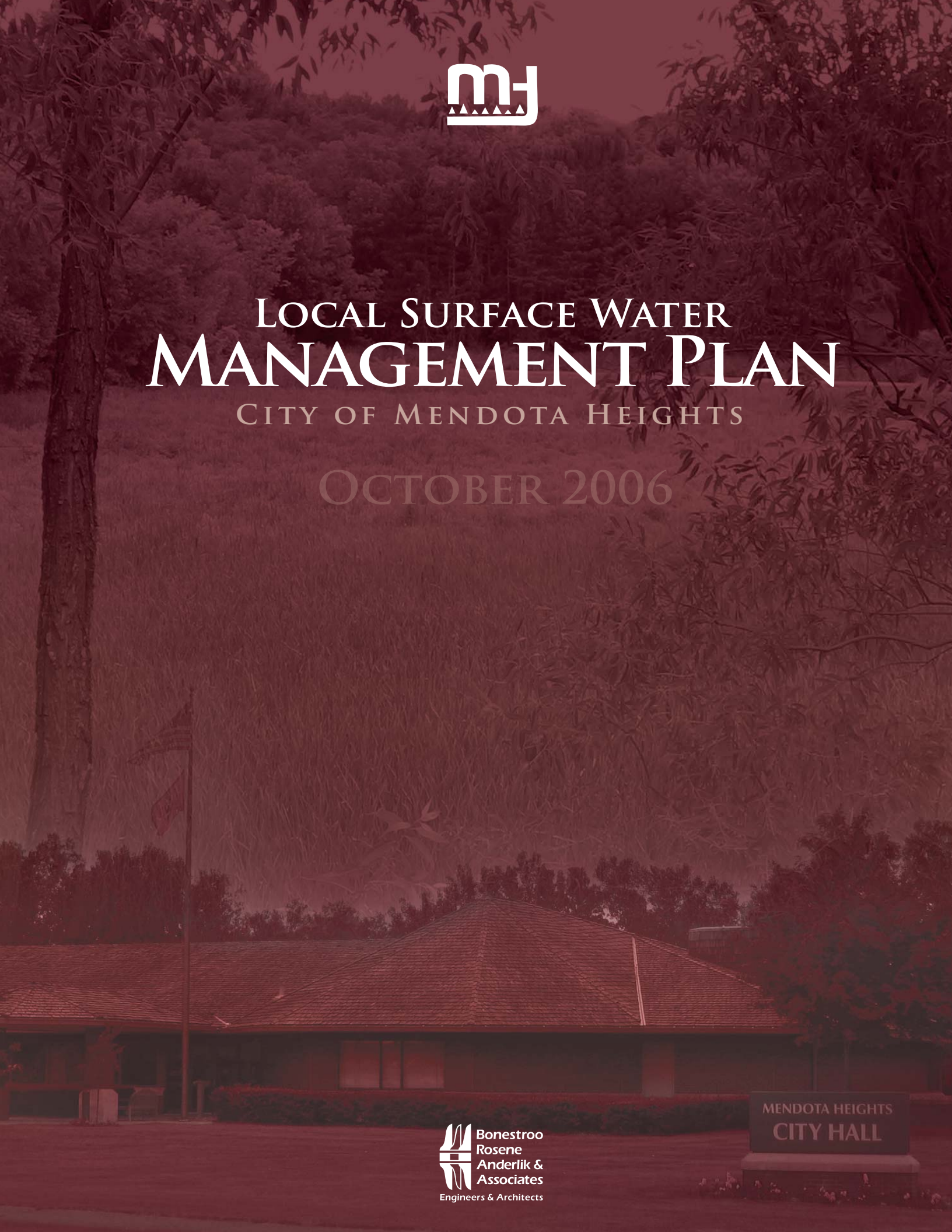
Local Surface Water Management Plan

City of Mendota Heights

October 2006



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EXECUTIVE SUMMARY

This report provides the City of Mendota Heights with a Local Surface Water Management Plan (LSWMP) that serves as a guide to managing the City's surface water system, and that brings the City into compliance with Minnesota Statute. The LSWMP will carry the City through the end of 2015. Periodic amendment to the Plan will likely occur in the intervening 10 years so that the Plan remains current to watershed plan amendments and Metropolitan Council requirements and current to the "state of the art" in surface water management.

The Mendota Heights LSWMP will serve as a comprehensive planning document to guide the City in conserving, protecting, and managing its surface water resources. This plan is an update to the 1993 Water Resources Management Plan (WRMP). The LSWMP has been updated to meet requirements as established in Minnesota Rules 8410. In addition, the Plan reflects the requirements of the watersheds with jurisdiction within the City: the Lower Minnesota River Watershed District (LMRWD), the Gun Club Lake Watershed Management Organization (GCLWMO), and the Lower Mississippi River Watershed Management Organization (LMRWMO). Meeting watershed requirements ensures the City's compliance with local and regional expectations.

The City submits its LSWMP to the Metropolitan Council and the three watershed organizations for review. These watersheds have 60 days for their review after written receipt of the City Plan. Met Council provides comments within 45 days. The Council directs its comments to the watershed organizations which consider these comments in formulating their own.

Based on the guidance provided by the Mendota Heights City council and staff, this report addresses the city's current surface water management needs and provides a framework for successful implementation of a comprehensive storm water management program.

This report is a culmination of the activities described above and is organized as follows:

- Section 2 - Land and Water Resource Inventory, describes the physical environment including watersheds and drainage patterns, dominant land uses, and significant water bodies within the City.

- Section 3 - Goals and Policies, lists the City's goals and policies along with public agency requirements affecting surface water management in the City.

- Section 4 - Wetland Management Plan, presents the results of a wetland inventory. The purpose of the inventory is to identify wetland and water resources that currently exist in the City.

- Section 5 - System Assessment and Design, presents an overview of all the major watersheds in the City. Section 5 also provides detail on the existing storm water management system. A synopsis of the modeling procedure, criteria, and assumptions are also included.

- Section 6 - Implementation Plan, covers regulatory responsibilities, priority implementation items, educational programs, operation and maintenance, and financing considerations. A plan amendment process is also identified.

- Section 7 - Summary and Outcomes, contains a summary the LSWMP and outcomes resulting from City Council adoption of the Plan.

The Goals and Policies section of the LSWMP outlines goals and policies specific to surface water management in Mendota Heights and its environs. The goals and policies are broad statements regarding the motivation and intent of the LSWMP. The policies that follow the individual goals are specific requirements that promote attainment of the goal.

The primary goal of Mendota Heights's LSWMP is to bring the City into statutory compliance and provide the City a framework for effective stormwater management - primarily to guide redevelopment activities but also as a guide for identifying and implementing retrofits to the existing system. These retrofits consist of both projects and programs. Additionally, the plan provides clear guidance on how Mendota Heights intends to manage surface water in terms of both quantity and quality.

Generally, the goals and policies of the 1993 WRMP are included in this LSWMP. In addition, the LSWMP incorporates the 1993 WRMP hydrologic model which was converted into HydroCad modeling software to facilitate its use by City staff.

Title 12, Chapter 2 of the Mendota Heights City Code provides for the protection, preservation, maintenance, and use of Mendota Heights wetlands and water resource related areas:

- to maintain the natural drainage system;
- to minimize the disturbance which may result from alteration by earthwork, loss of vegetation, loss of wildlife and aquatic organisms as a result of the disturbance of the natural environment, or from excessive sedimentation;
- to provide for protection of probable fresh water supplies;
- and to ensure safety from floods.

The Wetland Management Plan (Section 4) gives the results of the wetland inventory and the mapping effort (Map 1). This GIS-based wetland map has been developed for the City to use as a planning tool for future projects that may affect wetlands. The inventory of wetlands also allows the city to identify restoration areas within city-owned lands.

The wetland map and the management discussions of Section 4 are intended to provide the following benefits:

- Provide a more detailed inventory of wetlands and water resources than that provided by the National Wetlands Inventory.
- Enhance wildlife values of wetlands.
- Provide and enhance recreational values of wetlands.
- Designate wetland restoration/enhancement opportunities.
- Protect wetlands and adjacent resources that provide valuable ecological support.
- Provide stormwater protection for wetlands.

It should be noted that this wetland inventory has been created for planning purposes only. Regulation of activities potentially affecting individual wetlands will be based on a site-specific delineation of the wetland boundary as part of a proposed project.

The Wetland Management Plan addresses key management issues such as wetland protection, wetland restoration/enhancement opportunities, and wetland stewardship. Wetland protection is addressed by focusing on key issues such as the following:

- the relative susceptibility of a wetland to stormwater affects with respect to the type of wetland;
- wetland water quality and quantity;
- wetland buffer strip and setback protection.

The plan also gives key areas for focusing City resources on wetland restoration and enhancement opportunities. The plan recognized the following areas as highest priority for management recommendations:

- Wentworth Park,
- Friendly Hills Park,
- Valley Park.

Wetland stewardship is an important part of the Wetland Management Plan. There are a number of things that residents, cities, or counties can do voluntarily to enhance wetlands and buffer strips that surround wetlands. Section 4 describes some of these practices:

- Enhancement of the vegetative structure of the wetland. Native wildflowers, grasses, shrubs and trees can be planted in the wetland or the adjacent buffer areas to enhance habitat and stormwater filtering,
- Control of invasive exotic species,
- Install habitat structures for wildlife such as nesting structures for waterfowl and other birds, turtles, and amphibians,
- Schools and other organizations can adopt wetlands and adjacent areas for use as outdoor classrooms.

The System Assessment and Design section of the LSWMP (section 5) serves two functions. The system assessment portion catalogues the various assessments of problems that the Plan must address. The intent is to identify the source of problems and specific actions the City will take to address these problems either independently or in collaboration with some other organization – most commonly one of the watershed organizations.

The system design portion of this section describes the City's surface water management system. This system is shown on Map 2. The map indicates the major drainage divides, storage areas, conveyance (i.e. pipes and channels), and storage areas (i.e. wetlands and lakes) that have been incorporated into the Mendota Heights LSWMP hydrologic model.

The system assessment portion of section 5 summarizes water quality and water quantity assessments conducted by the City, the three watershed organizations, and the Minnesota Pollution Control Agency (MPCA). The MPCA's assessment role is through the TMDL program which stems from the federal Clean Water Act. TMDL stands for Total Maximum Daily Load. TMDLs are standards for pollutant loadings that are determined from studying individual water bodies. The pollutant loading standards, or restrictions, are intended to improve a water body so that its designated use can be attained. Designated uses include swimming, fish consumption, or other recreation.

The portion of the Minnesota River that is within the City limits is listed in the state impaired waters list. Known as the 303(d) list from the applicable section of the federal Clean Water Act, these waters are ones that do not currently meet their designated use due to the impact of a particular pollutant or stressor. If monitoring and assessment indicate that a water body is impaired by one or more pollutants, it is placed on the impaired waters list. At some point a strategy would be developed that would lead to attainment of the applicable water quality standard. The process of developing this strategy is TMDL process mentioned above.

The TMDL process involves the following phases:

1. Assessment and listing
2. TMDL study
3. Implementation plan development and implementation
4. Monitoring of the effectiveness of implementation efforts

Responsibility for implementing the requirements of the federal Clean Water Act falls to the U.S. Environmental Protection Agency (USEPA). In Minnesota the USEPA delegates much of the program responsibility to the state Pollution Control Agency (MPCA). Information on the MPCA program can be obtained at the following web address: http://www.pca.state.mn.us/water/tmdl/index.html.

The Mississippi River, downstream of the Mendota Heights city limits, is also listed (assessment unit ID # 07010206-505). This listing will potentially affect management of drainage that directly discharges to the Mississippi River.

The absence of a water body from the 303(d) list does not necessarily mean the water body is meeting its designated uses. It may be that it has either not been sampled or there is not enough data to make an impairment determination. Additionally, where mercury is identified as a stressor (as in portions of the Minnesota and Mississippi Rivers), the TMDL approach will be regional in nature as mercury is most commonly an air-borne pollutant.

It remains to be seen how the TMDL issues will be resolved for the Minnesota River and Mississippi River. The rivers' basins encompass a significant portion of the state of Minnesota. The TMDLs for the rivers could be implemented at the basin level or the smaller watershed level. It is probable that the emphasis for certain TMDLs, like nutrients, will be at the watershed, or multiple watershed, level. It is likely that once TMDL plans are in place, this LSWMP will have to be amended to incorporate the requirements of these TMDLs.

Since the City prepared its 1993 WRMP, no new water quantity assessments have been conducted by the City. This does not mean that the City has not been addressing new water quantity issues, only that these have not been significant enough in scope to warrant mention in this Plan. Refer to Section 5 for the status of issues identified in the 1993 WRMP. The watershed organizations have also addressed water quantity issues within Mendota Heights. Section 5 provides detail on these assessments.

Section 5 also describes the City's surface water management system.
The City was organized into 4 topographic watersheds, as follows:

- Interstate Valley Creek Watershed
- Ivy Falls Creek Watershed
- Mississippi River Bluffs Watershed
- Gun Club Lake Watershed

The Interstate Valley, Ivy Falls Creek, and Mississippi River Bluff topographic watersheds generally lie within the Lower Mississippi River WMO jurisdiction. The Gun Club Lake topographic watershed is in the Gun Club Lake WMO jurisdiction, though a small part lies within the Lower Minnesota River Watershed District jurisdiction.

Each major watershed was divided into drainage districts. The drainage districts are generally drawn to encompass all drainage to a particular pond, wetland or lake. This LSWMP identified 16 major drainage districts. As shown on map 2, these drainage districts are further subdivided into subdistricts, which are the smallest unit of land used in the update of the surface water system model.

Section 5.3 describes each drainage district in detail. Section 5.4 gives a discussion of the hydrologic modeling effort. Specifically, the discussion goes into detail regarding the conversion of the 1993 WRMP model into the HydroCAD hydrologic model.

Section 5.4 also discusses the concepts of the stormwater conveyance and storage system and the water quality system and includes a discussion of the water quality modeling that was done for the 1993 WRMP. The 1993 WRMP used PondNet as the modeling program. New modeling was not performed for this LSWMP.

The Implementation Plan of the Mendota Heights LSWMP (Section 6) describes those activities and programs the City might develop toward improving its surface water management program. Since Mendota Heights is largely developed, capital outlay for the trunk sewer system has already occurred so future outlay will be for upgrades and replacement. Typically, costs for upgrade and replacement would be borne by either the stormwater utility fund or would be recovered through direct assessment. Given this, a typical financing mechanism developed in most LSWMPs, an area charge, is not a part of the Mendota Heights LSWMP.

