup
- Water
- Feedlot
- Hazardous Waste
- Solid Waste
- Tanks and Leaks
- Multiple Activities

Lower Mississippi River WMO
Watershed Management Plan

Possible Pollutant Sources

Figure 19

Source: Minnesota Pollution Control Agency, 2009

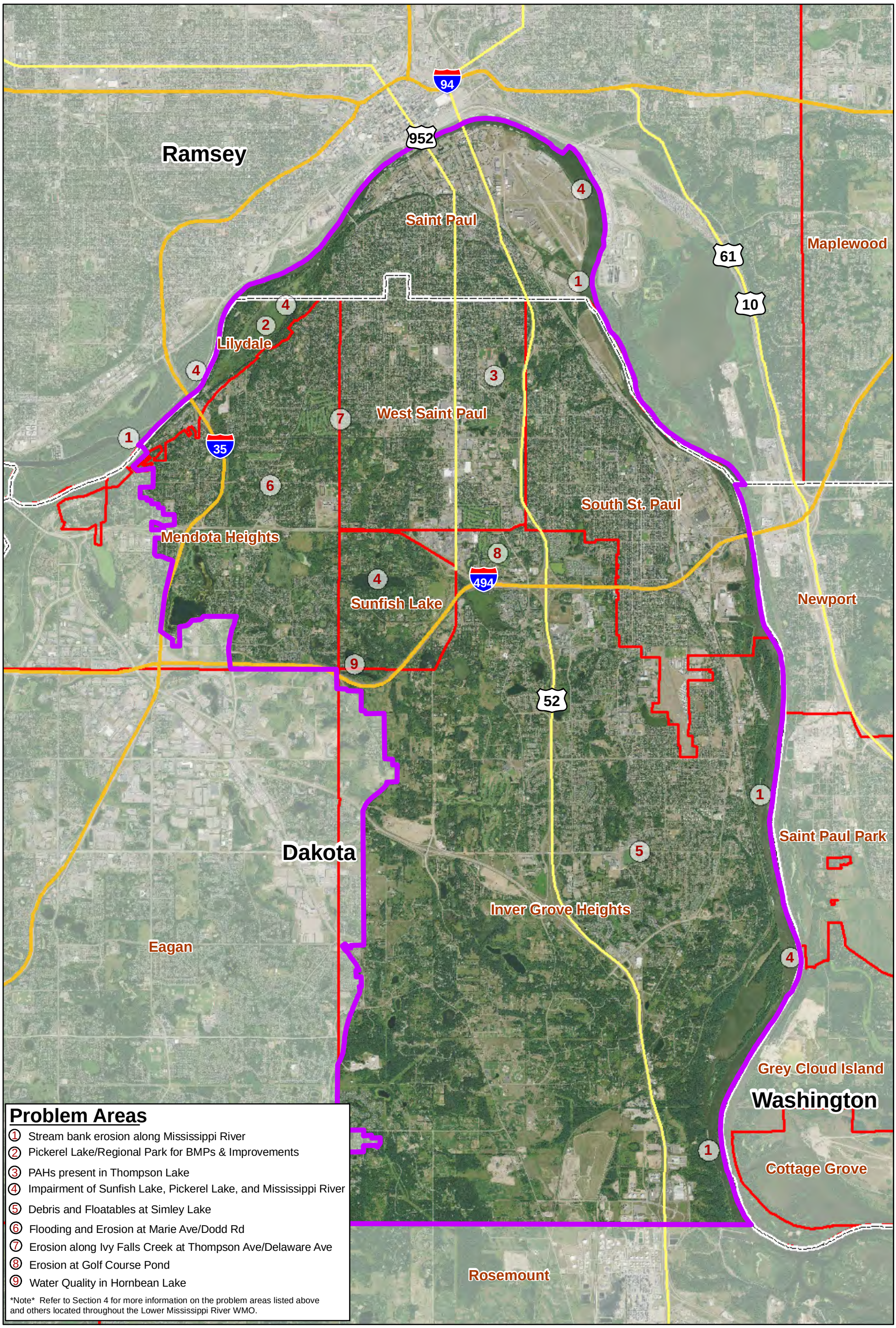
Contact the MPCA or go to "What's In My Neighborhood" at www.pca.state.mn.us for more information.

N

S

0 5,000 Feet

WSB & Associates, Inc.



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Legend

- Lower Mississippi River WMO
- Municipal Boundaries

Lower Mississippi River WMO
Watershed Management Plan

Problem Areas and Land Use Conflicts with Water Resources

Figure 20

N
S

0 5,000 Feet

Source: Technical Advisory Committee and Citizen Advisory Committee for 3rd Generation Plan, 2010

WSB & Associates, Inc.

APPENDIX B

JOINT POWERS AGREEMENT

REVISED AND RESTATED

JOINT POWERS AGREEMENT
ESTABLISHING A WATERSHED MANAGEMENT ORGANIZATION
FOR THE LOWER MISSISSIPPI RIVER WATERSHED

THE PARTIES TO THIS AGREEMENT ("Agreement") are Members of the Lower Mississippi River Watershed Management Organization and have land that drain surface water into the Mississippi River. This Agreement amends and restates the original Joint Powers Agreement between the Members which became effective in 1985 and includes all prior Amendments to the 1985 Joint Powers Agreement. This Agreement is made pursuant to the authority conferred upon the parties by Minn. Stat. §§ 471.59 and 103B.201 - 103B.252.

SECTION 1. NAME AND LEGAL BOUNDARY. The parties hereby establish the Lower Mississippi River Watershed Management Organization, hereinafter referred to as the "WMO." The "Legal Boundary Map of the Lower Mississippi River Watershed Management Organization" is attached hereto as Exhibit A.

SECTION 2. PURPOSE. The purpose of this Agreement is to provide an organization to regulate the natural water storage and retention of the Lower Mississippi watershed to:

A. Protect, preserve, and use natural surface and ground water storage and retention systems;

B. Minimize public capital expenditures needed to correct flooding and water quality problems;

C. Identify and plan for means to effectively protect and improve surface and ground water quality;

D. Establish more uniform local policies and official controls for surface and ground water management;

E. Prevent erosion of soil into surface water systems;

F. Promote ground water recharge;

G. Protect and enhance fish and wildlife habitat and water recreational facilities;

H. Secure the other benefits associated with the proper management of surface and ground water; and

I. Carry out all the duties and responsibilities in Minn. Stat. §§ 471.59 and 103B.201 - 103B.252.

SECTION 3. DEFINITIONS.

Subdivision 1. *"Allowable Flow"* means the rate and volume of flow, according the to design criteria set forth in the Watershed Management Plan, at which a Member community may discharge into the drainage system without financial obligation and as the rate and volume of surface water runoff from a tributary area under natural conditions, with a drainage system in place which has been designed and constructed according to the criteria stated herein, excluding diverted waters. Current topographic data that exists on the enactment date of this Agreement shall be used for the determination of the natural conditions and calculation of the allowable flow.

Subdivision 2. *"Board"* means the board of managers of the WMO.

Subdivision 3. *"Council"* means the governing body of a governmental unit which is a Member of this WMO.

Subdivision 4. *"Drainage Facilities"* means any improvement constructed for the conveyance or storage of surface water.

Subdivision 5. *"Drainage System"* means the combination of drainage facilities required to safely control or convey runoff water from a major tributary drainage area(s) to a point of final discharge into a water body.

Subdivision 6. *"Excessive Flow"* means that rate and volume of flow, calculated according to the design criteria in the Watershed Management Plan, from a Member which is in excess of the allowable flow of that Member.

Subdivision 7. *"Governmental Unit"* means any city.

Subdivision 8. *"Lower Mississippi River Watershed"* or *"Watershed"* means the area contained within the "Legal Boundary Map of the Lower Mississippi River Water Management Organization" attached hereto as Exhibit "A".

Subdivision 9. *"Manager"* means the representative appointed to the Board by a Member.

Subdivision 10. *"Member"* means a governmental unit which enters into this Agreement.

Subdivision 11. *"Natural Conditions"* means the characteristics of the land on the date of enactment without regard to any urban development including structures, parking lots, or other artificial improvements.

Subdivision 12. *"Rate of Flow"* means the discharge of surface water runoff as a function of time which has been calculated according to the design criteria identified in the Watershed Management Plan. The rate of flow shall apply to the design and construction of open channels and storm sewer conduits.

Subdivision 13. *"Volume of Flow"* means the total discharge of all surface water runoff which has been calculated according to the design criteria identified in the Watershed Management Plan. The volume of runoff flow shall apply to the design and construction of detention facilities.

Subdivision 14. *"Watershed Management Organization"* or *"WMO"* means the organization created by this Agreement the full name of which is "Lower Mississippi River Watershed Management Organization." It shall be a public agency of its Members.

SECTION 4. MEMBERSHIP. The Membership of the WMO shall consist of the following governmental units, each entitled to the following eligible votes:

Member	Votes
City of Inver Grove Heights	3 votes
City of Lilydale	1 vote
City of Mendota Heights	2 votes
City of Saint Paul	2 votes
City of South Saint Paul	2 votes
City of Sunfish Lake	1 vote
City of West Saint Paul	2 votes

No change in governmental boundaries, structure, organizational status, or character shall affect the eligibility of any governmental unit listed above to be represented on the WMO, so long as such governmental unit continues to exist as a separate political subdivision. A majority of all eligible votes shall be sufficient for all matters, unless otherwise provided for in this Agreement. A majority vote of all Members, with each Member having one vote, shall be required for Section 7. A Member may not cast a split vote. Any Member that fails to contribute their share of the WMO annual administration fund or their allocation of a capital improvement cost, shall be declared ineligible for voting on all matters before the Board, until such contribution is made to the WMO.

SECTION 5. ADVISORY COMMITTEES.

Subdivision 1. Technical Advisory Committee. The following governmental subdivisions or agencies shall be requested to appoint a non-voting advisory Member to the WMO: Dakota County, Ramsey County, Dakota County Soil and Water Conservation District. The advisory Members shall not be required to contribute funds for the operation

of the WMO, except as provided in Minn. Stat. § 103B.251, but may provide technical services.

Subdivision 2. Citizen Advisory Committee. The WMO may establish a citizen advisory committee ("CAC") from the public at large to provide input on Watershed Management Plan revisions and other matters as deemed appropriate. The CAC shall be appointed by the WMO considering individuals nominated by each Member. The WMO will notify each Member of its intent to establish a CAC, will specify the purpose and duration of the CAC, and will request each Member to nominate candidates to be considered for appointment by the WMO. At the time of establishment of a CAC, the WMO will appoint a chair of the CAC, a board member liaison to the CAC, establish a time for submittal of any comments, and specify the support the WMO will provide to the CAC.

SECTION 6. BOARD OF MANAGERS.

Subdivision 1. Appointment. The governing body of the WMO shall be its Board. Each Member shall be entitled to appoint one Manager and an alternate on the Board. The alternate shall have the right to vote in the absence of their representative. Vacancies in the office of Manager shall be filled for the remainder of the term by the Member which appointed or had the right to appoint the Manager. All vacancies shall be filled within ninety (90) days after they occur.

Subdivision 2. Eligibility or Qualification. The Council of each Member shall determine the eligibility or qualification of its representative on the WMO.

Subdivision 3. Term. The Managers shall not have a fixed term, but shall serve at the pleasure of the Member appointing such Manager to the Board.

Subdivision 4. Removal. A Manager may not be removed from the Board prior to the expiration of his or her term, unless the Manager consents in writing or unless removed in accordance with the procedures provided under Minnesota Rules 8410.0040.

Subdivision 5. Compensation. Managers shall serve without compensation from the WMO, but this shall not prevent a Member from providing compensation for its Manager.

Subdivision 6. Organizational Meeting. At the first meeting of the Board each year, the Board shall elect from its Managers a chair, a vice chair, a secretary/treasurer, and such other officers as it deems necessary to conduct its meetings and affairs. The Board shall adopt rules of order and procedure governing its meetings and affairs. The rules of order and procedure may be amended from time to time at either a regular or a special meeting of the Board provided that at least ten (10) days' prior notice of the proposed amendment has been furnished to each person to whom notice of the Board meetings is required to be sent. A majority vote of all eligible votes of the Members of the WMO shall be sufficient to adopt any proposed amendment to such rules of order and procedure.

Subdivision 7. Annual Meeting Requirement. The Board shall meet at least annually, at times and places selected by the Board. If the Board changes its regularly established meeting place or time, it shall place a notice of the change on a bulletin board at least three (3) days in advance in the building where it was scheduled to meet.

Subdivision 8. Committees. The Board may establish committees as it deems appropriate.

Subdivision 9. Quorum. The Board shall not take any action without a quorum present. A quorum shall be at least four Members.

SECTION 7. POWERS AND DUTIES OF THE WMO. The WMO, acting by its Board:

Subdivision 1. Shall prepare, adopt and implement a Watershed Management Plan meeting the requirements of Minn. Stat. § 103B.231;

Subdivision 2. Shall review and approve local water management plans as provided in Minn. Stat. § 103B.235;

Subdivision 3. Shall exercise the authority of a watershed district under Minn. Stat. Chapter 103D to regulate the use and development of land in the watershed when one or more of the following conditions exist:

A. The local government unit exercising planning and zoning authority over the land under Minn. Stat. §§ 366.10 to 366.19, 394.21 to 394.37, or 462.351 to 462.364 does not have a local water management plan approved and adopted in accordance with requirements of Minn. Stat. § 103B.235 or has not adopted the implementation program described in the plan.

B. An application to the local government unit for a permit for the use and development of land, requires an amendment to, or variance from, the adopted local water management plan or implementation program of the local unit.

C. The local government unit has authorized the WMO to require permits for the use and development of land.

Subdivision 4. Shall adopt an annual work plan.

Subdivision 5. May employ such persons as it deems necessary to accomplish its duties and powers.

Subdivision 6. May contract for space and for material and supplies to carry on its activities either with a Member or elsewhere.

Subdivision 7. May acquire necessary personal and real property to carry out its powers and its duties.

Subdivision 8. May make necessary surveys or use other reliable surveys and data, and develop projects to accomplish the purposes for which the WMO is organized.

Subdivision 9. May cooperate or contract with the State of Minnesota or any subdivision thereof or federal agency or private or public organization to accomplish the purposes for which it is organized.

Subdivision 10. May order any governmental unit to carry out the local water management plan which has been approved by the Board. If the local unit of government fails to do so, in addition to other remedies, in its discretion, the Board may implement any required action or improvement in accordance with this Agreement.

Subdivision 11. May acquire, operate, construct, and maintain the capital improvements delineated in the Watershed Management Plan adopted by the Board.

Subdivision 12. May contract for or purchase such insurance as the Board deems necessary for the protection of the WMO and its Board.

Subdivision 13. May establish and maintain devices for acquiring and recording hydrological and water quality data within the watershed area of the WMO.

Subdivision 14. May enter upon lands within or without the watershed to make surveys and investigations to accomplish the purposes of the WMO.

Subdivision 15. May provide any Member with technical data or any other information of which the WMO has knowledge which will assist the Member in preparing land use classifications or local water management plans within the watershed.

Subdivision 16. May provide legal and technical assistance in connection with litigation or other proceedings between one or more of its Members and any other political subdivision, commission, board, corporation, individual, or agency relating to the

planning or construction of facilities to drain or pond storm waters or relating to water quality within the WMO.

Subdivision 17. May accumulate reserve funds for the purposes herein mentioned and may invest funds of the WMO not currently needed for its operations.

Subdivision 18. May collect money, in accordance with the provisions of this Agreement, from its Members and from any other source approved by the Board.

Subdivision 19. May make contracts, incur expenses, and make expenditures necessary and incidental to the effectuation of its purposes and powers.

Subdivision 20. Shall cause to be made an annual audit of the books and accounts of the WMO and shall make and file a report to its Members at least once each year including the following information:

A. The financial condition of the WMO;

B. The status of all WMO projects and work within the watershed; and

C. The business transacted by the WMO and other matters which affect the interests of the WMO. Copies of the report shall be transmitted to the clerk of each Member by March 31 of each year.

Subdivision 21. Shall make the WMO's books, reports, and records available for and open to inspection by its Members or the public at all reasonable times.

Subdivision 22. May recommend changes in this Agreement to its Members. Any amendments shall require ratification by all the parties to this Agreement.

Subdivision 23. May exercise all other powers necessary and incidental to the implementation of the purposes and powers set forth herein and as authorized by Minn. Stat. §§ 103B.201 through 103B.252.

Subdivision 24. Must solicit proposals for all legal, engineering, auditing, and other technical services in accordance with Minnesota Statutes § 103B.227, subd. 5.

Subdivision 25. Shall coordinate its planning activities with contiguous watershed management organizations and counties conducting water planning and implementation under Minn. Stat. Chapter 103B.

Subdivision 26. Shall designate one or more legal newspapers of general circulation which are published in the county(ies) in which the watershed is located.

SECTION 8. POWERS AND DUTIES OF THE OFFICERS OF THE BOARD.

Subdivision 1. It shall be the duty of the Chair of the Board to:

A. Attend and preside at all meetings of the Board;

B. Assist in the preparation of meeting agendas and the annual work plan;

C. See that orders and resolutions of the Board are carried into effect;

D. Sign and execute documents as may be required for the Board's exercise of its powers, except as otherwise required by law; and

E. Perform such other duties applicable to the office as are necessary to fulfill the powers and duties of the Board as set forth in this Agreement, and as provided by law.

Subdivision 2. It shall be the duty of the Vice Chair of the Board to:

A. Perform the duties of the Chair in the Chair's absence; and

B. Perform other duties as assigned from time to time by the Board.

Subdivision 3. It shall be the duty of the Secretary/Treasurer of the Board to:

A. Keep and post a true and accurate record of the proceedings of all meetings of the Board;

B. Keep a record of all amendments, alterations and additions to this Agreement;

C. Prepare and process all correspondence;

D. Prepare and file all reports and statements as required by law and this Agreement;

E. Keep all financial accounts of the WMO, and prepare and present to the Board full and detailed financial statements of the WMO prior to its annual meeting; and

F. Perform other duties as assigned from time to time by the Board.

SECTION 9. CONSTRUCTION OF IMPROVEMENTS.

Subdivision 1. All construction, reconstruction, extension or maintenance of WMO improvements, including outlets, lift stations, dams, reservoirs, or appurtenances of a surface water or storm sewer system ordered by the WMO which involve potential construction by or assessment against any Member or against privately or publicly owned land within the watershed shall adhere to the following procedures set forth in this section. The Board shall secure from its engineers or some other competent person a preliminary report advising it whether the proposed improvement is feasible, whether there are feasible alternatives, whether the proposed improvement shall best be made as proposed or in conjunction with some other improvement, a determination of the quantity and/or quality of storm and surface water contributed to the improvement by each Member, the estimated cost of the improvement(s), including maintenance, the estimated cost to each Member, and evaluating the consistency of the improvement with the Watershed Management Plan capital improvement section. The Board shall then hold a public hearing on the proposed improvement. Notice of the hearing shall be mailed to the clerk of each affected Member and shall also be published in the Board's official newspaper(s). The notice shall be mailed not less than forty-five (45) days before the hearing, shall state the time and place of the hearing, the general nature of the improvement, the estimated total cost, and the estimated cost to each Member.

To order the improvement, a resolution setting forth the order shall require a favorable majority vote of all eligible votes of the Members of the WMO. The order shall

describe the improvement, shall allocate in percentages the cost allocation among the Members, shall determine the method of financing, shall designate the engineers to prepare plans and specifications, and shall designate the entity that will contract for the improvement. The Board shall not order and no engineer shall prepare plans and specification before the Board has adopted a resolution ordering the improvement. After the Board has ordered an improvement, it shall forward the preliminary report to all affected Members with an estimated time schedule for the construction of the improvement.

The Board shall allow not less than 90 days, nor more than 270 days, for each Member to conduct hearings as provided by law or applicable charter requirements, to approve the construction and the method of financing of the improvement which the Member will use to pay its proportionate share of the costs of the improvement.

If the WMO proposes to use Dakota County's and/or Ramsey County's bonding authority, or if the WMO proposes to certify all or any part of an improvement to Dakota and/or Ramsey County for payment, then and in that event all proceedings shall be carried out in accordance with Minn. Stat. § 103B.251.

The Board may order advertising for bids upon receipt of notice from each Member which will be assessed that it has completed its hearing or determined its method of payment, or upon expiration of 270 days after the mailing of the preliminary report to the Members, whichever occurs first.

Subdivision 2. Any Member aggrieved by the determination of the Board as to the financing of an improvement or allocation of the costs of an improvement shall have thirty (30) days after the WMO resolution ordering the improvement to appeal the determination to arbitration. The appeal shall be in writing requesting the arbitration and

shall be addressed to the Board in c/o City of South St. Paul, 125 3rd Ave. N., South St. Paul, MN 55075. The determination of the Member's appeal shall be referred to a Board of Arbitration. The Board of Arbitration shall consist of three (3) persons: one to be appointed by the Board, one to be appointed by the appealing Member, and the third to be appointed by the two so selected. In the event the two persons so selected do not appoint the third person within fifteen (15) days after their appointment, then the chief judge of the District Court of Dakota County shall have jurisdiction to appoint, upon application of either or both of the two earlier selected, the third person to the Board of Arbitration. The third person selected shall not be a resident of any Member and if appointed by the chief judge, shall be a person knowledgeable in the subject matter of the dispute. The arbitrators' expenses and fees, together with the other expenses, not including counsel fees, incurred in the conduct of the arbitration shall be divided equally between the WMO and the appealing Member. Arbitration shall be conducted in accordance with the Uniform Arbitration Act, Minn. Stat. Chapter 572. Arbitration must be completed within the 270 day period provided for in Subdivision 1 of this Section.

Subdivision 3. Contracts for Improvements. The bidding and contracting of the work may be let by any Member or by the WMO as determined by the Board, in compliance with state statutes. Contracts and bidding procedures shall comply with all legal requirements.

Subdivision 4. Supervision. All improvement contracts shall be supervised by the entity awarding the contract. A WMO representative shall also be authorized to observe and review the work in progress and the Members agree to cooperate with the WMO representative in accomplishing the WMO's purposes. Representatives of the WMO shall have the right to enter upon the place or places where the improvement work is in

progress for the purpose of making reasonable tests and inspections. The WMO representative shall report to the Board on the progress of the work.

Subdivision 5. Land Acquisition. The WMO shall not have the power of eminent domain. All easements or interest in land which are necessary for an improvement will be negotiated or condemned in accordance with Minn. Stat. Chapter 117 by the Member where the land is located, and each Member agrees to acquire the necessary easement or right-of-way or partial or complete interest in land upon order of the Board to accomplish the purposes of this Agreement. All reasonable costs of the acquisition, including attorney's and appraiser's fees, shall be a cost of the improvement, and shall be allocated according to the formula for allocating Capital Improvement cost in Section 10, Subdivision 7. If a Member determines it is in its best interests to acquire additional rights in lands for some other purposes, in conjunction with the taking of lands for the improvement, the costs of the acquisition of additional rights in lands will not be included in the improvement costs. The Board, in determining the amount of the improvement costs to be assessed to each Member, may take into consideration the land use for which the additional lands are being acquired and may credit the acquiring Member for the land acquisition to the extent that it benefits the other Members. Any credits may be applied to the cost allocation of the improvement, or the Board, if feasible and necessary, may defer the credits to a future improvement.

Members may not condemn or negotiate for land acquisition to pond or drain storm and surface waters within the corporate boundaries of another Member within the WMO.

SECTION 10. FINANCES.

Subdivision 1. Disbursements. The WMO funds may be expended by the Board in accordance with this Agreement in a manner determined by the Board. The Board shall designate one or more national or state bank or trust companies authorized to receive deposits of public monies to act as depositories for the WMO funds. In no event shall there be a disbursement of WMO funds without approval by the Board and the signature of at least two (2) Board Members, one of whom shall be an officer. The Board may require the secretary/treasurer to file with the Board a bond in the sum of at least $10,000 or such higher amount as shall be determined by the Board. The WMO shall pay the premium on said bond.

Subdivision 2. Budget. On or before July 1 of each year, the Board shall adopt a general fund budget ("Budget") by a majority vote of all Members (with each Member having one vote) for the ensuing year and decide upon the total amount necessary for the general fund. The secretary/treasurer of the Board shall certify the Budget to the clerk of each Member, together with a statement of the proportion of the Budget to be provided by each Member, computed in accordance with Section 10, Subdivision 5. The council of each Member shall review the Budget, and the Board shall upon notice from any Member received prior to August 1, hear objections to the Budget, and may, upon notice to all Members of the time, date, place of and right to participate in the hearing and after a hearing, modify or amend the Budget, and then give notice to the Members of any and all modifications or amendments. Each Member agrees to provide the funds required by the Budget by February 15th of each year.

If a Member fails to provide its share of the funds required by the Budget by February 15 of each year, the unpaid balance of the funds shall accrue interest at a rate of

eight percent (8%) per annum commencing the day following February 15th of the year in which the funds were due. The WMO may take whatever action, at law or in equity it deems appropriate, to collect any amounts due from a Member under this Agreement. The Member agrees to pay the cost of collection, including reasonable attorneys' fees.

Subdivision 3. Maintenance. The Board shall have the option of funding maintenance work through the Budget, or funding as a capital improvement in accordance with Subdivision 6 of this Section. Maintenance costs that are associated with an improvement in the approved Capital Improvement Program, shall be allocated according to the same formula as is applicable for allocating capital improvement costs as identified in Section 10, Subdivision 7. The Members affected by the improvement shall decide on the level of maintenance to be applied to the improvement. If the Members cannot agree, the Board shall make the determination.

Subdivision 4. Tax Levy. If authorized by law, the WMO may levy a tax. The proceeds of any tax levied under this subdivision shall be expended only for the purposes authorized by law. The WMO may accumulate the proceeds of levies as an alternative to issuing bonds to finance improvements.

Subdivision 5. General Fund. Each Member agrees to contribute each year to a general fund to be used for general administration purposes including, but not limited to: improvement projects, salaries, rent, supplies, development of an overall plan, insurance, bonds, and to purchase and maintain devices to measure hydrological and water quality data. The funds may also be used for any other purpose authorized by this Agreement. The annual contribution by each Member shall be based fifty percent (50%) on taxable market value (for the preceding year) and fifty percent (50%) on area in accordance with the following formula:

Annual Watershed Levy = L

Taxable Market Value of a
Member's Property in the Watershed = MV

Taxable Market Value of All Property in the Watershed = TV

Acres of Property a Member Has in the Watershed = A

Total Acres in Watershed = TA

Member Required Contribution = C

$$\frac{1}{2} L \times \frac{MV}{TV} + \frac{1}{2} L \times \frac{A}{TA} = C$$

Subdivision 6. Capital Improvement.

A. All capital improvements ordered by the Board must be included in the WMO's adopted capital improvement program. An improvement fund shall be established for each improvement ordered by the WMO. If ordered by the Board, each Member agrees to contribute to the funds its proportionate share of the engineering, legal, and administrative costs as determined by the amount to be assessed against each Member as a cost of the improvement. The Board shall submit in writing a statement to each Member, setting forth in detail the expenses incurred by the WMO for each improvement.

Each Member further agrees to pay its proportionate share of the cost of the improvement in accordance with the determination of the Board, under Section 10, Subdivision 7. The Board or the Member awarding the contract shall submit in writing copies of the engineer's certificate authorizing payment during construction and the Member being billed agrees to pay its share of the costs within thirty (30) days after receipt of the statement. The Board may also require payment from Members before awarding a contract based upon an engineer's estimate of cost. Billings will then be adjusted when actual costs are known. The Board or the Member awarding the contract shall advise other contributing Members of the tentative time schedule of the work and the estimated times when the contributions shall be necessary.

B. Notwithstanding the provisions of paragraph (A) of this Subdivision, the WMO may also fund all or any part of the cost of a capital improvement contained in the capital improvement program of the plan in accordance with Minn. Stat. § 103B.251. The WMO and Dakota County and/or Ramsey County may establish a maintenance fund to be used for normal and routine maintenance of an improvement constructed in whole or in part with money provided by Dakota and/or Ramsey County pursuant to Minn. Stat. § 103B.251. The levy and collection of an ad valorem tax levy for maintenance shall be by Dakota and/or Ramsey County based upon a tax levy resolution adopted by the WMO and remitted to the

county(ies) on or before October 1 of each year. If it is determined to levy for maintenance, the WMO shall be required to follow the hearing process established by Minn. Stat. §103D.921. Mailed notice shall also be sent to the clerk of each Member at least thirty (30) days prior to the hearing.

C. The WMO may also fund all or any part of the cost of a capital improvement contained in the capital improvement program of the plan in accordance with Minn. Stat. § 103B.241.

Subdivision 7. Capital Cost Allocation of Improvements in the Board's Watershed Management Plan. All capital improvement costs of improvements designated in the WMO's adopted Watershed Management Plan for construction by the WMO pursuant to Section 10, Subdivision 6A of this Agreement shall be apportioned by the following methods or a combination of these methods:

A. For improvements related to water quality:

1. For water quality monitoring, water quality trend analyses, water quality modeling, and water quality studies, the cost sharing will be proportional to the tributary watershed area.

2. For water quality projects and maintenance, the cost sharing will be based on Allowable Flow, tributary area, and/or relative phosphorus loading.

3. The cost sharing for WMO operation of a future Watershed Outlet Monitoring Program station, or other program that monitors the quality of the stormwater runoff that discharges into the Mississippi River from the WMO, will be proportional to the tributary watershed area.

4. Or other cost sharing method approved by the Board.

5. Pursuant to Minn. Stat. § 103B.251.

B. For improvements related to water quantity:

1. A Member shall be responsible for the costs of construction of that portion of a drainage system that is located within its borders and that is necessary to accommodate its Allowable Flow and the Allowable Flow of all other tributary Members.

2. A Member shall also be responsible for its share of construction costs of a drainage system, whether or not that system is located within its borders, that is necessary to convey Excessive Flows originating within the Member's borders.

3. Increased costs of construction incurred for acquisition of lands, easements and rights of way within natural watercourses shall be the obligation of the Member in which the land lies and shall not be apportioned to other Members to the extent that such costs exceed costs which would have been incurred if there had been no improvement on such lands, easements, or rights of way.

4. Costs of construction shall include all costs associated with a WMO approved improvement (whether trunk sewer or natural conveyance) and whether or not actually constructed, including, but not limited to, costs for design, administration, construction supervision, legal fees, acquisition of lands and improvements and actual construction and maintenance costs.

5. The WMO shall consider any grant money received or to be received by a Member for sanitary sewer/storm sewer separation or for the construction, reconstruction or replacement of storm sewer facilities before making cost allocations among Members and may consider the application of any grant proceeds toward the cost of the improvement before allocating costs between or among the Members involved, provided that such allocation would not violate the terms and conditions of the grant.