Section 6 also includes:

- An overview of the City's NPDES permit.
- A discussion of operation and maintenance procedures and strategies.
- An outline of an education program.
- Financial considerations for the stormwater utility.
- A section referencing applicable design standards for stormwater management.
- A section on Watershed implementation priorities.
- Implementation priorities for the City.
- A discussion of the process for amending this plan and an annual report to council.

The City of Mendota Heights implemented a stormwater utility in 1993. The current status and future funding for the Stormwater Utility is discussed in Section 6. Refer to Section 6 for details and cost summary tables for the Stormwater Utility. The costs in Section 6 include costs associated with meeting requirements for the Phase II NPDES permit and a Storm Water Pollution Prevention Plan (SWPPP).

Design standards for stormwater management pertain to design and analysis of the stormwater system, and are discussed in Section 6. As typically conceived, they cover the following areas:

- Submittal Requirements
- Erosion and Sediment Control
- Stormwater Management
- Storm Sewer Design

The City does not have a public works design manual, and it is recommended that one be developed in conjunction with other activities, such as ordinance implementation.

The City of Mendota Heights, through its NPDES permit, has made a commitment to implementing the following ordinances:

- Erosion and Sediment Control (ESC)
- Illicit Discharge
- Stormwater Management Ordinance

According to the City's NPDES permit the ESC ordinance was to be completed in year 2 of the current permit, which ended in March 2005. The City delayed implementation of this ordinance until the LSWMP could be completed, since portions of the LSWMP might be referenced as part of the ordinance writing. In addition to ordinance identified in the City's NPDES permit, this LSWMP also recommends implementation of a shoreland ordinance as required by the Minnesota Department of Natural Resources and the watershed organizations with jurisdiction over the City.

Section 6 continues with discussions on the operation and maintenance of the stormwater management system, Watershed implementation priorities, and City of Mendota Heights implementation priorities.

1. INTRODUCTION

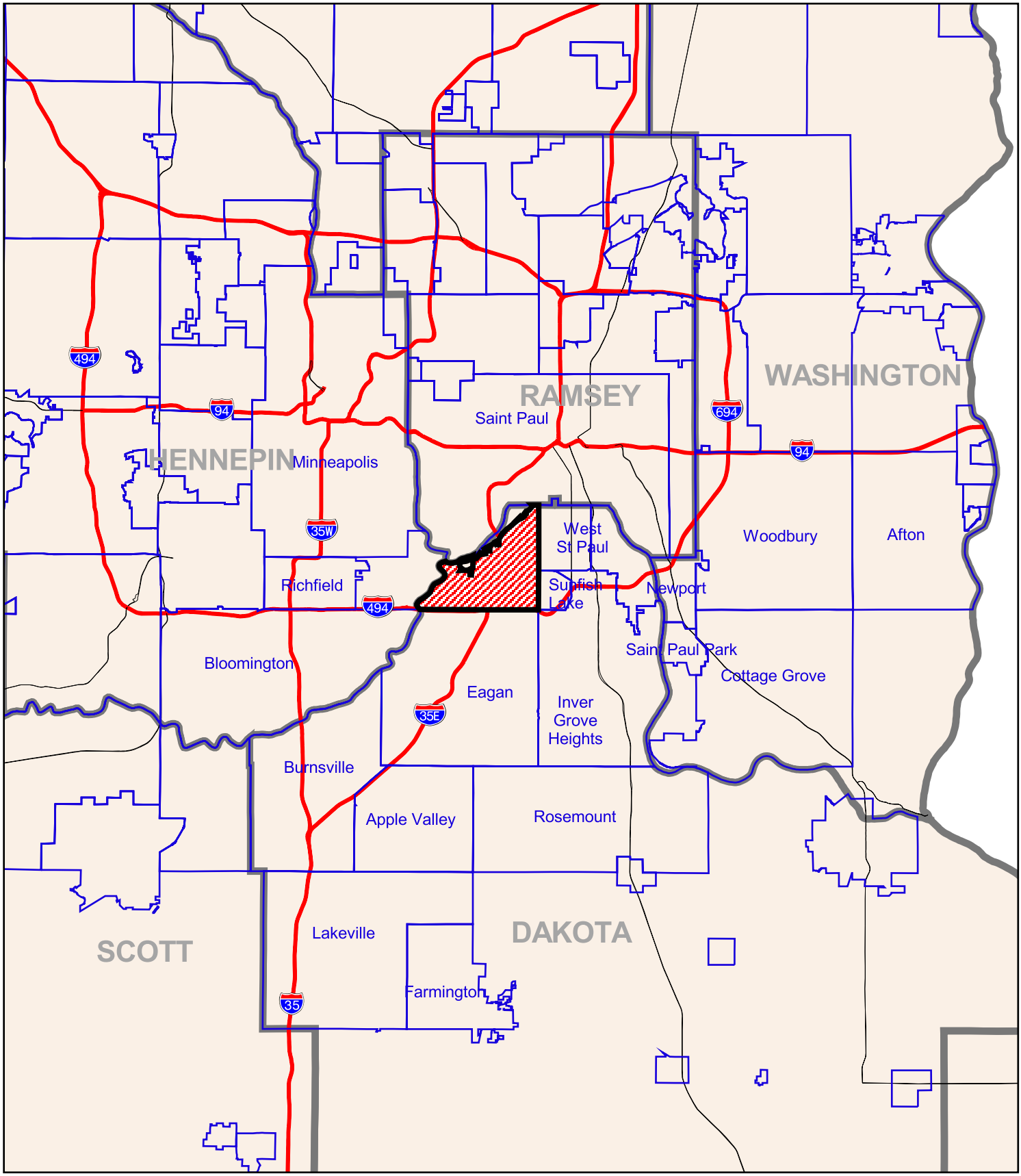
1.1 Background

This report provides the City of Mendota Heights with a Local Surface Water Management Plan (LSWMP) that serves as a guide to managing the City's surface water system, and that brings the City into compliance with Minnesota Statute. The LSWMP will carry the City through the end of 2015. Periodic amendment to the Plan will likely occur in the intervening 10 years so that the Plan remains current to watershed plan amendments and Metropolitan Council requirements and current to the "state of the art" in surface water management.

The City of Mendota Heights is located in northern Dakota County at the confluence of the Mississippi and Minnesota Rivers (Figure 1). Mendota Heights is a well established community that is nearly fully developed. The community has put emphasis on high quality residential neighborhoods, open space and parks, and well-planned commercial and industrial areas.

The Township of Mendota was organized in 1858. After World War II, the area was experiencing rapid growth, especially in the northern part of the township. The need for community planning and services prompted a portion of the original township to incorporate as the Village of Mendota Heights in 1956. The Village of Mendota Heights became the City of Mendota Heights in 1974.

The City had its highest rate growth from the 1950s through the 1990s. Population growth is expected to slow because of the limited amount of land available for development. Table 1.1 provides City populations and population projections from 1970 through 2020.



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City of Mendota Heights

Surface Water Management Plan

PROJECT LOCATION

Figure 1

N W E S

Mendota Heights
County Boundaries

Table 1.1
Population and Households

Year	Population	Number of Households
1970	6,565	1,641
1980	7,288	2,210
1990	9,381	3,302
2000	10,900	4,200
2010	11,150	4,300
2020	11,453	4,405

Source: Comprehensive Plan (2002), City of Mendota Heights

1.2 Purpose and Scope

The Mendota Heights LSWMP will serve as a comprehensive planning document to guide the City in conserving, protecting, and managing its surface water resources. This plan is an update to the 1993 Water Resources Management Plan (WRMP). The LSWMP has been updated to meet requirements as established in Minnesota Rules 8410. In addition, the Plan reflects the requirements of the watersheds with jurisdiction within the City: the Lower Minnesota River Watershed District (LMRWD), the Gun Club Lake Watershed Management Organization (GCLWMO), and the Lower Mississippi River Watershed Management Organization (LMRWMO). Meeting watershed requirements ensures the City's compliance with local and regional expectations.

Local plans must do the following:

- Describe existing and proposed environment and land use.
- Provide a narrative addressing stormwater infrastructure philosophy, which details regulatory authority, and implementation and financial responsibilities.
- Define areas and elevations of stormwater storage adequate to meet performance standards established in the watershed organization plans.
- Identify quality and quantity protection methods which meet standards.
- Identify regulated areas and potential easements or land acquisition areas.
- Outline a procedure for submitting annual reports to agencies which document Wetland Conservation Act and monitoring program data consistent with state compatibility guidelines.
- Set forth an implementation program, including a description of official controls, inspection and maintenance, and a capital improvement plan.
- Describe official controls and the responsible unit of government in the following areas: wetlands, erosion control, shore land, floodplain, grading, and drainage.
- Meet other requirements as outlined in watershed organization plans.

The City submits its LSWMP to the Metropolitan Council and the three watershed organizations for review. These watersheds have 60 days for their review after written receipt of the City Plan. Met Council provides comments within 45 days. The Council directs its comments to the watershed organizations which consider these comments in formulating their own.

Beyond the statutory requirements outlined above, the Mendota Heights LSWMP has its own particular emphasis. Some areas of emphasis include:

- Collecting and compiling the efforts of agencies and organizations including the City, its departments and residents. This includes past reports and studies, management plans, monitoring studies, as well as completed and proposed improvement projects.
- Reviewing the current state of the City's surface water resources in the context of goals and policies, ordinances, operations and maintenance, flood mitigation, and achievement of targeted water quality levels in its surface water bodies.
- Establishing reasonable, achievable and affordable goals, and supporting them with a strong regulatory and management culture. Developing an implementation plan that includes projects and processes that derive from a thorough assessment of current City problem areas and current City surface water regulations and controls.
- Recommending ordinance implementation to cover gaps between goals and actual practice.
- Reviewing the Stormwater Utility funding in light of current and future responsibilities.
- Updating the hydrologic model from the 1993 Water Resources Management Plan (WRMP). The 1993 WRMP model was converted to HydroCad modeling software to facilitate its use by City staff.
- Providing a more accurate wetland map that reflects current conditions and is geographically accurate.

City staff has participated in collecting data, providing feedback, and contributing knowledge of local systems to aid in developing a strategy that encompasses water quality and quantity issues. The City of Mendota Heights is the organizer of the final document though contributions from the watershed organizations have been substantial.

Based on the guidance provided by the Mendota Heights City council and staff, this report addresses the city's current surface water management needs and provides a framework for successful implementation of a comprehensive storm water management program. A specific outline of the steps involved in the preparation of the LSWMP is presented below:

1. System Inventory and Mapping – Reassess and update drainage patterns and major trunks/conveyors of the storm water system. Develop a map on the basis of this analysis.

2. Goals, Policies and Guidelines – Develop goals and policies that guide the City's surface water management philosophy. Augment design guidelines for development and redevelopment. This gives the City guidance for facilities design and standards for reviewing development plans. Included in this process is determining regulatory agencies involved in the storm water management of the City and working with City staff to develop feasible goals, policies and guidelines.

3. System Assessment and Design – Convert the 1993 WRMP model into a HydroCad model, and update the model for changes in the storm water system.

4. Stormwater Utility – Provide financial estimates for supporting the City's Stormwater Utility.

5. Stormwater Ordinances – Recommend ordinances or revision to existing ordinances.

6. Stormwater System Management – Provide recommendations on operating and maintaining the storm water system as well as Best Management Practices (BMPs) for water quality and erosion control. Information regarding compliance with NPDES Phase II Storm water permits is also included.

1.3 Organization

This report is a culmination of the activities described above and is organized as follows:

- Section 2 - Land and Water Resource Inventory, describes the physical environment including watersheds and drainage patterns, dominant land uses, and significant water bodies within the City.

- Section 3 - Goals and Policies, lists the City's goals and policies along with public agency requirements affecting surface water management in the City.

- Section 4 - Wetland Management Plan, presents the results of a wetland inventory. The purpose of the inventory is to identify wetland and water resources that currently exist in the City.

- Section 5 - System Assessment and Design, presents an overview of all the major watersheds in the City. Section 5 also provides detail on the existing storm water management system within the four watershed areas. A synopsis of the modeling procedure, criteria, and assumptions are included as well.

- Section 6 - Implementation Plan, covers regulatory responsibilities, priority implementation items, educational programs, operation and maintenance, and financing considerations. A plan amendment process is also identified.

- Section 7 - Summary and Outcomes, contains a summary the LSWMP and outcomes from City Council adoption of the Plan.