6. The attached Exhibit B is incorporated by reference and serves as a compilation of general examples of cost allocation under this Agreement for the hypothetical circumstances stated in the examples.

Subdivision 8. Capital Cost Allocation of Improvements Delineated in Local Watershed Management Plans. All capital improvement costs incurred by the WMO for improvements delineated in local watershed management plans that benefit only that Member, which the WMO undertakes because the Member fails to do so, shall be apportioned entirely to that Member.

SECTION 11. SPECIAL ASSESSMENTS. The WMO shall not have the power to levy special assessments. All such assessments shall be levied by the Member within which the land is located.

SECTION 12. DURATION.

Subdivision 1. Each Member agrees to be bound by the terms of this Agreement until January 1, 2012. It may be continued thereafter upon the agreement of all the parties.

Subdivision 2. This Agreement may be terminated prior to January 1, 2012, by the written agreement of a majority of the Members.

Subdivision 3. In addition to the manner provided in Subdivision 2 for termination, any Member may petition the Board to dissolve the WMO. Upon thirty (30) days' notice in writing to the clerk of each Member, the Board shall hold a hearing and upon a favorable majority vote of all eligible votes of the Members, the Board may by resolution recommend that the WMO be dissolved. The resolution shall be submitted to each Member and if ratified by a majority of the governing bodies of all Members within sixty (60) days, the Board shall then give ninety (90) days written notice of its intent to dissolve the WMO to Dakota County, Ramsey County and the Board of Water and Soil Resources. After the expiration of this 90-day notice period, the Board shall dissolve the WMO, allowing a reasonable time to complete work in progress and to dispose of personal property owned by the WMO.

SECTION 13. DISSOLUTION. Upon dissolution of the WMO or termination of this Agreement, all property of the WMO shall be sold and the proceeds thereof, together with monies on hand, shall be distributed to the Members. Such distribution of WMO assets shall be made in proportion to the total contribution to the WMO required by the last annual Budget.

SECTION 14. EFFECTIVE DATE. This Agreement shall be in full force and effect when all seven (7) Members file a certified copy of a resolution approving this Agreement and have executed this Agreement and filed the executed Agreement with the Board. All Members need not sign the same copy.

IN WITNESS WHEREOF, the undersigned governmental units, by action of their governing bodies, have caused this Agreement to be executed in accordance with the authority of Minn. Stat. § 471.59.

Approved by the City Council
December 26, 20 01.

CITY OF INVER GROVE HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF LILYDALE

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF MENDOTA HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF ST. PAUL

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF SOUTH ST. PAUL

BY: _____

Attest: _____

IN WITNESS WHEREOF, the undersigned governmental units, by action of their governing bodies, have caused this Agreement to be executed in accordance with the authority of Minn. Stat. § 471.59.

Approved by the City Council
December 26, 20 01.

CITY OF INVER GROVE HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
April 28, 2003.

CITY OF LILYDALE

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF MENDOTA HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF ST. PAUL

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF SOUTH ST. PAUL

BY: _____

Attest: _____

IN WITNESS WHEREOF, the undersigned governmental units, by action of their governing bodies, have caused this Agreement to be executed in accordance with the authority of Minn. Stat. § 471.59.

Approved by the City Council
_____, 20____.

CITY OF INVER GROVE HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF LILYDALE

BY: _____

Attest: _____

Approved by the City Council
November 20, 2001.

CITY OF MENDOTA HEIGHTS

BY: Charles E. Mathews

Attest: Linda L. Shipton

Approved by the City Council
_____, 20____.

CITY OF ST. PAUL

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF SOUTH ST. PAUL

BY: _____

Attest: _____

IN WITNESS WHEREOF, the undersigned governmental units, by action of their governing bodies, have caused this Agreement to be executed in accordance with the authority of Minn. Stat. § 471.59.

Approved by the City Council
_____, 20____.

CITY OF INVER GROVE HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF LILYDALE

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF MENDOTA HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
JANUARY 16, 20 02.
COUNCIL FILE #02-52

Approved as to Form:

BY: Lisa A. Veith
Assistant City Attorney

CITY OF ST. PAUL

BY: Randy Kelly
Randy Kelly, Mayor

Approved by the City Council
_____, 20____.

CITY OF SOUTH ST. PAUL

BY: _____

Attest: _____

IN WITNESS WHEREOF, the undersigned governmental units, by action of their governing bodies, have caused this Agreement to be executed in accordance with the authority of Minn. Stat. § 471.59.

Approved by the City Council
_____, 20____.

CITY OF INVER GROVE HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF LILYDALE

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF MENDOTA HEIGHTS

BY: _____

Attest: _____

Approved by the City Council
_____, 20____.

CITY OF ST. PAUL

BY: _____

Attest: _____

Approved by the City Council
November 5, 20 01.

CITY OF SOUTH ST. PAUL

BY: Kathleen A Gaylord

Attest: Christy M. Wilcox

Approved by the City Council
12/4, 2001.

CITY OF SUNFISH LAKE

BY: _____ Mayor

Attest: _____, Clerk

Approved by the City Council
_____, 20____.

CITY OF WEST ST. PAUL

BY: _____
Its Mayor

BY: _____
Its City Manager

Approved by the City Council
_____, 20____.

CITY OF SUNFISH LAKE

BY: _____

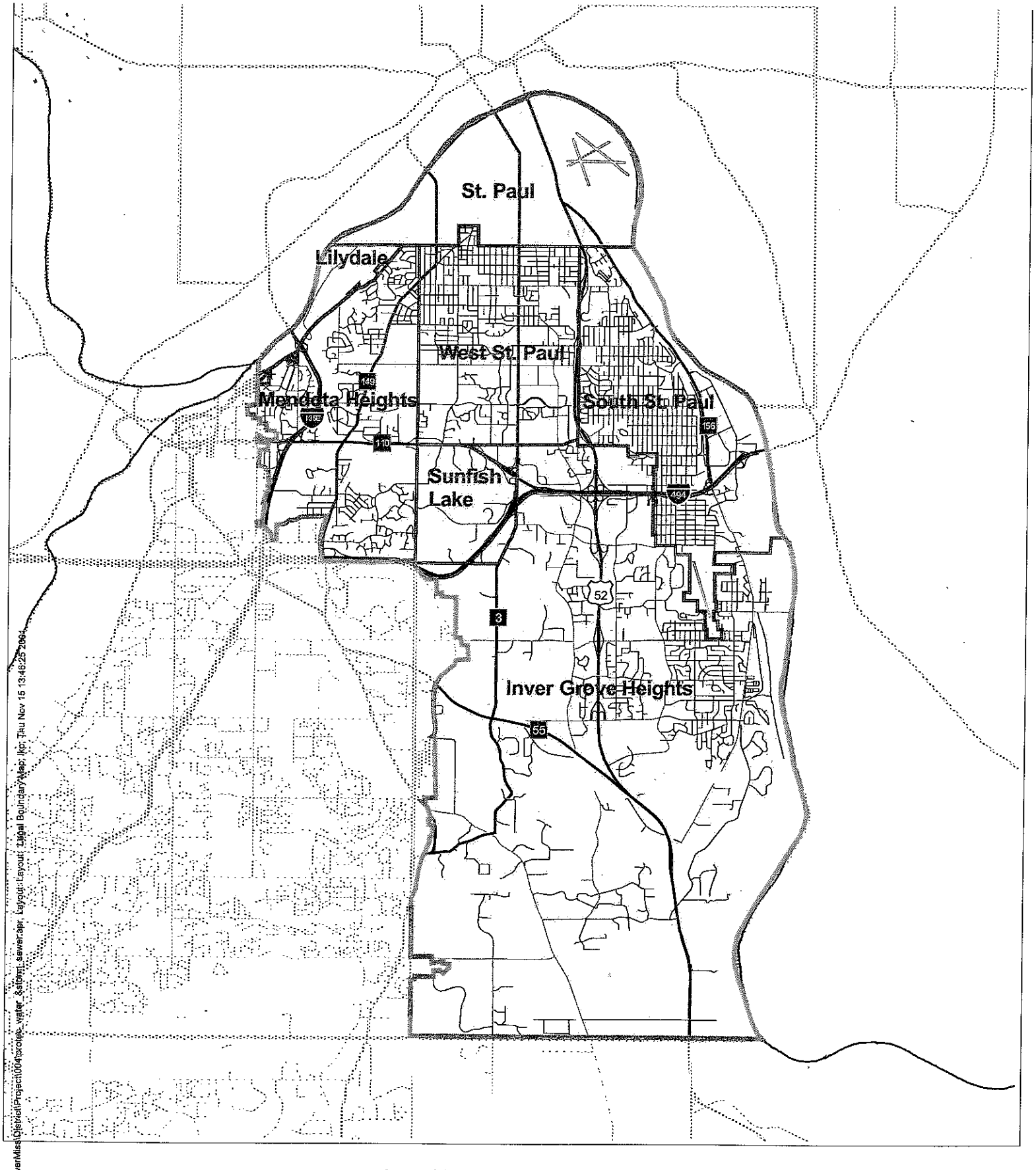
Attest: _____

Approved by the City Council
Nov. 26, 2001.

CITY OF WEST ST. PAUL

BY: _____
Its Mayor

BY: _____
Its City Manager



Legal Boundary Map of the
Lower Mississippi River
Watershed Management Organization

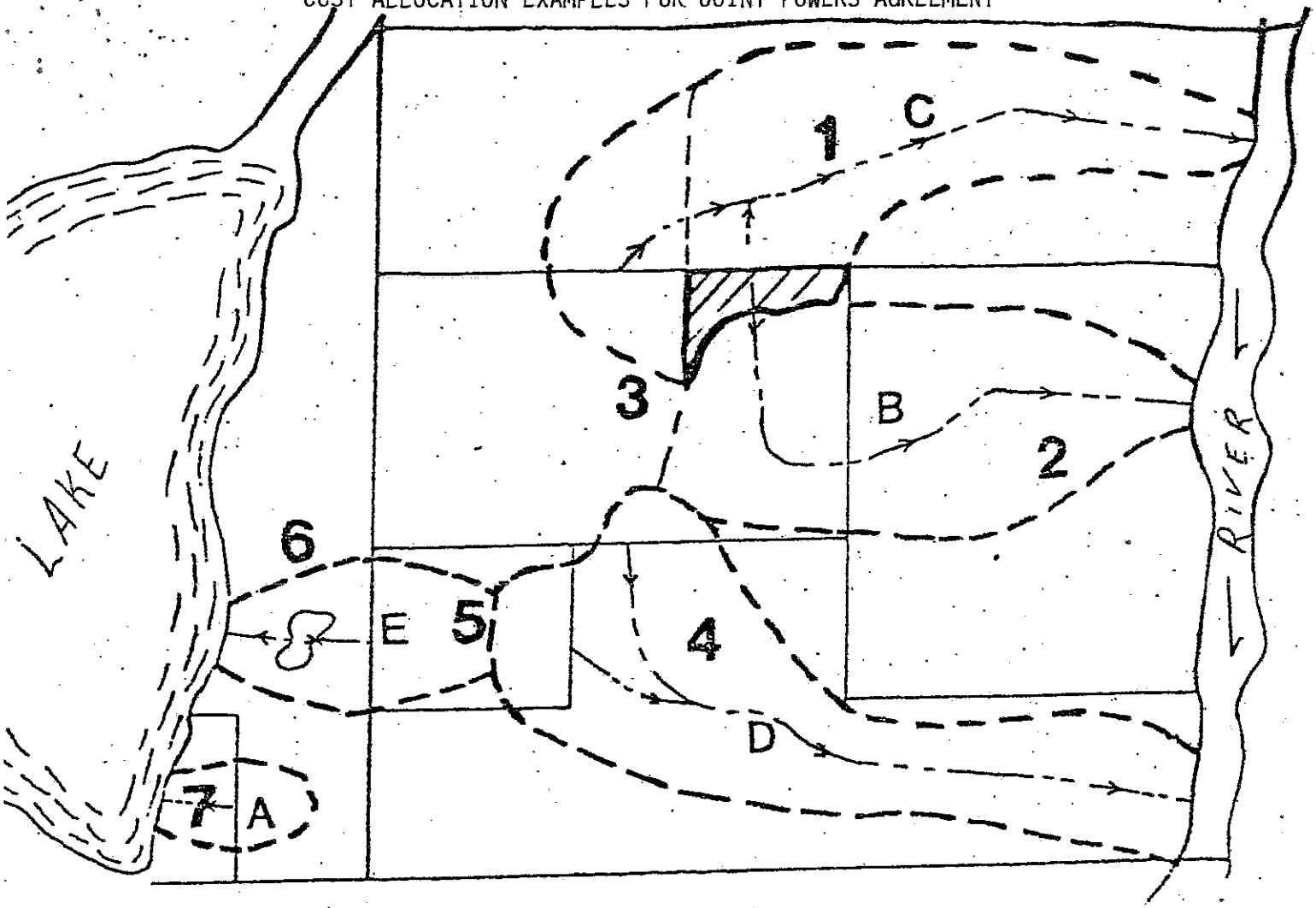
Exhibit A

1 0 1 Miles

N

Barr: Arcview 3.1,PIIIAF, I:\Client\LowerMiss\District\Project\004\protec_water_&storm_sewer.apr, Layout: Layout, Legal Boundary.Map: Thu Nov 15 13:46:25 2001

COST ALLOCATION EXAMPLES FOR JOINT POWERS AGREEMENT



EXAMPLE	DESCRIPTION
A.	Two Cities
B.	Two Cities With Diversion In
C.	Two Cities With Diversion Out
D.	Three Cities
E.	Added Ponding

LEGEND

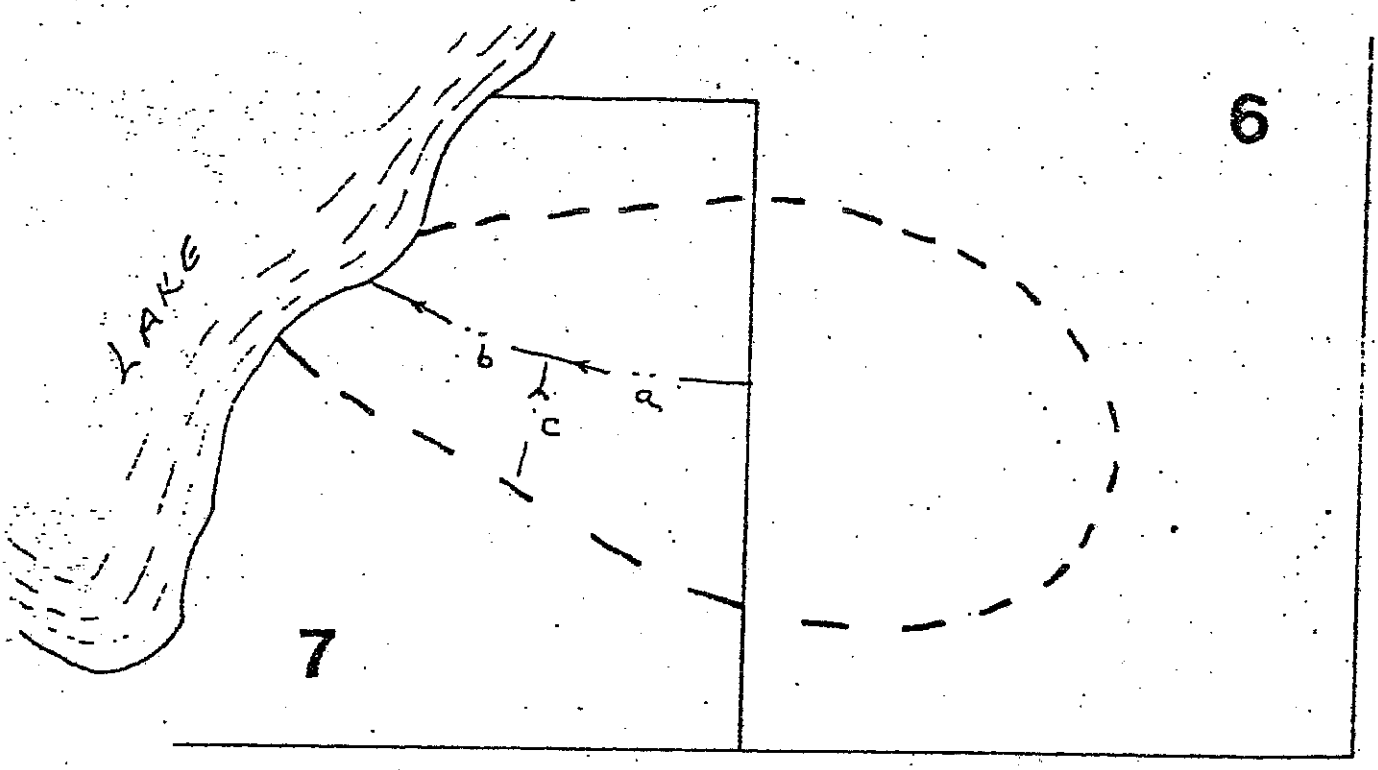
Watershed Boundary

Drainage Facility

City Boundary

Detention Pond

Diverted Area



EXAMPLE "A" - TWO CITIES

Project: Construct project (Segments "a" and "b") in City #7 to provide drainage for Cities #6 and #7 under fully developed conditions.

Cost Allocation:

City #6: Cost share $= \frac{Q_{E6}}{Q_T} \times$ Total project cost for "a".

City #7: Cost share = Total project cost $- \left(\frac{Q_{E6}}{Q_T} \times \text{Total project cost} \right)$

Where: $Q_{E6} = Q_{T6} - Q_{A6}$;

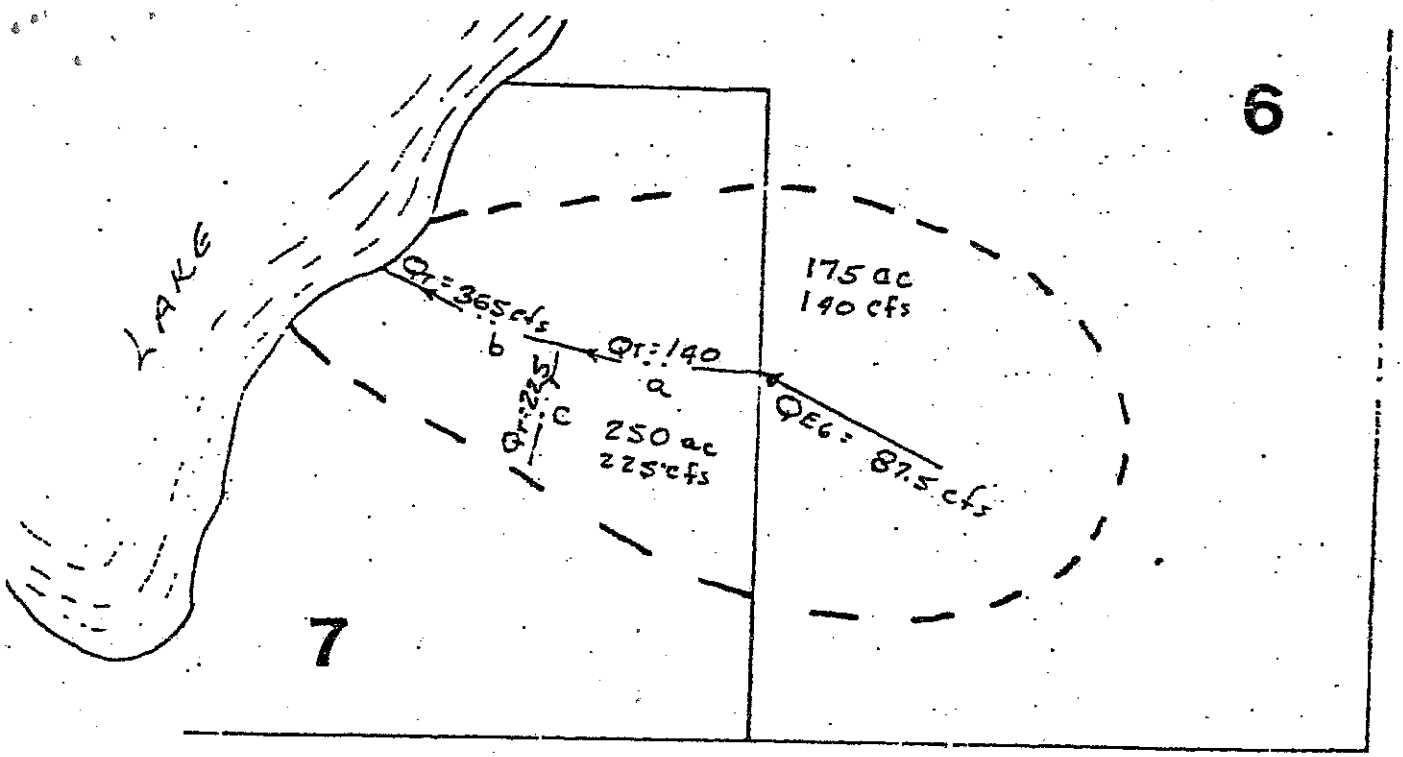
Q_{E6} is the design flow rate from City #6 which is in excess of the allowable flow rate from City #6;

Q_{A6} is the allowable flow rate from City #6;

Q_{T6} is the total design flow rate from City #6;

Q_T is the total flow rate for which the project is designed in each Segment.

City #6: Cost share for Segment "c" = Zero dollar (no tributary flow).



EXAMPLE "A" - TWO CITIES

Sample Calculations

Assume:

City #6 - Area of Watershed within City #6 = 175 acres
Full development runoff (Q_{T6}) = CIA = 0.40 x 2.0"/h x 175 = 140 cfs
Predevelopment runoff (Q_{A6}) = CIA = 0.15 x 2.0"/h x 175 = 52.5 cfs

Then:

Excess runoff (Q_{E6}) (from formulae: $Q_E = Q_T - Q_A$) = 87.5 cfs

1. City #6 cost share for Segment "a" = $\frac{87.5}{140}$ x project cost for "a" = .63 x Project cost for "a".

(From formulae: share = $\frac{Q_E}{Q_T}$ x Project cost)

Note: Segment "a" ends at first point of entry into the system from City #7.

Assume:

City #7 - Area of Watershed within City #7 = 250 acres and all flows from City #7 enter system by way of Segment "c".
Full development runoff (Q_{T7}) = CIA = .50x1.8x250 = 225 cfs
Design flow for Segment "b" = $Q_{T(SEG.\ "a")} + Q_{T7}$ = 140 + 225 = 365 cfs

2. City #6 has no cost share obligation in Segment "c" when there is no tributary flow from City #6.

(continued)

Then:

3. City #6 cost share for Segment "b" = $\frac{87.5}{365}$ x Project cost for "b" = 0.24 Project cost of "b".

(From formulae: Share = $\frac{Q_{E6}}{Q_T}$ x Project cost)

Note:

City #6 can reduce the excess flow (Q_{E6}) by detention ponding even to the amount that the rate of flow from City #6 (Q_{T6}) is no greater than the allowable flow rate (Q_{A6}). Any reduction in the total rate from City #6 would be applied to the excess rate and thereby reduce the obligation of City #6 to share in the cost of constructing any conveyance system in City #7.

SUMMARY OF COSTS

Segment "a":

City #6: Cost share = $\frac{87.5}{140}$ x Project cost for "a".

City #7: Cost share = $\frac{52.5}{140}$ x Project cost for "a".

Segment "b":

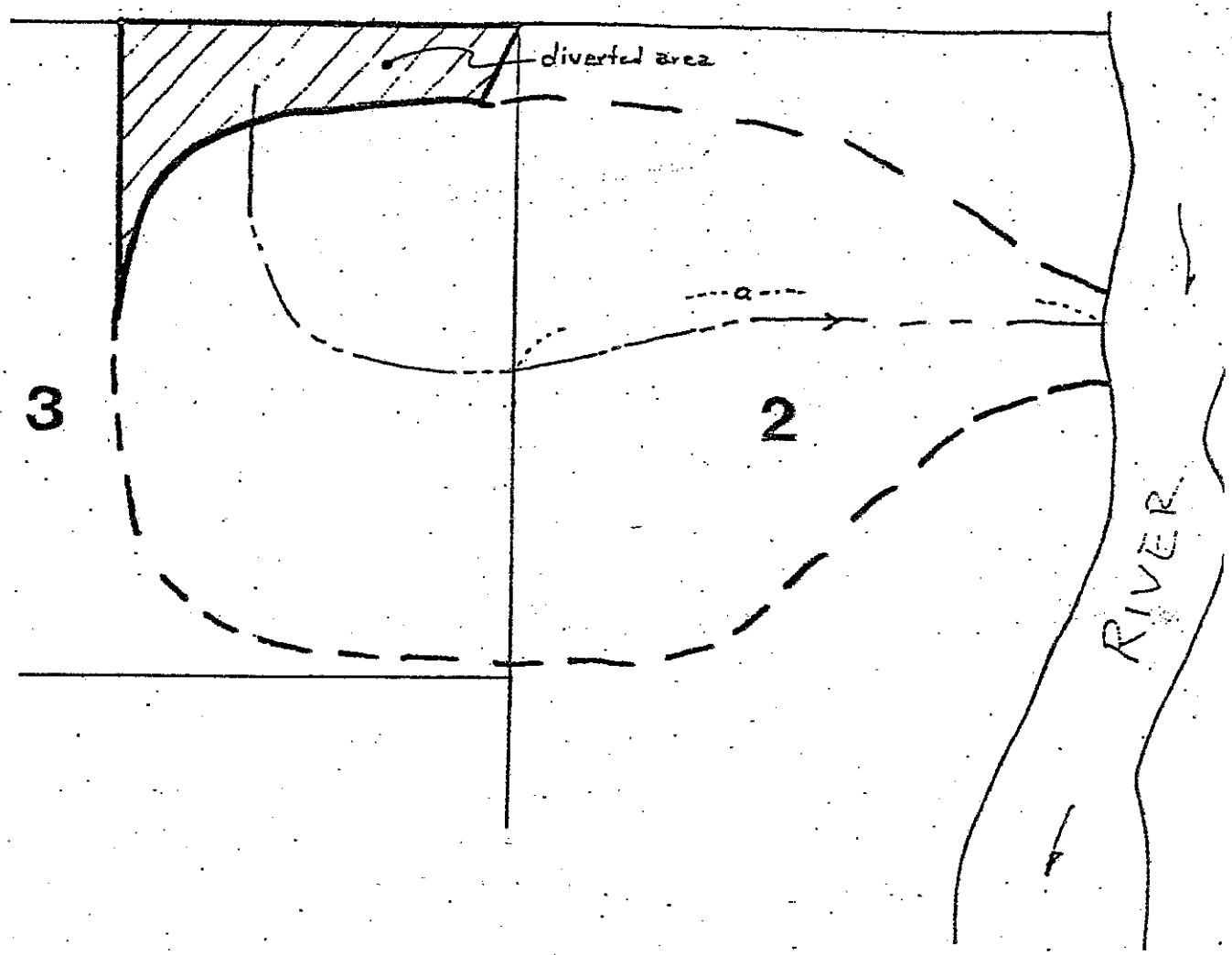
City #6: Cost share = $\frac{87.5}{365}$ x Project cost for "b".

City #7: Cost share = $\frac{277.5}{365}$ x Project cost for "b".

Segment "c":

City #6: Cost share = Zero dollar (no tributary flow).

City #7: Cost share = All of Project cost for "c".



EXAMPLE "B" - TWO CITIES WITH DIVERSION IN

Project: Construct Trunk facility "a" in City #2 only for Cities #2 and #3 under fully developed conditions.

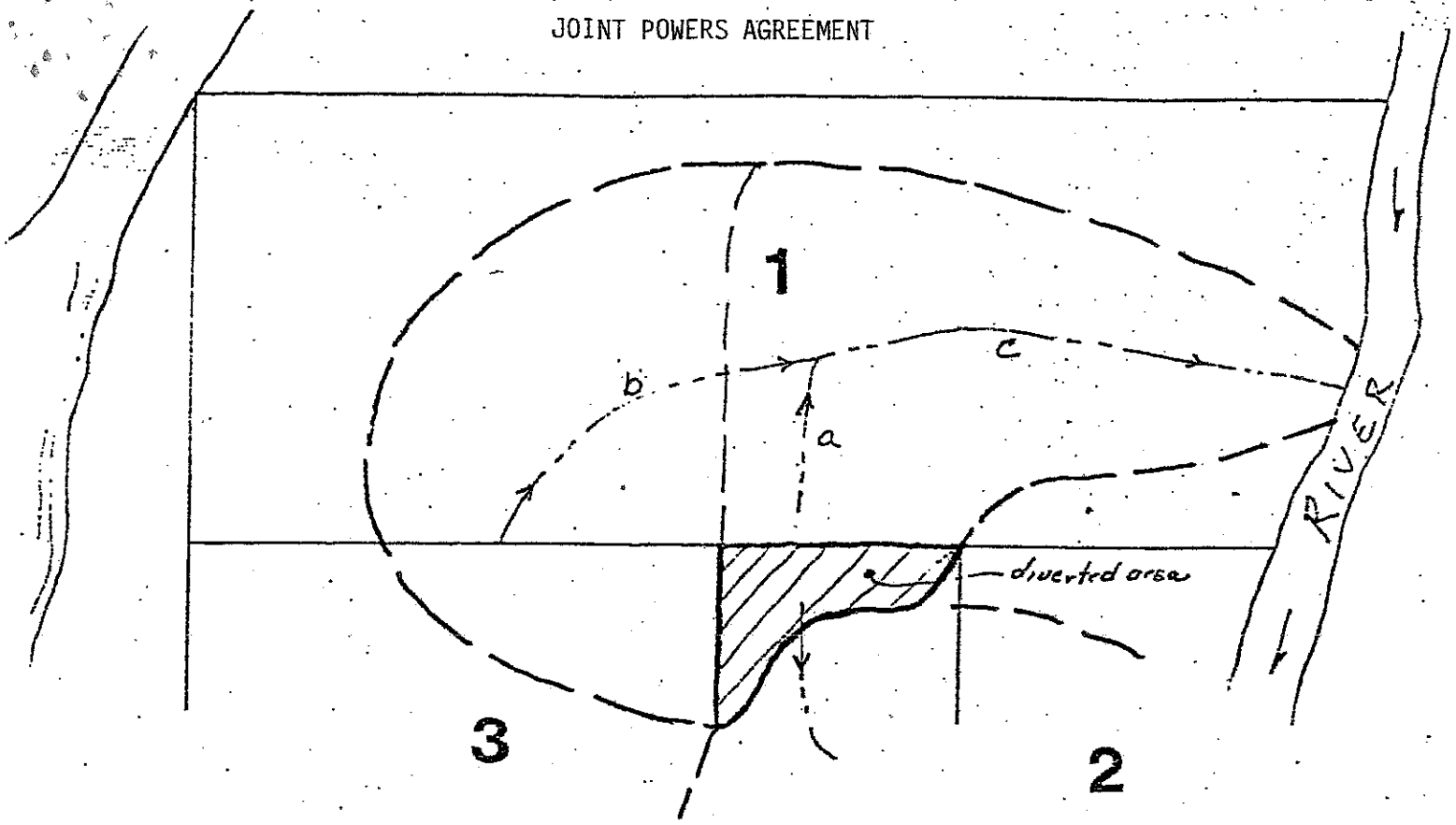
Cost Allocation:

City #3: Cost share $= \frac{Q_{E3}}{Q_T}$ x Total project cost.

Where: $Q_{E3} = Q_{T3} - Q_{A3}$
And Q_{E3} is the design flow from City #3 as described in Example "A" plus all flows coming from the area diverted. All facilities within City #3 are constructed by City #3. Detention in City #3 can reduce Q_{E3};

Q_T and Q_A are as defined in Example "A".

Note: This case applies only where waters are diverted from one City to another City or from one major drainage district to another.



EXAMPLE "C" - TWO CITIES WITH DIVERSION OUT

Project: Construct Trunk Segments "a", "b", "c" in City #1 under fully developed conditions.

Cost Allocation:

City #3: Cost share for Segment "a" = Zero dollars (all flows have been diverted away)

Cost share for Segment "b" $= \frac{Q_{E3}}{Q_T}$ x Total project cost for "b".

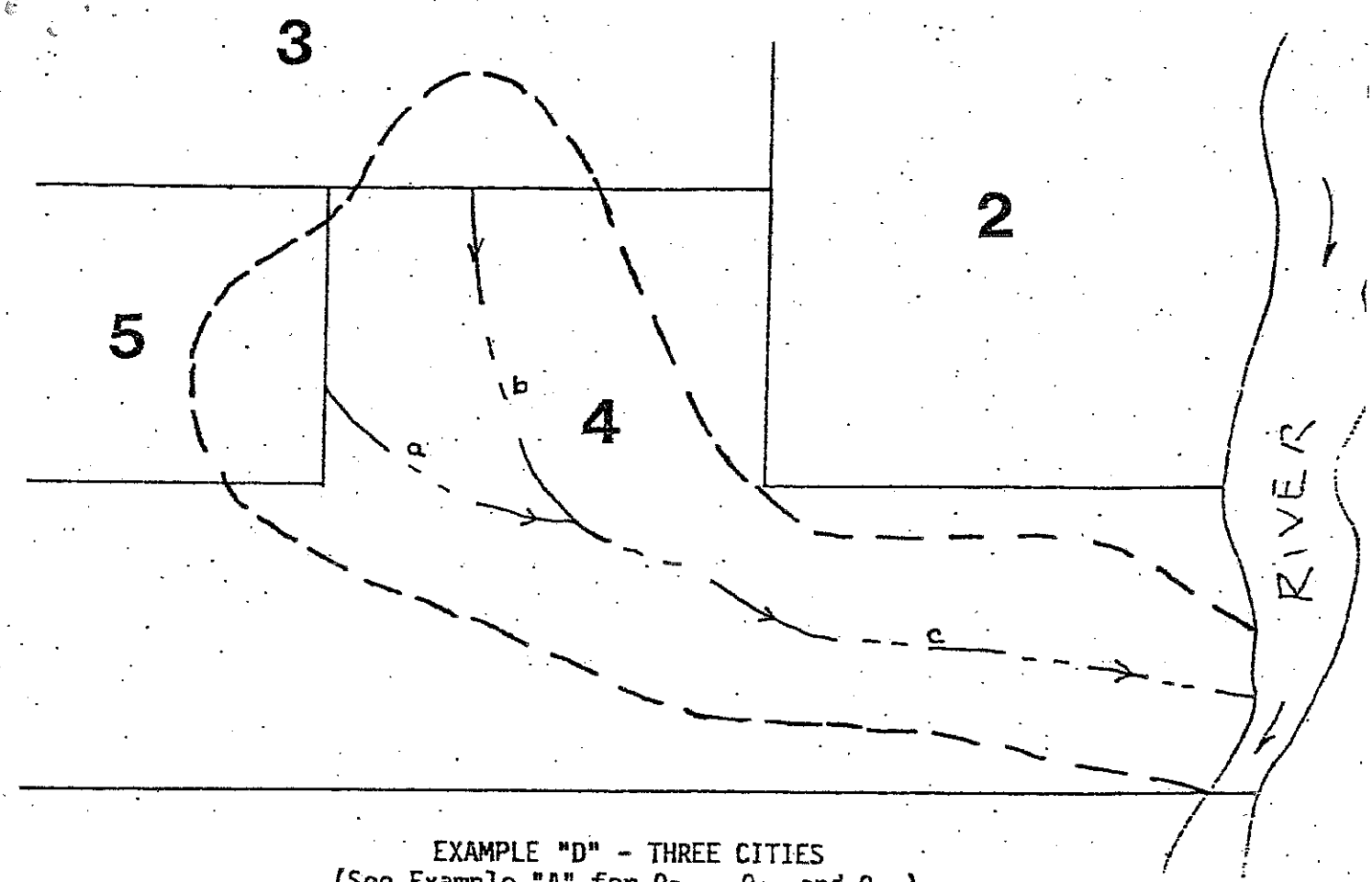
Where: Q_{E3} is the excess flow from City #3 that is tributary to Segment "b" only.

City #3: Cost share for Segment "c" $= \frac{Q_{E3}}{Q_T}$ x Total project cost for "c".

Where: Q_{E3} is the excess flow from City #3 that is tributary to Segment "c" calculated as Q_{E3} tributary to "b" minus Q_{A3} that would have been tributary to "a" had there been no diversion out of the drainage district.

Q_T and Q_A are as defined in Example "A".

Note: This case applies only where waters are diverted from one City to another City or from one major drainage district to another.



EXAMPLE "D" - THREE CITIES
(See Example "A" for Q_T, Q_A and Q_E)

Project: Construct Project (Segments "a", "b" and "c") in City #4 to provide drainage for Cities #3, #4, and #5 under fully developed conditions.

Cost Allocations:

City #3: Cost share Segment "b" = $\frac{Q_{E3}}{Q_T}$ x Project cost for "b".

Cost share Segment "a" = Zero dollars (no tributary flow).

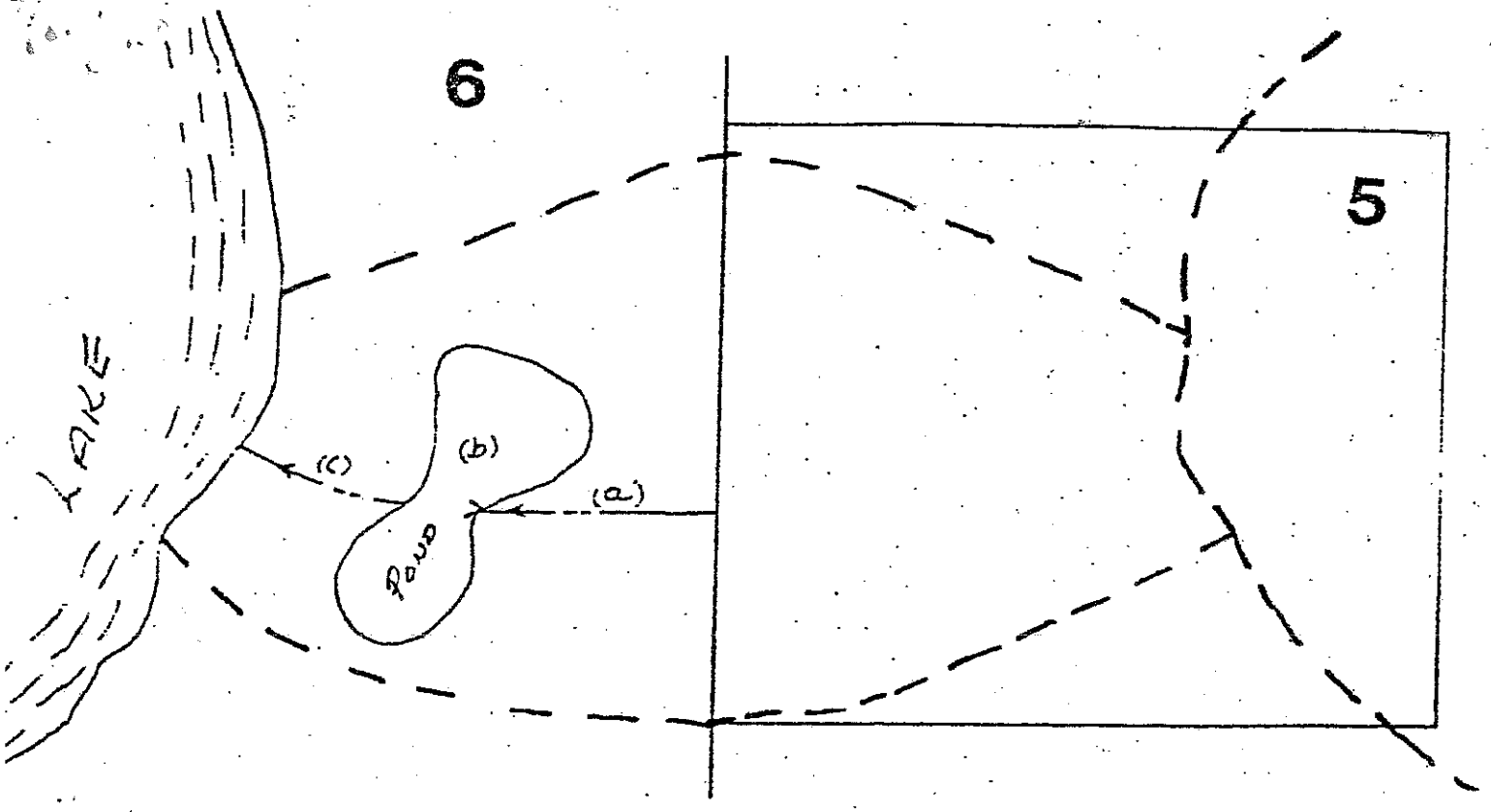
Cost share Segment "c" = $\frac{Q_{E3}}{Q_T}$ x Project cost for "c".

City #5 Cost share Segment "a" = $\frac{Q_{E5}}{Q_T}$ x Project cost for "a".

Cost share Segment "b" = Zero Dollars (no tributary flow).

Cost share Segment "c" = $\frac{Q_{E5}}{Q_T}$ x Project cost for "c".

Where: Q_T is the total flow rate for which each respective Segment is designed.



EXAMPLE "E" - ADDED PONDING
(See Example "A" for definition of Q_T , Q_A and Q_E)

Project: Construct Trunk "a", Detention Pond "b" and Outlet "c" for cities #5 and #6 under fully developed conditions.

Cost Allocation:

City #5 (Trunk "a"): Cost share $= \frac{Q_{E5}}{Q_T}$ x Project cost of Trunk "a".

Where: Q is the total flow rate in Trunk "a".

City #5 (Pond "b"): Cost share $= \frac{V_{E5}}{V_T}$ x Project cost of Pond "b".

Where: V_{E5} is the design Volume of runoff from City #5 which is in excess of the allowable Volume from City #5;

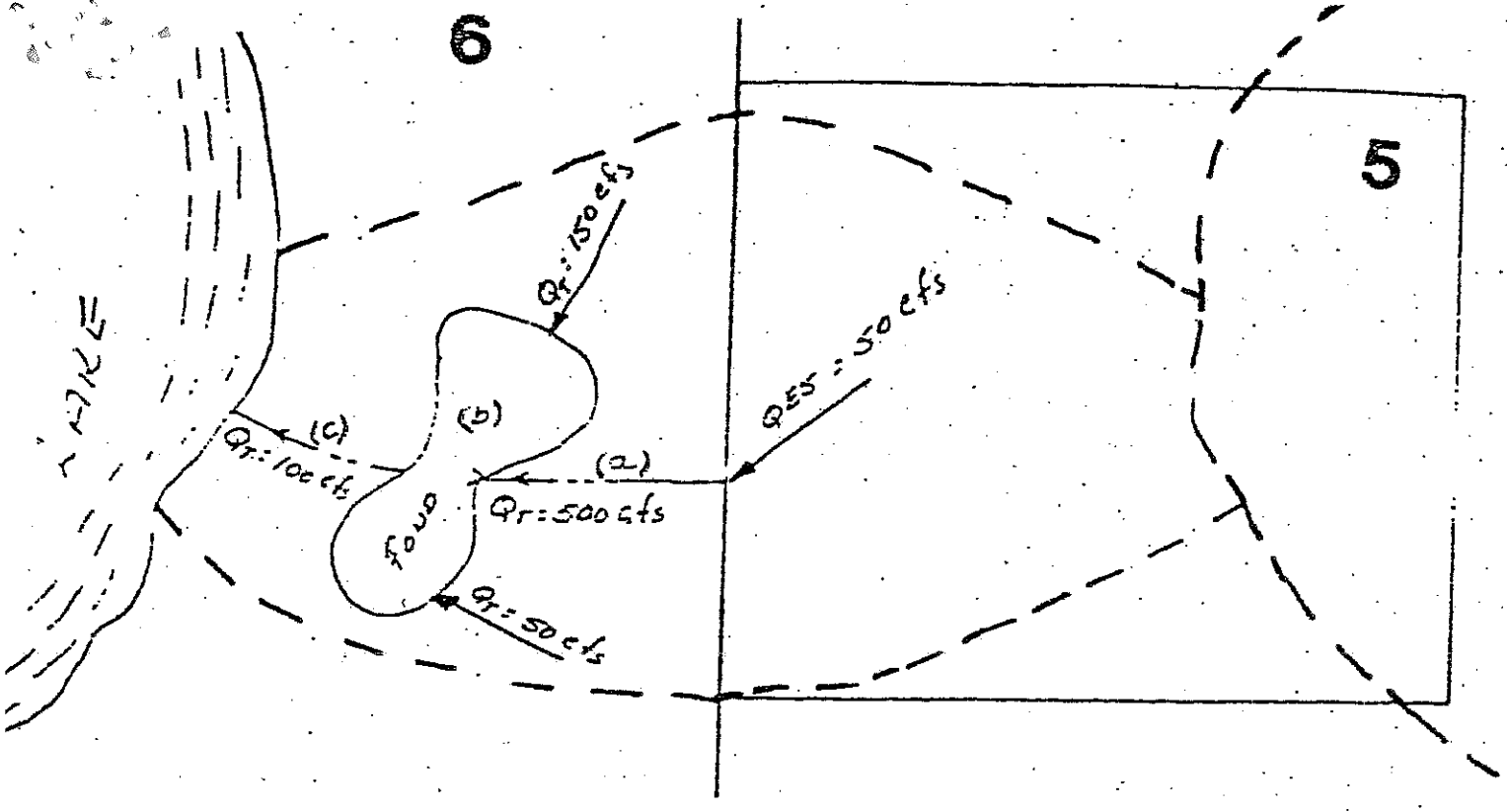
V_T is the total Volume used in the design of the detention pond.

City #5 (Outlet "c"): Cost share $= \frac{Q_{E5}}{Q_T}$ x Project cost of Outlet "c".

Where: Q_{E5} is reduced from Trunk "a" Inlet Q_{E5} by the ratio of $\frac{\text{Outlet } Q_T}{\text{Inlet } Q_T}$;

Inlet Q_T is the summation of all flows into the pond;
Outlet Q_T is the total flow rate out of the pond under design conditions.

Note: See Page 9 for sample calculations



EXAMPLE "E" - ADDED PONDING

Sample calculation for City #5 cost share for Outlet "c":

Assume:

Q_{E5} = 50 cfs

Q_T Pond inflow in Segment "a" = 500 cfs

Q_T Pond inflow from other areas = 200 cfs

Σ Q_T Pond inflow = 700 cfs

Q_T Pond Outlet "c" = 100 cfs

And:

$$Q_{E5\ (OUTLET)} = Q_{E5\ (INLET)} \times \frac{Q_{T\ (OUTLET)}}{\Sigma Q_{T\ (INLET)}}$$

$$\text{City \#5 cost share} = \frac{Q_{E5\ (OUTLET)}}{Q_{T\ (OUTLET)}} \times \text{Project cost of Outlet "c"}$$

Then:

$$Q_{E5}\ \text{(for Segment "c")} = \frac{100}{700} \times 50 = 7.14\ \text{cfs}$$

$$\text{City \#5 cost share} = \frac{7.14}{100} \times \text{Project cost of Outlet "c"}$$

BARR ENGINEERING CO.

MEMORANDUM

TO: Lower Mississippi River Watershed Management Organization Managers

FROM: James R. Langseth

SUBJECT: Allowable Flow - Summary of Understanding Based on the Discussions at the Informal Meeting Held February 1, 1988

DATE: March 9, 1988

Allowable Flow - Rate of Flow Calculation

Allowable flow is a set of conditions defined for the purposes of cost apportionment. Allowable flow is not a historic condition or a natural condition of the watershed. The application of the Joint Powers Agreement (JPA) provisions for allowable flow calculation was interpreted as described below.

1. The allowable flow calculation shall be based on the following watershed, land use, precipitation event, and drainage system definitions:

   a. Watershed: Consists of the entire tributary watershed, defined by natural flow pathways, overflow routes, and the drainage system existing as of the effective date of the JPA.

      1) Landlocked areas are included.

      2) Areas diverted in by the drainage system existing as of the effective date of the JPA are included.

      3) Areas diverted out by the drainage system existing as of the effective date of the JPA are not included.

4) Natural flow pathways and overflow routes are defined by the topography available as of the effective date of the JPA.

b. Land use: The entire tributary watershed is considered to contribute flow as if it were all in a "natural vegetation" state.

1) Regardless of past or present land use or vegetation, landlocked status, proportion covered by water surface, or other "natural condition" land use variables, all areas are treated as land surface.

2) All stormwater detention basins, including lakes, are considered as though they had been filled and are treated as land surface in the analysis.

3) The runoff coefficient "C" for the Rational Method is to be 0.15 for "natural conditions". Other computational methods shall select variables which provide similar representations of conditions (for example, the percent impervious for the Barr Hydrograph Method will probably be ~~5~~ 0% for "natural conditions").

c. Precipitation event: critical 10-year frequency storm.

1) The Joint Powers agreement examples use the Rational Method and imply the critical frequency storm is a 10-year frequency rainfall intensity for a duration corresponding to the time of concentration of the watershed.

2) For hydrograph methods, the critical storm is that storm resulting in the highest peak flowrate. This will most likely be a storm having its peak rainfall rate at a time approximately equal to the watershed time of concentration.

d. Drainage system: A developed conveyance system is assumed to exist, that is, runoff is efficiently conveyed to the outlet in a system adequate to convey the 10-year runoff rates.

1) Times of concentration are to be appropriate to the typical slopes of the subwatersheds.

2) Flow velocities are to be appropriate to 10-year drainage system design.

3) No storage routing is considered because detention basins are considered not to exist.

2. To determine Excess Flow - Rate of Flow:

a. the allowable rate of flow shall be compared to the greater of:

1) The 10-year frequency critical storm design rate of flow.

2) Where there is a detention basin at the outlet of the upstream community's drainage system: the 100-year frequency critical storm design rate of flow.

b. The design condition will use:

1) Anticipated ultimate tributary watershed

2) Ultimate land use development, with appropriately applied runoff ("C") factors

3) Design storm - the critical duration 10-year or 100-year frequency event

4) Proposed drainage system, including detention basins and including the routing of runoff through those basins

Allowable Flow - Volume of Flow Calculation

1. The meaning of Allowable Flow - Volume of Flow, used for cost sharing on downstream detention basins, was not specifically discussed at this meeting. However, based on the discussion and reading the JPA, I have the following understanding:

   a. Watershed: as above (1.a.)

   b. Land use: as above (1.b.)

   c. Precipitation event: The 100-year frequency storm that is critical for the conveyance system design. (The JPA specifies the 100-year frequency 24-hour precipitation event as the criteria for detention basin design, but I interpret this to mean the critical duration storm.)

   d. Drainage system: as above (1.d.)

   e. Allowable flow: Volume of flow is the total runoff volume from the storm.

2. To determine Excess Flow - Volume of Flow: the allowable volume of flow shall be compared to the total runoff volume from the design storm, less the design volume of the upstream community's detention basins.

BARR ENGINEERING CO.

MEMORANDUM

TO: Jim Langseth/File

FROM: Dennis Palmer

SUBJECT: LMRWMO Cost Allocation Formula

DATE: August 18, 1988

The following paragraphs summarize my interpretation of the cost allocation formula based on my reading of the Joint Powers Agreement, the memorandum from the February 1, 1988 meeting, the memorandum of June 22, 1988 from SEH, the letter of June 22 from the WMO attorney, and what I believe to be a reasonable and workable solution.

In general, an upstream community will be permitted to discharge an "allowable flow" without being required to participate in the cost of the downstream conveyance system. The cost to be apportioned to an upstream community will be based upon flows which exceed the "allowable flow". Calculation of the allowable flow involves: 1) definition of the contributing watershed, and 2) application of hydrologic criteria for the calculation of flow from that watershed.

1

- The watershed should be that ". . . area within a line drawn around the extremities of all terrain whose surface drainage is tributary . . ." to the point at which the allowable flow is to be calculated.

  Comment: The quoted portion of the above definition comes from Section 3, Subdivision 10 of the Joint Powers Agreement, where it refers to the watershed of the WMO as being that area tributary to the Mississippi River. A similar definition would include landlocked areas in the watershed area when calculating allowable flow. However, the definition of "allowable flow" in Section 3,

Subdivision 3 could be strictly interpreted as excluding any landlocked areas which had not been provided an outlet as of the enactment date of the agreement. Thus, I believe the agreement is technically unclear as to consideration of landlocked areas.

The following thoughts are offered as a rationale for addressing landlocked basins. I have no personal knowledge of the intent of those who framed the Joint Powers Agreement; however, I believe that the tributary watershed should include any landlocked basins tributary to the point in question for the following reasons:

1) I believe we should presume that engineers and planners operating within and designing systems for an urban environment would have included within the design of any existing systems some allowance for future flow from presently landlocked areas. Thus, in Section 3, Subdivision 3 of the Joint Powers Agreement, I believe it would be appropriate to interpret that ". . . drainage system in place . . ." refers to a system which allows for ultimate discharge from such areas, whether or not they were landlocked as of the enactment date of the agreement. Note that I have no firsthand knowledge of discussions that took place between those who drafted this agreement - I am stating an opinion as to what my intent would have been.

2) When the effect of ponding in a landlocked area is considered, the contribution of the landlocked area to the allowable flow at the point in question will probably be negligible, and the inclusion of the landlocked area will therefore have little, if any, effect on cost allocation for the conveyance system or storage facilities downstream.

For landlocked basins entirely within a single community and when a landlocked basin occurs at a drainage boundary between communities, an allowable flow must be determined in order to apply the cost allocation formula in the agreement. I propose the following:

(2)

- The allowable flow from landlocked basins will be 0.0252 cfs per acre.

  Comment: Under natural conditions, the effective outflow is limited to seepage and is very small. Thus, it follows that a snowmelt event would be critical. The 100 year snowmelt is approximately 6 inches of runoff in 10 days. I propose that the allowable flow from a landlocked basin be defined as the 100 year runoff (6 inches of runoff in 10 days) or an average of 0.0252 cfs per acre. Note that this is much less than the flow which would be calculated using a rational coefficient of 0.15.

  An alternative procedure would be to permit discharge from landlocked basins at no cost to the discharging community unless their discharge required oversizing of downstream systems. In that case, the upstream community would pay for the actual cost of oversizing the downstream conveyor to accommodate discharge from the landlocked basin. In practice, this would mean that the upstream community would participate in the cost of a limited length of the downstream system since local peak discharges soon become the prevailing design criteria when compared with outflow rates from upstream storage basins. This alternative is not favored because it differs more greatly from the formula in the agreement than does the defined allowable flow above.

(3)

- Delineation of the watershed area should consider the conveyance system in place as of the date of the enactment of the agreement. The conveyance system should be interpreted to include (1) all detention areas which had been constructed as a part of the drainage system in place and (2) all detention areas which happened to occur because of ". . . the characteristics of the land on the date of enactment . . ." (from Section 3, Subdivision 12).

Comment: Storm sewer systems which existed as of the date of enactment may have altered the natural watershed divides. If an area is diverted away from the point where allowable flow is to be calculated, the agreement is clear; Section 3 subdivision 3 excludes any flow which is diverted away by the system in place. However, I believe that the agreement intends to include any water which may have been diverted into the watershed being considered by in-place systems. Likewise for calculating the allowable flow I believe the agreement intends to include any waters contributed by existing systems serving areas which were landlocked in their natural state.

Detention basins should be considered to be a "characteristic of the land on the date of enactment". As such, they are a part of the conveyance system and should be considered in the calculation of allowable flow. To ignore their effects would result in an allowable flow that was unreasonably high, just as to ignore landlocked basins could yield an allowable flow that was unreasonably low.

4 • For calculation of allowable flow, the same criteria should be used as was employed for calculation of the design flow, except that runoff factors should be appropriately reduced (C=0.15) to represent undeveloped watershed conditions.

Comment: The design flow at a given point would be (1) that flow calculated to result from a 10-year rainfall event, or 2) the peak outflow from ponds immediately upstream of the point in question (which results from the critical 100-year runoff event), whichever is greater. The allowable flow should be calculated in exactly the same manner, assuming the drainage system at the time of enactment and non-urban conditions. It is conceivable that a well-designed storage basin could actually reduce the peak flow from an urban area to a level below that which would occur under natural conditions, as defined in the agreement. It is therefore

necessary to consider both the 10 year and 100 year events when calculating the allowable flow.

The use of a Rational Formula coefficient equal to 0.15 appears to be an agreed upon compromise developed by the technical advisors to those who drew the Agreement. It will adequately serve the purpose for which it was intended. It should not, however, be used to exclude the calculation of allowable flow by hydrograph methods and other standard engineering techniques.

FR/332,0/cmf

BARR ENGINEERING CO.

MEMORANDUM

TO: File

FROM: Jim Langseth

SUBJECT: Allowable Flow

DATE: August 25, 1988

A meeting was held on August 11, 1988 to discuss the meaning of allowable flow as defined in the Joint Powers Agreement (JPA). This meeting was attended by Jim Langseth representing Barr Engineering, John Sachi representing Inver Grove Heights, Bill Price representing Sunfish Lake, Jim Danielson representing Mendota Heights, Skip Stephaniak representing West St. Paul, and Mark Loebermeyer from SEH and Bob Simon representing South St. Paul.

A letter inviting all members and alternates of the Lower Mississippi River Watershed Management Organization to the meeting had been mailed out prior to the meeting. Copies of the letter had also been distributed to all advisors to the LMRWMO. In that letter four topics were identified for discussion at the meeting. A copy of the letter is attached. For each of the topics, a series of reasonable interpretations of the agreement were presented in the letter. It was hoped that the group would agree on one set of interpretations.

Bill Price, Skip Stephaniak, and Jim Danielson had been involved at one level or another in the formulation of the allowable flow definitions in the JPA. Bill Price had been retained by the framers of the JPA to prepare the examples in the JPA. Bill Price explained some of the factors that went into the formulation of the allowable flow concept. First, the upstream communities have the right to discharge some flow downstream without cost. Second, the examples were simplified so that they would be easy to apply and would serve to illustrate the fundamental concepts. Third, the examples in the JPA must be used to interpret the language regarding these matters.

Skip Stephaniak explained that the "C" factor of 0.15 was a compromise number that was arrived at as a way to reduce the variability in the calculation of allowable flow.

Mark Loebermeyer, speaking for South St. Paul, suggested that if the examples defined allowable flow then they could also be used to define excess flow. One could simply change the "C" factor from natural conditions to developed conditions to arrive at the excess flow.

Bob Simon pointed out that the examples might be for illustration but were not definitive. A reference to the examples was found in the JPA. That reference occurs on page A-15 of the JPA in the Watershed Management Plan. Section 9, Subdivision 6(f) of the JPA states "The attached Exhibit A is incorporated by reference and serves as a compilation of general examples of cost allocation under this agreement for the hypothetical circumstances stated in the examples."

Bill Price pointed out that during the discussions leading to the JPA, the possibility was discussed that a community could hold back enough water so that they would not owe any cost sharing for downstream construction.

The position maintained by the representatives from South St. Paul through all of the discussions was that calculation of allowable flow and design flow should be commensurate. They should be done using the same watershed, the same drainage system, the same ponds, and so forth. That is, if allowable flow is calculated without ponds, excess flow should be calculated without ponds. If design flow is calculated including ponds, allowable flow should be calculated including ponds. The South St. Paul representatives maintained that the examples and the language of the Joint Powers Agreement provided no basis for calculation of allowable and excess flows by two different approaches.

After further discussion, the questions raised in the letter of August 5 were discussed directly. A summary of the discussion of those questions follows:

1. What is the allowable flow from landlocked areas (such as the watershed tributary to Sunfish Lake)?

   Three communities indicated that the allowable flow would be an amount determined by the methods in the examples incorporated in the Joint Powers Agreement. By this they meant that the allowable flow is determined by the rational method applying a "C" factor of .15, rainfall intensity according to the time of concentration of the watershed, and the full watershed area. Inver Grove Heights indicated that they would answer D, "other", by which they meant that the allowable flow would be related to the ultimate development drainage system (answer B from Question 2). South St. Paul indicated the answer was B: the allowable flow would depend upon the drainage system in place on October 1, 1985. This implied that if no drainage system were in place there would be no allowable flow in that landlocked area.

2. What is the drainage system in place and the definition of "allowable flow"?

   Four communities indicated that the answer would be C, a hypothetical system adequate to convey only the allowable flow with no ponding considered. One community elaborated to explain that this implied that there would be a whole new hypothetical drainage system in place sufficient to carry the allowable flow rate. South St. Paul indicated that the drainage system in place meant the system in place on October 21, 1985. West St. Paul pointed out that the date was meant to define when waters were considered diverted in or out of a watershed and was not intended to define ponds and detention basins and the drainage system that should be used in the calculation of allowable flow. Bill Price pointed out that the language regarding diversion was added because there was existing diversion even at that stage. Thus the diverted waters in Section 3, Subdivision 3 of the JPA refers to the waters diverted after the signing of the JPA.

There was some discussion of whether or not DNR-protected public waters could be ignored in calculating allowable flow.