2. LAND AND WATER RESOURCE INVENTORY

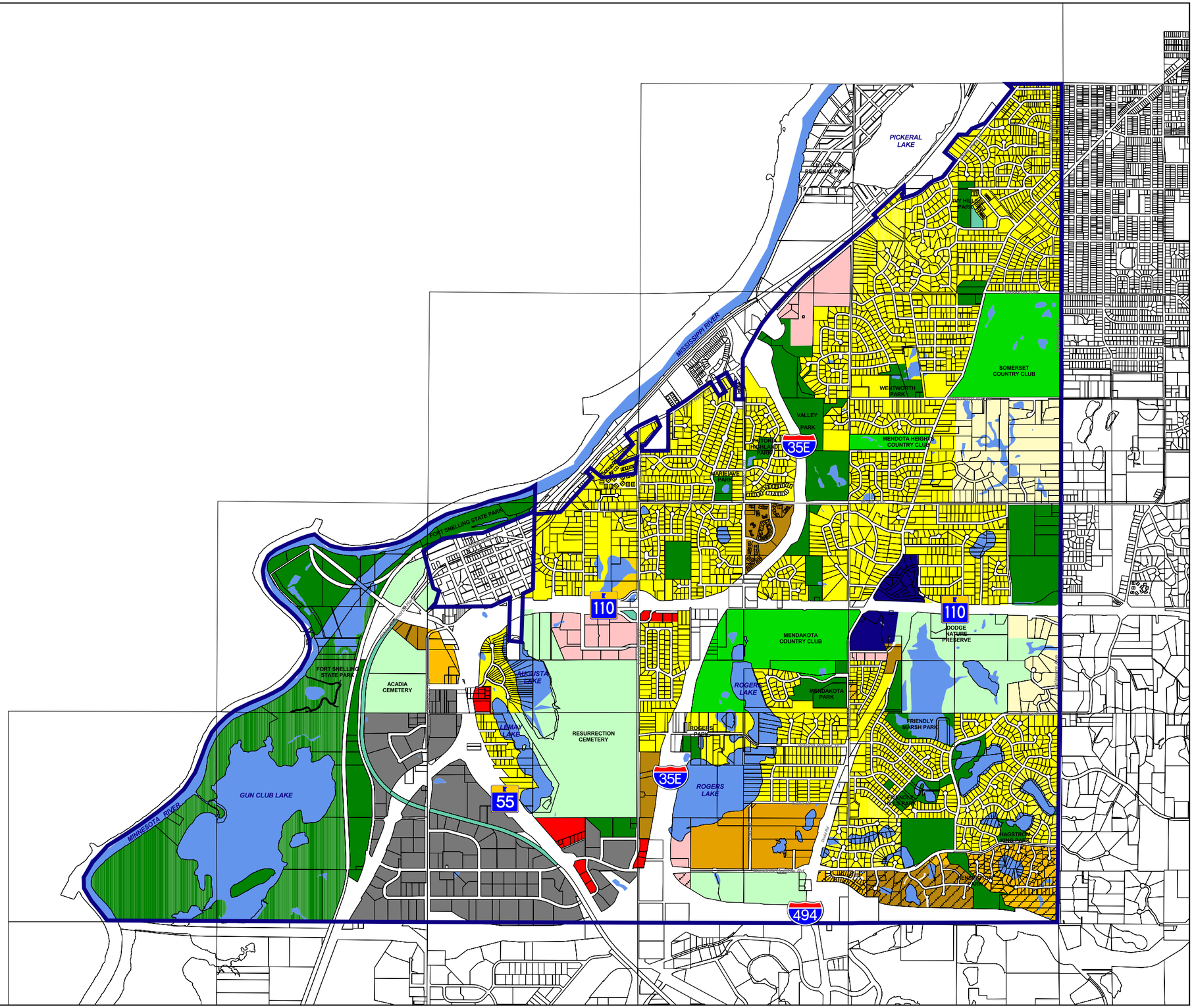
2.1 Land Use

Figure 2 provides the land use classifications for the City of Mendota Heights. This figure comes directly from the City's 2002 Comprehensive Plan. The comprehensive plan states that the City of Mendota Heights is predominantly developed. However, the City has substantial areas of public open space, wetlands, lakes, bluffs, and wooded areas that give the impression of a lower density of development. According to the comprehensive plan, the City will strive to protect the quiet seclusion of its mature neighborhoods by preserving natural features and the environment and promoting high quality and well functioning developments.

The City's 2002 Comprehensive Plan provides a significant amount of narrative and statistical detail on existing and proposed land use and the reader is referred to that document for more information on land use planning. Specifically, the comprehensive plan noted that the City has "focus" areas, or remaining parcels to be developed. These focus areas are the Garron, Acacia, Resurrection, Somerset, St. Thomas Visitation, and Dodd/Highway 110 sites. The total area of these focus areas is approximately 310.5 acres which is approximately 5% of the total area of the City's total area of approximately 10 square miles. Some of these areas have recently developed however. The Augusta Shores development resides in the Resurrection site; the Hidden Creek Estates development resides in the Somerset area site; and the Dodd/Highway 110 site is currently under development as the Villages at Mendota Heights. The City has purchased the Garron site, which will now be public open space.

The hydrologic modeling that supports the LSWMP used the land use that was used in the 1993 Water Resources Management Plan hydrologic model. The 1993 Plan model used future full development land use conditions as envisioned at that time. The updated model incorporates the changes in land use for existing conditions, such as those areas in the focus areas. A combination of aerial photos, the land use classification map, and as-built drawings were used to determine hydrologic characteristics of the full development landscape.

Changes from undeveloped land uses, like natural and agricultural, to more heavily developed land uses like low, medium and high density residential, and commercial have a pronounced affect on hydrology. The increased impervious surface associated with the urban land uses leads to higher runoff peak flows and increased runoff volume. Table 2.1 shows how volume and peak increase for two typical rainfall events.



City of
Mendota Heights

Surface Water Management Plan

Land Use

Figure 2

Bonestroo
Rosene
Anderlik &
Associates
Engineers & Architects

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Residential
- Rural Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Planned Unit Development Only

Commercial
- Limited Business
- Business
- Planned Unit Development Only

Industrial
- Industrial
- Planned Unit Development Only

Mixed Use
- Mixed Use (PUD Only)

Other
- Public
- Open Space/Trail
- Golf Course
- Institutional
- Water
- Right-of-Way

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Table 2.1
Land Use Based Peak and Volume Comparisons

Land Use	2-year (2.8") SCS Type II, 24-hour Rainfall		100-year (5.9") SCS Type II, 24-hour Rainfall	
	Runoff Peak	Runoff Volume	Runoff Peak	Runoff Volume
	cfs/ac	Inches	cfs/ac	Inches
Natural	0.08	0.2	1.7	1.7
Low Density Residential (30% impervious)	1.0	0.7	4.4	2.9
Medium Density Residential (38% impervious)	1.2	0.8	4.8	3.2
Commercial (85% impervious)	2.9	2.0	6.9	5.0

2.2 Topography and Watersheds

The surficial geology of Mendota Heights consists of the glacial and alluvial (outwash) deposits which cover most of the City. The City of Mendota Heights is within the Twin Cities Formation of the Eastern St. Croix Moraine geomorphic area. This area was formed at the southern extent of the Superior and Rainey glacial lobes as they flowed side by side as a single lobe and then terminated to form the St. Croix Moraine. As the glacier retreated and melted, it left behind areas of outwash and till deposit formations. The area of outwash formations that is located in the west portion of the City is comprised of silt, sand, and gravel that were carried, sorted, and deposited by glacial melt-water. The area of till formations located in the eastern two-thirds of the City is composed of unsorted clay, silt, sand, and boulders transported and deposited by glacial ice. Silt and sand lenses are interspersed throughout this formation.

The City of Mendota Heights is located near the confluence of the Minnesota and Mississippi Rivers in northern Dakota County. Most of Mendota Heights is rolling to hilly terrain interspersed with poorly drained depressions that form many ponds and small lakes. Steep slopes occur along the Minnesota and Mississippi river bluffs along the west and north border of the City. These steep slopes are usually wooded and are not well suited for development. Flat areas can be found along the Minnesota River floodplain on the City's west border. Elevation in the City ranges from approximately 690 feet along the Minnesota River to approximately 1030 feet along the City's border with West St. Paul.

The City's hydrologic system is part of both the Minnesota River and Mississippi River Basins. The City lies within two watershed management organizations and one watershed management district. The southwestern portion of the City along the Minnesota River is in the Lower Minnesota River Watershed District. Portions of the southwest area of the City reside in the Gun Club Lake Watershed Management Organization. The remaining area of the City resides in the Lower Mississippi River Watershed Management Organization. Figure 3 shows jurisdictional boundaries for the 3 watershed organizations within the City.

2.3 Soils

Soils of the Mendota Heights area are classified into three associations of multiple soil series:

- Kingsley-Mahtomedi Association
- Waukegan-Wadena-Hawick Association
- Colo-Algansee-Minneiska Association

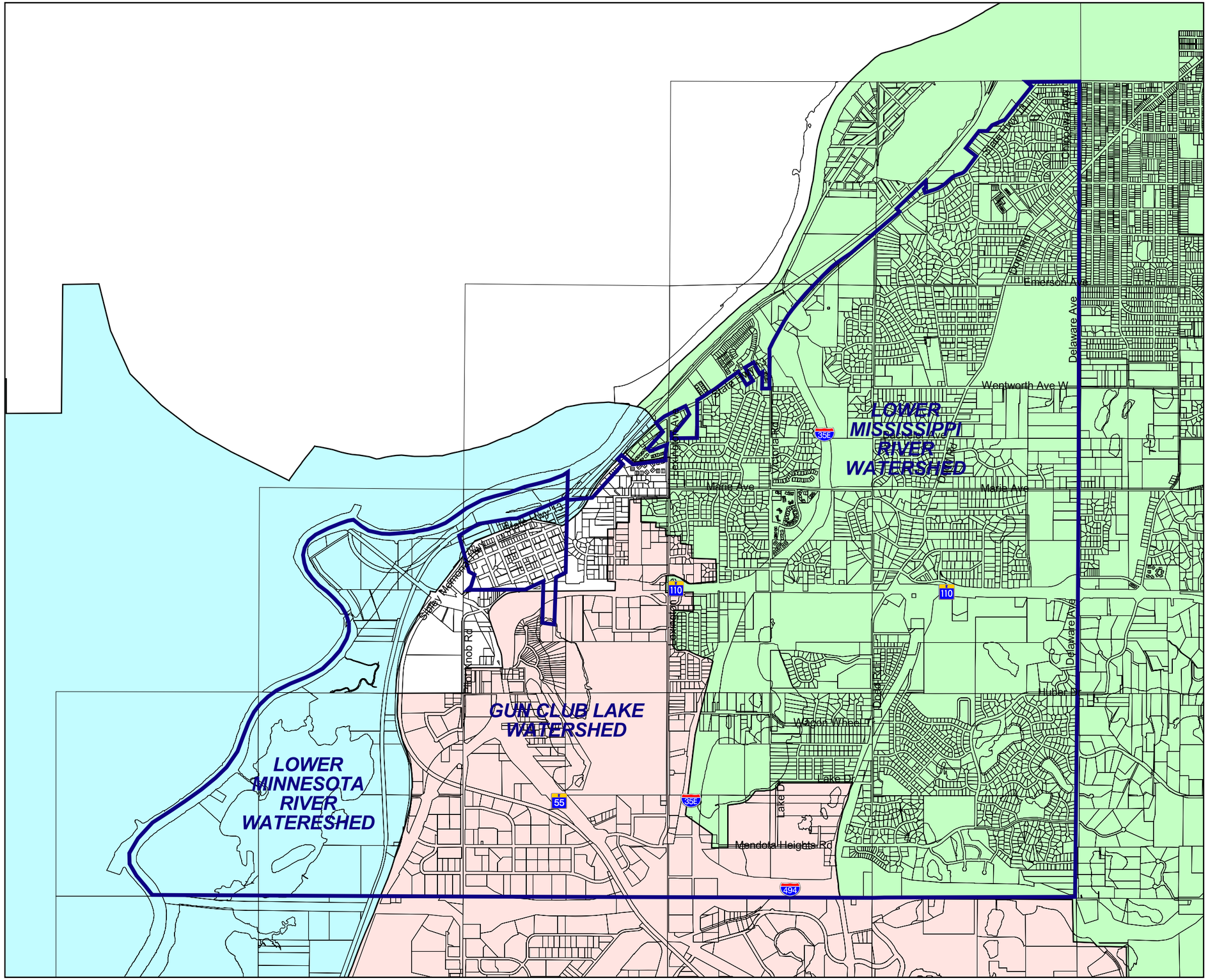
Information about each of the soils in these associations are available from the Soil Survey of Dakota County (SCS 1983). Table 2.2 shows the drainage characteristic of each soil series from the above associations.

Table 2.2
Soil Drainage Characteristics

Soil Series	Draining Characteristic	Hydrologic Soil Group
Kingsley	Deep, well drained	B
Mahtomedi	Deep, excessively drained	A
Waukegan	Deep, well drained	B
Wadena	Deep, well drained	B
Hawick	Deep, excessively drained	A
Colo-Algansee-Minneiska (alluvial soils)	Poorly to moderately well drained	B/D

The drainage nature of the soil is important for determining the surface water runoff from a given area. If the soil is well-drained, a significant portion of the precipitation will be infiltrated into the ground, whereas if a soil is very poorly drained, much more precipitation becomes runoff.

The Hydrologic Soil Group (HSG) defines a soils propensity to generate runoff for a given rainfall event. Four HSG groups are identified: A, B, C, and D. HSG A soils have the lowest potential to generate runoff and are typically sandy or gravelly soils. HSG D soils have the highest potential to generate runoff and typically consist of muck, peaty muck, and tight clay soils. Most of the area of the City of Mendota Heights has soil associations ranging from HSG A to B, indicating a low to moderate potential to generate runoff. The Colo-Algansee-Minneiska association lies along the Minnesota River beneath the bluffs. These alluvial soils were not part of the modeling effort for this LSWMP.



City of
Mendota Heights

Surface Water Management Plan

Watershed Boundaries

Figure 3

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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Watershed Boundaries
- Gun Club Lake
- Lower Minnesota River
- Lower Mississippi River
- City Boundary
- Parcel Base Map

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2.4 Key Water Resources

The City of Mendota Heights has many water resources available for the use and enjoyment of its residents. These major water resources tend to be State of Minnesota protected waters. Others are streams that are important for the City's stormwater system. Below is a brief summary of the major surface water resources. The protected waters are labeled with their Protected Waters Inventory (PWI) number. Wetland resources are discussed in Section 4.

Lake Augusta (PWI # 81P)
Lake Augusta is a Minnesota Department of Natural Resources (DNR) protected water. It is a deeper lake with a maximum depth of 33 feet; the median depth is approximately 18 feet. Its area is approximately 44 acres. The area of its watershed is 410 acres, giving a watershed to lake ratio of 9.3 to 1. The lake is landlocked and, at present, the City does not intend to provide an outlet, though Gun Club Lake WMO has indicated the need for one. The implementation section includes initiating discussions with the WMO related to a Lake Augusta outlet.

Lake LeMay (PWI # 82W)
This lake is considered a protected water wetland by the Minnesota DNR. This lake resides in the upper reaches of the Industrial Park drainage district. It is a shallow lake. The area of its watershed is 98.5 acres; its surface area is 30 acres, giving a watershed to lake ratio of 3.3 to 1. It drains via an outlet that extends under Hwy 55.

Gun Club Lake (PWI # 78P)
This lake and its outlet stream are protected waters. The lake resides along the Minnesota River, within its flood plain. Gun Club Lake resides in the lower reaches of the Gun Club Lake watershed. The lake discharges to an unnamed stream that flows to the Minnesota River. Although Gun Club Lake resides within city limits, it is managed by Fort Snelling State Park.

Roger's Lake (PWI # 80P)
Roger's Lake is a protected water (80P). The lake is shallow, with a maximum depth of 8.0 feet. Its surface area is approximately 114 acres. Its watershed is approximately 366 acres, giving a watershed to lake ratio of 3.2 to 1. The lake discharges to storm sewer pipe along Wagon Wheel Trail.