3. What shall the allowable flow storm be?

This question was more or less skipped because with allowable flow being defined as incorporating the examples in the back of the JPA, the allowable flow from an upstream community is defined as the 10-year frequency discharge. The initial answers indicated by the parties were that the allowable flow storm should be the 10-year frequency for pipes and 100-year frequency only for open channels and pond volumes, but that the upstream community allowable flow is computed without ponds.

4. How are detention basins treated in calculation of allowable flow?

Four of the communities indicated that the answer is A. Detention basins are ignored as in Example "A" of Exhibit A of the JPA. South St. Paul indicated the answer would be either B, as defined by the topographic data available on October 21, 1985 or C, as defined by the drainage system in-place on October 21, 1985 or a combination of both.

Following this discussion, a vote was taken on what to tell the Board regarding the outcome of the meeting. What we agreed to report to the Board was that the Committee could not come to unanimous agreement on the meaning of allowable flow, but the majority supported the definition as explained in the memo from the February 1, 1988 meeting. The meeting concluded after this vote.

LMRW/322,0/tvo

MEMORANDUM

TO: Lower Mississippi River Watershed Management Organization

FROM: James R. Langseth

DATE: February 19, 1992

RE: Allowable Flow, Summary of Understanding Based on the Discussions at the Meeting Held December 13, 1991

This meeting was held to address three topics and a fourth topic was briefly discussed.

1. Allowable flow 100-year frequency storm design conveyance systems.

2. Allowable volume.

3. Cost apportionment downstream of ponds.

4. Cost allocation principles for diversions where more than one city contributes flow.

These interpretations use the definitions for watershed, land use, and drainage system set forth in the March 9, 1988 Allowable Flow memorandum. The current memorandum provides an interpretation of the allowable flow for cases where the design is not based on a 10-year storm.

1. Allowable Flow for 100-Year Frequency Storm Design Conveyance Systems

The Joint Powers Agreement, Section 3, Subd. 3, states that the allowable flow is a rate an volume of flow according to the design criteria in Section 8, Subd. 6. Section 8, Subd. 6 provides that detention basins and open channel conveyance systems be designed for a 100-year return frequency storm.

Consistent with these provisions, for drainage systems for which the design criteria are 100-year return frequency precipitation events, the allowable flow shall be computed as a 100-year rate and volume flow.

The allowable rate of flow shall be computed by Q = CIA
where:

Q is the allowable flow rate in cubic feet per second.

C is the runoff coefficient, defined to be 0.15.

I is the 100-year return frequency rainfall intensity appropriate to the watershed time of concentrations, in inches per hour.

A is the watershed area in acres.

Excess flow is the 100-year design flow less the 100-year allowable flow.

This approach shall be applied for conveyance systems where the design is governed by 100-year return frequency events. This includes [redacted], detention basin outlets, conveyance systems downstream of detention basins, open channels, and other conveyance that is designed for 100-year return frequency events. Similar logic would apply to any system for which the design criteria was neither 10-year or 100-year. See Example F for an illustration of a 100-year excess flow calculation.

2. Allowable Volume

The allowable volume is the total runoff volume from the design storm, for a watershed with the land use defined in the March 9, 1988 memorandum. Where the ponding in the upstream community is negligible, the allowable volume may be estimated as being in the same proportion to the design volume as the allowable flow is to the design flow.

In general, the allowable volume may be computed with the same techniques used to determine the design volume, provided the technique also accurately calculates the allowable discharge rate.

The excess volume is the difference between design and allowable volume.

Where there is upstream ponding, the volume of those ponds is deducted from the excess volume to the extent the upstream detention reduces the volume needed in downstream ponds. Thus, only the storage in upstream detention basin at the time of peak of the downstream detention basin may be used to reduce the excess volume from the upstream community. For instance, assume the peak elevation at a downstream community pond occurs at 6 hours. Assume the upstream community pond stores 10 acre-feet at its peak at 3 hours, but only 5 acre-feet at 6 hours. The "excess volume" from the upstream community would be reduced by 5 acre-feet to account for the storage. See Example G for an illustration of this case.

3. <u>Cost Apportionment Downstream of Ponds</u>

In the Joint Power Agreement, Exhibit A, page 9 of 9, the formula for adjustment to excess flow as a result of ponding is presented:

$$Q_{excess}(\text{outlet}) = Q_{excess}(\text{inlet}) \times \frac{Q_{total}(\text{outlet})}{\Sigma\, Q_{total}(\text{inlet})}$$

The proportioning $Q_{total}(\text{outlet})/\Sigma\, Q_{total}(\text{inlet})$ shall be computed on the same return frequency event used for the pond design. If the pond is designed for a 100-year event, the adjustment in excess flow through the pond shall be based on the 100-year outflow and inflow values. Thus, if a 10-year design governs cost sharing for construction downstream of a pond, the 10-year excess flow would be reduced as follows:

$$Q_{excess}\ 10\text{-year (outlet)} = Q_{excess}\ 10\text{-year (inlet)} \times \frac{Q_{total}\ 100\text{-year (outlet)}}{\Sigma\ Q_{total}\ 100\text{-year (inlet)}}$$

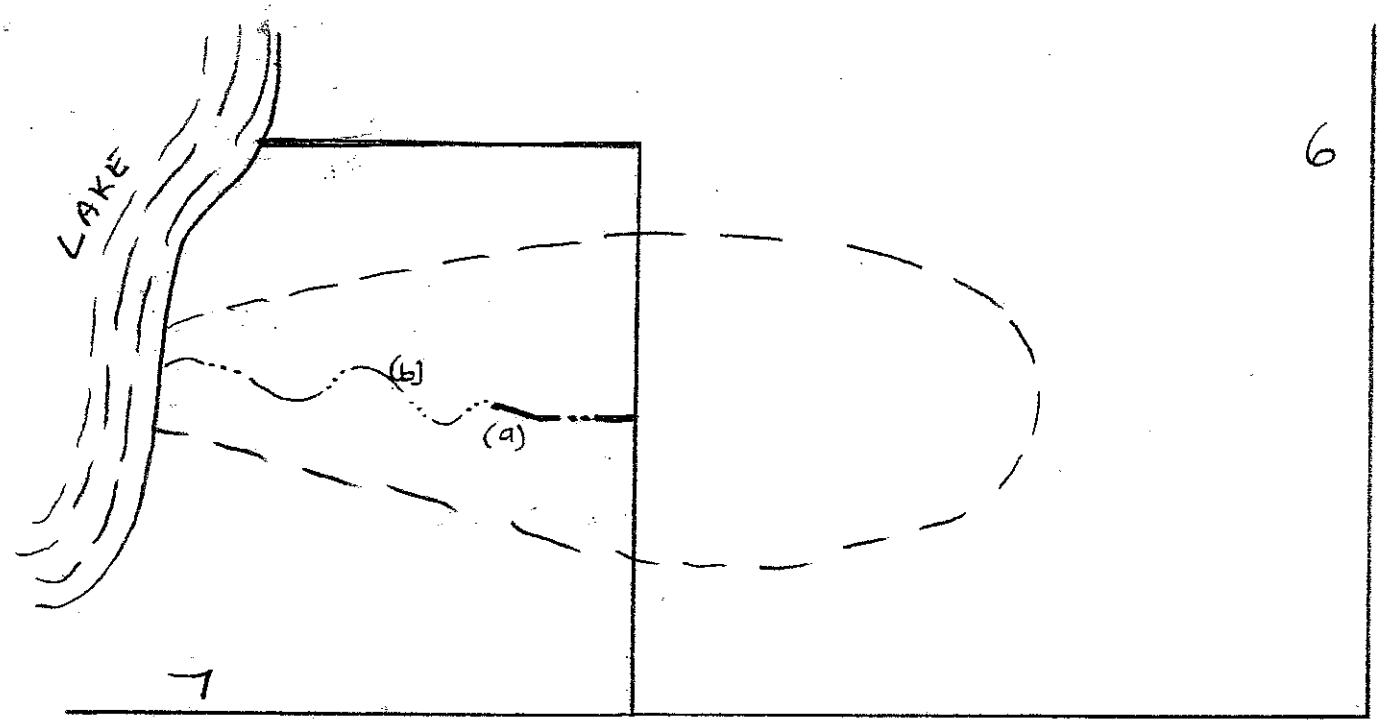
See Example H for an illustration of this case.

4. <u>Cost Allocation Principles for Diversion Where More Than One City Contributes Flow</u>

For diversion of water out of its current watershed, into a watershed to which it did not previously flow, there is no allowable flow associated with the diverted water. Consequently, the excess flow from the diverted area equals the design flow. If more than one city contributes water to the diversion, the excess flow from each community is their portion of the design flow from the diverted area. Thus, the cost allocation proportion for each city is their proportion of the design flow.

The "diversion in" is associated with an equal area of "diversion out" of another watershed. The cities retain their allowable flow in the watershed from which the area was "diverted out." This is illustrated for "diversion out" by one city on Page 6 of 9 of Exhibit A to the Joint Powers Agreement.

This principal was applied to the Lexington Avenue drainage case with Lilydale and Mendota Heights. The situation is illustrated conceptually in Example I.



Example F - Other than 10-year Design

Project: Construct storm sewer "a" and open channel "b" in City #7 to provide drainage for Cities #6 and #7 under fully developed conditions.

Cost Allocation:

City #6 Cost Share: $\frac{Q_{E6-10}}{Q_{D-10}}$ x Total Project Cost for "a"

$\frac{Q_{E6-100}}{Q_{D-100}}$ x Total Project Cost for "b"

Q_{E6-10} = 10 year excess flow from City #6 $= Q_{D6-10} - Q_{A6-10}$

Q_{D6-10} = 10 year design flow from City #6

Q_{A6-10} = 10 year allowable flow from City #6

Q_{D-10} = 10 year design flow for storm sewer "a"

Q_{E6-100} = 100 year excess flow from City #6 $= Q_{D6-100} - Q_{A6-100}$

Q_{D6-100} = 100 year design flow from City #6

Q_{A6-100} = 100 year allowable flow from City #6

Q_{D-100} = 100 year design flow for open channel "b"

Example F- Continued

City #7 Cost Share: Total Project Cost - (City #6 Cost Share)

Sample Calculations

City #6 - Watershed area = 100 acres

$Q_{D6-10} = .40 \times 2''/hr \times 100 = 80$ cfs

$Q_{A6-10} = .15 \times 2''/hr \times 100 = 30$ cfs

$Q_{E6-10} = 80 - 30 = 50$ cfs

1. City #6 cost share for storm sewer "a" = $\frac{50 \text{ cfs}}{80 \text{ cfs}} \times$ "a" Project Cost =

$= 0.625 \times$ "a" Project Cost.

2. City #6 cost share for open channel "b":

$Q_{D6-100} = .40 \times 4''/hr \times 100 = 160$ cfs

$Q_{A6-100} = .15 \times 4''/hr \times 100 = 60$ cfs

$Q_{E6-100} = 160 - 60 = 100$ cfs

Assume Q_{D-100} for channel "b" = 200 cfs

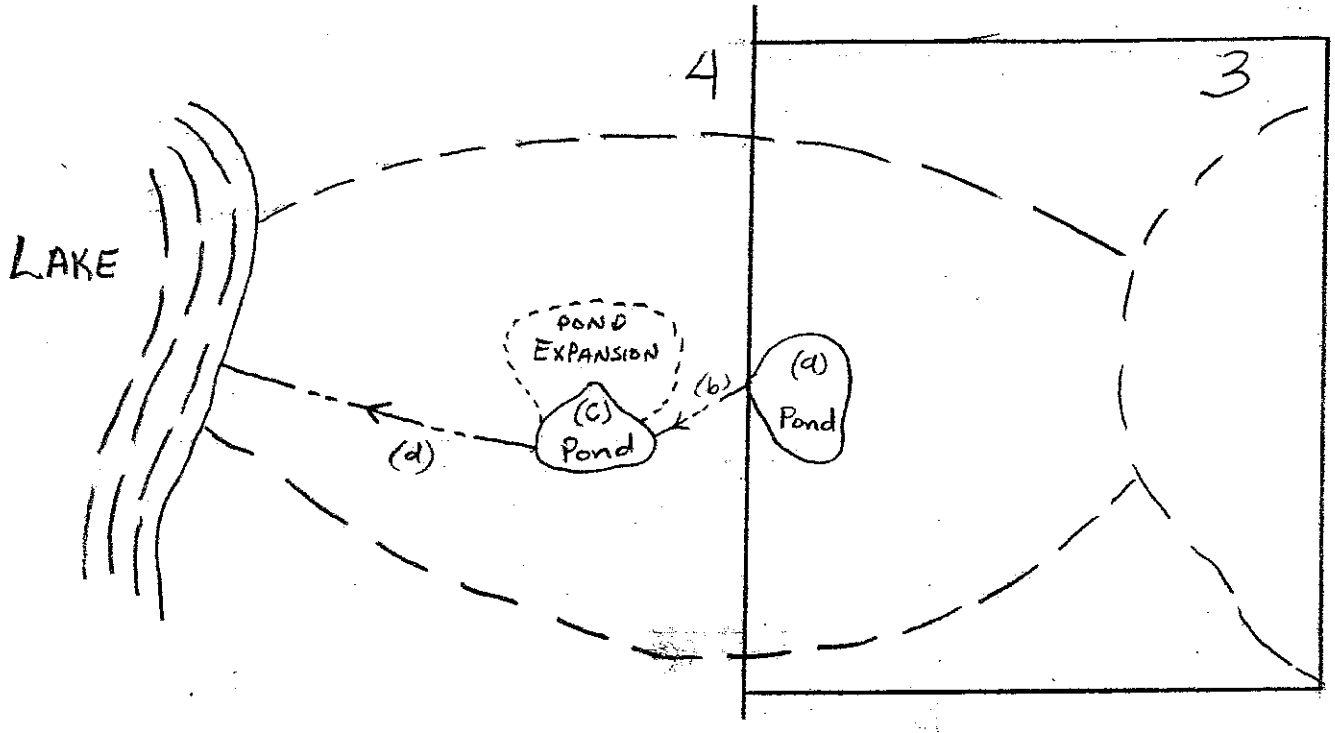
City #6 cost share = $\frac{100 \text{ cfs}}{200 \text{ cfs}} \times$ "b" Project Cost

$= 0.5 \times$ "b" Project Cost

Summary of Costs:

Segment "a" (10 year design)	City #6 Cost Share = 0.625 x Project Cost for "a"
	City #7 Cost Share = 0.375 x Project Cost for "a"
Segment "b" (100 year design)	City #6 Cost Share = 0.5 x Project Cost for "b"
	City #7 Cost Share = 0.5 x Project Cost for "b"

EXAMPLE G



EXAMPLE G : ALLOWABLE VOLUME

Pond "c" is to be expanded from a 10 acre-foot (AF) storage capacity to a 50 AF storage capacity detention basin. The critical design storm for Pond "c" will be the 6-hour 100 year return frequency rainfall.

Background & Assumptions:

Q_{D_b-100} = Design flow (100 year) in segment b = 50 cfs

Q_{A_3-100} = Allowable flow (100 year) from City #3 = 60 cfs
i.e. .15 x 4 in/hr x 100 acres = 60 cfs

Q_{E_3-100} = Excess flow (100 year) from City #3

$= Q_{D_6-100} - Q_{A_3-100} = 50 - 60 = -10$ cfs

Conveyance system

Therefore there is <u>no</u> excess flow from City #3, and City #3 does <u>not</u> participate financially in conveyance system improvements and maintenance in the downstream community, City #4.

City #3 may nevertheless be obligated to share in

EXAMPLE "G" continued

the Pond expansion costs. & maintenance costs of entire Pond

Excess Volume Calculation

$$V_{E_3} = V_{D_3} - V_{A_3} - V_{P_3}$$

V_{E_3} = Excess volume, from City #3, for the Pond "c" critical design storm (i.e. 100year-6 hour storm)

V_{D_3} = Design volume of runoff from City #3 for the Pond "c" critical design storm.

V_{A_3} = Allowable volume of runoff from City #3 for the Pond "c" critical design storm.

V_{P_3} = Volume of runoff stored in ponds in City #3 at the time of the peak volume stored in Pond "c" for the Pond "c" critical design storm.

Assume:

V_{D_3} = 75 AF

V_{A_3} = 35 AF

V_{P_3} = 10 AF. Say Pond "a" was designed to store 30 AF for its critical storm - a 1-hour 100 year storm. But, say the time of peak at Pond "c" is 6 hours later, so only 10 AF remains stored in Pond "a" at the time of peak in Pond "c".

$$V_{E_3} = 75\text{ AF} - 35\text{ AF} - 10\text{ AF} = 30\text{ AF}$$

Thus, although there is no excess flow (flowrate) from City #3, there is excess volume from City #3.

The allowable volume should be calculated using the same methodology as used to calculate the design volume, but the land use should be converted to 100% turf or pasture in good condition.

Example "C" continued

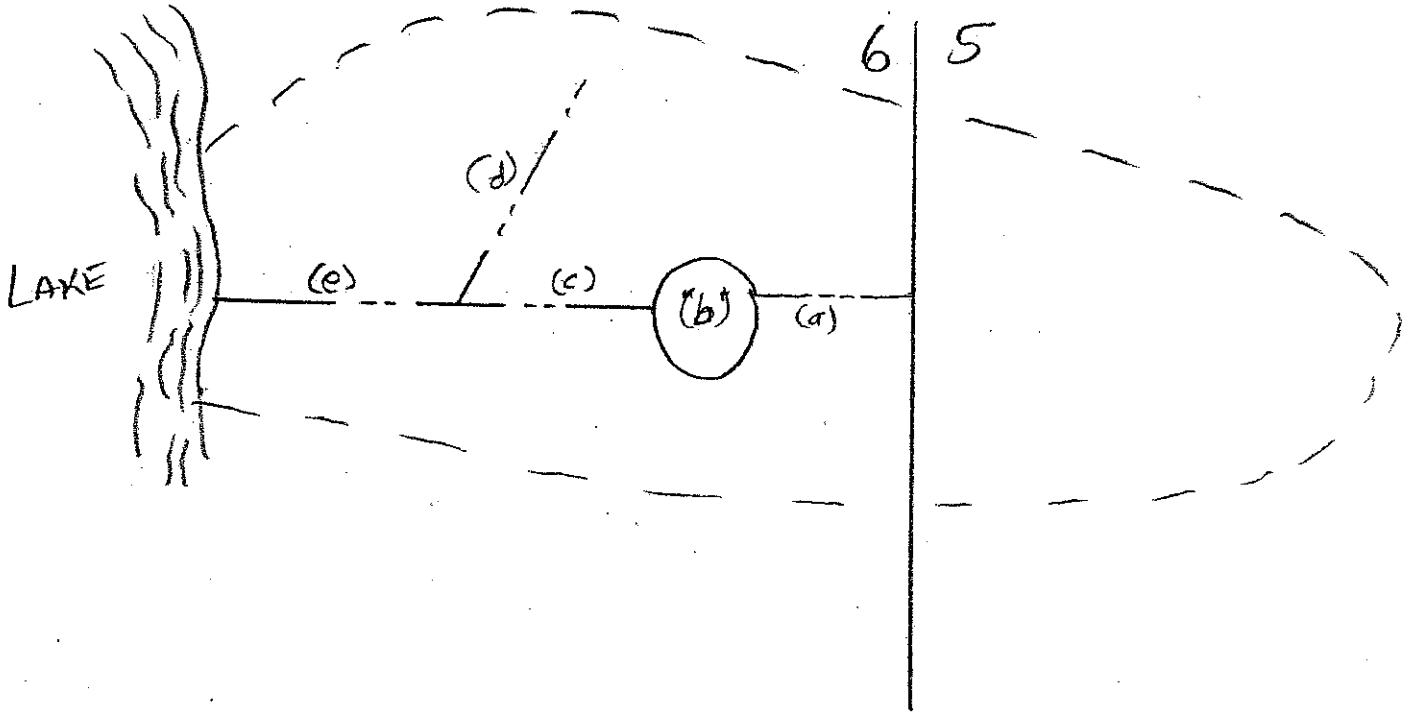
COST ALLOCATION

Cost share for Pond "c" expansion:

City #3 cost share: $\frac{V_{E_3}}{V_T}$ x Project Cost for Pond "c" expansion

where V_T = the design increase in storage volume of Pond "c" for the critical storm. Note – this does not include the former design volume of the pond. The former design volume of the pond (before expansion) should be computed as the volume of detention storage below the 'design level' for the former pond, for the Pond "c" expansion design storm at the time of peak for the Pond "c" expansion.

For instance, say former Pond "C" was designed for a 25-year storm, and held 10 AF. But in the 6-hour-100year design storm, the pond would overtop, cause flooding, and the storage at the pond and surrounding area would be 15 AF. Only the 10 AF design volume is counted as the "former design volume" for V_T.



EXAMPLE H

Refer to Example E of the Joint Powers Agreement

Assume

Pond "b" reduces outflow to 10% of inflow.

i.e. $\dfrac{Q_T\,(\text{outlet})\ 100\text{year}}{\Sigma Q_T\,(\text{inlet})\ 100\text{year}} = 0.1$

$Q_{E_5\text{-}100}$ = 100-year excess flow from City #5 = 100cfs

$Q_{E_5\text{-}10}$ = 10-year excess flow from City #5 = 70cfs

Then, for segments "c" and "e":

c: 100 year design : $Q_{E_5\text{-}100} = 100 \times .1 = 10$ cfs

e: 10 year design : $Q_{E_5\text{-}10} = 70 \times .1 = 7$ cfs

Assume

$Q_{D_{100}}$ for segment c = 50 cfs

$Q_{D_{10}}$ for segment e = 70 cfs

EXAMPLE H continued

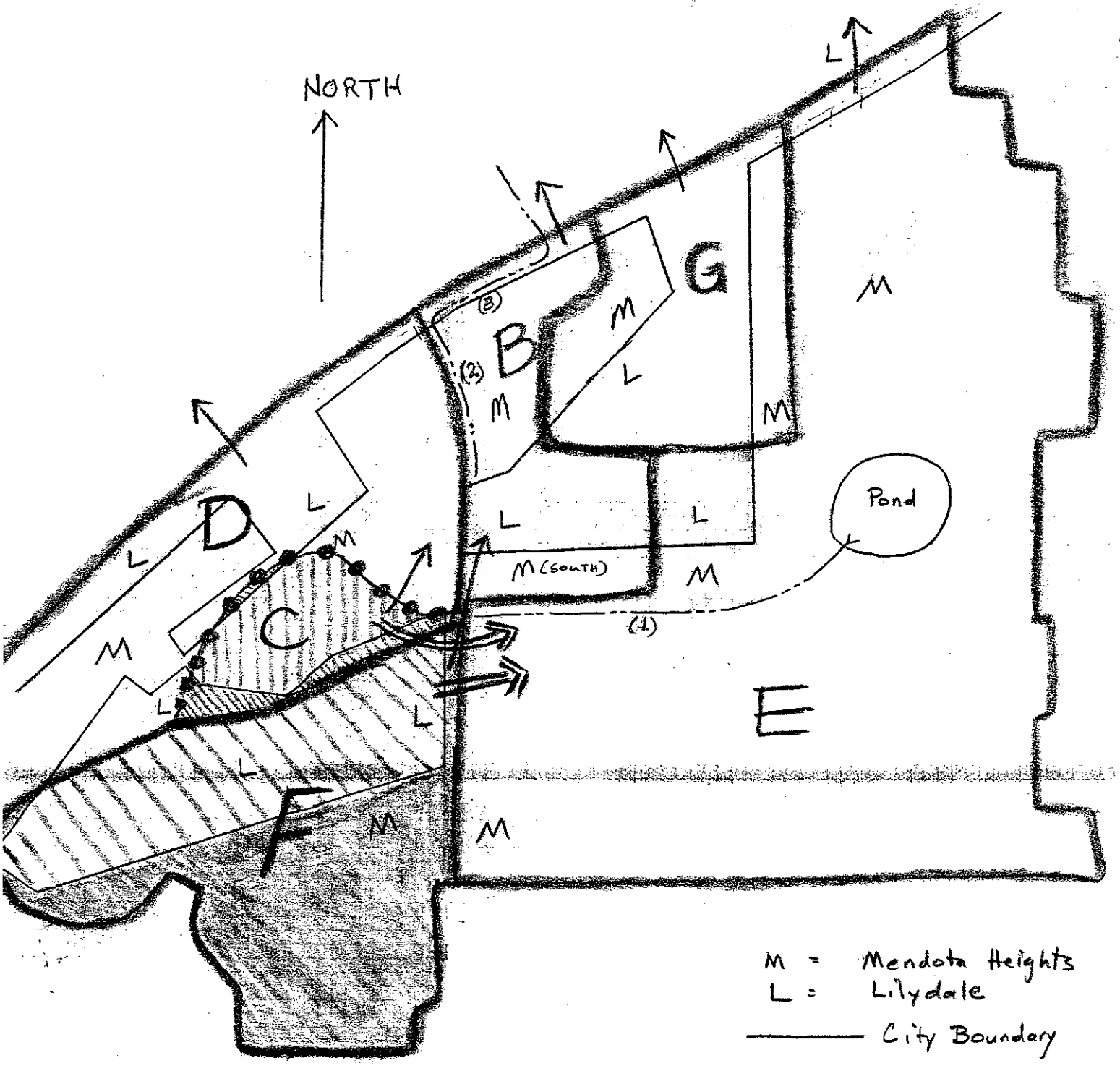
COST ALLOCATION

Segment "c", City #5 cost share = $\frac{10\,cfs}{50\,cfs}$ x Segment "c" Project Cost

= 0.20 X Segment "c" Project Cost

Segment "e", City #5 cost Share = $\frac{7\,cfs}{70\,cfs}$ x Segment "e" Project Cost

= 0.10 X Segment "e" Project Cost



M = Mendota Heights
L = Lilydale

City Boundary

Principal Watershed Divide

New Principal Watershed Divide as a result of Diversion

Original Flow Patter

EXAMPLE "I" Changed Flow Pattern as a result of Diversion

Portions of Lilydale diverted from B to E

Portions of Lilydale diverted from D to E

Portions of Mendota Heights diverted from B to E

Portions of Mendota Heights diverted from D to E

COST ALLOCATIONS, Segment "1" in Watershed E

Segment "1" serves Area C and Area F, which have been diverted into Area E. Because this is a diversion, there is no allowable flow attributable to any of Areas C or F diverted into Area E. The cost allocations for Segment "1" are in proportion to the flow contributions from the 2 communities from Areas C and F.

Q_{D_1} = design flow for segment "1" from Area C plus Area F.

$Q_{D_{1_L}}$ = design flow from Lilydale in Area C plus Area F.

$Q_{D_{1_M}}$ = design flow from Mendota Heights in Area C plus Area F.

$$\text{Lilydale Cost Share} = \frac{Q_{D_{1_L}}}{Q_{D_1}} \times \text{Project Cost for Segment "1"}$$

$$\text{Mendota Heights Cost Share} = \frac{Q_{D_{1_M}}}{Q_{D_1}} \times \text{Project Cost for Segment "1"}$$

COST ALLOCATIONS, Segment "2" in Watershed B

Area F (but not Area C) has been diverted out of Area B and into Area E. The allowable flow from Area F is still counted for cost allocation in Area B and the watersheds downstream of Area B. In addition, portions of both Mendota Heights and Lilydale contribute to Segment "2". Segment "2" is considered to be constructed entirely in Mendota Heights.

Q_{D_2} = design flow for segment "2"

$Q_{D_{M_S}}$ = design flow from the portion of Mendota Heights labeled "M (south)" in Area B

Q_{A_L} = allowable flow for Lilydale for segment "2"

Q_{E_L} = excess flow for Lilydale for segment "2"

EXAMPLE "I" continued

$$Q_{E_L} = Q_{D_2} - Q_{D_{M_S}} - Q_{A_L}$$

$$Q_{A_L} = Q_{A_{F_L}} + Q_{A_{B_L}}$$

$Q_{A_{F_L}}$ = allowable flow for that portion of Area F which is Lilydale.

$Q_{A_{B_L}}$ = allowable flow for that portion of Area B which is Lilydale

Assume: $Q_{D_2} = 20$ cfs

$Q_{D_{M_S}} = 6$ cfs

$Q_{A_{F_L}} = 12$ cfs

$Q_{A_{B_L}} = 6$ cfs

$$Q_{E_L} = 20_{cfs} - 6\,cfs - (12\,cfs + 6\,cfs) = -4\,cfs$$

Thus Lilydale has no excess flow in Segment "2".

Lilydale Cost Share = Zero Dollar.

Mendota Heights Cost Share = 100% of Project Cost for Segment "2".

(note - these are assumed values. The analysis of the actual case may lead to other conclusions.)

COST ALLOCATION, Segment "3" in Watershed B (and immediately downstream of Watershed B).

This case is similar to the cost allocation for Segment "2", except that Mendota Heights has an allowable flow, since segment "3" is constructed in Lilydale.

Q_{D_3} = design flow for segment "3".

Q_{D_L} = design flow for the portion of Lilydale in Area B.

Q_{A_M} = allowable flow for Mendota Heights for segment "3".

Q_{E_M} = excess flow for Mendota Heights for segment "3".