Unnamed Lake (PWI # 103P)
This lake is actually split into three different basins. The upper basin has a normal water level approximately two feet higher than the lower basin. These two basins resemble ponds or small lakes. They are separated by a narrow isthmus, and a culvert connects the two basins. The third basin is downstream of the lower pond basin, and is called the Friendly Marsh. According to the Minnesota DNR PWI map, the two ponds and the Friendly Marsh taken together constitute protected water 103P. But given the actual differences in normal water level elevations for each of these three basins, the hydrologic model considers these as three different basins.

Interstate Valley Creek
This creek is an intermittent stream that begins near the intersection of Hwy 110 and Hwy 149 (Dodd Road) at the outflow point of Friendly Marsh. The creek flows northward, and generally parallels Interstate 35E. Interstate Valley Creek is the single largest watershed within the City of Mendota Heights. Its watershed also includes areas within the cities of Inver Grove Heights, Sunfish Lake, and West St. Paul.

Ivy Falls Creek
Ivy Falls Creek is an intermittent stream as well. It begins in the Somerset Golf Course. The gradient of the creek is steep; it drops 180 feet in 3000 feet from Dodd Road to Hwy 13. The steep gradient has allowed erosion problems to occur. The creek eventually discharges to Pickerel Lake in the City of Lilydale.

Minnesota and Mississippi Rivers
Both of these rivers are Minnesota protected waters. Shoreline of both of these rivers reside within the city limits, but these shorelines reside also in Fort Snelling State Park. The Mississippi River and Minnesota River shorelines that are within the City's limits are managed by Fort Snelling State Park.

2.5 Existing Flood Insurance Studies

A search of the Federal Emergency Management Agency (FEMA) website showed no flood insurance studies for the City of Mendota Heights, other than those for the Mississippi and Minnesota Rivers.

2.6 Other Natural, Biologic, and Water Resources

Section 4 discusses the wetland inventory of the City. The inventory covered the area of the City above the bluffs along the Minnesota and Mississippi Rivers. A Minnesota Land Cover Classification System (MLCCS) search was performed for the areas below the bluffs. The bluffs themselves are upland areas. Table 2.3 shows a listing of the land cover types below the bluffs and the area of each type that falls within the Mendota Heights City limits. Of special note is the presence of calcareous seepage fen prairie. The Lower Minnesota River Watershed District considers calcareous fens to be high priority areas for wetland preservation and restoration.

Table 2.3
MLCCS Summary of Areas Below the Bluffs
City of Mendota Heights

Land Cover Description	Total Area (acres)
Oak (forest or woodland) with 11-25% impervious cover	1.9
51% to 75% impervious cover with deciduous trees	18.0
Pavement with 91-100% impervious cover	2.5
Short grasses with sparse tree cover on upland soils	10.2
Short grasses on upland soils	5.5
Oak forest	3.9
Floodplain forest	209.8
Lowland hardwood forest	6.1
Aspen forest - temporarily flooded	1.5
Mixed hardwood swamp - seasonally flooded	7.2
Altered/non-native deciduous woodland	2.8
Altered/non-native dominated temporarily flooded shrubland	0.8
Willow swamp	3.3
Medium-tall grass altered/non-native dominated grassland	12.8
Temporarily flooded altered/non-native dominated grassland	2.0
Calcareous seepage fen prairie subtype	37.0
Mixed emergent marsh - seasonally flooded	62.5
Mixed emergent marsh	106.4
Mixed emergent marsh - intermittently exposed	57.2
Mixed emergent marsh - permanently flooded	22.1
Grassland with sparse deciduous trees - altered/non-native dominated vegetation	3.4
River mud flats	3.6
Slow moving linear open water habitat	139.3
Limnetic open water	145.1
Palustrine open water	41.6

3. GOALS AND POLICIES

3.1 Purpose

The primary goal of Mendota Heights's LSWMP is to bring the City into statutory compliance and provide the City a framework for effective stormwater management - primarily to guide redevelopment activities but also as a guide for identifying and implementing retrofits to the existing system. These retrofits consist of both projects and programs. Additionally, the plan provides clear guidance on how Mendota Heights intends to manage surface water in terms of both quantity and quality.

This plan is an update to the 1993 Water Resources Management Plan (WRMP) for the purposes of providing the City with a plan that meets the requirements of Minnesota Statute 103B and Rules 8410, which describe the content and requirements for local surface water management plans. The goals and policies of the 1993 WRMP are included in this LSWMP. This LSWMP also incorporates the 1993 WRMP hydrologic model which was converted into HydroCad modeling software to facilitate its use by City staff.

3.2 Background

The City completed its first comprehensive plan in 1960, about 16 years before the Metropolitan Council required such plans. The City amended its plan in 1979 and the latest plan was completed in 2002. The 2002 Comprehensive Plan reiterated the goals of previous plans, and it also reaffirmed the City's commitment to those aspects of the community that makes it a desirable place to live.

Specific to the goals and policies of this Local Surface Water Management Plan are the following 2002 Comprehensive Plan goals under the Natural Features subsection and Stormwater Management subsection.

> **Natural Features Goal:** Protect and enhance the natural living environment for its residents.

Stormwater Management Goal: To develop drainage facilities in a cost-effective manner, while maintaining or improving the quality of its water resources. The following objectives for this goal are referenced from the 1993 WRMP.

a. Water Quantity: Prevent flooding from surface flows while reducing, to the maximum extent practicable, the public capital expenditures necessary to control excessive volumes and rates of runoff.
b. Water Quality: Maintain or improve the quality of water resources within the City.
c. Erosion and Sediment: Prevent the extent possible, sediment from construction sites from entering the City's surface water resources and to control the erosion from drainage ways.
d. Groundwater: Maintain and improve groundwater quality and promote groundwater recharge.
e. Floodplains: Control development in floodplains and floodways.
f. Fish and Wildlife Habitat and Water Recreation Facilities: Protect and enhance fish and wildlife habitats, water recreational facilities, and water resource aesthetics.

The 2006 Mendota Heights LSWMP expands upon the goals and objectives provided in the 2002 Comprehensive Plan and the 1993 Water Resources Management Plan.

3.3 City of Mendota Heights LSWMP Goals and Policies

This section of the LSWMP outlines goals and policies specific to surface water management in Mendota Heights and its environs. The goals and policies identified below are broad statements regarding the motivation and intent of the LSWMP. The policies that follow individual goals are specific requirements that promote attainment of the goal.

The City of Mendota Heights has maintained its natural drainage patterns throughout most of its development. The City's goal is to foster continued optimum use of that natural drainage system while enhancing the overall water quality entering lakes and wetlands. The intent is to prevent flooding while using identified Best Management Practices to enhance surface water quality with minimal capital expenditures by the City.

The City of Mendota Heights has adopted by ordinance the MPCA's publication "Protecting Water Quality in Urban Areas" (including periodic updates) for implementing Best Management Practices for erosion control. The City of Mendota Heights goals were established along the guidelines of the goals developed by the Metropolitan Surface Water Management Act (M.S. 473.875 to 473.883; recodified as 103B.201).

"The purpose of the surface water management programs required by Sections 473.875 to 473.883 is to preserve and use natural water storage and retention systems in order to (a) reduce to the greatest practical extent the public capital expenditures necessary to control excessive volumes and rates of runoff, (b) improve water quality, (c) prevent flooding and erosion from surface flows, (d) promote ground water recharge, (e) protect and enhance fish and wildlife habitat and water recreational facilities, and (f) secure the other benefits associated with the proper management of surface water."

3.3.1 Water Quantity

Goal 1:

Prevent flooding from surface flows while reducing, to the greatest extent practicable, the public capital expenditures necessary to control excessive volumes and rates of runoff.

Policy 1.1:

Trunk storm sewers shall be designed with capacity for 100-year ponded outflows plus 10-year directly connected flows.

Policy 1.2:

In addition to the 10-year and 100-year ponded flow primary capacity, the conveyance system shall provide capacity in excess of the 100-year event in the form of overland overflow routes or adequate surface storage volume. This surface storage volume consists of storage in street low points, within ditches, or in other transient ponding areas.

Policy 1.3:

Detention basins shall be designed with capacity for the critical 100-year event. At a minimum, detention basins should maintain existing flow rates for the 2, 10, and 100-year 24-hour rainfalls.

Definition: The 100-year critical event is the 100-year event that produces the highest water level among a 2-hour, 6-hour, 12-hour, or 24-hour rainfall events or the 10-day, 7.2-inch runoff event.

Policy 1.4:

The maximum duration for rainfall critical event analysis shall be 24 hours except in cases where basins are landlocked, where back to back 24-hour events and the 10-day 7.2-inch runoff event shall also be used. In all cases a hydrograph method of analysis should be used. For the 24-hour rainfall event, or back to back 24-hour rainfall events, an SCS Type II distribution should be used. For shorter duration critical events other distributions may be used with the approval of the City Engineer.

Definition: Landlocked basins are those where no outlet exists below proposed or existing structures.

Regarding policies 1.2, 1.3, and 1.4: For systems designed and implemented prior to the 1993 Water Resources Management Plan, conveyance capacity and storage requirements may not meet these requirements. These policy statements in no way imply that the City intends to unilaterally upgrade these systems.

Policy 1.5:

All drainage system analyses and designs shall be based on proposed full development land use patterns.

Policy 1.6:

Intercommunity water resources issues planning shall consider alternative solutions:

a. All drainage studies or feasibility studies, whether by a watershed organization or municipality, leading to projects in a subwatershed with an intercommunity drainage issue, shall consider the impact of the project on the drainage issue and shall consider the total intercommunity project cost.

b. Except in emergencies, no solutions or partial solutions to intercommunity drainage issues shall be implemented without prior completion of a feasibility study of options and adoption of a preferred option by the applicable watershed organization.

Policy 1.7:

The following items shall be considered in the management of landlocked basins:

a. The flood levels established for landlocked basins shall take into consideration the effects of water level fluctuations on trees, vegetation, erosion, and property values. Steeply sloped shorelines subject to slope failure and shoreline damage should not be in contact with floodwaters for extended periods of time.

b. The capacity of proposed outlets to formerly landlocked basins should not be so small as to cause extended duration of high water levels that would result in damage to upland vegetation.

c. Only the existing tributary area may discharge to a landlocked basin, unless a provision has been made for an outlet from the basin or the right to augmented storage within the basin has been secured through purchase or easement, except in cases where adverse impacts to vegetation would occur. The form of outlet may range from temporary pumps to gravity storm sewers. The outlet shall be implemented before increased water levels are likely to affect vegetation, slope stability, and property values.

d. Critical event analysis of landlocked basins shall include the 10-day, 7.2-inch runoff event and back to back 24-hour, 100-year events.

Policy 1.8:

When development occurs adjacent to a landlocked basin and the basin is not provided an outlet, freeboard should be determined based on one of three methods (whichever provides for the highest freeboard elevation):

1. Three feet above the HWL determined by modeling back to back 100-year, 24-hour events,

2. Three feet above the highest known water level, or

3. Five feet above the HWL determined by modeling a single 100-year, 24-hour event.

When modeling landlocked basins, the starting water surface elevation should be the basins Ordinary High Water elevation, which can be determined through hydrologic modeling or, in the case of a DNR regulated basin, from a DNR survey. Additionally, continuous simulation of average annual rainfall conditions will also provide insight into whether significant, adverse impact to vegetation would occur due to development around the landlocked basin.

Definition: Freeboard is the vertical separation between the HWL of the simulated rainfall or runoff event and the lowest ground elevation adjacent to a structure.

Policy 1.9:

For basins with a suitable outlet, freeboard will be 2-feet above the HWL determined by modeling the 100-year critical event. Emergency overflows a minimum of 1.5 feet below lowest ground elevation adjacent to a structure should also be provided.

Policy 1.10:

Adjacent to channels, creeks, and ravines freeboard will also be 2 feet to the 100-year critical event elevation.

Policy 1.11:

Work cooperatively with the Department of Natural Resources and watershed organizations on cooperative and collaborative projects in the public lands below the river bluffs.

Discussion: This policy is essentially a blanket policy covering the many subject areas for which goals have been developed. The City of Mendota Heights understands that its drainage system has the potential to damage ecologically sensitive areas below the bluffs in Fort Snelling State Park. The City envisions the State or Watershed organizations as the lead on such projects.

3.3.2 Water Quality

Goal 2:

Maintain or improve the quality of water resources within the City.

Policy 2.1:

Wetlands and water bodies identified in Map 1 will be protected according to regulations given in City Code Title 12, Chapter 2 (as revised per the recommendations of this Plan) and according to other applicable local, state and federal regulations.

Policy 2.2:

The use of watershed Best Management Practices (BMPs) will be required to help minimize pollutants in stormwater runoff.

Policy 2.3:

Wherever practical, new water quality ponds will be designed and constructed to provide a water quality treatment volume equivalent to the runoff from a 2.5-inch rainfall event, or the requirements of the NPDES construction site permit, whichever leads to higher treatment capacity. In some cases other BMPs will be used in conjunction with water quality ponds. In such cases performance of the water quality system shall be no less than the performance of a single pond designed under the 2.5-inch criterion.

Policy 2.4:

Given that many of the soils underlying the City have higher than typical infiltration capacity, infiltration, or reducing impervious surface, should be considered in all projects that involve stormwater management. If either infiltration or limiting impervious surface is rejected for a project, specific reasons for doing so will be provided by the project proposer.

Policy 2.5:

Newly constructed ponds shall include an outlet design allowing for extended detention of the 1 to 5 year rainfall event. The hydrograph duration for pond discharge should extend a minimum of 24 hours for events within the 1 to 5 year range.

Policy 2.6:

Outlet skimming will be required in all ponds. Skimming shall occur for up to the 5-year, 24-hour event.

3.3.3 Recreation and Fish and Wildlife

Goal 3:

Protect and enhance fish and wildlife habitats, water recreational facilities, and water resource aesthetics.

Policy 3.1:

The neighborhood and regional benefits to wildlife habitat and aesthetics should be considered in any proposal to alter or eliminate wetlands, understanding that wetland elimination without mitigation is precluded by state law and understanding that even mitigated wetland impacts must meet strict sequencing guidelines.

Policy 3.2:

The City will review inlets and outlets for aesthetics.

Policy 3.3:

Mendota Heights shall seek to coordinate with the Minnesota Department of Natural Resources regarding development of DNR public waters and public water wetlands. Notwithstanding ordinance provisions, both existing and future, that control development of shoreland areas, the City will seek Minnesota DNR comments on development proposals adjacent to DNR public waters and public water wetlands. As part of its implementation plan the City will adopt a shoreland protection ordinance.