EXAMPLE "I" continued

$$Q_{E_M} = Q_{D_3} - Q_{D_L} - Q_{A_M}$$

$$Q_{A_M} = Q_{A_{F_M}} + Q_{A_{B_M}}$$

$Q_{A_{F_M}}$ = allowable flow for that portion of Area F which is Mendota Heights

$Q_{A_{B_M}}$ = allowable flow for that portion of Area B which is Mendota Heights

Assume:

$$Q_{D_3} = 40 \text{ cfs}$$
$$Q_{D_L} = 14 \text{ cfs}$$
$$Q_{A_{F_M}} = 15 \text{ cfs}$$
$$Q_{A_{B_M}} = 10 \text{ cfs}$$

Then:

$$Q_{A_M} = 15 \text{cfs} + 10 \text{cfs} = 25 \text{cfs}$$

$$Q_{E_M} = 40 \text{cfs} - 14 \text{cfs} - 25 \text{cfs} = 1 \text{cfs}$$

$$\text{Lilydale Cost Share} = \frac{Q_{D_3} - Q_{E_M}}{Q_{D_3}} \times \text{Project Cost for Segment "3"}$$

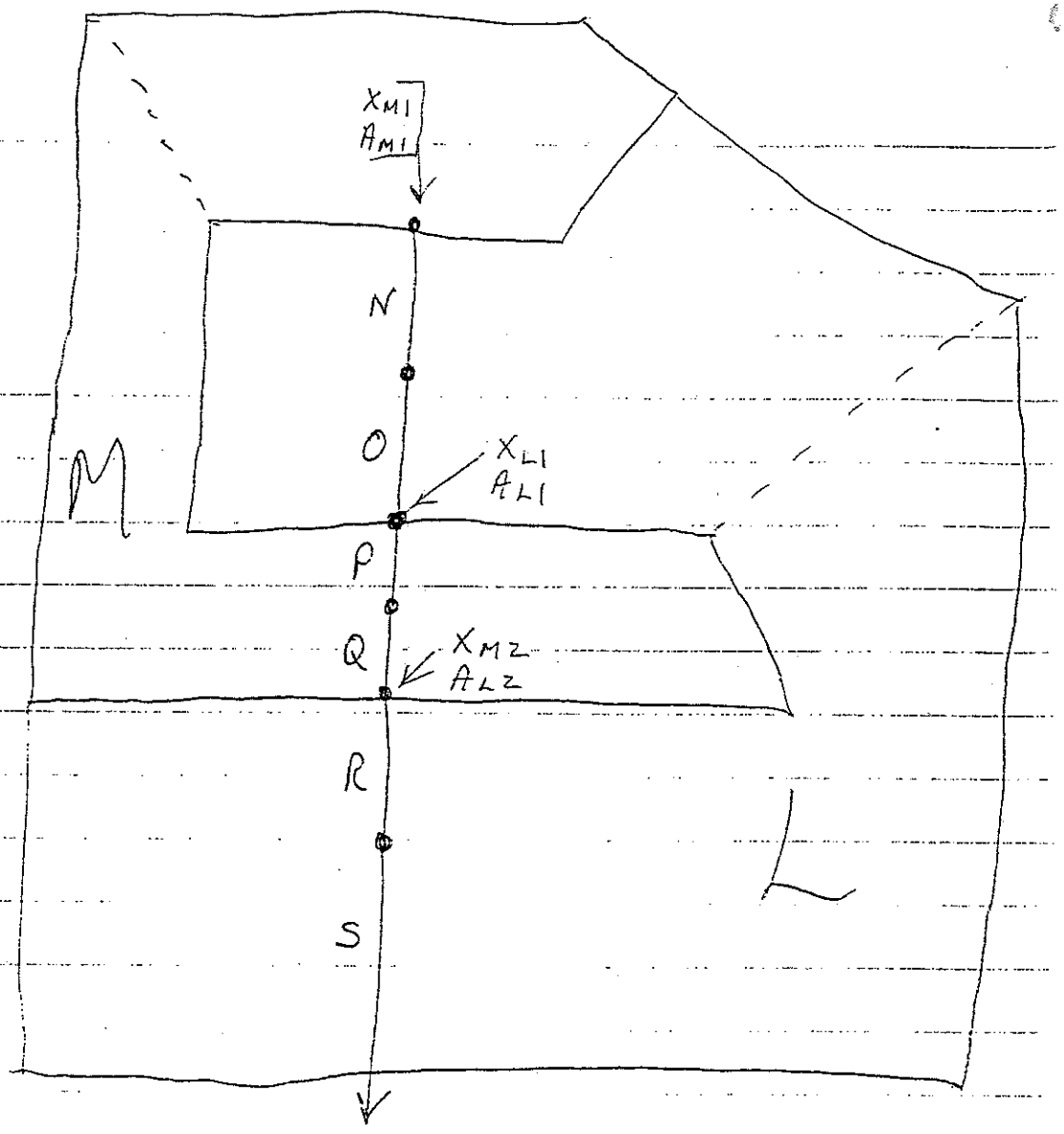
$$= \frac{40-1}{40} \times \text{Cost} = \frac{39}{40} \times \text{Project Cost, Seg. "3"}$$

$$\text{Mendota Heights Cost Share} = \frac{Q_{E_M}}{Q_{D_3}} \times \text{Project Cost for Segment "3"}$$

$$= \frac{1}{40} \times \text{Project Cost for Segment "3"}.$$

(note - these are assumed values. The analysis of the actual case may lead to other conclusions)

M = Community M
L = Community L
X = Excess Flow
A = Allowable Flow
C = Cost
D = Design Flow



Cost Shares

Section N $\quad M_N = C_N\left(\frac{X_{M1}}{D_N}\right) \qquad L_N = C_N\left(\frac{A_{M1}}{D_N}\right)$

Section O $\quad M_O = C_O\left(\frac{X_{M1}}{D_O}\right) \qquad L_O = C_O\left(\frac{A_{M1}}{D_O}\right)$

Section P $\quad M_P = C_P\left(\frac{D_P - X_{L1}}{D_P}\right) \qquad L_P = C_P\left(\frac{X_{L1}}{D_P}\right)$

Section Q $\quad M_Q = C_Q\left(\frac{D_Q - X_{L1}}{D_Q}\right) \qquad L_Q = C_Q\left(\frac{X_{L1}}{D_Q}\right)$

Section R $\quad M_R = C_R\left(\frac{X_{M1} + X_{M2}}{D_R}\right) \qquad L_R = C_R\left(\frac{D_R - X_{M1} - X_{M2}}{D_R}\right)$

Section S $\quad M_S = C_S\left(\frac{X_{M1} + X_{M2}}{D_S}\right) \qquad L_S = C_S\left(\frac{D_S - X_{M1} - X_{M2}}{D_S}\right)$

MEMORANDUM

TO: Lower Mississippi River Watershed Management Organization

FROM: James R. Langseth

DATE: June 12, 1992

RE: Allowable Flow, Summary of Understanding Based on the Discussions at the Meetings Held December 13, 1991 and May 15, 1992

These meetings addressed four topics.

1. Allowable flow for conveyance systems designed for 100-year frequency storms.

2. Allowable volume.

3. Cost apportionment downstream of ponds (detention basins).

4. Cost allocation principles for diversions where more than one city contributes flow.

These interpretations use the definitions for watershed, land use, and drainage system set forth in the March 9, 1988 Allowable Flow memorandum. The current memorandum provides an interpretation of the allowable flow for cases where the design is not based on a 10-year storm, as well as amplifying the principles to be used for diversion of drainage.

1. Allowable Flow for 100-Year Frequency Storm Design Conveyance Systems

The Joint Powers Agreement, Section 3, Subd. 3, states that the allowable flow is a rate an volume of flow according to the design criteria in Section 8, Subd. 6. Section 8, Subd. 6 provides that detention basins and open channel conveyance systems be designed for a 100-year return frequency storm.

Consistent with these provisions, for drainage systems for which the design criteria are 100-year return frequency precipitation events, the allowable flow shall be computed as a 100-year rate and volume flow.

The allowable rate of flow shall be computed by $Q = CIA$

where:

Q is the allowable flow rate in cubic feet per second.

C is the runoff coefficient, defined to be 0.15.

I is the 100-year return frequency rainfall intensity appropriate to the watershed time of concentrations, in inches per hour.

A is the watershed area in acres.

Excess flow is the 100-year design flow less the 100-year allowable flow.

This approach shall be applied for conveyance systems where the design is governed by 100-year return frequency events. This includes detention basin outlets, conveyance systems downstream of detention basins, open channels, and other conveyance that is designed for 100-year return frequency events. Similar logic would apply to any system for which the design criteria was neither 10-year or 100-year. See Example F for an illustration of a 100-year excess flow calculation.

2. Allowable Volume

The allowable volume is the total runoff volume from the design storm, for a watershed with the land use defined in the March 9, 1988 memorandum. Where the ponding in the upstream community is negligible, the allowable volume may be estimated as being in the same proportion to the design volume as the allowable flow is to the design flow.

In general, the allowable volume may be computed with the same techniques used to determine the design volume, provided the technique also accurately calculates the allowable discharge rate.

The excess volume is the difference between design and allowable volume.

Where there is upstream ponding, the volume of those ponds is deducted from the excess volume to the extent the upstream detention reduces the volume needed in downstream ponds. Thus, only the storage in upstream detention basins at the time of peak of the downstream detention basin may be used to reduce the excess volume from the upstream community. For instance, assume the peak elevation at a downstream community pond occurs at 6 hours. Assume the upstream community pond stores 10 acre-feet at its peak at 3 hours, but only 5 acre-feet at 6 hours. The "excess volume" from the upstream community would be reduced by 5 acre-feet to account for the storage. See Example G for an illustration of this case.

3. <u>Cost Apportionment Downstream of Ponds</u>

In the Joint Power Agreement, Exhibit A, page 9 of 9, the formula for adjustment of excess flow as a result of ponding is presented:

$$Q_{excess}(\text{outlet}) = Q_{excess}(\text{inlet}) \times \frac{Q_{total}(\text{outlet})}{\Sigma\, Q_{total}(\text{inlet})}$$

The proportioning $Q_{total}(\text{outlet})/\Sigma\, Q_{total}(\text{inlet})$ shall be computed on the same return frequency event used for the pond design. If the pond is designed for a 100-year event, the adjustment in excess flow through the pond shall be based on the 100-year outflow and inflow values. Thus, if a 10-year design governs cost sharing for construction downstream of a pond, the 10-year excess flow would be reduced as follows:

$$Q_{excess}\ 10\text{-year (outlet)} = Q_{excess}\ 10\text{-year (inlet)} \times \frac{Q_{total}\ 100\text{-year (outlet)}}{\Sigma\ Q_{total}\ 100\text{-year (inlet)}}$$

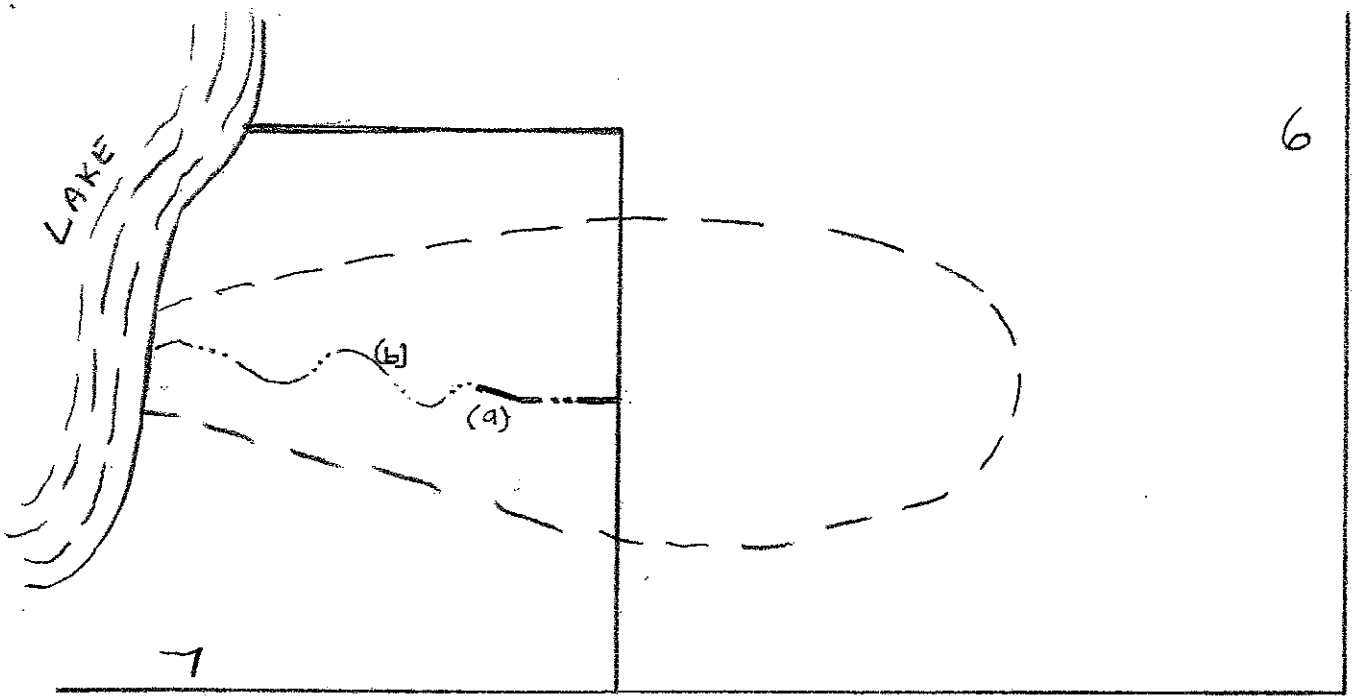
See Example H for an illustration of this case.

4. <u>Cost Allocation Principles for Diversion Where More Than One City Contributes Flow</u>

For diversion of water out of its current watershed, into a watershed to which it did not previously flow, there is no allowable flow associated with the diverted water. Consequently, the excess flow from the diverted area equals the design flow. If more than one city contributes water to the diversion, the excess flow from each community is their portion of the design flow from the diverted area. Thus, the cost allocation proportion for each city is their proportion of the design flow.

The "diversion in" is associated with an equal area of "diversion out" of another watershed. The cities retain their allowable flow in the watershed from which the area was "diverted out." This is illustrated for "diversion out" by one city on Page 6 of 9 of Exhibit A to the Joint Powers Agreement.

This principal was applied to the Lexington Avenue drainage case with Lilydale and Mendota Heights. The situation is illustrated conceptually in Example I.



Example F - Other than 10-year Design

Project: Construct storm sewer "a" and open channel "b" in City #7 to provide drainage for Cities #6 and #7 under fully developed conditions.

Cost Allocation:

City #6 Cost Share: $\frac{Q_{E6-10}}{Q_{D-10}}$ x Total Project Cost for "a"

$\frac{Q_{E6-100}}{Q_{D-100}}$ x Total Project Cost for "b"

Q_{E6-10} = 10 year excess flow from City #6 $= Q_{D6-10} - Q_{A6-10}$

Q_{D6-10} = 10 year design flow from City #6

Q_{A6-10} = 10 year allowable flow from City #6

Q_{D-10} = 10 year design flow for storm sewer "a"

Q_{E6-100} = 100 year excess flow from City #6 $= Q_{D6-100} - Q_{A6-100}$

Q_{D6-100} = 100 year design flow from City #6

Q_{A6-100} = 100 year allowable flow from City #6

Q_{D-100} = 100 year design flow for open channel "b"

Example F- Continued

City #7 Cost Share: Total Project Cost - (City #6 Cost Share)

Sample Calculations

City #6 - Watershed area = 100 acres

Q_{D6-10} = .40 x 2"/hr x 100 = 80 cfs

Q_{A6-10} = .15 x 2"/hr x 100 = 30 cfs

Q_{E_6-10} = 80-30 = 50 cfs

1. City #6 cost share for storm sewer "a" = $\frac{50 \text{ cfs}}{80 \text{ cfs}}$ x "a" Project Cost =

= 0.625 x "a" Project Cost.

2. City #6 cost share for open channel "b":

Q_{D6-100} = .40 x 4"/hr x 100 = 160 cfs

Q_{A6-100} = .15 x 4"/hr x 100 = 60 cfs

Q_{E_6-100} = 160 - 60 = 100 cfs

Assume Q_{D-100} for channel "b" = 200 cfs

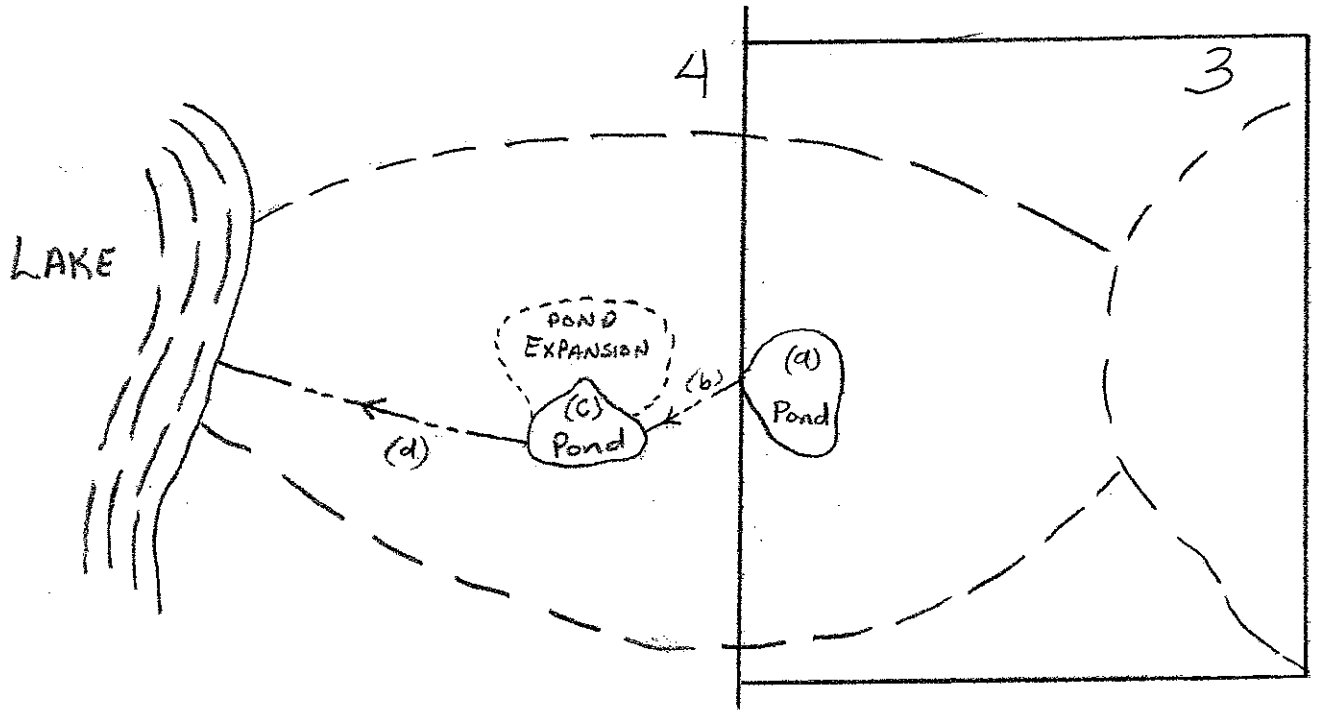
City #6 cost share = $\frac{100 \text{ cfs}}{200 \text{ cfs}}$ x "b" Project Cost

= 0.5 x "b" Project Cost

Summary of Costs:

Segment "a" (10 year design)	City #6 Cost Share = 0.625 x Project Cost for "a" City #7 Cost Share = 0.375 x Project Cost for "a"
Segment "b" (100 year design)	City #6 Cost Share = 0.5 x Project Cost for "b" City #7 Cost Share = 0.5 x Project Cost for "b"

EXAMPLE G



EXAMPLE G : ALLOWABLE VOLUME

Pond "c" is to be expanded from a 10 acre-foot (AF) storage capacity to a 50 AF storage capacity detention basin. The critical design storm for Pond "c" will be the 6-hour 100 year return frequency rainfall.

Background & Assumptions:

Q_{D_b-100} = Design flow (100 year) in segment b = 50 cfs

Q_{A_3-100} = Allowable flow (100 year) from City #3 = 60 cfs
i.e. .15 x 4 in/hr x 100 acres = 60 cfs

Q_{E_3-100} = Excess flow (100 year) from City #3

$= Q_{D_6-100} - Q_{A_3-100} = 50 - 60 = -10$ cfs

Therefore there is <u>no</u> excess flow from City #3, and City #3 does <u>not</u> participate financially in conveyance system improvements or conveyance system maintenance in the downstream community, City #4.

City #3 may nevertheless be obligated to share in

EXAMPLE "G" continued

the Pond expansion costs and maintenance costs of the pond expansion (not of the whole pond).

Excess Volume Calculation

$$V_{E_3} = V_{D_3} - V_{A_3} - V_{P_3}$$

V_{E_3} = Excess volume, from City #3, for the Pond "c" critical design storm (i.e. 100year-6 hour storm)

V_{D_3} = Design volume of runoff from City #3 for the Pond "c" critical design storm.

V_{A_3} = Allowable volume of runoff from City #3 for the Pond "c" critical design storm.

V_{P_3} = Volume of runoff stored in ponds in City #3 at the time of the peak volume stored in Pond "c" for the Pond "c" critical design storm.

Assume:

V_{D_3} = 75 AF

V_{A_3} = 35 AF

V_{P_3} = 10 AF. Say Pond "a" was designed to store 30 AF for its critical storm - a 1-hour 100 year storm. But, say the time of peak at Pond "c" is 6 hours later, so only 10 AF remains stored in Pond "a" at the time of peak in Pond "c".

$$V_{E_3} = 75\text{ AF} - 35\text{ AF} - 10\text{ AF} = 30\text{ AF}$$

Thus, although there is no excess flow (flowrate) from City #3, there is excess volume from City #3.

The allowable volume should be calculated using the same methodology as used to calculate the design volume, but the land use should be converted to 100% turf or pasture in good condition.

Example "G" continued

COST ALLOCATION

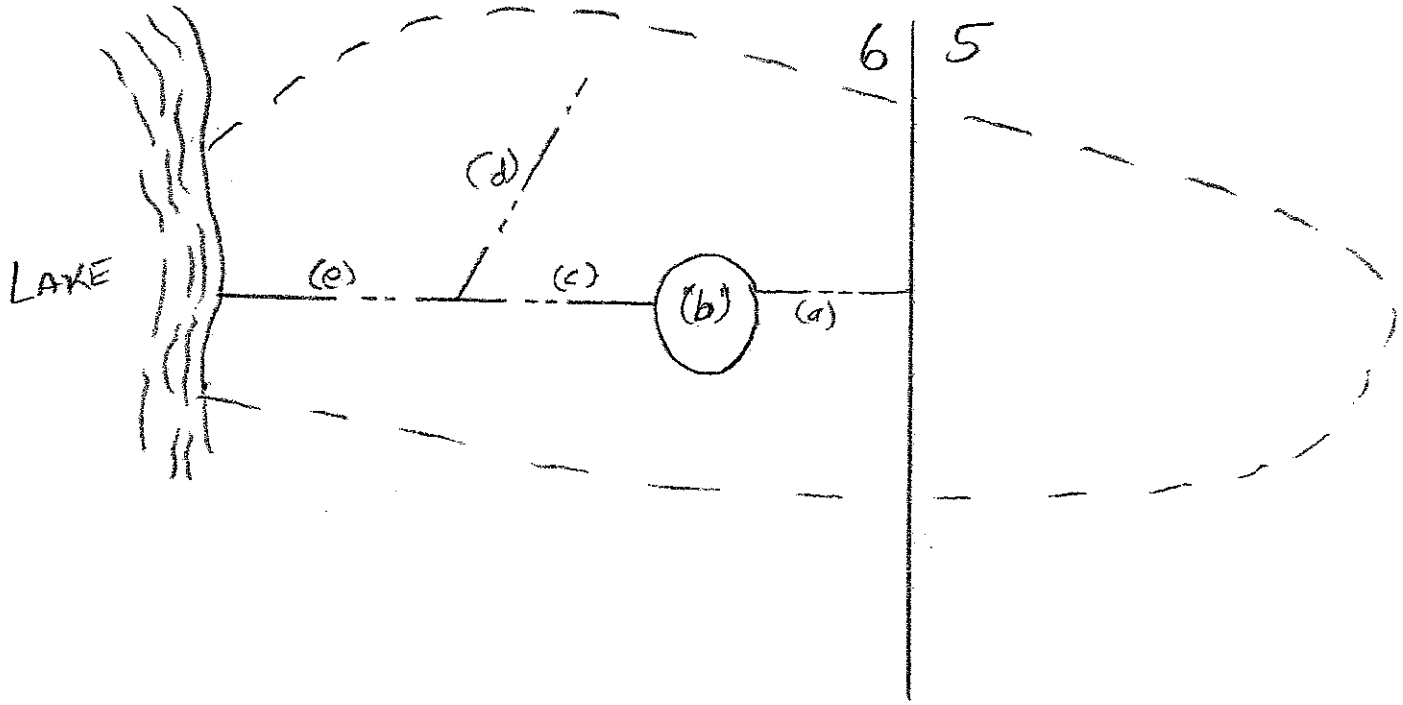
Cost share for Pond "c" expansion.

City #3 cost share: $\frac{V_{E_3}}{V_T}$ x Project Cost for Pond "c" expansion

where V_T = the design increase in storage volume of Pond "c" for the critical storm. Note - this does not include the former design volume of the pond. The former design volume of the pond (before expansion) should be computed as the volume of detention storage below the 'design level' for the former pond, for the Pond "c" expansion design storm at the time of peak for the Pond "c" expansion.

For instance, say former Pond "C" was designed for a 25-year storm, and held 10 AF. But in the 6-hour-100year design storm, the pond would overtop, cause flooding, and the storage at the pond and surrounding area would be 15 AF. Only the 10AF design volume is counted as the "former design volume" for V_T.

Note that for maintenance costs, the City #3 share applies only to the pond expansion, not to maintenance of the whole pond.



EXAMPLE H

Refer to Example E of the Joint Powers Agreement

Assume

Pond "b" reduces outflow to 10% of inflow.

i.e. $\dfrac{Q_T\,(\text{outlet})\ 100\text{year}}{\Sigma Q_T\,(\text{inlet})\ 100\text{year}} = 0.1$

$Q_{E_5\text{-}100}$ = 100-year excess flow from City #5 = 100cfs

$Q_{E_5\text{-}10}$ = 10-year excess flow from City #5 = 70cfs

Then, for segments "c" and "e":

c: 100 year design : $Q_{E_5\text{-}100} = 100 \times .1 = 10$ cfs

e: 10 year design : $Q_{E_5\text{-}10} = 70 \times .1 = 7$ cfs

Assume

$Q_{D_{100}}$ for segment c = 50 cfs

$Q_{D_{10}}$ for segment e = 70 cfs

EXAMPLE H continued

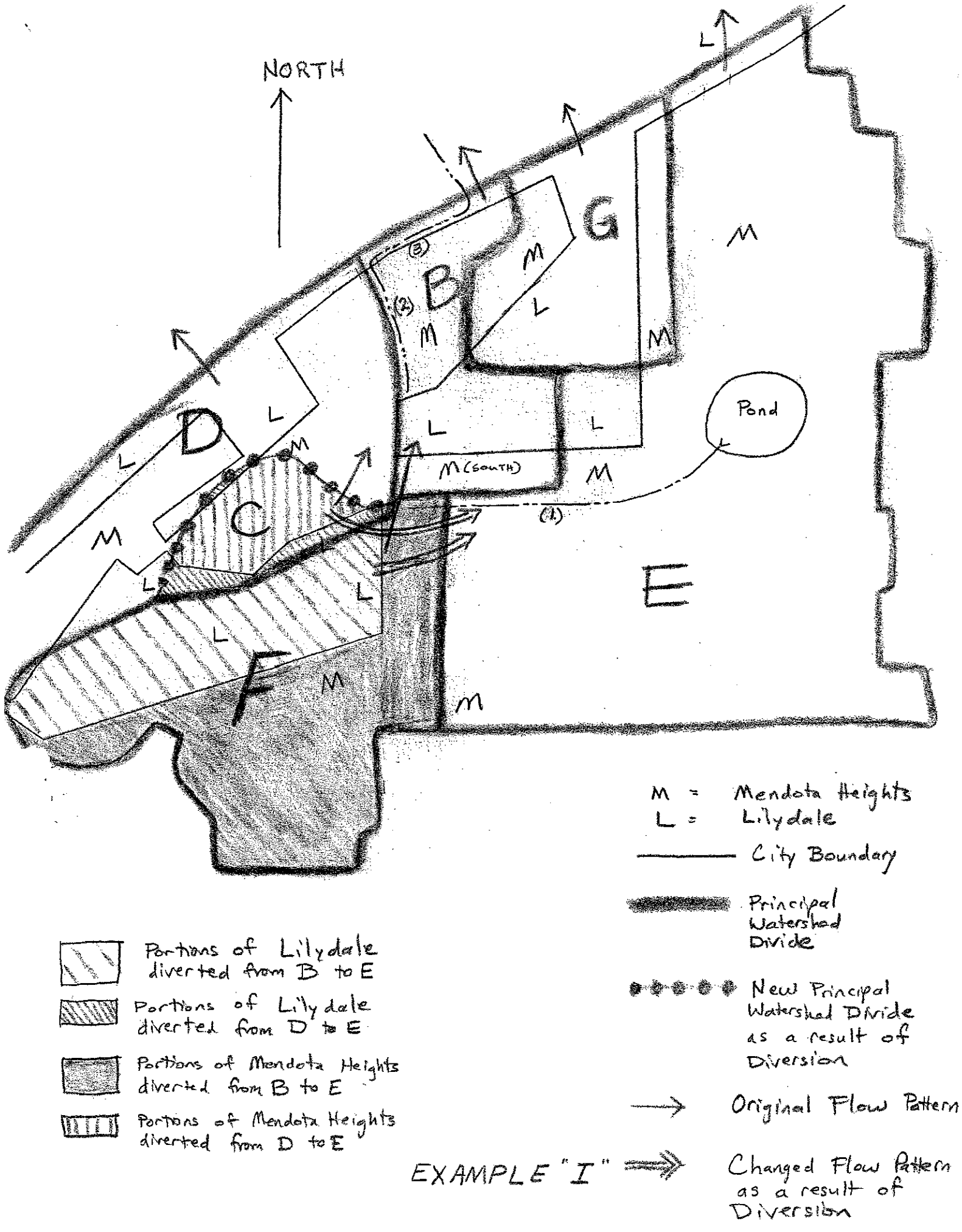
COST ALLOCATION

Segment "c", City #5 cost share = $\frac{10\,cfs}{50\,cfs}$ x Segment "c" Project Cost

= 0.20 X Segment "c" Project Cost

Segment "e", City #5 cost Share = $\frac{7\,cfs}{70\,cfs}$ x Segment "e" Project Cost

= 0.10 X Segment "e" Project Cost


NORTH
L
G
M
B
M
L
(3)
(2)
M
M
D
L
L
L
L
Pond
M
M (SOUTH)
M
(1)
C
M
L
L
L
E
F
M
M
M = Mendota Heights
L = Lilydale
City Boundary
Principal Watershed Divide
New Principal Watershed Divide as a result of Diversion
Original Flow Pattern
EXAMPLE "I"
Changed Flow Pattern as a result of Diversion
Portions of Lilydale diverted from B to E
Portions of Lilydale diverted from D to E
Portions of Mendota Heights diverted from B to E
Portions of Mendota Heights diverted from D to E

COST ALLOCATIONS, Segment '(1)' in Watershed E

Segment '(1)' serves Area C and Area F, which have been diverted into Area E. Because this is a diversion, there is no allowable flow attributable to any of Areas C or F diverted into Area E. The cost allocations for Segment '(1)' are in proportion to the flow contributions from the 2 communities from Areas C and F.

Q_{D_1} = design flow for segment '(1)' from Area C plus Area F.

$Q_{D_{1_L}}$ = design flow from Lilydale in Area C plus Area F.