Policy 3.4:

Water resources shall be maintained in such a manner as to preserve or restore their intrinsic aesthetic qualities and wildlife habitat.

3.3.4 Enhancement of Public Participation; Information and Education

Goal 4:

Inform and educate the public concerning urban stormwater management and the problems pollutants cause if allowed to enter into our water resources.

Policy 4.1:

Enact a public education program based on the following objectives to reduce stormwater pollution:

1. Raise awareness of the problem and solutions,
2. Promote community ownership of the all surface water features,
3. Recognize responsible parties and actions to date,
4. Merge public feedback into program execution.

Policy 4.2:

Enact a public education program to satisfy the minimum control measures identified in the City's NPDES permit.

Policy 4.3:

Coordinate education efforts with the watershed organizations so that redundant efforts are avoided.

3.3.5 Groundwater

Goal 5:

Maintain and improve groundwater quality and promote groundwater recharge.

Policy 5.1:

To the extent that Wellhead Protection Plans identify areas of groundwater recharge that require protection, the City shall work with the Minnesota Department of Health (MDH) and neighboring communities in developing adequate protection measures.

Policy 5.2:

Surface water management improvements in likely recharge areas and areas of high vulnerability to chemical or petroleum spills shall be designed to assist groundwater protection. Practically, this means infiltration shall not be considered in developments that include the potential for these types of spills.

Note: The City of Mendota Heights obtains its potable water from the St. Paul Water Utility. The neighboring communities of Eagan and Inver Grove Heights have separate municipal water systems, but neither community has identified a 10-year well capture zone that overlaps into Mendota Heights. Inver Grove Heights has yet to prepare a Wellhead Protection Plan so it remains to be seen whether Mendota Heights will be affected by a 10-year capture zone for Inver Grove Heights' wells. Since Mendota Heights is not an active participant in the MDH Wellhead Protection Program, the City will have to rely on MDH and neighboring communities to identify 10-year capture areas. To the extent that future analyses identify these areas within Mendota Heights, the City will then use its subdivision authority to properly regulate these areas.

3.3.6 Wetlands

Goal 6:

Protect and preserve wetlands through administration of the Wetland Conservation Act.

Policy 6.1:

Act as the local government unit responsible for enforcing the Wetland Conservation Act of 1991.

Policy 6.2:

Discourage wetland disturbance. Wetlands must not be drained or filled, wholly or partially, unless replaced by restoring or creating wetland areas of equal public value, as permitted by the Wetland Conservation Act.

Policy 6.3:

Up to one-half acre of "debit" wetland (filled or drained) will be allowed to be replaced through wetland "credit" in a bank which is located outside of Mendota Heights's city limits, but State and County governments are exempt from this policy (M.S. 103G.222 (e)).

Policy 6.4:

Restrict clearing and grading within close proximity of the wetland boundary to provide for a protective buffer strip of natural vegetation to promote infiltration of sediment and nutrients. In the event that grading occurs close to the wetland boundary native plant materials shall be reestablished as a buffer strip.

Policy 6.5:

Require that a wetland assessment be prepared for any project that includes a wetland. Minnesota Routine Assessment Methodology for evaluating wetland function (current version 3.0 but as updated in the future) is the required method of assessment.

3.3.7 Erosion and Sediment Control

Goal 7:

Prevent, to the extent possible, sediment from construction sites from entering the City's surface water resources and to control the erosion from drainageways within the City.

Policy 7.1:

The City will adopt an Erosion and Sediment Control Ordinance as outlined in its NPDES permit.

Policy 7.2:

The City will adopt an Erosion and Sediment Control Ordinance that meets or exceeds standards contained in the NPDES construction site permit and watershed organization plans.

3.3.8 Floodplains

Goal 8:

Control development in floodplains and floodways including those subject to FEMA Studies (Mississippi and Minnesota Rivers) and those that are not regulated by FEMA Studies like ponds, wetlands, lakes and channels within the City limits.

Note: Title 12, Chapter 1, Article D, Section 11 (12-1D-11) of the Mendota Heights City Code defines permitted uses within Floodway and Floodplain Districts. Chapter 2 controls development adjacent to wetlands lakes and channels that are not FEMA designated floodplain or floodway. Additionally, the City will be preparing a shoreland ordinance, similar to the Minnesota DNR model ordinance that will further define limitations to development along shoreland and non-federally regulated floodplain areas.

3.3.9 Mendota Heights's NPDES Permit

Goal 9:

Operate and manage the City's surface water system consistent with best current practices and the City's NPDES Permit.

Policy 9.1:

Projects to correct existing deficiencies, to the extent they are identified, will be prioritized as follows:

1. Projects intended to reduce or eliminate flooding of structures in known problem areas.
2. Projects intended to improve water quality in the City's lakes.
3. Projects intended to retrofit water quality treatment into developed areas.
4. Projects intended to reduce maintenance costs.
5. Projects intended to restore wetlands and habitat.

Policy 9.2:

The City will actively inspect, and properly operate, maintain and repair its storm water system. The City will follow a regular inspection, cleaning, and repair schedule. Frequency of maintenance will be event-based and informed by experience and inspection history. The City's Stormwater Pollution Prevention Plan (SWPPP) outlines the frequency of these activities. Section 5 of this Plan provides some guidelines on pond maintenance and inspection cycles, but the SWPPP will remain the definitive source on the City's intended maintenance and inspection schedules.

Policy 9.3:

The City will follow best management practices on its own lands and for its own projects including street reconstruction projects – in accordance with the NPDES construction site permit and the City's NPDES MS4 Permit.

3.3.10 Financial Management

Goal 10:

Ensure that the costs of the surface water system are equitably distributed.

Policy 10.1:

The City will periodically update its stormwater utility rate structure to accomplish the following:

1. Meet the requirements of its NPDES permit.
2. Provide for the maintenance of ponds and outfall structures.
3. Conduct repairs to the system.
4. Update its system planning efforts.
5. Implement rainwater gardens or other water quality retrofits with downtown redevelopment.

3.3.11 Individual Sewage Treatment Systems (ISTS)

Goal 11:

Ensure that ISTS that remain in the City do not constitute an environmental hazard.

Policy 11.1:

Where ISTS are known to be failing and pose an imminent environmental hazard, the City will take the necessary steps to see that these systems are repaired or eliminated.

Background: Within Mendota Heights are approximately 60 ISTS. The City has an ISTS ordinance equivalent to that of Dakota County whereby property owners provide pump and inspection records to the City.

3.4 County, State and Federal Agency Requirements

This section of the LSWMP presents a synopsis of the current agency requirements while acknowledging the existence of other requirements that may be applicable. The City is committed to the preservation and enhancement of its wetlands and water resources through full compliance with local, state, and federal wetland regulations.

3.4.1 Minnesota Department of Natural Resources

At the state level, Types 3, 4, and 5 wetlands are protected by statute. These are areas typically recognized as wetlands and are generally characterized by open water and emergent vegetation throughout most of the year. The state has jurisdiction over only those wetlands appearing on the state's inventory of protected waters. Further, wetlands in the inventory were generally those in excess of 10 acres in rural areas or in excess of 2.5 acres in municipalities and incorporated areas. Map 1 shows the DNR protected waters within the Mendota Heights LSWMP study area.

If an area meets the jurisdictional criteria but is not on the state's inventory, it is not regulated by the DNR. If it does not meet the statutory criteria but is listed on the inventory, it still is subject to DNR regulation. There is no mechanism presently for adding wetlands to or deleting wetlands from the inventory. The inventory was begun in the late 1970s and all state inventories were completed during the early 1980s.
The MNDNR rules specify that permits may not be issued for any project except those that provide for public health, safety, and welfare. Any private development projects are effectively excluded from permit consideration by this requirement.

The western portions of the City abutting the Minnesota River are located in the Mississippi River Critical Area Corridor. According to the DNR:

> The purposes of designating the Mississippi River and this portion of the Minnesota River as a state critical area include the following:
>
> a. protecting and preserving 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;
> b. preventing and mitigating irreversible damage to this resource;
> c. preserving and enhancing its natural, aesthetic, cultural, and historical value for public use;
> d. protecting and preserving the river as an essential element in the national, state, and regional transportation, sewer and water, and recreational systems; and protecting and preserving the biological and ecological functions of the corridor.
>
> The DNR has three primary roles for the Mississippi River Critical Area Program. The DNR has undertaken the mandate of reviewing existing ordinances that affect lands within the Mississippi River Critical Area Corridor for their compliance with state critical area standards and guidelines. Technical assistance for ordinance development will be provided to local communities to ensure adoption and approval of a compliant state critical area ordinance or any ordinance amendments. DNR will also provide individualized technical assistance for amending existing ordinances or developing proposed ordinances that will be consistent with the voluntary MNRRA Comprehensive Management Plan (CMP) policies.
>
> In addition, adoption or amendment of plans and ordinances affecting lands within the Mississippi River Critical Area Corridor and relating to Executive Order 79-19 purposes and standards are effective only after approval by the DNR. The DNR reviews the plans and ordinances to ensure their consistency with the provisions of Executive Order 79-19, following an evaluation by the Metropolitan Council.
>
> In communities where critical area plans and ordinances have become effective, the local governmental unit also must notify the DNR area hydrologist at least 30 days before action is taken for all development applications or variances requiring a public hearing or discretionary action.
> In communities where plans and regulations have not been adopted or approved, the DNR is also to be notified about additional types of projects listed in the Interim Regulations. DNR will review and comment on the project's compliance with critical area and state requirements and MNRRA policies, as well as provide technical assistance as requested. Notice of the final action is to be sent to the DNR.

The other powers and duties of this Minnesota state agency and its commissioner are wide-ranging. As they affect surface water management within the City they include:

- Regulation of all public waters inventory waterbodies within the City – to the extent of their ordinary high water level.
- Regulation of certified floodplains around rivers, creeks, lakes and wetlands.
- Management of the Flood Hazard Mitigation program.
- Shoreland Management.

3.4.2 U.S. Army Corps of Engineers (USACE)

Under Section 404 of the Clean Water Act, including subsequent modifications, the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (USACE) regulate the placement of fill into all wetlands of the U.S. In 1993, there was a modification of the definition of "discharge of dredged material" to include incidental discharges associated with excavation. This modification of the "discharge of dredged material" definition meant that any excavation done within a wetland required the applicant to go through Section 404 permitting procedures. In 1998, however, this decision was modified so that excavation in wetlands is now regulated by the USACE only when it is associated with a fill action.

3.4.3 Board of Water and Soil Resources (BWSR)

The local and regional wetland rules are governed by the Wetland Conservation Act (WCA). The WCA, passed in 1991, extends protection to all wetlands unless they fall under one of the exemptions of the WCA. The WCA follows a "no net loss" policy. The wetlands covered under the WCA must not be drained or filled, wholly or partially, unless replaced by restoring or creating wetland of at least equal public value under an approved replacement plan. Replacement ratio is typically 2:1 (2 acres created for every 1 acre filled) for wetland impacts.

A designated Local Government Unit (LGU) is responsible for making exemption and no-loss determinations and approving replacement plans. Currently, Mendota Heights acts as the LGU for WCA within the City's subdivision authority.

The powers and duties of this Minnesota state agency also include:

- Coordination of water and soil resources planning among counties, watersheds, and local units of government.
- Facilitation of communication among state agencies in cooperation with the Environmental Quality Board.
- Approval of watershed management plans.

3.4.4 Minnesota Pollution Control Agency

The Minnesota Pollution Control Agency (MPCA) implements provisions of Section 404 of the Clean Water Act with guidance from the EPA through a permitting process. The Section 404 permit also requires a Section 401 water quality certification before it is valid. The EPA has given Section 401 certification authority to the MPCA.

The powers and duties of this Minnesota state agency and its commissioner include:

- Fulfilling mandates from the EPA, particularly in regard to the Clean Water Act.
- Administration of Mendota Heights's NPDES Phase II MS4 permit.
- Administration of the NPDES construction site permit program.
- Administration of the NPDES industrial site discharge permit program.
- Development of TMDLs for waterbodies and watercourses in Minnesota (often in conjunction with other agencies or joint powers organizations such as watersheds).

3.4.5 Environmental Protection Agency

As it relates to surface water management within Mendota Heights, this agency is charged with interpreting and applying aspects of the Clean Water Act. This has led to the City's need for its NPDES MS4 permit. Total maximum daily load limits, a new initiative mandated by the EPA, also stem from the EPA's role as steward of the Clean Water Act.

3.4.6 Lower Minnesota River Watershed District, Lower Mississippi River Watershed Management Organization, and Gun Club Lake Watershed Management Organization

The powers and duties of these Minnesota statutory authorities include:

- Approval authority over local water management plans.
- Ability to develop rules regarding management of the surface water system.
- Ability to determine a budget and raise revenue for the purpose of covering administrative and capital improvement costs.
- Regulation of land use and development when one or more of the following apply:
    - The City does not have an approved local plan in place.
    - The City is in violation of their approved local plan.
    - The City authorizes the watershed toward such regulation.
- Other powers and duties as given in statute and joint powers agreements.

3.4.7 State and Federal Jurisdictional Boundaries for Public Wetlands and Waters

Wetlands are delineated in accordance with the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1987). Wetlands must have a predominance of hydric soils. Hydric soils, by definition, are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, under normal circumstances, a prevalence of hydrophytic (water tolerant) vegetation typically adapted for life in saturated soil conditions. The USACE and the BWSR regulate wetlands as defined by a jurisdictional delineation.

For wetlands that fall under the MNDNR jurisdiction, the Ordinary High Water Level (OHW) determines the boundary of MNDNR jurisdiction. The OHW is established by the DNR. A summary of agency jurisdiction is presented in Figures 4 and 5.