$Q_{D_{1_M}}$ = design flow from Mendota Heights in Area C plus Area F.

$$\text{Lilydale Cost Share} = \frac{Q_{D_{1_L}}}{Q_{D_1}} \times \text{Project Cost for Segment '(1)'}$$

$$\text{Mendota Heights Cost Share} = \frac{Q_{D_{1_M}}}{Q_{D_1}} \times \text{Project Cost for Segment '(1)'}$$

COST ALLOCATIONS; Segment '(2)' in Watershed B

Area F (but not Area C) has been diverted out of Area B and into Area E. The allowable flow from Area F is still counted for cost allocation in Area B and the watersheds downstream of Area B. In addition, portions of both Mendota Heights and Lilydale contribute to Segment '(2)'. Segment '(2)' is considered to be constructed entirely in Mendota Heights.

Q_{D_2} = design flow for segment "2"

$Q_{D_{M_S}}$ = design flow from the portion of Mendota Heights labeled "M (south)" in Area B

Q_{A_L} = allowable flow for Lilydale for segment "2"

Q_{E_L} = excess flow for Lilydale for segment "2"

EXAMPLE "I" continued

$$Q_{E_L} = Q_{D_2} - Q_{D_{M_S}} - Q_{A_L}$$

$$Q_{A_L} = Q_{A_{F_L}} + Q_{A_{B_L}}$$

$Q_{A_{F_L}}$ = allowable flow for that portion of Area F which is Lilydale.

$Q_{A_{B_L}}$ = allowable flow for that portion of Area B which is Lilydale

Assume: $Q_{D_2} = 20$ cfs

$Q_{D_{M_S}} = 6$ cfs

$Q_{A_{F_L}} = 12$ cfs

$Q_{A_{B_L}} = 6$ cfs

$$Q_{E_L} = 20\text{cfs} - 6\text{cfs} - (12\text{cfs} + 6\text{cfs}) = -4\text{ cfs}$$

Thus Lilydale has no excess flow in Segment '(2)'.

Lilydale Cost Share = Zero Dollar.

Mendota Heights Cost Share = 100% of Project Cost for Segment '(2)'.

(note - these are assumed values. The analysis of the actual case may lead to other conclusions.)

COST ALLOCATION, Segment '(3)' in Watershed B (and immediately downstream of Watershed B).

This case is similar to the cost allocation for Segment '(2)', except that Mendota Heights has an allowable flow, since segment '(3)' is constructed in Lilydale.

Q_{D_3} = design flow for segment '(3)'.

Q_{D_L} = design flow for the portion of Lilydale in Area B.

Q_{A_M} = allowable flow for Mendota Heights for segment '(3)'.

Q_{E_M} = excess flow for Mendota Heights for segment '(3)'.

EXAMPLE "I" continued

$$Q_{E_m} = Q_{D_3} - Q_{D_L} - Q_{A_m}$$

$$Q_{A_m} = Q_{A_{F_m}} + Q_{A_{B_m}}$$

$Q_{A_{F_m}}$ = allowable flow for that portion of Area F which is Mendota Heights

$Q_{A_{B_m}}$ = allowable flow for that portion of Area B which is Mendota Heights

Assume:

$$Q_{D_3} = 40 \text{ cfs}$$
$$Q_{D_L} = 14 \text{ cfs}$$
$$Q_{A_{F_m}} = 15 \text{ cfs}$$
$$Q_{A_{B_m}} = 10 \text{ cfs}$$

Then:

$$Q_{A_m} = 15\text{cfs} + 10\text{cfs} = 25\text{cfs}$$

$$Q_{E_m} = 40\text{cfs} - 14\text{cfs} - 25\text{cfs} = 1\text{cfs}$$

$$\text{Lilydale Cost Share} = \frac{Q_{D_3} - Q_{E_m}}{Q_{D_3}} \times \text{Project Cost for Segment '(3)'}$$

$$= \frac{40-1}{40} \times \text{Cost} = \frac{39}{40} \times \text{Project Cost, Seg. '(3)'}$$

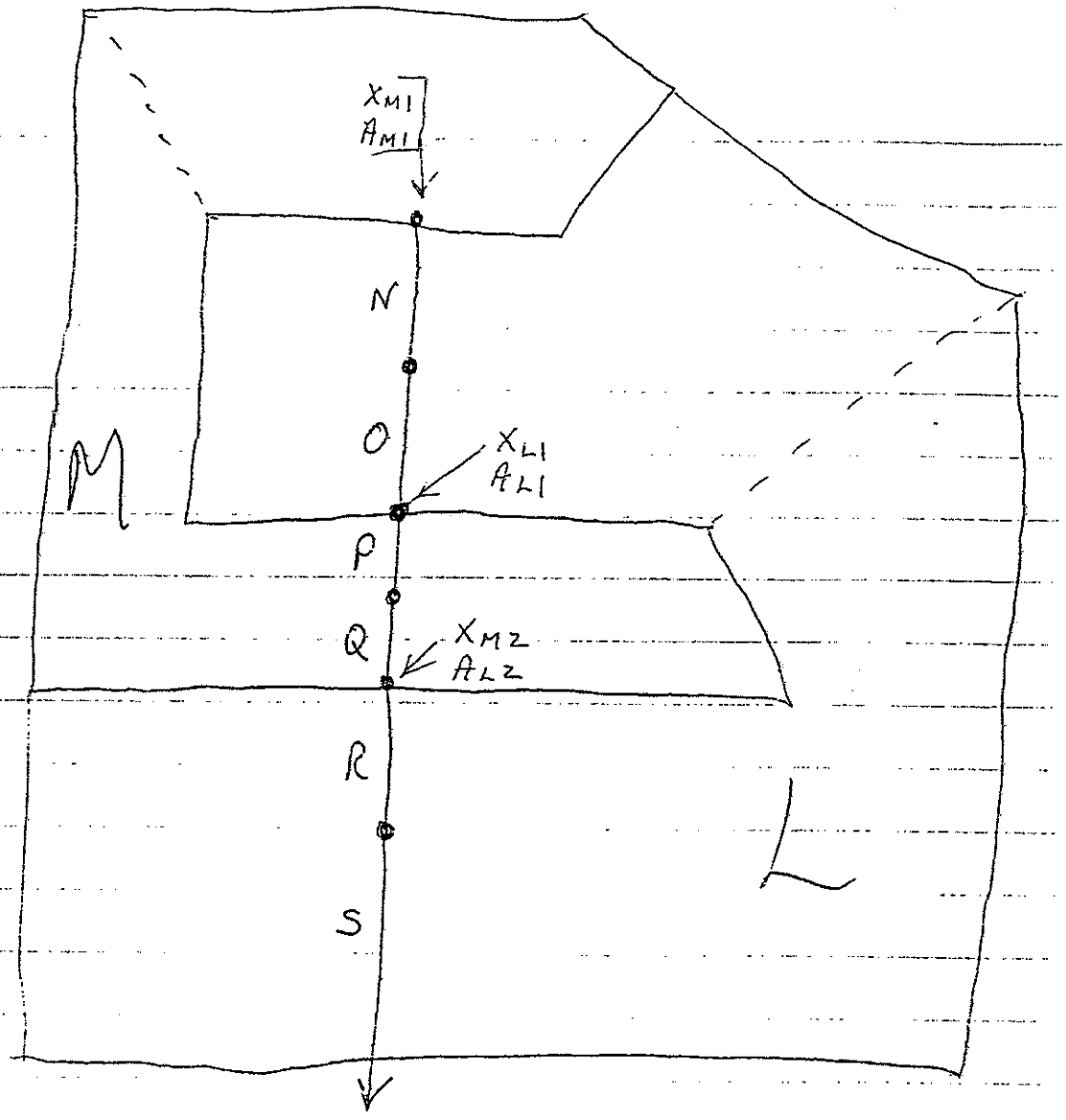
$$\text{Mendota Heights Cost Share} = \frac{Q_{E_m}}{Q_{D_3}} \times \text{Project Cost for Segment '(3)'}$$

$$= \frac{1}{40} \times \text{Project Cost for Segment '(3)'}.$$

(note - these are assumed values. The analysis of the actual case may lead to other conclusions)

The attached sheet, Appendix A, presents cost allocation for the case of no diversion, but flow re-entering communities after it has once left them.

M = COMMUNITY M
L = COMMUNITY L
X = EXCESS FLOW
A = ALLOWABLE FLOW
C = COST
D = DESIGN FLOW



COST SHARES

SECTION N $\quad M_N = C_N\left(\frac{X_{M1}}{D_N}\right) \qquad L_N = C_N\left(\frac{A_{M1}}{D_N}\right)$

SECTION O $\quad M_O = C_O\left(\frac{X_{M1}}{D_O}\right) \qquad L_O = C_O\left(\frac{A_{M1}}{D_O}\right)$

SECTION P $\quad M_P = C_P\left(\frac{D_P - X_{L1}}{D_P}\right) \qquad L_P = C_P\left(\frac{X_{L1}}{D_P}\right)$

SECTION Q $\quad M_Q = C_Q\left(\frac{D_Q - X_{L1}}{D_Q}\right) \qquad L_Q = C_Q\left(\frac{X_{L1}}{D_Q}\right)$

SECTION R $\quad M_R = C_R\left(\frac{X_{m1} + X_{m2}}{D_R}\right) \qquad L_R = C_R\left(\frac{D_R - X_{m1} - X_{m2}}{D_R}\right)$

SECTION S $\quad M_S = C_S\left(\frac{X_{m1} + X_{m2}}{D_S}\right) \qquad L_S = C_S\left(\frac{D_S - X_{m1} - X_{m2}}{D_S}\right)$

APPENDIX C

GEOLOGIC COLUMN

SYSTEM	GEOLOGIC UNIT	THICKNESS (Feet)	LITHOLOGY
Quaternary	Alluvium	0-150	
	Glacial Drift	0-400	
Ordovician	Decorah Shale	0-95	Decorah-Platteville Aquifer
	Platteville Limestone	30-50	
	St. Peter Sandstone	140-160	St. Peter Aquifer
	Shakopee Dolomite	35-60	Prairie Du Chien-Jordan Aquifer
	New Richmond Sandstone	0-10	
	Oneota Dolomite	70-90	
Cambrian	Jordan Sandstone	80-105	
	St. Lawrence Formation	35-70	
	Franconia Sandstone	100-200	Franconia-Galesville Aquifer
	Ironton - Galesville Sandstones	250-400	
	Eau Claire Formation		
	Mount Simon Sandstone		Mount Simon-Hinckley Aquifer
Precambrian	Hinckley Sandstone	75-175	

SOURCE: United States Geological Survey

Figure 2
GEOLOGIC COLUMN

APPENDIX D

WATERBODY CLASSIFICATION INVENTORY FROM THE MPCA (8/23/10)

ID_NoBay	Acres	PWI	Name	**Waterbody Type** (deep lake, shallow lake, wetland, pond)	Notes
19-0079	107	lake	**Pickerel**	shallow lake	11 ft max depth; 100% littoral
19-0080	107	lake	**Rogers**	shallow lake	8 ft max depth; 97% littoral; fish stocked
19-0052	61	lake	**Schmitt**		
19-0050	45	lake	**Sunfish**	deep lake	32 ft max depth (from lake depth map)
19-0046	24	lake	**Dickman**		
19-0042	22	lake	**Marcott**	deep lake	33 ft max depth (from lake depth map)
19-0047	22	lake	**Hornbean**	shallow Lake	waterbody type P
19-0041	20	lake	**Marcott**	deep lake	27 ft max depth; 95% littoral
19-0103	18	lake			
19-0035	17	lake			
19-0049	15	lake	**Unnamed**		
19-0051	14	lake	**Horseshoe**	shallow lake	
19-0034	14	lake	**Unnamed**		
19-0241	13	wetland	**Unnamed**		
19-0039	12	wetland	**Marcott**		
19-0037	11	lake	**Unnamed (Simley)**	shallow lake	17 ft max depth; fish stocked; waterbody type P
19-0038	10	lake	**Unnamed**		
19-0043	9	lake			
19-0102	9	wetland			
19-0053	9	wetland	**Unnamed**		
19-0040	8	wetland	**Marcott**		
19-0296	8	wetland	**Unnamed**		
19-0272	8	wetland			
19-0233	8	wetland			
19-0245	7	wetland	**Unnamed (Gun Club)**		DNR says 4 acres
19-0240	7	wetland			
19-0048	7	wetland	**Thompson**	shallow lake	8 ft max depth
19-0093	6	wetland			
19-0227	6	wetland	**Unnamed**	shallow lake	waterbody type W
19-0084	6	wetland	**Lily**		
19-0295	6	wetland	**Unnamed**		
19-0234	6	wetland	**Unnamed**		
19-0263	5	wetland	**Unnamed**		
19-0228	5	wetland			
19-0281	5	wetland			
19-0243	5	wetland			
19-0096	5	wetland			
19-0232	5	wetland	**Unnamed**		
19-0303	4	wetland			

19-0091	4	lake	**Marthaler Pond**		6 ft max depth
19-0249	4	wetland			
19-0284	4	wetland			
19-0086	4	lake			
19-0267	4	wetland	**Unnamed (IGH City Hall Pond)**		DNR says 13.5 acres; 20% littoral; 17 ft max depth; fish stocked
19-0095	4	wetland	**Unnamed (Seidl)**	shallow lake	waterbody type W
19-0235	4	wetland			
19-0270	4	wetland			
19-0304	3	wetland			
19-0264	3	wetland			
19-0242	3	wetland			
19-0282	3	wetland			
19-0277	3	wetland			
19-0276	3	wetland			
19-0108	3	wetland			
19-0237	3	wetland			
19-0265	3	wetland			
19-0236	3	wetland			
19-0269	3	wetland			
19-0087	3	lake			
19-0297	3	wetland			
19-0229	3	wetland			
19-0310	3	wetland			
19-0260	3	wetland			
19-0279	3	wetland			
19-0231	3	wetland			
19-0305	3	wetland			
19-0244	2	wetland			
19-0306	2	wetland			
19-0238	2	wetland			
19-0101	2	wetland			
19-0088	2	wetland			
19-0287	2	wetland			
19-0268	2	wetland			
19-0089	2	lake			
19-0098	2	wetland			
19-0274	2	wetland			
19-0094	2	wetland			
19-0239	2	wetland			
19-0097	2	wetland			
19-0271	2	wetland			
19-0044	2	not protected			

19-0266	2	wetland			
19-0278	2	wetland			
19-0085	1	wetland	**Mud**		
19-0100	1	wetland			
19-0246	1	wetland			
19-0104	1	wetland			
19-0099	0	wetland			

notes are information from DNR lake finder unless otherwise noted
waterbodies are usually classified as lakes if they are greater than 10 acres

APPENDIX E

WATER QUALITY MONITORING INFORMATION

Sunfish Lake [Sunfish Lake] (19-0050) *City of Sunfish Lake*

Sunfish Lake is located in the City of Sunfish Lake (Dakota County). The lake has a surface area of 49 acres and a maximum depth of 9.8 m (32 ft).

During each sampling event the lake was monitored for total phosphorus (TP), chlorophyll-a (CLA), and total kjeldahl nitrogen (TKN), and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

2009 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	24.6	12.0	36.0	B
CLA (µg/l)	13.3	1.6	43.0	B
Secchi (m)	2.6	1.1	5.5	B
TKN (mg/l)	0.78	0.58	1.00	
			Lake Grade	B

The lake received a lake grade of B for 2009, which is the best lake grade yet received in its limited monitoring history. Additional years of monitoring are suggested for continuing to build the water quality database so as to better understand the lake's water quality and determine potential water quality trends.

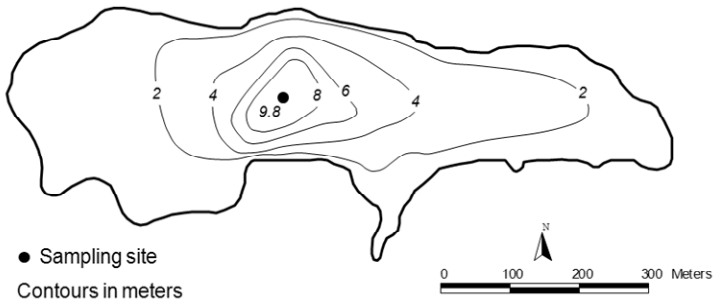
Throughout the monitoring period, the volunteer's opinions of the lake's physical condition and recreational suitability were ranked on a 1-to-5 scale. These user perception rankings are shown on the following page.

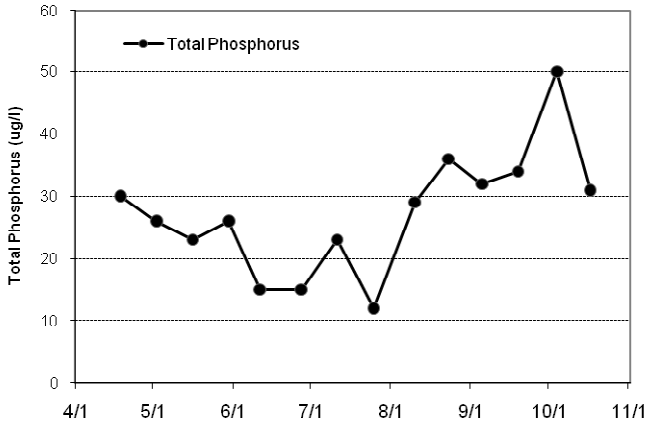
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Brian Johnson of the Metropolitan Council at (651) 602-8743 or brian.johnson@metc.state.mn.us.

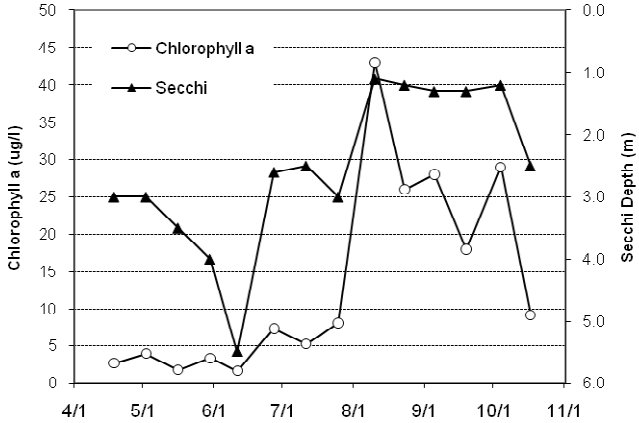
Sunfish Lake

Sunfish Lake, Dakota Co.

Lake ID: 190050-00
WMO: Lower Mississippi River
Volunteer: Dick Bancroft

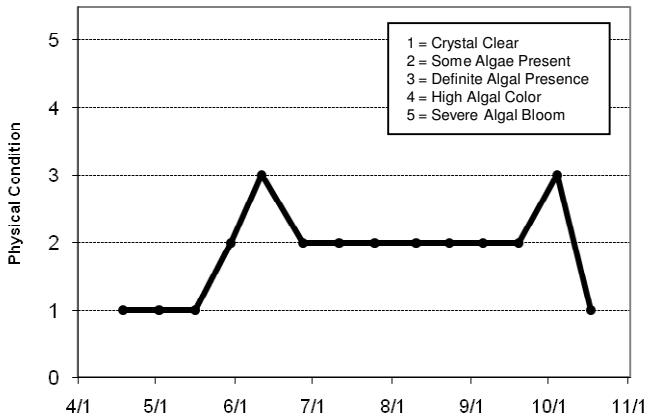






2009 Data

DATE	Surf Tmp (ºC)	Bot Tmp (ºC)	Surf DO (mg/L)	Bot DO (mg/L)	CLA (µg/L)	Surf TP (µg/L)	Bot TP (µg/L)	Secchi (m)	PC	RS
4/18	15.2				2.6	30		3.0	1	1
5/2	16.3				3.9	26		3.0	1	1
5/16	15.5				1.7	23		3.5	1	1
5/30	19.8				3.3	26		4.0	2	1
6/11	18.4				1.6	15		5.5	3	3
6/27	26.2				7.3	15		2.6	2	3
7/11	24.6				5.2	23		2.5	2	3
7/25	23.6				8.1	12		3.0	2	1
8/10	24.9				43	29		1.1	2	1
8/23	22.6				26	36		1.2	2	1
9/5	22.7				28	32		1.3	2	1
9/19	24.1				18	34		1.3	2	1
10/4	12.7				29	50		1.2	3	1
10/17	8.6				9.2	31		2.5	1	1



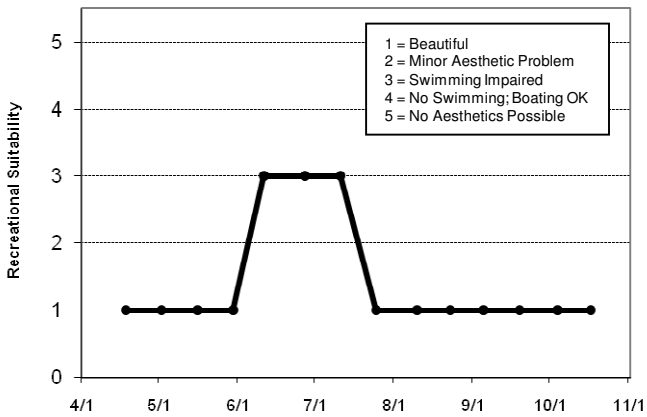
Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total Phosphorus												
Chlorophyll a												
Secchi Depth					C	C	C					C
Lake Grade												

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total Phosphorus												
Chlorophyll a												
Secchi Depth												
Lake Grade												

Year	2004	2005	2006	2007	2008	2009
Total Phosphorus			C	C	C	B
Chlorophyll a			C	C	C	B
Secchi Depth			D	C	C	B
Lake Grade			**C**	**C**	**C**	**B**

Source: Metropolitan Council and STORET data



Minnesota Pollution Control Agency

Connection Failure

Physical Information

Name: Sunfish
DNR Lake ID number: 19-0050
County: DAKOTA
Location from nearest town: AT SUNFISH LAKE (TOWN)
Ecoregion: NCHF
Basin: UM
Hydrologic Unit Code: 7010206
Surface Area: 45.077 (acres)
Maximum depth: 32 (feet)
Water Body Type: P

Latitude/Longitude: 44.87611111/-93.09777778
UTMx/UTMy: 492282/4969189

Lake Water Quality Assessment

This summary is based on available summer (June through September) data in STORET (STOF the national water quality data repository developed by the United States Environmental Protec Agency. All water quality data collected by MPCA or received from external groups is placed in STORET.) collected between 1999 and 2008.

Data Quality: excellent
Aquatic Recreation Use Support: Non-supporting Lakes are worse than (exceed) the aquatic recrea support thresholds with sufficient data to make an assessment for aquatic recreation use (at least 10 T Chl-a, and 10 Secchi). These lakes appear on the 303(d) Impaired Waters List.

Lake Water Quality Data Summary

Total Phosphorus Mean: 48.84615385 ppb (parts per billion)
Total Phosphorus Standard Error: 4.588511509 ppb
Total Phosphorus # of Observations: 26

Chlorophyll-a Mean: 31.52093023 ppb
Chlorophyll-a Standard Error: 3.437155392 ppb
Chlorophyll-a # of Observations: 43

Secchi Disk Mean: 1.296153846 meters
Secchi Disk Standard Error: 0.153771136 meters
Secchi Disk # of Observations: 26
www.pca.state.mn.us/water/clmp.html

Alkalinity Mean: ppm (parts per million)
Color Mean: Platinum-cobalt Units
Carlson Trophic Status for Total Phosphorus: 60.22470275
Carlson Trophic Status for Chlorophyll-a: 64.45089393
Carlson Trophic Status for Secchi Disk: 56.26202728
Overall Trophic Status: E
(O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic)

See the Difference! **Oligotrophic** vs. **Hypereutrophic**

Watch how lakes change over the summer.

Compare this lake to reference lakes or all assessed lakes.

Transparency *Chlorophyll-a* *Total Phosphorus*

If you have suggestions on how we can improve this site, or if you have questions or problems, please contact us.
If you have technical questions or problems with this site, contact webmaster@pca.state.mn.us
Minnesota Pollution Control Agency, 520 Lafayette Road, St. Paul, MN 55155-4194
Phone: 651-296-6300, 800-657-3864; 24-hour emergency number: 651-649-5451 or 800-422-0798; TTY: 651-282-5332, TTY 24-hoı
651-297-5353 or 800-627-3529 dione

Horseshoe Lake [Sunfish Lake] (19-0051) *City of Sunfish Lake*

Horseshoe Lake is an approximate 16-acre lake located within the City of Sunfish Lake (Dakota County). There is very little morphological information available for the lake.

On each sampling day the lake was monitored for total phosphorus (TP), chlorophyll-a (CLA), total kjeldahl nitrogen (TKN), and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The resulting data and graphs appear on the next page.

2009 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	25.6	16.0	42.0	B
CLA (µg/l)	4.5	2.7	10.0	A
Secchi (m)	2.3	2.0	3.2	B*
TKN (mg/l)	0.69	0.55	0.88	
			Lake Grade	B

* see discussion below

The lake's 2009 lake water quality grade was a B, which was similar to last year's lake grade. However, the water clarity was better than the Secchi depth data would suggest since most of the measurements were made with the Secchi disk visible on the lake bottom. Therefore the Secchi depth mean and grade given above underestimate the actual water clarity. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

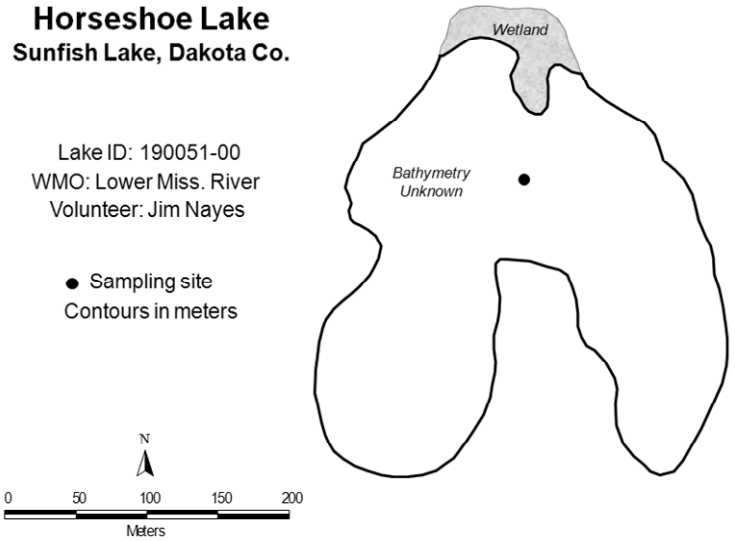
Throughout the monitoring period, the volunteer's opinions of the lake's physical condition and recreational suitability were ranked on a 1-to-5 scale. These user perception rankings are shown on the following page.

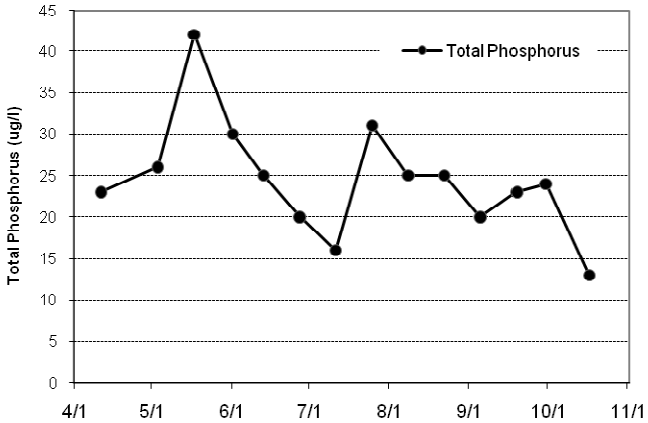
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Brian Johnson of the Metropolitan Council at (651) 602-8743 or brian.johnson@metc.state.mn.us.

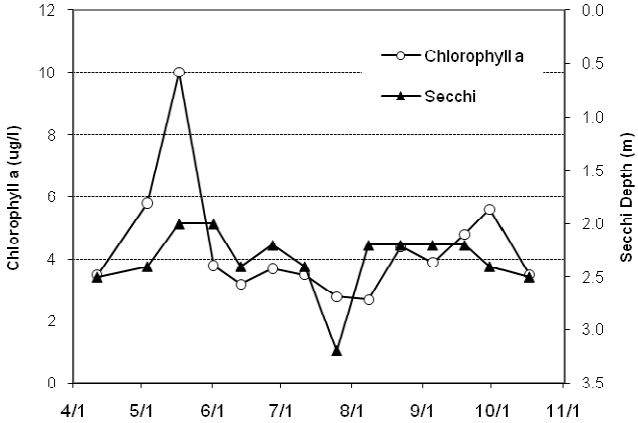
Horseshoe Lake
Sunfish Lake, Dakota Co.

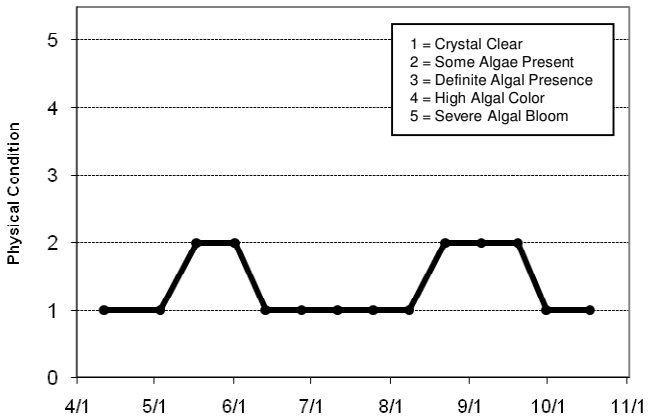
Lake ID: 190051-00
WMO: Lower Miss. River
Volunteer: Jim Nayes

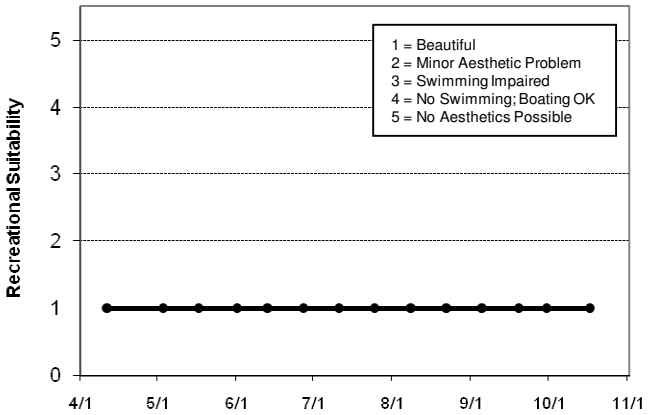
● Sampling site
Contours in meters











2009 Data

DATE	Surf Tmp (ºC)	Bot Tmp (ºC)	Surf DO (mg/L)	Bot DO (mg/L)	CLA (µg/L)	Surf TP (µg/L)	Bot TP (µg/L)	Secchi (m)	PC	RS
4/11	10.3				3.5	23		2.5	1	1
5/3	16.7				5.8	26		2.4	1	1
5/17	18.7				10	42		2.0	2	1
6/1	20.4				3.8	30		2.0	2	1
6/13	18.6				3.2	25		2.4	1	1
6/27	27.6				3.7	20		2.2	1	1
7/11	25.2				3.5	16		2.4	1	1
7/25	24.5				2.8	31		3.2	1	1
8/8	24				2.7	25		2.2	1	1
8/22	22				4.4	25		2.2	2	1
9/5	24.4				3.9	20		2.2	2	1
9/19	23.7				4.8	23		2.2	2	1
9/30	14.7				5.6	24		2.4	1	1
10/17	8.1				3.5	13		2.5	1	1

Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total Phosphorus												
Chlorophyll a												
Secchi Depth												
Lake Grade												

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total Phosphorus												
Chlorophyll a												
Secchi Depth												
Lake Grade												

Year	2004	2005	2006	2007	2008	2009
Total Phosphorus			C	C	A	B
Chlorophyll a			A	A	A	A
Secchi Depth			C	C	C	B
Lake Grade			**B**	**B**	**B**	**B**

Source: Metropolitan Council and STORET data

Minnesota Pollution Control Agency

Connection Failure

Physical Information

Name: Horseshoe
DNR Lake ID number: 19-0051
County: DAKOTA
Location from nearest town: IN SUNFISH LAKE
Ecoregion: NCHF
Basin: LM
Hydrologic Unit Code: 7040001
Surface Area: 14.269 (acres)
Water Body Type:

Latitude/Longitude: 44.86357/-93.08663
UTMx/UTMy: /

Lake Water Quality Assessment

This summary is based on available summer (June through September) data in STORET (STOF the national water quality data repository developed by the United States Environmental Protec Agency. All water quality data collected by MPCA or received from external groups is placed in STORET.) collected between 1999 and 2008.