3.4.8 Dakota County

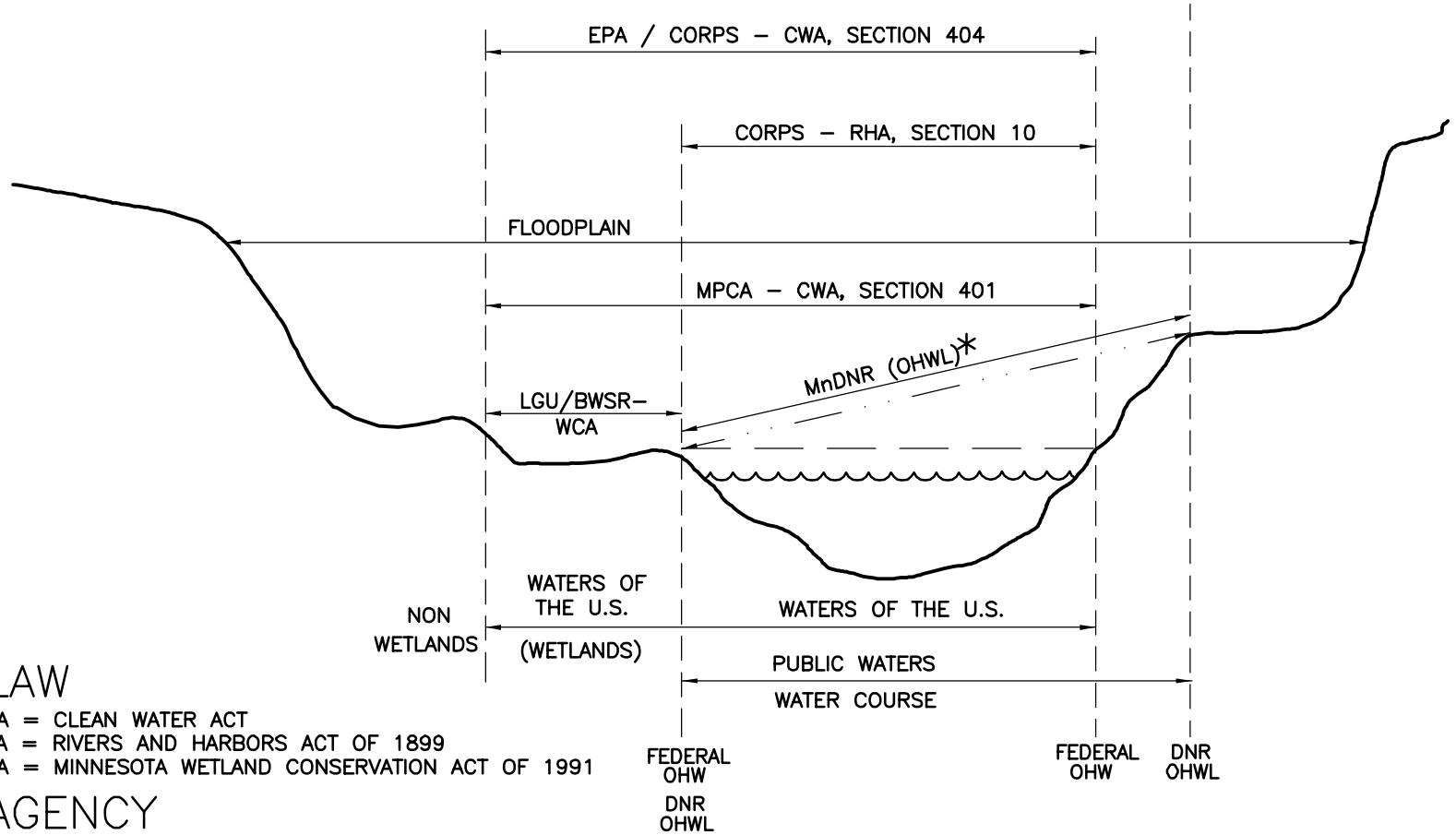
Dakota County SWCD sits on the Technical Evaluation Panel for administration of the Wetland Conservation Act. Dakota County SWCD also conducts NPDES erosion control inspection for construction sites that have obtained the NPDES Construction Permit for Construction Activities. This inspection program is a pilot project funded by the MPCA.

3.4.9 Metropolitan Council

Metropolitan Council, through Metropolitan Council Environmental Services, serves as a review agency for local surface water management plans. They also review and approve municipal comprehensive plans and have a prominent role in the Mississippi River Critical Area Corridor as described on the DNR website:

> The Metropolitan Council reviews existing plans that affect lands within the Mississippi River Critical Area Corridor. Technical assistance is provided to assist communities in amending or adopting plans to become consistent with Executive Order 79-19 standards and guidelines and any voluntary MNRRA CMP policies. The council reviews all critical area plans and ordinances and makes an evaluation to DNR prior to the approval decision. In addition, the council administers the pass-through funds from the National Park Service to provide financial assistance to communities wishing to revise their plans and ordinances. The council is also involved with oversight of the Metropolitan Land Planning Act.

MINNESOTA STATE AND FEDERAL JURISDICTION OVER "WATERS"



LAW

CWA = CLEAN WATER ACT
RHA = RIVERS AND HARBORS ACT OF 1899
WCA = MINNESOTA WETLAND CONSERVATION ACT OF 1991

AGENCY

EPA = U.S. ENVIRONMENTAL PROTECTION AGENCY
CORPS = U.S. ARMY CORPS OF ENGINEERS
BWSR = MINNESOTA BOARD OF WATER AND SOIL RESOURCES
MnDNR = MINNESOTA DEPARTMENT OF NATURAL RESOURCES
LGU = LOCAL GOVERNMENTAL UNIT
MPCA = MINNESOTA POLLUTION CONTROL AGENCY

* THIS LINE COULD CHANGE ELEVATION AT ANY GIVEN X–SECTION. CONSEQUENTLY THE JURISDICTION CHANGES

PUBLIC WATERS: WATER COURSE

CITY OF MENDOTA HEIGHTS

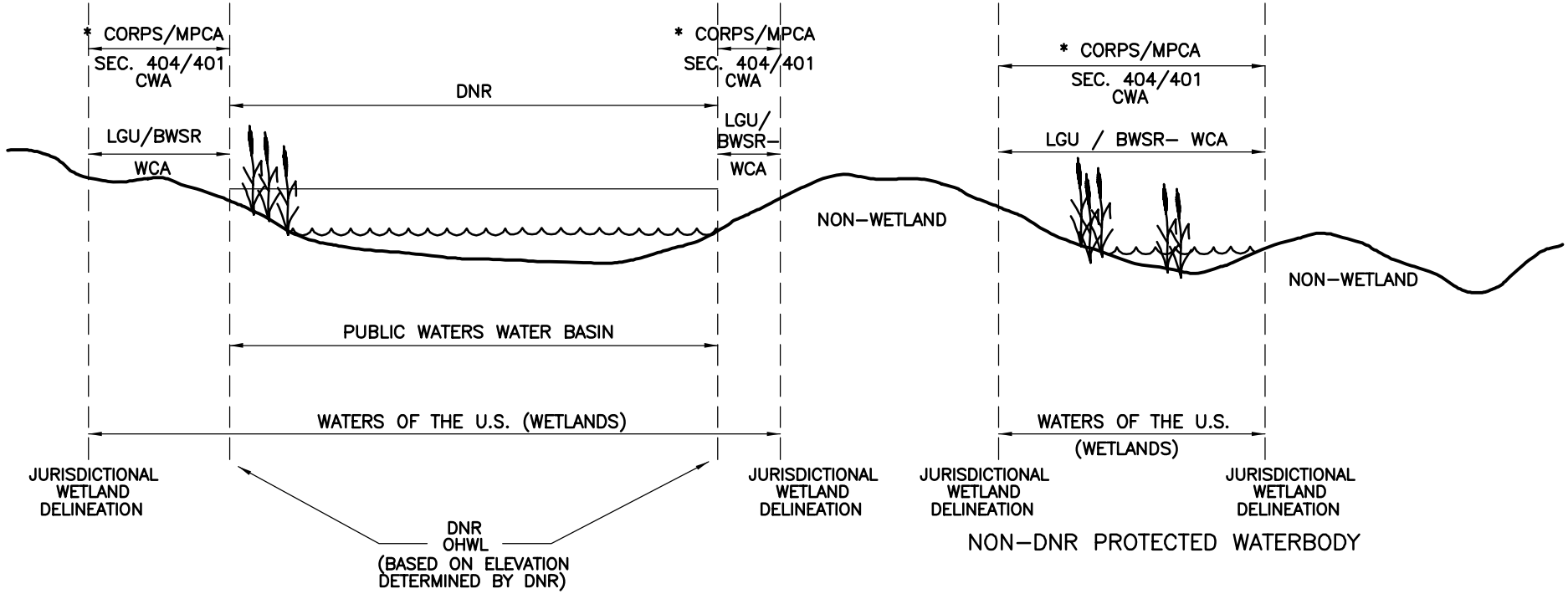
SURFACE WATER MANAGEMENT PLAN

FIGURE 4

Bonestroo Rosene Anderlik & Associates

i:\333\33305103\cad\dwg\figure4.dwg 5.3.05

MINNESOTA STATE AND FEDERAL JURISDICTION OVER "WATERS"



* U.S. ARMY CORPS OF ENGINEERS. THE CORPS HAS JURISDICTION ON WETLANDS THAT ARE PART OF, OR CONNECTED BY TRIBUTARY, TO A NAVIGABLE WATER.

LAW

CWA = CLEAN WATER ACT
WCA = MINNESOTA WETLAND CONSERVATION ACT

AGENCY

CORPS = U.S. ARMY CORPS OF ENGINEERS
BWSR = MINNESOTA BOARD OF WATER AND SOIL RESOURCES
DNR = MINNESOTA DEPARTMENT OF NATURAL RESOURCES
LGU = LOCAL GOVERNMENTAL UNIT
MPCA = MINNESOTA POLLUTION CONTROL AGENCY

PUBLIC WATERS: WATER BASIN

CITY OF MENDOTA HEIGHTS
SURFACE WATER MANAGEMENT PLAN

FIGURE 5

Bonestroo Rosene Anderlik & Associates

i:\333\33305103\cad\dwg\figure5.dwg July 2005

3.5 Agency Contacts

The primary contacts for local regulating agencies described above are presented below. These contacts are accurate as of October, 2006.

City of Mendota Heights

City Engineer
City of Mendota Heights
1101 Victoria Curve
Mendota Heights, MN 55118
(651) 452-1850

Lower Minnesota River Watershed Management District

District Administrator
Lower Minnesota River Watershed Management District
Scott County Government Center
200 Fourth Avenue West
Shakopee, MN 55379
(952) 496-8842

Lower Mississippi River Watershed Management Organization

Chairperson
Lower Mississippi River Watershed District Organization
125 3rd Avenue North
South St. Paul, MN 55075
(651) 554-3210

Gun Club Lake Watershed Management Organization

Chairperson
Gun Club Lake Watershed Management Organization
3830 Pilot Knob Road
Eagan, MN 55122
(651) 675-5300

Dakota County Soil and Water Conservation District

District Manager
Dakota County Soil and Water Conservation District
4100 220th Street West, Suite 102
Farmington, MN 55024
(651) 480-7777

Minnesota Department of Natural Resources

Area Hydologist
Minnesota Department of Natural Resources
1200 Warner Road
St. Paul, MN 55106
(651) 772-7910

Minnesota Board of Water and Soil Resources

Board Conservationist
Minnesota Board of Water and Soil Resources
520 Lafayette Road North
St. Paul, MN 55155
(651) 296-3767

3.6 Water Resource Management-related Agreements

The City of Mendota Heights is party to six separate joint powers agreements related to surface water management:

1. With Dakota County for the Wetland Health Evaluation Program
2. With the City of Sunfish Lake relating to an outlet for Sunfish Lake
3. With Lower Minnesota Watershed District allowing the City to be the enforcement and permitting agency for the watershed
4. With the cities of St. Paul, West St. Paul, South St. Paul, Inver Grove Heights, Sunfish Lake, and Lilydale establishing the Lower Mississippi River WMO
5. With the cities of Eagan and Inver Grove Heights establishing the Gun Club Lake WMO
6. With the City of Lilydale for inspection of their storm sewer system

3.7 Impacts of the Mendota Heights LSWMP on Other Units of Government

Upon approval of this LSWMP by the three watersheds with jurisdiction over the City, it is the City's intent to maintain and potentially expand its permitting powers. Currently, the Lower Mississippi River WMO, the Gun Club Lake WMO, and the Lower Minnesota River WD do not issue permits, so no impact to these organizations would occur. Within its jurisdiction, the City will use the permit submittal requirements outlined in Section 5.4.3.1 of this Plan. The Watersheds would continue in their role as project review agencies.

Section 6, Implementation Plan, describes how the City will implement a permit process. Through the Erosion and Sediment Control Ordinance the City will create a permit program. Site review will be a requirement of the permit, and site review will include runoff management and whether the proposed project meets the requirements of this LSWMP and its updates.

3.8 Watershed Goals and Strategies that Affect the City of Mendota Heights

The City of Mendota Heights goals and policies, outlined above, are a close reflection of those of the watershed organizations, only presented through the municipal filter. The watershed organizations also have specific design standards and criteria that are required to achieve their goals. Table 3.1 is a summary of the design standards and criteria for each of the three watershed organizations. The far right column describes the applicable City standards as described in this LSWMP plus a reference as to where the standard appears in the LSWMP.

Table 3.1
Summary of Design Standards and Criteria for the Watershed Organizations and District

Design Standard/Criteria	Lower Mississippi River WMO	Lower Minnesota River WMD	Gun Club Lake WMO	City of Mendota Heights
Runoff Management Plans	Required for projects that disturb one or more acres of land.	Required for projects that disturb one or more acres of land.	Undefined	Submittal requirements of Section 5 specify submittal of this. Future Erosion and Sediment Control or other ordinance will make this an ordinance requirement.
Erosion and Sediment Control Plans	Required for projects that disturb one or more acres of land.	Required.	Required for projects that disturb or remove existing vegetative cover.	Future erosion and sediment control ordinance and the LSWMP Plan make this a requirement.
Storm Sewer System Design Critical Duration Events				
Storage basins[1], trunk conveyors, channels	100-year	100-year	100-year	100-year
Trunk sewer	No less than 10-year	Undefined	No less than 10-year	10-year
Non-trunk sewer	No less than 5-year, preferably 10-year.	No less than 5-year, preferably 10-year.	No less than 10-year	10-year
Minimum building elevation above 100-year elevation adjacent to inundated areas	1 foot; greater for land-locked basins.	Undefined	Undefined	Two feet
New discharge points and outfalls	Pretreatment required, at least grit removal, prior to discharge to wetlands and water resources.	Undefined	Provisions required for coarse sedimentation and oil and floatable skimming prior to discharge to the Minnesota River.	See Section 5.4.3 for requirements.
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 100-year return frequency critical duration storm events.	Shall not exceed the existing peak rate of runoff for the 5-year (or 10-year) and 100-year return frequency critical duration storm events.	Undefined	Shall not exceed existing conditions for the 2, 10, and 100-year events.
Detention Pond and Treatment Basin Design				
Permanent pool volume	Volume below the NWL outlet which is greater than or equal to runoff from a 2.5-inch 24-hour storm over the entire subwatershed of the pond/basin, assuming full development.	Level I and II Water Resources: Volume below the NWL outlet which is greater than or equal to runoff from a 2.5-inch 24-hour storm over the entire subwatershed of the pond/basin, assuming full development. Level III, IV, and V Water Resources: Volume below the NWL outlet which is greater than or equal to runoff from a 2.0-inch 24-hour storm over the entire subwatershed of the pond/basin, assuming full development.	Volume below the NWL outlet which is greater than or equal to runoff from a 2.5-inch 24-hour storm over the entire subwatershed of the pond/basin, assuming full development.	Water quality volume shall be equal to the runoff from a 2.5” rainfall or based on the requirements of the NPDES construction site permit, whichever leads to a larger wet volume. Equivalent performance using BMPs in addition to wet ponds is allowed for.