Data Quality: excellent
Aquatic Recreation Use Support: Fully Supporting Lakes are better than the aquatic recreation use thresholds with sufficient data to make an assessment. These lakes are considered to be assessed fo recreation and fully supporting by the MPCA.

Lake Water Quality Data Summary

Total Phosphorus Mean: 37.8 ppb (parts per billion)
Total Phosphorus Standard Error: 5.986651819 ppb
Total Phosphorus # of Observations: 20

Chlorophyll-a Mean: 4.060606061 ppb
Chlorophyll-a Standard Error: 1.133753315 ppb
Chlorophyll-a # of Observations: 33

Secchi Disk Mean: 1.805 meters
Secchi Disk Standard Error: 0.075210232 meters
Secchi Disk # of Observations: 20
www.pca.state.mn.us/water/clmp.html

Alkalinity Mean: ppm (parts per million)
Color Mean: Platinum-cobalt Units
Carlson Trophic Status for Total Phosphorus: 56.52789726
Carlson Trophic Status for Chlorophyll-a: 44.34706926
Carlson Trophic Status for Secchi Disk: 51.49002187
Overall Trophic Status: E
(O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic)

See the Difference! **Oligotrophic** vs. **Hypereutrophic**

Watch how lakes change over the summer.

Compare this lake to reference lakes or all assessed lakes.

Transparency *Chlorophyll-a* *Total Phosphorus*

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651-297-5353 or 800-627-3529 dione

Hornbean Lake (19-0047) *City of Sunfish Lake*

Hornbean Lake is located within the City of Sunfish Lake (Dakota County), and has an area of approximately 22-acres. There is very little morphological information available for the lake.

On each sampling day the lake was monitored for total phosphorus (TP), chlorophyll-a (CLA), total kjeldahl nitrogen (TKN), and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The resulting data are summarized in the tables and figures on the next page.

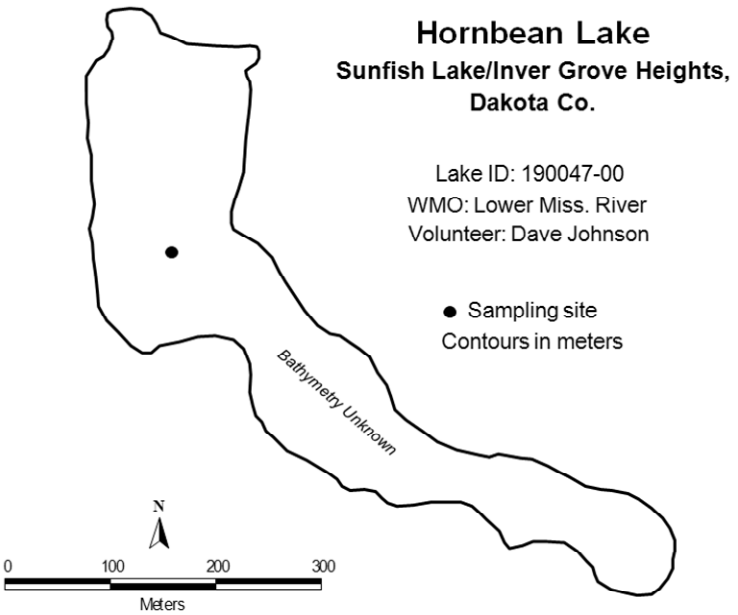
2009 summer (May-September) data summary

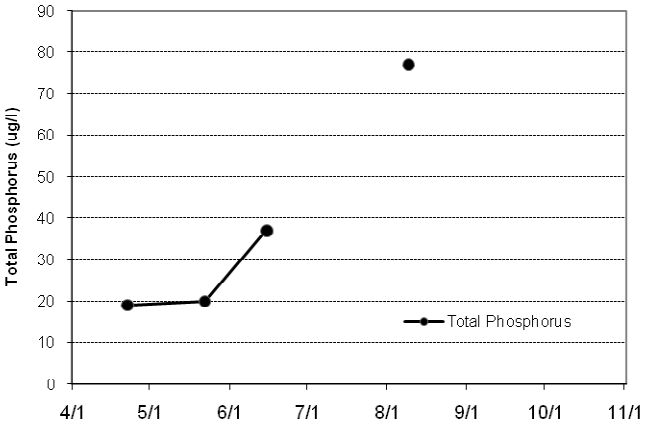
Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	44.7	20.0	77.0	N/A
CLA (µg/l)	20.2	4.5	36.0	N/A
Secchi (m)	1.7	0.8	2.7	N/A
TKN (mg/l)	1.49	0.96	1.80	
			Lake Grade	N/A

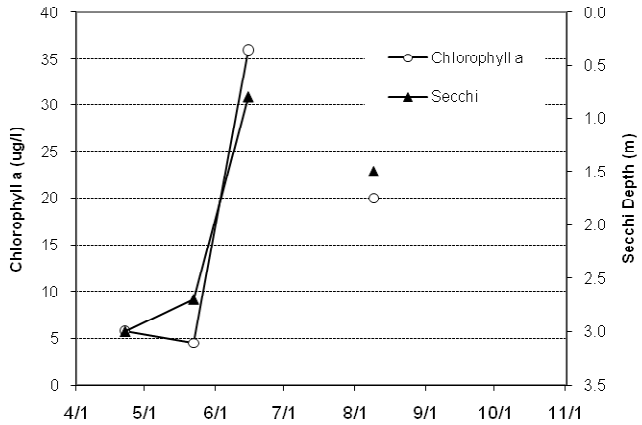
There was an insufficient quantity of data to calculate grades for the lake in 2009. At least 5 monitoring events during the summer-time period (May – September) are needed. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

Throughout the monitoring period, the volunteer's opinions of the lake's physical condition and recreational suitability were ranked on a 1-to-5 scale. These user perception rankings are shown on the following page.

If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Brian Johnson of the Metropolitan Council at (651) 602-8743 or brian.johnson@metc.state.mn.us.

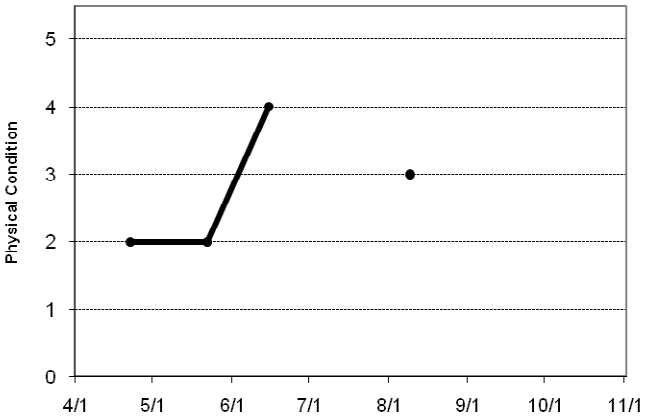






2009 Data

DATE	Surf Tmp (ºC)	Bot Tmp (ºC)	Surf DO (mg/L)	Bot DO (mg/L)	CLA (µg/L)	Surf TP (µg/L)	Bot TP (µg/L)	Secchi (m)	PC	RS
4/22	13.2				5.8	19		3.0	2	2
5/22	21.3				4.5	20		2.7	2	2
6/15	24.8				36	37		0.8	4	3
8/9	25.1				20	77		1.5	3	3



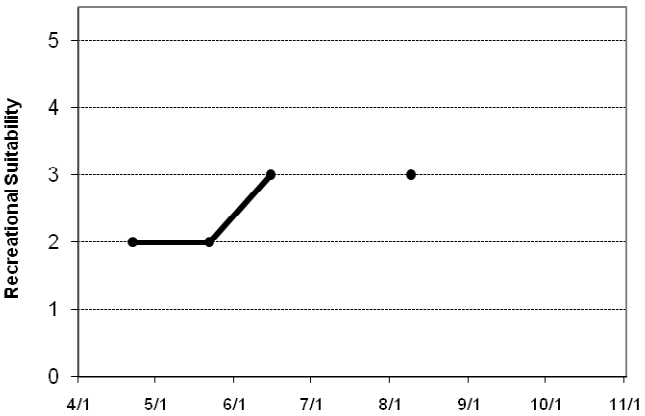
Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total Phosphorus												
Chlorophyll a												
Secchi Depth												
Lake Grade												

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total Phosphorus												
Chlorophyll a												
Secchi Depth												
Lake Grade												

Year	2004	2005	2006	2007	2008	2009
Total Phosphorus			C	C	C	
Chlorophyll a			B	C	A	
Secchi Depth			C	C	B	
Lake Grade			**C**	**C**	**B**	**NA**

Source: Metropolitan Council and STORET data



Minnesota Pollution Control Agency

Connection Failure

Physical Information

Name: Hornbean
DNR Lake ID number: 19-0047
County: DAKOTA
Location from nearest town:
Ecoregion: NCHF
Basin: UM
Hydrologic Unit Code: 7010206
Surface Area: 22.039 (acres)
Maximum depth: 0 (feet)
Water Body Type: P

Latitude/Longitude: 44.86377544/-93.10380495
UTMx/UTMy: /

Lake Water Quality Assessment

This summary is based on available summer (June through September) data in STORET (STOF the national water quality data repository developed by the United States Environmental Protec Agency. All water quality data collected by MPCA or received from external groups is placed in STORET.) collected between 1999 and 2008.

Data Quality: excellent
Aquatic Recreation Use Support:

Lake Water Quality Data Summary

Total Phosphorus Mean: 56.55555556 ppb (parts per billion)
Total Phosphorus Standard Error: 5.610577209 ppb
Total Phosphorus # of Observations: 18

Chlorophyll-a Mean: 22.40714286 ppb
Chlorophyll-a Standard Error: 5.016346107 ppb
Chlorophyll-a # of Observations: 28

Secchi Disk Mean: 1.494444444 meters
Secchi Disk Standard Error: 0.181761933 meters
Secchi Disk # of Observations: 18
www.pca.state.mn.us/water/clmp.html

Alkalinity Mean: ppm (parts per million)

Color Mean: Platinum-cobalt Units
Carlson Trophic Status for Total Phosphorus: 62.33792199
Carlson Trophic Status for Chlorophyll-a: 61.1030157
Carlson Trophic Status for Secchi Disk: 54.21071724
Overall Trophic Status: E
(O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic)

See the Difference! **Oligotrophic** vs. **Hypereutrophic**

Watch how lakes change over the summer.

Compare this lake to reference lakes or all assessed lakes.

Transparency *Chlorophyll-a* *Total Phosphorus*

If you have suggestions on how we can improve this site, or if you have questions or problems, please contact us.
If you have technical questions or problems with this site, contact webmaster@pca.state.mn.us
Minnesota Pollution Control Agency, 520 Lafayette Road, St. Paul, MN 55155-4194
Phone: 651-296-6300, 800-657-3864; 24-hour emergency number: 651-649-5451 or 800-422-0798; TTY: 651-282-5332, TTY 24-hoı
651-297-5353 or 800-627-3529 dione

Seidl's Lake (19-0095) Cities of ***Inver Grove Heights and South St. Paul***

Seidl's Lake is a 14-acre lake located in the City of Inver Grove Heights (Dakota County) which receives inflow from five inlets. The maximum depth of the lake is approximately 5.0 m (17 feet). There are little known morphological data available.

On each sampling day the lake was monitored for total phosphorus (TP), chlorophyll-a (CLA), total kjeldahl nitrogen (TKN), and secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The resulting data are summarized in tables and figures on the following page.

2009 summer (May-September) data summary

Parameter	***Mean***	***Minimum***	***Maximum***	***Grade***
TP (µg/l)	50.0	48.0	52.0	N/A
CLA (µg/l)	17.0	17.0	17.0	N/A
Secchi (m)	1.0	1.0	1.0	N/A
TKN (mg/l)	1.65	1.60	1.70	
			Lake Grade	N/A

No lake grade or parameter grades were issued this year because of too few monitoring events. At least 5 monitoring events during the summer-time period are required to determine grades.

Throughout the monitoring period, the volunteer's opinions of the lake's physical condition and recreational suitability were ranked on a 1-to-5 scale. These user perception rankings are shown on the following page.

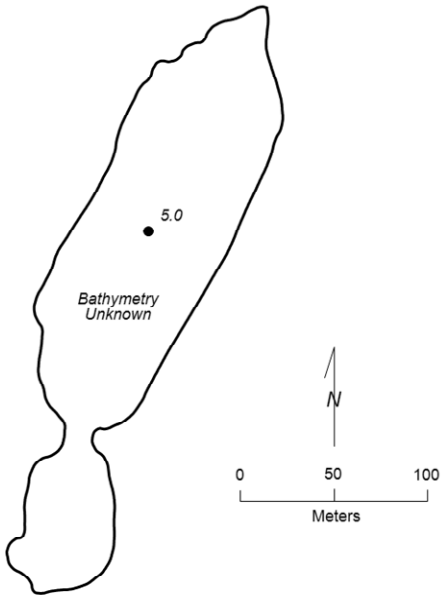
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Brian Johnson of the Metropolitan Council at (651) 602-8743 or brian.johnson@metc.state.mn.us.

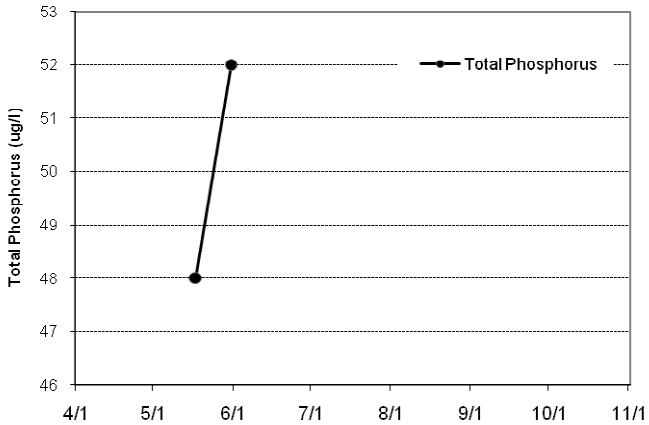
Seidl Lake

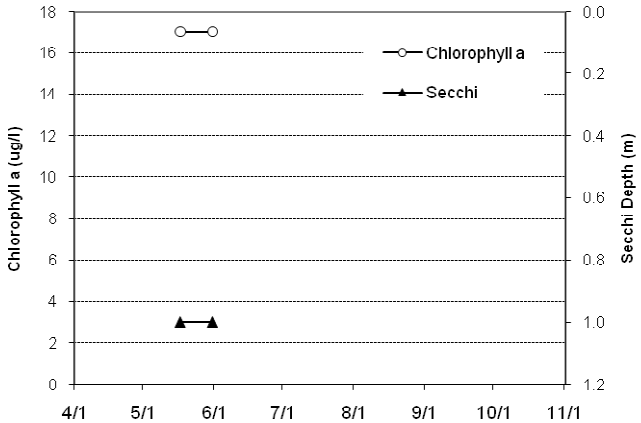
Inver Grove Heights, Dakota Co.

Lake ID: 190095-00
WMO: Lower Mississippi River
Volunteer: Randy Bjorklund

● Sampling site
Contours in meters

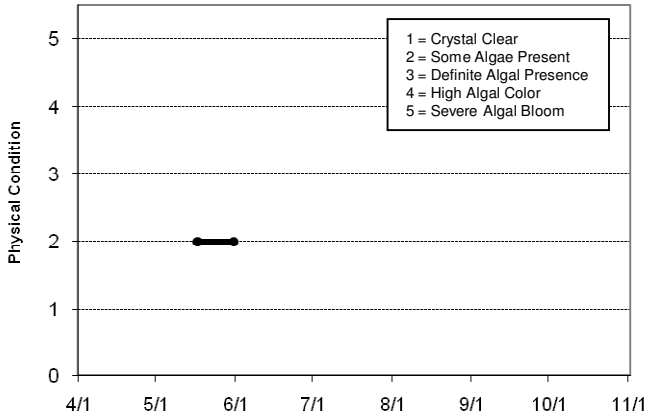






2009 Data

DATE	Surf Tmp (ºC)	Bot Tmp (ºC)	Surf DO (mg/L)	Bot DO (mg/L)	CLA (µg/L)	Surf TP (µg/L)	Bot TP (µg/L)	Secchi (m)	PC	RS
5/17	21.5				17	48		1.0	2	4
5/31	22.9				17	52		1.0	2	4



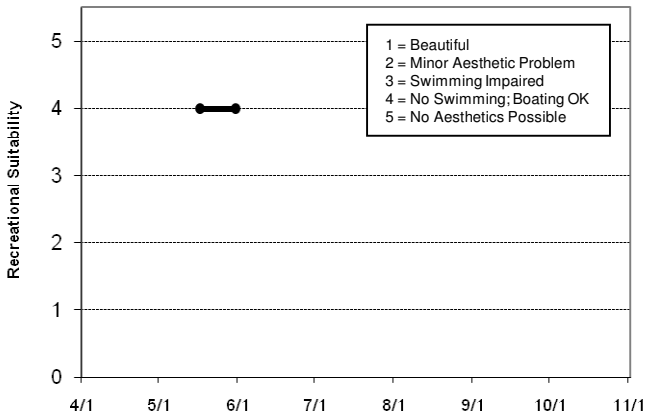
Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total Phosphorus												C
Chlorophyll a												C
Secchi Depth												D
Lake Grade												**C**

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total Phosphorus				C	C	C	C	D	C	C	D	C
Chlorophyll a				A	B	B	C	C	C	C	C	B
Secchi Depth		D	D	B	B	C	D	D	C	C	D	D
Lake Grade				**B**	**B**	**C**	**C**	**D**	**C**	**C**	**D**	**C**

Year	2004	2005	2006	2007	2008	2009
Total Phosphorus	D	C	D	D		
Chlorophyll a	B	C	C	C		
Secchi Depth	C	D	F	F		
Lake Grade	**C**	**C**	**D**	**D**		**NA**

Source: Metropolitan Council and STORET data



Minnesota Pollution Control Agency

Connection Failure

Physical Information

Name: Unnamed (Seidl)
DNR Lake ID number: 19-0095
County: DAKOTA
Location from nearest town: IN SOUTH ST. PAUL
Ecoregion: NCHF
Basin: UM
Hydrologic Unit Code: 7010206
Surface Area: 3.633 (acres)
Maximum depth: 0 (feet)
Water Body Type: W

Latitude/Longitude: 44.88555556/-93.05327778
UTMx/UTMy: 495793/4970235

Lake Water Quality Assessment

This summary is based on available summer (June through September) data in STORET (STOF the national water quality data repository developed by the United States Environmental Protec Agency. All water quality data collected by MPCA or received from external groups is placed in STORET.) collected between 1999 and 2008.

Data Quality: excellent
Aquatic Recreation Use Support:

Lake Water Quality Data Summary

Total Phosphorus Mean: 72.97727273 ppb (parts per billion)
Total Phosphorus Standard Error: 5.976414715 ppb
Total Phosphorus # of Observations: 66

Chlorophyll-a Mean: 28.14070796 ppb
Chlorophyll-a Standard Error: 1.890183837 ppb
Chlorophyll-a # of Observations: 113

Secchi Disk Mean: 0.998797468 meters
Secchi Disk Standard Error: 0.053705988 meters
Secchi Disk # of Observations: 79
www.pca.state.mn.us/water/clmp.html

Alkalinity Mean: ppm (parts per million)

Color Mean: Platinum-cobalt Units
Carlson Trophic Status for Total Phosphorus: 66.01393503
Carlson Trophic Status for Chlorophyll-a: 63.33810083
Carlson Trophic Status for Secchi Disk: 60.01733891
Overall Trophic Status: E
(O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic)

See the Difference! **Oligotrophic** vs. **Hypereutrophic**

Watch how lakes change over the summer.

Compare this lake to reference lakes or all assessed lakes.

Transparency *Chlorophyll-a* *Total Phosphorus*

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651-297-5353 or 800-627-3529 dione

Rogers Lake (19-0080) – *Lower Mississippi River Watershed Management Organization*

Rogers Lake lies within the City of Mendota Heights. The lake has a surface area of 94 acres and a maximum depth of 2.4 m (7.9 ft). The entire area of the lake is considered littoral zone which is the 0-15 feet depth zone of aquatic plant dominance. Furthermore, the lake does not maintain a thermocline, which is a density gradient caused by changing water temperatures throughout the water column.

On each sampling day the lake was monitored for total phosphorus (TP), chlorophyll-a (CLA), total kjeldahl nitrogen (TKN), and secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The resulting data are summarized in tables and figures on the following page.

2009 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	39.9	28.0	68.0	C
CLA (µg/l)	8.5	4.2	12.0	A
Secchi (m)	1.3	1.0	1.5	C
TKN (mg/l)	1.32	0.86	1.90	
			Lake Grade	B

The lake received a lake grade of B for 2009. Additional years of monitoring are suggested for continuing to build the water quality database so as to better understand the lake's water quality and determine potential water quality trends.

The water clarity grade of C does not correlate well with the chlorophyll-a grade of A. A possible explanation may be that the water clarity may be affected by higher levels of total suspended solids from surface runoff from the surrounding urbanized watershed. It is possible for higher suspend solids loadings to decrease water clarity which would decrease light penetration thereby inhibiting algal growth.

Throughout the monitoring period, the volunteer's opinions of the lake's physical condition and recreational suitability were ranked on a 1-to-5 scale. These user perception rankings are shown on the following page.

The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 259-5831 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

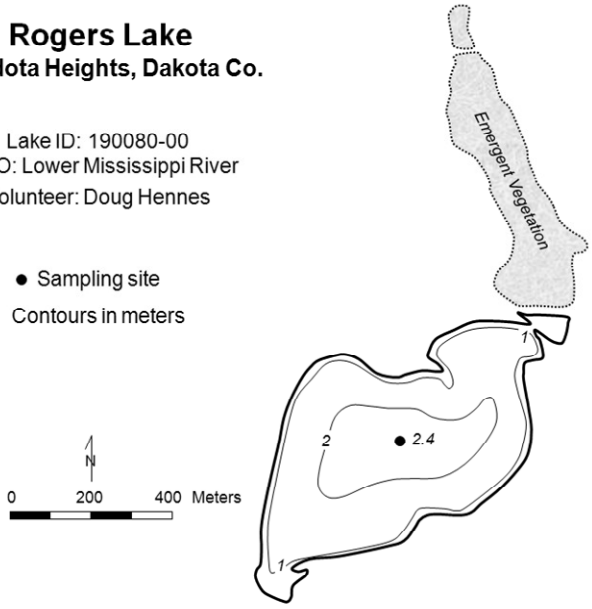
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Brian Johnson of the Metropolitan Council at (651) 602-8743 or brian.johnson@metc.state.mn.us.

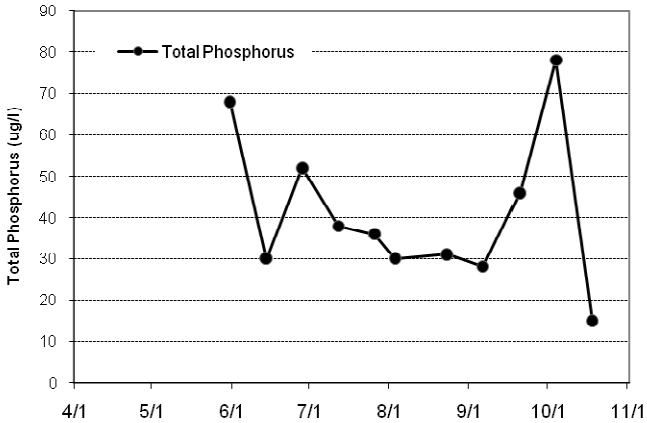
Rogers Lake

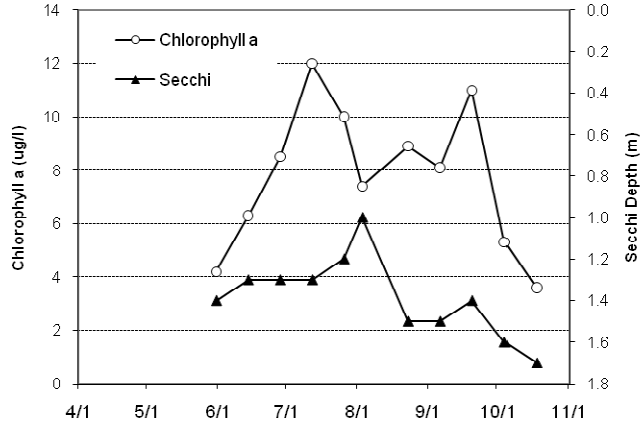
Mendota Heights, Dakota Co.

Lake ID: 190080-00
WMO: Lower Mississippi River
Volunteer: Doug Hennes

● Sampling site
Contours in meters

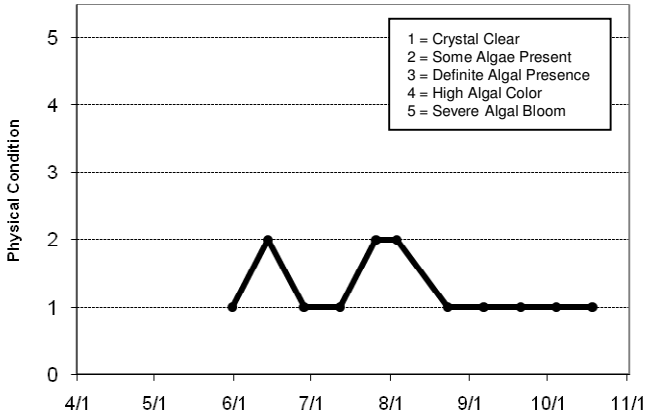






2009 Data

DATE	Surf Tmp (ºC)	Bot Tmp (ºC)	Surf DO (mg/L)	Bot DO (mg/L)	CLA (µg/L)	Surf TP (µg/L)	Bot TP (µg/L)	Secchi (m)	PC	RS
5/31	18.9				4.2	68		1.4	1	1
6/14	23.9				6.3	30		1.3	2	2
6/28	24.6				8.5	52		1.3	1	1
7/12	26.8				12	38		1.3	1	1
7/26	24.5				10	36		1.2	2	1
8/3	24.3				7.4	30		1.0	2	1
8/23	23.5				8.9	31		1.5	1	2
9/6	24.2				8.1	28		1.5	1	1
9/20	23.9				11	46		1.4	1	1
10/4	12.1				5.3	78		1.6	1	1
10/18	9				3.6	15		1.7	1	1



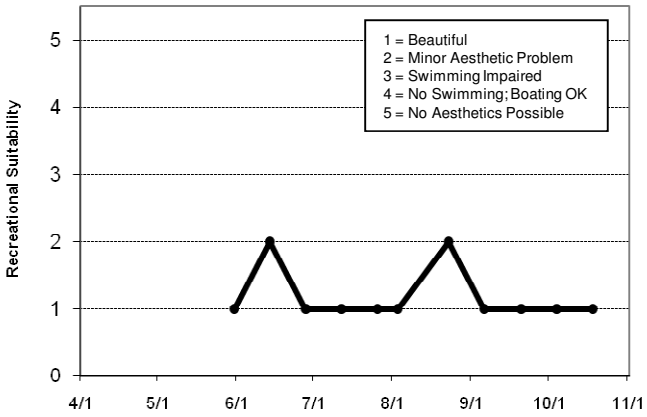
Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total Phosphorus												
Chlorophyll a												
Secchi Depth												
Lake Grade												

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total Phosphorus												
Chlorophyll a												
Secchi Depth												
Lake Grade												

Year	2004	2005	2006	2007	2008	2009
Total Phosphorus				C	B	C
Chlorophyll a				A	A	A
Secchi Depth				D	C	C
Lake Grade				**C**	**B**	**B**

Source: Metropolitan Council and STORET data



Minnesota Pollution Control Agency

Connection Failure

Physical Information

Name: Marcott
DNR Lake ID number: 19-0041
County: DAKOTA
Location from nearest town: IN INVER GROVE HEIGHTS
Ecoregion: NCHF
Basin: LM
Hydrologic Unit Code: 7040001
Surface Area: 19.865 (acres)
Maximum depth: 27 (feet)
Water Body Type: P

Latitude/Longitude: 44.82861111/-93.08272222
UTMx/UTMy: 493461/4963911

Lake Water Quality Assessment

This summary is based on available summer (June through September) data in STORET (STOF the national water quality data repository developed by the United States Environmental Protec Agency. All water quality data collected by MPCA or received from external groups is placed in STORET.) collected between 1999 and 2008.

Data Quality: excellent
Aquatic Recreation Use Support: Fully Supporting Lakes are better than the aquatic recreation use thresholds with sufficient data to make an assessment. These lakes are considered to be assessed fo recreation and fully supporting by the MPCA.