Design Standard/Criteria	Lower Mississippi River WMO	Lower Minnesota River WMD	Gun Club Lake WMO	City of Mendota Heights
Permanent pool average depth	Greater than 4 feet and less than 10 feet.	Greater than 4 feet and less than 10 feet.	Greater than 4 feet and less than 10 feet.	Average depth of 4 feet is preferred, with shallower average depths allowed if adequate wet volume is provided. A maximum depth no deeper than 6 feet is preferred.
Emergency Over Flow (EOF)	Required to control events greater or equal to the 100-year critical duration event or plugged outlet conditions.	Required to control events greater or equal to the 100-year critical duration event.	Required to control events greater or equal to the 100-year critical duration event.	Required, a minimum of 1.5' below the lowest ground elevation at any adjacent structure.
Side slope	No steeper than 3:1.	No steeper than 3:1	No steeper than 3:1	No steeper than 4:1 is preferred. Side slopes of 3:1 will be allowed with appropriate slope stabilization measures such as erosion control blanket or turf reinforcement mat.
Aquatic/safety bench	Minimum width of 10 feet and 1 foot deep below the NWL.	Minimum width of 10 feet and 1 foot deep below the NWL.	Minimum width of 10 feet and 1 foot deep below the NWL.	Minimum 10-foot width at 10:1 cross slope.
Discharge rate and flood volume	Sufficient volume above the NWL so that peak discharge rate from the 100-year critical duration storm is not greater than the peak discharge of predevelopment watershed conditions of a similar storm event.	Sufficient volume above the NWL so that peak discharge rate from the 100-year critical duration storm is not greater than the peak discharge of predevelopment watershed conditions of a similar storm event.	Undefined	Shall not exceed existing conditions for the 2, 10, and 100-year events.
Duration for extended detention of hydrograph for more frequent storms (1-year to 5-year storm events)	24 hours	24 hours	Undefined	Minimum of 24 hours for the 1 to 5 year event range. See Section 3.3.2
Maximum velocity for inlet and outlet outfalls	4 feet per second	4 feet per second	Undefined	Four feet per second into channels. Maximum of 6 feet per second into ponds, lakes, and wetlands when inlet is at or below NWL.
Distance between major inlets and normal outlets	Maximized as much as possible.	Maximized as much as possible.	Maximized as much as possible.	Maximum separation possible or use of submerged berms to force a longer hydraulic length.
Skimmer device design criteria	5-year storm event; less than 0.5 foot per second through a baffled weir.	5-year storm event; less than 0.5 foot per second through a baffled weir.	Skimmer shall extend a minimum of 4 inches below the water surface; less than 0.5 foot per second through the skimmer for a one-year storm event.	Skimming for up to the 5-year event upstream of wetlands and in any pond found within a multi-family, industrial or commercial area. Also applies to institutional areas with large parking lots.

Notes:
1. Storage basins mean wetlands, ponds, detention basins, and lakes.

4. WETLAND MANAGEMENT PLAN

4.1 Title 12, Chapter 2, City Code

Title 12, Chapter 2 of the Mendota Heights City Code provides for the protection, preservation, maintenance, and use of Mendota Heights wetlands and water resource related areas:

- to maintain the natural drainage system;
- to minimize the disturbance which may result from alteration by earthwork, loss of vegetation, loss of wildlife and aquatic organisms as a result of the disturbance of the natural environment, or from excessive sedimentation;
- to provide for protection of probable fresh water supplies;
- and to ensure safety from floods.

Regulation applies to wetlands and water resource related areas and to adjacent land within one hundred feet (100') of normal high water markers of wetlands and water resource related areas as delineated on the official city wetlands systems map: "Wetlands Systems Map - Mendota Heights, dated November 2, 1976."
This map is on file in the office of the city clerk.

The Wetland Ordinance requires a permit when any one of the following is proposed:

1. The deposit or removal or permitting the deposit or removal of any debris, fill or any other material over one hundred (100) cubic yards.
2. Any excavation over one hundred (100) cubic yards.
3. The digging, dredging, filling, or in any other way altering or removing any material from water bodies, watercourses, wetlands, floodplain, or natural drainage system.
4. The construction, alteration, or removal of any structure.
5. The removal of vegetation.
6. The altering of any embankment or ponding area or the changing of the flow of water or ponding capacity.
7. Permanently storing materials.
8. Disposing of waste materials, including, but not limited to, sewage, garbage, rubbish, and other discarded materials.
9. Installation and maintenance of essential services.

Title 12, Chapter 2 also specifies submittal requirements for those seeking a permit. Generally, the requirements of Title 12, Chapter 2 complement the content of the LSWMP and, more specifically, this section: Wetland Management Plan. Revisions to the ordinance are needed, though. Specifically, reference should be made to the updated wetland map included with this Plan (Map 1). The ordinance revision should also account for the fact that some wetlands may not be identified on the official map, but that the provisions of Title 12, Chapter 2 would apply to these regardless. The current code also specifies some design requirements related to freeboard and analysis requirements related to the types of rainfall events that should be used for analysis. These portions of the code should be modified to include the more detailed requirements contained in this LSWMP, as shown in Tables 4.3 and 4.4 later in this section. Additionally, the submittal requirements should be modified to include the MnRAM submittal specified in the submittal requirements of this Plan. Modification of the ordinance is included in the implementation section of this Plan.

4.2 Wetland Inventory Goals

The results of the wetland inventory and mapping effort are shown in Map 1 of this Plan. The goal of the wetland inventory is to identify wetland and water resources that currently exist within the city. A GIS-based wetland map has been developed for the City to use as a planning tool for future projects that may affect wetlands. The inventory of wetlands also allows the city to set up priority areas within city-owned lands.

The wetland map and the management discussions of this section of the LSWMP are intended to provide the following benefits:

- Provide a more detailed inventory of wetlands and water resources than that provided by the National Wetlands Inventory
- Enhance wildlife values of wetlands
- Provide and enhance recreational values of wetlands
- Designate wetland restoration/enhancement opportunities
- Protect wetlands and adjacent resources that provide valuable ecological support
- Provide stormwater protection for wetlands

The wetland inventory includes wetlands that could be identified through cross referencing aerial photographs and the National Wetlands Inventory Map. Though not all wetlands are included in the inventory, all wetlands are regulated by Title 12, Chapter 2 of the City Code and the Wetland Conservation Act, regardless of whether they appear in Map 1 or not. In the future, regulation of activities affecting individual wetlands will be based on:

1. a site-specific delineation of the wetland boundary as part of a proposed project.
2. and preparation of a MnRAM worksheet for the wetland.

4.3 Wetland Mapping

ArcView Geographic Information System (GIS) software was used to aid in the inventory and final mapping of wetlands within the study area. GIS provides the city with a map that can be easily updated and integrated with other data. The Wetland Map (Map 1) includes the wetland location and estimate of the wetland boundary and identifies basins that are utilized as storm ponds. Preliminary layouts for future development projects should consider the wetland boundaries on the map as a guide. The study area did not include mapping the wetlands along the Minnesota River which are mostly within Fort Snelling State Park.

4.4 Wetland Evaluation Methodology

4.4.1 Wetland Boundary Rectification

A base map was produced that included placing the City boundary on a 2003 color aerial photograph (USDA, 2003). National Wetlands Inventory (NWI) polygons were then overlaid on the base map (USFWS, 1990). Using AutoCAD Map, the NWI polygons were corrected to reflect current conditions in the City. For example, because the NWI polygons were created from 1980 aerial photographs, wetland polygons within existing roadways were removed. Minnesota Land Cover Classification System (MLCCS) from the Dakota County Natural Resource Inventory (Dakota SWCD, 2001) and field observations further refined the boundaries of the wetlands. Basins that are primarily used for storm water treatment were also separated from wetlands on the map.

4.5 Wetland and Water Body Classification

Map 1 also provides a roman numeral classifying individual wetlands and water bodies within Mendota Heights. The classifications originate from the City's 1993 WRMP and are updated to be consistent with the Lower Mississippi River Watershed Management Organization classification system provided in Section 5.2 of the WMO's 2001 Plan. Table 4.1 describes how the 1993 classifications were converted to the 2001 Lower Mississippi River WMO classification scheme.

Table 4.1
Conversion of Classifications

1993 Mendota Heights WRMP Category	Updated to following 2001 LMRWMO Plan Category
I	I
II	II
III	III
IV	III
V	IV
VI, VII	V

4.6 Wetland Protection

Wetland protection strategies depend upon the wetland type. The inventory conducted for the LSWMP, as shown in Map 1, does not identify wetland type. Consequently, the LSWMP requires that projects with wetland impacts include preparation of a function and values assessment using the latest version of MnRAM software and that this assessment be submitted to the City Engineer for review. This function and value assessment, once accepted by the City Engineer, becomes the basis for applying the protection standards outlined in Tables 4.3 and 4.4.

4.6.1 Stormwater Susceptibility

There are many types of wetlands, each determined by its hydrology and vegetative composition. The two hydrology alterations that effect wetlands the most are bounce and inundation duration.

A wetland's sensitivity to stormwater input is dependent on the wetland's community type and the quality of its plant community. Some wetlands (e.g., sedge meadows with carex species) are sensitive to disturbance and will show signs of degradation unless water quality, bounce and duration are maintained at existing conditions. So development adjacent to these types of wetlands must include appropriate mitigation for potential impacts. On the other hand, there are other wetlands (e.g., floodplain forests) which are better adapted to handle the fluctuating water levels and influx of sediment often associated with stormwater.

The *Guidance for Evaluating Urban Storm Water and Snowmelt Runoff Impacts to Wetlands* (State of Minnesota Storm Water Advisory Group, 1997) was used as a guide in the determination of wetland sensitivity to stormwater.

This document divides wetlands into rankings that include: highly susceptible, moderately susceptible, slightly susceptible, and least susceptible.

Table 4.2
Relative Susceptibility of Wetlands to Stormwater Impacts

Highly Susceptible Wetland Types[1]		**Moderately Susceptible Wetland Types[2]**
Sedge Meadow	Low Prairies	Shrub-Carrs[a.]
Coniferous Bogs	Coniferous Swamps	Alder Thickets [b.]
Open Bogs	Lowland Hardwood Swamps	Fresh (wet) Meadows [c.,e.]
Calcareous Fens	Seasonally Flooded Basins	Shallow Marsh [d.,e.]
		Deep Marsh [d.,e.]
Slightly Susceptible Wetland Types[3]		**Least Susceptible Wetland Types[4]**
Floodplain Forests [a.]		Gravel Pits
Fresh (wet) Meadows [b.]		Cultivated Hydric Soils
Shallow Marshes [c.]		Degraded Wetlands[a.]
Deep Marshes [c.]		Dredged Material/ Fill Material Disposal Sites

1. Special consideration must be given to avoid altering these wetland types. Inundation must be avoided. Water chemistry changes due to alteration by storm water impacts can also cause adverse impacts. Note: All scientific and natural areas and pristine wetlands should be considered in this category regardless of wetland type.

2. a.,b.,c. Can tolerate inundation from 6 inches to 12 inches for short periods of time. May be completely dry in drought or late summer conditions.
d. Can tolerate +12" inundation, but adversely impacted by sediment and/or nutrient loading and prolonged high water levels.
e. Some exceptions.

3. a. Can tolerate annual inundation of 1 to 6 feet or more, possibly more than once per year.
b. Fresh meadows which are dominated by reed canary grass.
c. Shallow marshes dominated by reed canary grass, cattail, giant reed grass or purple loosestrife.

4. These wetlands are usually so degraded that input of urban storm water may not have adverse impacts.
a. Some reed canary grass monotypes and wetlands currently receive direct storm water inputs that may be placed in this category.

Notes: There will always be exceptions to the general categories listed above.
Use best professional judgment. Pristine wetlands are those that show little disturbance from human activity.

Source: (MPCA, 1997)

4.6.2 Water Quality

Water quality plays a significant role in the overall quality of a wetland. When the quality of the incoming water declines, the wetland's plant community may change with species diversity diminishing – leaving only those species that are tolerant of high nutrient and sediment loads. Once a wetland's plant community is changed, the wetland's character and ecosystem will change, often to a less valuable system in terms of biodiversity, habitat for wildlife, and aesthetic enjoyment. Pretreatment requirements have been developed that, if followed, will help maintain the character of the City's wetlands. Table 4.3 summarizes these pretreatment recommendations. BMPs can be used to accomplish the pretreatment requirements given in Table 4.3.

Table 4.3
Stormwater Protection Standards

Management Category	Stormwater Phosphorus Pretreatment Requirement
Highly Susceptible[1]	150 ppb[2]
Moderately Susceptible	200 ppb
Slightly Susceptible	200 ppb
Least Susceptible	250 ppb

1) Includes lakes, creeks, streams, and rivers (as defined by the USGS).
2) A multi-cell configuration with lower cell being a constructed wetland or infiltration basin is recommended to achieve these levels of removal.

It should be understood that the treatment levels in Table 4.3 are minimum treatment levels. For land uses that produce a high phosphorus loading rate that discharges into a highly susceptible wetland, the Table 4.3 treatment levels may be higher than that provided by the City's standard water quality sizing criteria outlined in Section 3: water quality volume equivalent to the runoff from the 2.5-inch rainfall event. In cases of least susceptible wetlands, the 2.5-inch volume may control. In any case, the standard that leads to the highest treatment capacity is the one required of any specific development.

4.6.3 Water Quantity

In the recent past, surface water management plans have protected wetlands from nutrients but not water fluctuations or duration. In fact, it was common to use wetlands to reduce flooding potential through sizing storm sewer pipes to maximize bounce and detention time in wetlands.