Lake Water Quality Data Summary

Total Phosphorus Mean: 23.875 ppb (parts per billion)
Total Phosphorus Standard Error: 1.743738799 ppb
Total Phosphorus # of Observations: 16

Chlorophyll-a Mean: 3.492 ppb
Chlorophyll-a Standard Error: 0.465650799 ppb
Chlorophyll-a # of Observations: 25

Secchi Disk Mean: 2.520625 meters
Secchi Disk Standard Error: 0.192051358 meters
Secchi Disk # of Observations: 16
www.pca.state.mn.us/water/clmp.html

Alkalinity Mean: ppm (parts per million)
Color Mean: Platinum-cobalt Units
Carlson Trophic Status for Total Phosphorus: 49.9022358
Carlson Trophic Status for Chlorophyll-a: 42.8671562
Carlson Trophic Status for Secchi Disk: 46.67785576
Overall Trophic Status: M
(O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic)

See the Difference! **Oligotrophic** vs. **Hypereutrophic**

Watch how lakes change over the summer.

Compare this lake to reference lakes or all assessed lakes.

Transparency *Chlorophyll-a* *Total Phosphorus*

If you have suggestions on how we can improve this site, or if you have questions or problems, please contact us.
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651-297-5353 or 800-627-3529 dione

Minnesota Pollution Control Agency

Photo not available

Lake Station Information

Station Name	UNNAMED (GOLF COURSE)
Alternate IDs:	19-0049
Waterbody Name:	
Data Steward Org:	MPCA
Station ID: (Lake ID)	19-0049
Hydrologic Unit Code (HUC):	07010206
Assessment Unit:	
Period of Record:	1988 through 1988

Connection Failure

Lat/Lon: 44.8806/-93.0705
Datum: NAD83
County: Dakota

Projects Associated with this Station

Project	Purpose
Citizen Lake Monitoring Program	Monitor lake eutrophication status. Project manager formerly Jennifer Klang and assis project manager Johanna Schussler. 2008 new project manager Johanna Schussler.

Station Data Collection Years

1988

Station Data

Sample Date:	Sample Type	Sample Depth	BOD mg/L	Chl-a µg/L	DO mg/L	TKN mg/L	NOx mg/L	pH	Pheo µg/L	TP mg/L	TSS mg/L	Temp Degrees C	Turb	FC #/100ml	E #/
10/04/1988	Routine Sample/Observation	0 m													
09/07/1988	Routine Sample/Observation	0 m													
08/31/1988	Routine Sample/Observation	0 m													
08/17/1988	Routine Sample/Observation	0 m													
07/27/1988	Routine Sample/Observation	0 m													

07/13/1988	Routine Sample/Observation	0 m
06/28/1988	Routine Sample/Observation	0 m
06/21/1988	Routine Sample/Observation	0 m
06/13/1988	Routine Sample/Observation	0 m

Station Dataset Download

Download Standard Parameter Data (Same format as above)

Download All Monitoring Data (Including all Parameters)

Additional Information and Links

Secchi Disk readings for 19-0049 Lake

- Full Secchi information from the MPCA site
- Lake Water Quality Information from the MPCA site

This page was last updated 19-Jul-10

If you have suggestions on how we can improve this site, or if you have questions or problems, please contact us.
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Minnesota Pollution Control Agency

Connection Failure

Physical Information

Name: Unnamed (Simley)
DNR Lake ID number: 19-0037
County: DAKOTA
Location from nearest town: 2 MI SW OF INVER GROVE
Ecoregion: NCHF
Basin: UM
Hydrologic Unit Code: 7010206
Surface Area: 10.638 (acres)
Maximum depth: 17 (feet)
Water Body Type: P

Latitude/Longitude: 44.83416667/-93.04188889
UTMx/UTMy: 496689/4964526

Lake Water Quality Assessment

This summary is based on available summer (June through September) data in STORET (STOF the national water quality data repository developed by the United States Environmental Protec Agency. All water quality data collected by MPCA or received from external groups is placed in STORET.) collected between 1999 and 2008.

Data Quality: excellent
Aquatic Recreation Use Support:

Lake Water Quality Data Summary

Total Phosphorus Mean: 45.11111111 ppb (parts per billion)
Total Phosphorus Standard Error: 2.773107185 ppb
Total Phosphorus # of Observations: 36

Chlorophyll-a Mean: 26.06326531 ppb
Chlorophyll-a Standard Error: 3.048191019 ppb
Chlorophyll-a # of Observations: 49

Secchi Disk Mean: 0.994444444 meters
Secchi Disk Standard Error: 0.075060234 meters
Secchi Disk # of Observations: 36
www.pca.state.mn.us/water/clmp.html

Alkalinity Mean: ppm (parts per million)

Color Mean: Platinum-cobalt Units
Carlson Trophic Status for Total Phosphorus: 59.07763416
Carlson Trophic Status for Chlorophyll-a: 62.58576853
Carlson Trophic Status for Secchi Disk: 60.08027876
Overall Trophic Status: E
(O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic)

See the Difference! **Oligotrophic** vs. **Hypereutrophic**

Watch how lakes change over the summer.

Compare this lake to reference lakes or all assessed lakes.

Transparency *Chlorophyll-a* *Total Phosphorus*

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651-297-5353 or 800-627-3529 dione

CITY OF SAINT PAUL
INTERDEPARTMENTAL MEMORANDUM

October 3, 1984

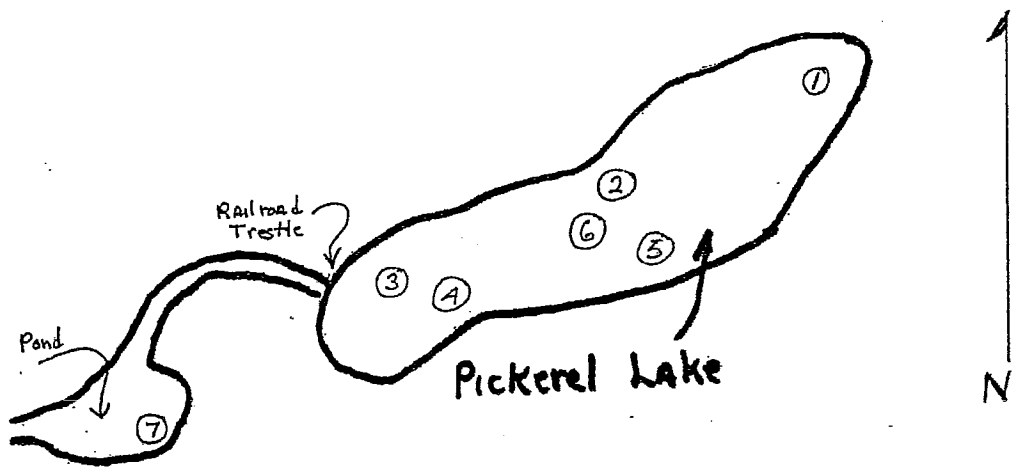
TO: Timothy M. Agness

FROM: William F. Gunther, Laboratory Director WFG
CITY OF ST. PAUL HEALTH DIVISION

SUBJECT: Test results from Pickerel Lake

The test results from the water samples taken from Pickerel Lake on Sept. 14, 1984 are as follows:

Location number	Fecal Coliform	Total Plate Count
1	43	220
2	93	750 est
3	9	160
4	< 3	430 est
5	< 3	320 est
6	3	170
7	240	1,080 est



The standard for natural water for swimming is less than 200 fecal coliforms and less than a 1,000 on the total plate count. All of the samples passed bacteriologically accept the pond sample #7.

The samples indicate that the lake water quality is bacteriologically safe for swimming.

WFG:cw

Minnesota Pollution Control Agency

Photo not available

Connection Failure

Lake Station Information

Station Name	DICKMAN
Alternate IDs:	19-0046
Waterbody Name:	
Data Steward Org:	MPCA
Station ID: (Lake ID)	19-0046
Hydrologic Unit Code (HUC):	07010206
Assessment Unit:	
Period of Record:	1996 through 1997

Lat/Lon: 44.8622/-93.0791
Datum: NAD83
County: Dakota

Projects Associated with this Station

Project	Purpose
MPCA Lake Monitoring Program Project	This is an inclusive project created to migrate data to modernized STORET from t 21MINNL Agency Code in Legacy STORET where project information was not s the sample or result level. Specific purposes for Legacy STORET data collection ı available in the station descriptions.
Atmospheric and Nonpoint Trends in MN Lakes LCMR study	Trends

Station Data Collection Years

1997 1996

Station Data

Sample Date:	Sample Type	Sample Depth	BOD mg/L	Chl-a µg/L	DO mg/L	TKN mg/L	NOx mg/L	pH	Pheo µg/L	TP mg/L	TSS mg/L	Temp Degrees C	Turb	FC #/100ml
08/15/1997	Routine Sample/Observation	0 m			6.8			7.57				22.3		
08/15/1997	Routine Sample/Observation	1.00 m			5.5							21.9		

08/15/1997	Routine Sample/Observation	2.00 m		5						21.8		
08/15/1997	Routine Sample/Observation		59.2		1.34			10.4	0.103	7.6		
05/13/1997	Routine Sample/Observation	0 m		9.9			9.25			13		
05/13/1997	Routine Sample/Observation	1.00 m		10						12.6		
05/13/1997	Routine Sample/Observation	2.00 m		9.4						12.4		
05/13/1997	Routine Sample/Observation		46.7		1.45	< 0.05		< 0.85	0.076	13		8.7

Station Dataset Download

Download Standard Parameter Data (Same format as above)

Download All Monitoring Data (Including all Parameters)

Additional Information and Links

Secchi Disk readings for 19-0046 Lake

- Full Secchi information from the MPCA site
- Lake Water Quality Information from the MPCA site

This page was last updated 07-Jul-10

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Minnesota Pollution Control Agency

Photo not available

Connection Failure

Lake Station Information

Station Name	DICKMAN
Alternate IDs:	19-0046
Waterbody Name:	
Data Steward Org:	MPCA
Station ID: (Lake ID)	19-0046
Hydrologic Unit Code (HUC):	07010206
Assessment Unit:	
Period of Record:	1996 through 1997

Lat/Lon: 44.8622/-93.0791
Datum: NAD83
County: Dakota

Projects Associated with this Station

Project	Purpose
MPCA Lake Monitoring Program Project	This is an inclusive project created to migrate data to modernized STORET from t 21MINNL Agency Code in Legacy STORET where project information was not s the sample or result level. Specific purposes for Legacy STORET data collection r available in the station descriptions.
Atmospheric and Nonpoint Trends in MN Lakes LCMR study	Trends

Station Data Collection Years

1997 1996

Station Data

Sample Date:	Sample Type	Sample Depth	BOD mg/L	Chl-a µg/L	DO mg/L	TKN mg/L	NOx mg/L	pH	Pheo µg/L	TP mg/L	TSS mg/L	Temp Degrees C	Turb	FC #/100ml	I #
09/19/1996	Routine Sample/Observation			86					28.44	0.136					

Station Dataset Download

Download Standard Parameter Data (Same format as above)

Download All Monitoring Data (Including all Parameters)

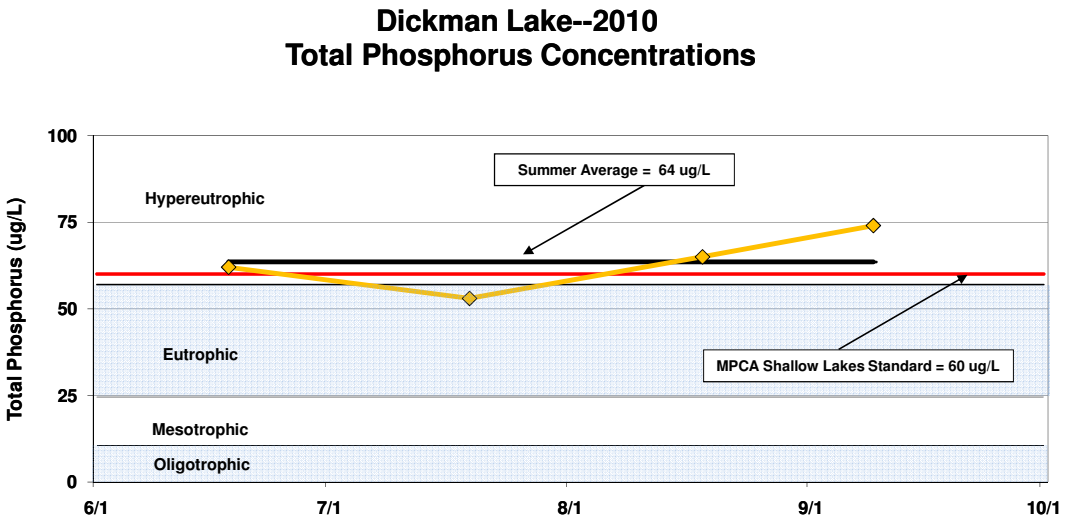
Additional Information and Links

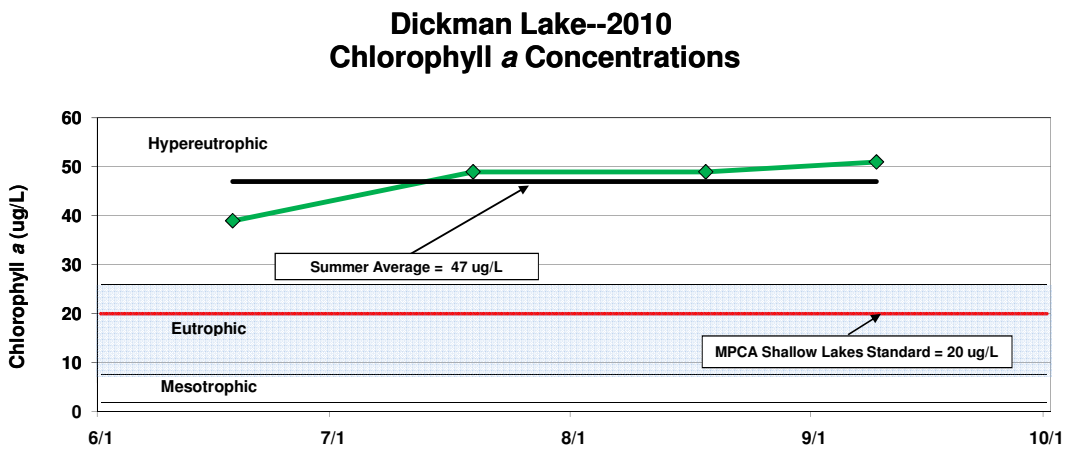
Secchi Disk readings for 19-0046 Lake

- Full Secchi information from the MPCA site
- Lake Water Quality Information from the MPCA site

This page was last updated 07-Jul-10

If you have suggestions on how we can improve this site, or if you have questions or problems, please contact us.
If you have technical questions or problems with this site, contact webmaster@pca.state.mn.us
Minnesota Pollution Control Agency, 520 Lafayette Road, St. Paul, MN 55155-4194
Phone: 651-296-6300, 800-657-3864; 24-hour emergency number: 651-649-5451 or 800-422-0798; TTY: 651-282-5332, TTY 24-hour emergency number: 651 627-3529 dione





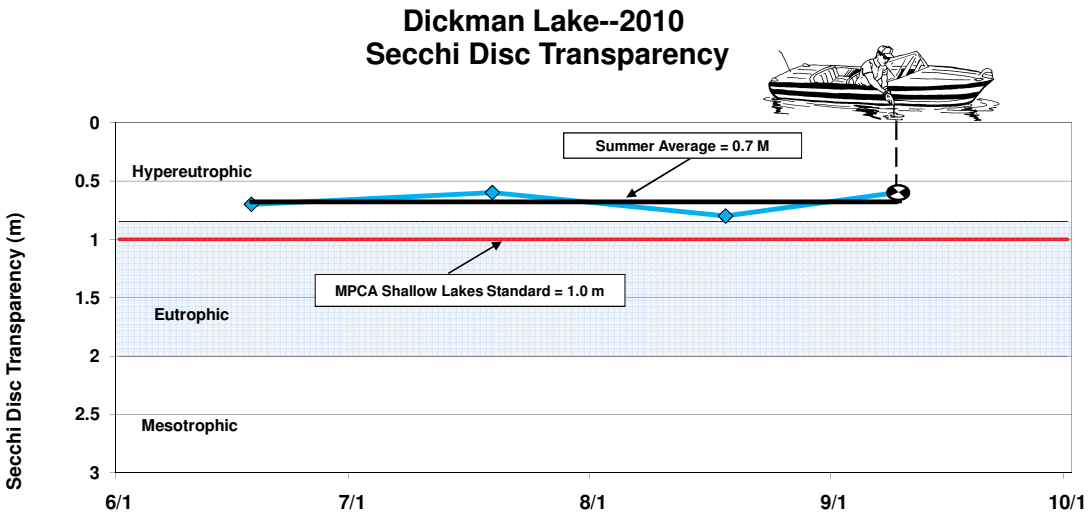
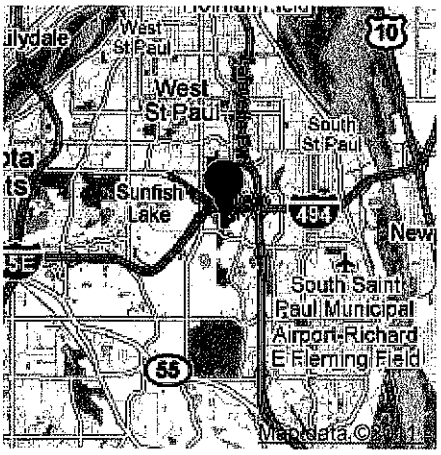


Figure 1.
Dickman Lake 2010 Monitoring Results

Table 1. 2010 Monitoring Data for Dickman Lake

Dickman Lake

Date	Max Depth (m)	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	Turbidity (NTU's)	D. O. (mg/L)	Temp (℃)	Sp. Cond. (µmho/cm @ 25℃)	Total P (mg/L)	Chloride (mg/L)	pH (S.U.)	ORP (mv)
6/18/10	2.4	0-2	0.7	39.0	6.5	--	--	--	0.062	49	--	--
		0.0				10.8	23.4	299	--	--	8.8	186
		1.0				10.8	23.4	299	--	--	8.8	176
		2.0				5.1	20.3	302	--	--	7.6	185
		Aquatic plant grow near shore 0-3.5 feet of depth										
		P. sp. (narrowleaf), Najas sp., Ceratophyllum demersum present										
7/19/10	2.4	0-2	0.6	49.0	10.3	--	--	--	0.053	47	--	--
		0.0				9.9	26.1	273	--	--	9.4	161
		1.0				9.1	25.8	272	--	--	9.3	154
		2.0				0.2	24.6	290	0.055	--	7.5	-45
8/18/10	2.4	0-2	0.8	49.0	5.4	--	--	--	0.065	46	--	--
		0.0				10.1	24.9	254	--	--	9.0	102
		1.0				9.3	24.6	254	--	--	8.8	103
		2.0				0.3	24.4	254	--	--	8.6	104
9/9/10	2.4	0-2	0.6	51.0	6.9	--	--	--	0.074	46	--	--
		0.0				10.3	18.1	256	--	--	9.2	119
		1.0				10.0	18.1	257	--	--	9.2	118
		2.0				10.1	18.1	257	--	--	9.2	115



Physical Information

Name: Schmitt
DNR Lake ID number: 19-0052
County: Dakota
Location from nearest town:
Ecoregion: North Central Hardwood Forests
Basin: Upper Mississippi
Hydrologic Unit Code: 7010206
Surface Area: 57 (acres)
Water Body Type:

Latitude/Longitude: 44.86999893/-93.07350159
UTMx/UTMy: /

Lake Water Quality Assessment

This summary is based on available summer (June through September) data in STORET (STORET is the national water quality data repository developed by the United States Environmental Protection Agency. All water quality data collected by MPCA or received from external groups is placed in STORET.) collected between 2001 and 2010.

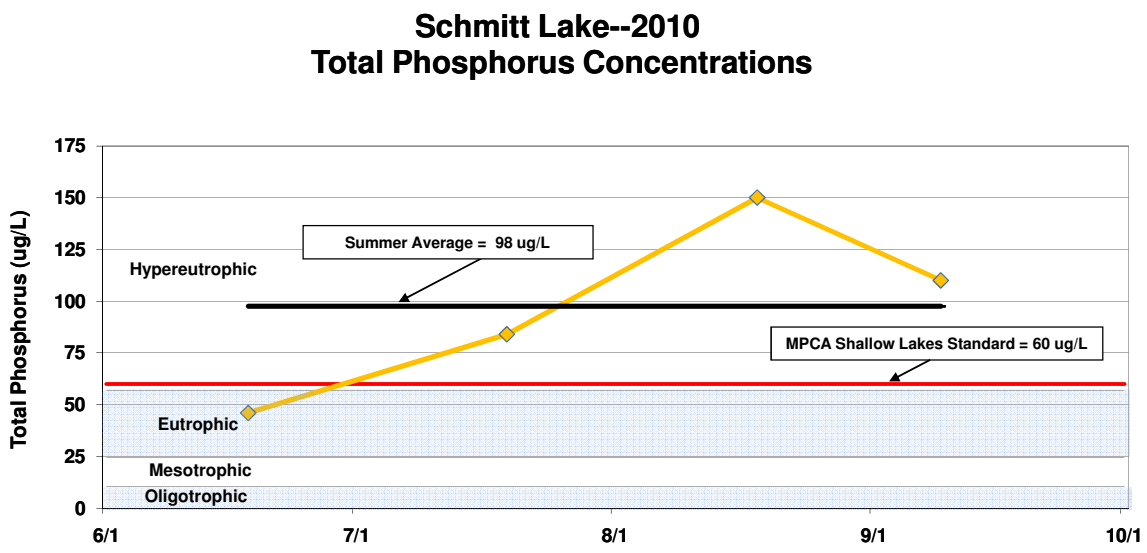
Data Quality:
Aquatic Recreation Use Support: Insufficient Information

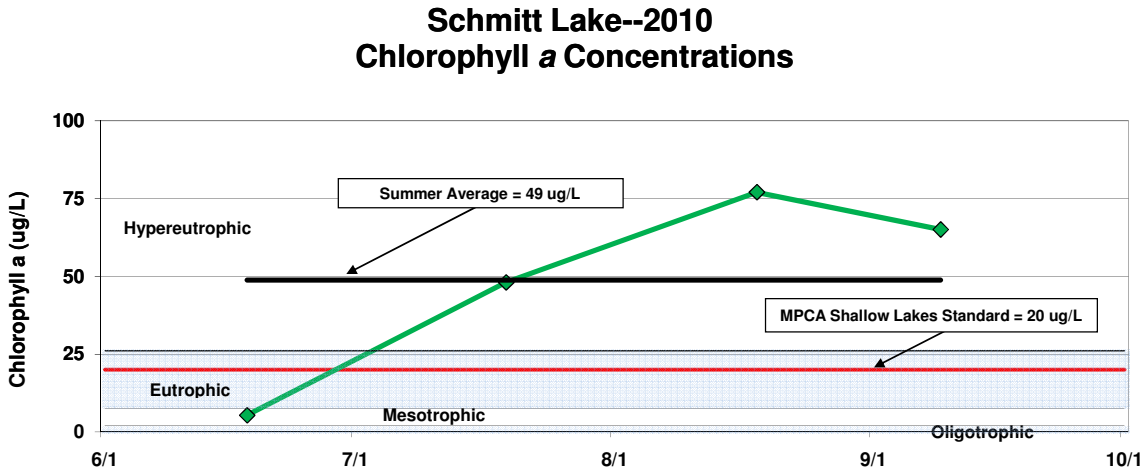
Lake Water Quality Data Summary

Chlorophyll-a Mean: 0.0 ppb
Chlorophyll-a Standard Error: 0.0 ppb
Chlorophyll-a # of Observations:

Secchi Disk Mean: 0.0 meters
Secchi Disk Standard Error: 0.0 meters
Secchi Disk # of Observations: 7
www.pca.state.mn.us/water/clmp.html

Alkalinity Mean: 0.0 ppm (parts per million)
Color Mean: 0.00 Platinum-cobalt Units
Carlson Trophic Status for Total Phosphorus: 0.0
Carlson Trophic Status for Chlorophyll-a: 0.0
Carlson Trophic Status for Secchi Disk: 118.6
Overall Trophic Status: Hypereutrophic
(O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic)





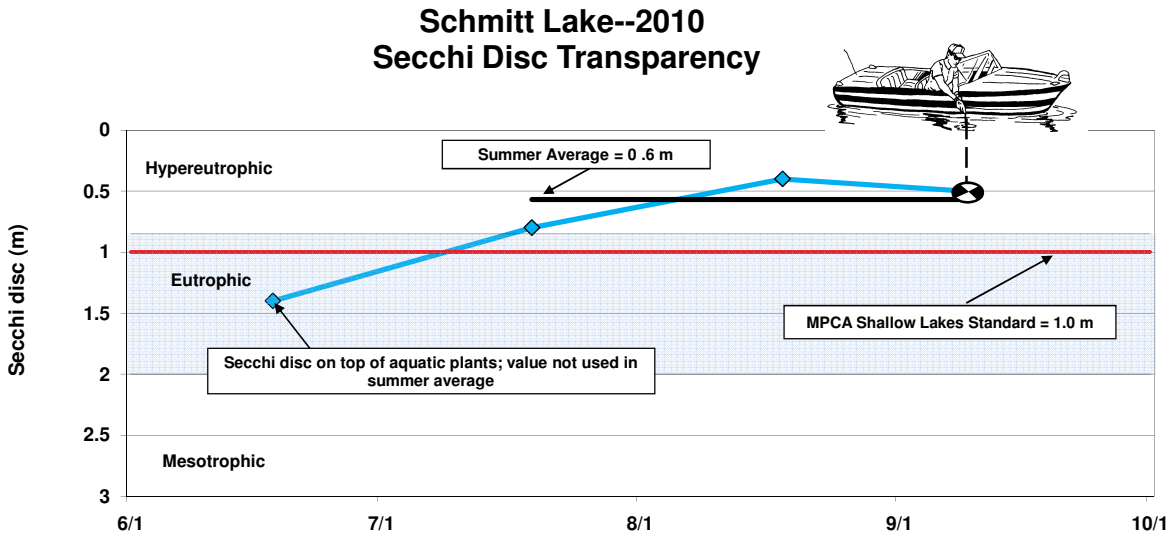


Figure 2.
Schmitt Lake 2010 Monitoring Results

Table 2. 2010 Monitoring Data for Schmitt Lake

Schmitt Lake

Date	Max Depth (m)	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	Turbidity (NTU's)	D. O. (mg/L)	Temp (°C)	Sp. Cond. (µmho/cm @ 25°C)	Total P (mg/L)	Chloride (mg/L)	pH (S.U.)	ORP (mv)
6/18/10	1.8	0-1.5	1.4	5.3	1.3	--	--	--	0.046	200	--	--
		0.0				13.1	23.4	770	--	--	9.9	208
		1.0				13.1	23.4	770	--	--	9.8	193
		1.5				8.5	21.8	801	--	--	9.3	99
			secchi disc on top of aquatic plants									
			P. crispus present, algal mats near shore, dense Elodea canadensis									
			Myriophyllum spicatum present (sample pressed and dried)									
7/19/10	1.5	0-1	0.8	48.0	8.1	--	--	--	0.084	150	--	--
		0.0				5.9	25.0	610	--	--	8.5	156
		1.0				3.2	24.9	615	--	--	8.2	160
8/18/10	1.5	0-1	0.4	77.0	16.8	--	--	--	0.150	130	--	--
		0.0				9.2	23.5	583	--	--	8.8	113
		1.0				4.4	22.7	596	--	--	8.0	124
9/9/10	1.5	0-1	0.5	65.0	13.9	--	--	--	0.110	120	--	--
		0.0				10.2	16.6	560	--	--	8.7	115
		1.0				10.2	16.6	560	--	--	8.7	115

APPENDIX F

Water Body Categories from 2001 Classification System

The 2001 plan required the member cities to manage the non-intercommunity water bodies to achieve the cities' goals, while the WMO was responsible for monitoring the intercommunity water bodies. The classifications were preliminary due to limited amounts of water quality information. Member cities classified their water bodies individually based on their level of use.

Category I - Water bodies in this category are typically used for swimming and other direct contact recreational activities. These water bodies have the highest/best water quality and are usually the most popular water bodies with the public.

- Rogers Lake – Mendota Heights
- Sunfish Lake – Sunfish Lake

Category II - Water bodies in this category are typically used for indirect contact recreational activities such as boating and fishing that involve incidental contact with surface water. These water bodies have poorer water quality than Category I water bodies, but are still popular with the public.

- Seidl's Pond – South St. Paul/Inver Grove Heights
- Thompson Lake – West St. Paul
- Marthaler Pond – West St. Paul
- 19-93 W – Mendota Heights
- Wood Duck Pond – Sunfish Lake
- Horseshoe Lake – Sunfish Lake

Category III - Water bodies in this category serve important functions for wildlife habitat and aesthetic enjoyment, and may also provide opportunities for warm-water fishing, provided winterkill does not occur. These water bodies have poorer water quality than Category I and II water bodies and typically are not viewed as swimmable.

- Dickman Lake/Loch Gregor – Inver Grove Heights/Sunfish Lake
- Bohrer Pond – Inver Grove Heights/South St. Paul
- Hornbean Lake – Sunfish Lake/Inver Grove Heights
- Pickerel Lake – Lilydale/St. Paul
- Schmitt Lake – Inver Grove Heights/Sunfish Lake/West St. Paul
- Lily Lake – West St. Paul
- Mud Lake – West St. Paul
- Dodge Nature Center Ponds – West St. Paul
- Friendly Marsh – Mendota Heights
- 19-103 P, 19-227 W, 19-228 W, 19-118 W, 19-108 W, 19-235 W, 19-232 W – Mendota Heights

Category IV - Nutrient Traps. Water bodies in this category are intended to reduce downstream loading of phosphorus and other nutrients that contribute to water pollution. These water bodies are designed to have phosphorus removal efficiencies of at least 50%.

- Golf Course Pond – Inver Grove Heights/West St. Paul
- LeVander Pond – South St. Paul
- Anderson Pond – South St. Paul
- 19-229 W, 19-234 W, 19-231 W, 19-233 W – Mendota Heights

Category V - Sediment Traps. These water bodies are similar to Category IV water bodies, but are too small to effectively remove a significant fraction of nutrients. These basins will generally have phosphorus removal efficiencies of less than 50%.

- 19-119 W, 19-104 W – Mendota Heights

The monitoring effort required for water bodies using this classification system is as follows:

Water Body Classification	**Type of Monitoring**
Category I	Survey Level – minimum requirement Management Level– only under certain conditions.
Category II/III	Secchi disk monitoring (i.e. MPCA's Citizen Lake Monitoring Program).
Category IV/V	As required by city maintenance plans and policies.