This Plan addresses stormwater quantity impacts to wetlands by providing protection strategies to maintain the existing integrity of the wetland through special protection strategies for highly, moderately, and slightly susceptible rankings as described in Table 4.4.

Table 4.4
Wetland Quantity Standards

Hydroperiod Standard	Highly Susceptible	Moderately Susceptible	Slightly Susceptible	Least Susceptible
Storm bounce	Existing	Existing plus 0.5 feet	Existing plus 1 foot	No limit
Discharge Rate	Existing	Existing	Existing or less	Existing or less
Indundation period for 1 & 2 yr precipitation event	Existing	Existing plus 1 day	Existing plus 2 days	Existing plus 7 days
Indundation period for 10 yr precipitation event or greater	Existing	Existing plus 7 days	Existing plus 14 days	Existing plus 21 days
Run-out control elevation (free flowing)	No change	No change	0 to 1 feet above existing run out	0 to 4 feet above existing run out
Run-out control elevation (landlocked)	Above delineated wetland	Above delineated wetland	Above delineated wetland	Above delineated wetland

Source: (MPCA, 1997)

"Existing" in this chart means the existing hydrologic conditions. If there have been recent significant changes in conditions, it means the conditions that established the current wetland, which would predate the recent disturbance.

4.6.4 Wetland Buffer Strip and Setback Protection

A wetland buffer is a vegetated area that surrounds a wetland and reduces negative impacts to wetlands from adjacent development. The needs identified for the establishment of wetland buffers are related to the functions that wetlands perform. Wetlands perform a variety of functions such as groundwater recharge, stormwater retention to improve water quality and reduce flooding, and wildlife habitat. Wetlands are often neighborhood amenities because they can provide screening from adjacent neighbors and wildlife viewing opportunities.

Wetland buffers can help mitigate potential development impacts to wetlands by reducing erosion by stormwater; filtering suspended solids, nutrients, and harmful substances; and moderating water level fluctuations during storms. Buffers also provide essential wildlife habitat for feeding, roosting, breeding, and rearing of young, and cover for safety, movement, and thermal protection for many species of birds and animals.

Buffer Width Effectiveness for Wetland Protection

Buffer strips help mitigate the impacts of development adjacent to wetlands. Catch basins and storm sewers typically collect street and front yard drainage and direct the drainage to an appropriately sized pond for pretreatment prior to discharge to a wetland or waterbody. Backyard drainage typically reaches wetlands or waterbodies without pretreatment, thereby allowing lawn and garden chemicals, sediments, pet wastes, fertilizer and other types of contaminants to directly impact the receiving waterbody.

Buffer strips can provide needed treatment of stormwater drainage to protect wetlands from human impacts as areas develop. A secondary benefit is valuable habitat protection, especially near aquatic areas. Habitats adjacent to aquatic areas generally have a higher density of bird species than other habitats (Johnson, 1992). The reasons for this include: the proximity of habitat requirements (i.e., food, cover, and water), the increased number of niches (because of wider diversity of plant species and structure), and the high edge-to-area ratio that results from the linear shape of most riparian zones (MPCA, 1997).

As the buffer width increases, the effectiveness of removing sediments, nutrients, and other pollutants from surface water increases. In addition, as buffer width increases, direct human impacts, such as dumped debris (i.e., garbage, lawn and garden cuttings, or fill) and trampled vegetation will decrease. A field study of wetland buffers in Seattle showed that 95% of buffers less than 50 feet wide suffered a direct human impact within the buffer, while only 35% of buffers wider then 50 feet suffered direct human impact (Schueler, 1995).

An overview of scientific literature on wetland buffers suggests the following minimum buffer widths for protection of these buffer functions (MPCA, 1997):

Water Quality Protection:	25 feet or more

(Depends on vegetation, slope, density and type of adjacent land use and quality of receiving water)

Protection from human encroachment:	50 – 150 feet or more
Bird Habitat preservation:	50 feet or more
Protection of threatened, rare or endangered species:	100 feet or more

Although these buffer widths are suggested by the MPCA, the Wetland Conservation Act may require a different minimum buffer width to obtain wetland credits. Title 12, Chapter 2 of the City Code regulates disturbance within 100-feet of the ordinary high water mark of a wetland. Essentially, the ordinary high water mark is the wetland boundary so the City Code, while not explicitly stating that the 100-foot zone is to be maintained as a buffer, allows the City to obtain adequate buffer around its wetlands.

4.7 Wetland Restoration/Enhancement Opportunities

Wetland restoration/enhancement sites were identified during the inventory process. The focus will be on sites that are within city lands and which can provide the most benefit in terms of public education, recreational use, vegetation enhancement, wildlife habitat and aesthetics.

Potential resources to help fund wetland projects:

- Department of Natural Resources, Shoreline Restoration grants
- Department of Natural Resources, Conservation Partners and Community Environmental Partnerships grants
- Department of Natural Resources Greenway grants
- Soil and Water Conservation District grants

4.7.1 Priority Area Inventory

This study focused on wetlands within City owned land and parks. Areas that were identified within the Northern Dakota County Greenway and in the City's Natural Resource Management Plan were given the highest priority for management recommendations. Each priority area has varying degrees of degradation and thus varying degrees of difficulty in restoration. Three main issues influence most of the wetlands within the city: vegetation communities dominated by invasive species, inputs of untreated stormwater, and lack of adequate buffers. The following discussion details current issues and management recommendations.

<u>Wentworth Park:</u>

- Increase buffer area on west pond. Eliminate mowing to the edge of the pond and replant with native vegetation. Buffer will help filter runoff into pond and reduce nutrient loading that causes excessive algae. Place a wetland buffer educational sign near trail head from parking lot.
- Construct pretreatment ponds for incoming stormwater.
- Raise water level in wetland to help control invasive reed canary grass and allow filtration of nutrients prior to entering west pond.

<u>Friendly Hills Park:</u>

- Increase wetland buffers by limiting mowing near edge of ponds. Replant with native vegetation.
- Provide pretreatment for stormwater inputs in pond and along ditch outlet. This would also help water quality in the downstream Copperfield Ponds.

Valley Park:

- Wetlands along stream channel have been degraded by invasive species and lack of hydrology, due to the channel acting like a ditch.
- Severe erosion along channel banks in the portion of the park north of Marie Avenue.
- Install rock checks to prevent further bank erosion and restore hydrology to the adjacent wetlands.
- Reduce further bank erosion with a combination of bioengineering practices, which could include planting native shrubs to help stabilize.
- Examine watershed for solutions to control rate and volume of water coming into the park.

4.8 Wetland Stewardship

There are a number of things that residents, cities, or counties can do voluntarily to enhance wetlands and buffer strips that surround wetlands. This section describes some of these practices.

4.8.1 Enhancement

Native wildflowers, grasses, shrubs and trees can be planted in the wetland or the adjacent buffer areas to enhance habitat and stormwater filtering. Habitat can be enhanced by creating more vertical layers (such as adding trees or shrubs where these are absent), and by adding plants that provide food and cover, such as fruiting shrubs. Increasing the structural and plant species diversity in the landscape provides additional habitat niches, and can increase the numbers and species of animals using the area. Many of these plants also make the landscape more attractive for human inhabitants.

Species that are native to the area will probably require the least maintenance, survive harsh Minnesota weather more easily, and provide the greatest habitat benefits. The book Landscaping for Wildlife by Carroll Henderson and other references that are available in most bookstores or from Minnesota Extension Services, can help landowners to add plants that enhance the wetland and increase the variety of attractive plants and wildlife.

4.8.2 Control of Invasive Exotic Species

Several non-native species (sometimes called exotics) have become problems in Minnesota wetlands and adjacent uplands. These include purple loosestrife, European buckthorn, black locust, reed canary grass, and leafy spurge. These plants invade native plant communities and can take over rapidly, eliminating native plants that provide important food and habitat benefits.

Invasion by exotic species can be controlled by minimizing disturbance to wetlands and buffer areas as much as possible to avoid the creation of openings for exotics to invade. Small populations of many exotic species can be controlled by hand removal or direct application of appropriate herbicides that are licensed for use near water. The Minnesota DNR provides information about identifying or controlling exotic species around wetlands.

4.8.3 Habitat Structures

Wetlands provide important habitat for many species of birds and other animals. Adding wood duck nest boxes and other types of nesting structures for ducks and other birds can augment nesting habitat, help birds to avoid predators, and enhance opportunities to view and enjoy wildlife. The Minnesota DNR, Minnesota Waterfowl Association, and other habitat enhancement organizations can provide information about the types and sources of structures available. Retaining or adding stones, logs, and dead trees near wetlands and within buffers provides habitat for turtles, other reptiles and amphibians, and resting areas for birds and animals.

Habitat areas may also become refuges for large populations of deer, geese, and wildlife that may become a nuisance in urban areas. When needed, population control measures should be included in management plans for these areas. Minnesota DNR staff can provide assistance in the development and implementation of these plans.

4.8.4 Learning Opportunities

Schools and other organizations can adopt wetlands and adjacent areas for use as outdoor classrooms. Students, parents, and teachers can add native wetlands and upland plants, habitat structures, and other enhancements to increase learning opportunities and encourage other wetland owners in the area to make similar enhancements.

4.8.5 Minnesota Wetland Health Evaluation Program (WHEP)

The Minnesota WHEP utilizes adult volunteers within Mendota Heights to sample and evaluate wetlands within the City. Sampling methods and evaluation metrics were developed by the MPCA with both plant and macroinvertebrate communities being used to indicate the overall health of wetlands. Volunteers are trained by scientists from the MPCA and conduct their sampling during the months of June and July. The data is reviewed, analyzed, and summarized in a final report that is presented to City officials.

Eight cities within Dakota County are currently involved in the program. Within Mendota Heights, two wetlands were evaluated in 2004: Copperfield and Hagstrom King. The Copperfield wetland was found to have a Moderate rating for invertebrates and Moderate quality for vegetation. Hagstrom King was found to have a Moderate rating for invertebrates and Excellent quality for vegetation.

4.9 Monitoring and Water Quality Action Levels

According the Lower Mississippi River WMO 2001 Watershed Management Plan, responsibility for monitoring "non-intercommunity" Category I and II water bodies falls to the City of Mendota Heights. These water bodies and the watershed organization jurisdiction in which they lie include:

Category I
South Rogers Lake (Lower Mississippi River WMO)

Category II
August Lake (Gun Club Lake WMO)
Lemay Lake (Gun Club Lake WMO)
North Rogers Lake (Lower Mississippi River WMO)

Gun Club Lake WMO has determined the necessity of a diagnostic feasibility study for water quality improvements to Lemay Lake and is looking to partner with the City on this study. A monitoring program and the City's role in this is a likely outcome of this study.

Rogers Lake is monitored annually by environmental studies students at St. Thomas Academy. To some extent this monitoring may meet the requirements for "survey level" monitoring as required in Section 5.2 of the LMRWMO 2001 Plan. In conjunction with Lower Mississippi River WMO, the City will determine the extent to which this monitoring is compatible with Section 5.2 and determine whether modifications to the monitoring or reporting are necessary. It is desirable to continue using the environmental studies students to monitor the lake as this provides a unique educational opportunity for these students. The City's only goal is to ensure that this monitoring is compatible with the "survey level" requirements in the Lower Mississippi River WMO 2001 Plan. Review of the monitoring program is an implementation item identified in Section 6 of this LSWMP.

Metropolitan Council's September, 2005 policy statements require that Cities update their stormwater plans by 2008 to include additional requirements including:

- Information on TMDL compliance
- Information on NPDES Phase 2 MS4 compliance
- Information on policies intended to accomplish nondegradation
- A wetland management plan

The wetland management plan will incorporate a function and values assessment consistent with the wetland policies of the watershed organizations. Initial guidance from Metropolitan Council suggests that the implementation of a function and values assessment for all a municipality's wetlands can be a phased project with areas of imminent development having a higher priority. Even if the project is phased, the function and values assessment must be completed for the entire municipality. Consequently, this LSWMP includes a function and values assessment as an implementation item. The results of the function and values assessment will allow the City to better classify wetlands and set action levels for them. The water quality data the City currently possesses is not adequate to set waterbody action levels.

References:

Barr Engineering. 2001. Mendota Heights Natural Resource Management Plan.

Dakota County SWCD. 2002. Dakota County Natural Resources Inventory.

Minnesota Department of Natural Resources Protected Waters Inventory Map, Dakota County. 1984.

Minnesota Pollution Control Agency. 1997. *Storm Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm Water and Snow Melt Runoff on Wetlands*. State of Minnesota Storm Water Advisory Group.

United States Fish and Wildlife Service National Wetlands Inventory Map – St. Paul West, St. Paul East, St. Paul SW, and Inver Grove Heights quadrangle. Published 1990, from May 1980 aerial photograph interpretation.

5. SYSTEM ASSESSMENT AND DESIGN

5.1 General

This section of the Mendota Heights Local Surface Water Management Plan (LSWMP) serves two functions. The system assessment portion catalogues the various assessments of problems that the Plan must address. The intent is to identify the source of problems and specific actions the City will take to address these problems either independently or in collaboration with some other organization – most commonly one of the watershed management organizations.

The system design portion of this section describes the City's surface water management system. This system is shown on Map 2. The map indicates the major drainage divides, storage areas, conveyance (including pipe and channels), wetlands and lakes that have been incorporated into the Mendota Heights LSWMP hydrologic model.

5.2 System Assessment

5.2.1 Water Quality Assessments

5.2.1.1 City Assessments

The City investigated the location of storm water discharge into a fen that is located near the southwest part of the City. The assumption was that the storm water was discharging to the Fort Snelling State Park Fen, which is a Restricted Discharge Water under the City's NPDES permit. But the investigation determined that the storm water discharge flowed to the Gun Club Lake Fen, which is not a Restricted Discharge Water.

The City prepared a self-assessment as part of developing its Storm Water Pollution Prevention Program (SWPPP). In that self-assessment, a list of potential sources or types of pollution was developed. The City does not know of any particular source or type of pollution to be prevalent within the City. Although the list is not a list of actual pollution occurrences, the list does provide information for consideration and management. The list is repeated below.

- At Ivy Park Pond there appears to be a problem where skimmers are collecting excessive floatables. A significant portion of stormwater entering the pond comes from West St. Paul. Increased maintenance attention is paid to this location.

- Lawn and landscape fertilizers are a potential source of pollution. The City purchases and uses only phosphorous-free products. Application of fertilizers containing phosphorus is currently prohibited by state law unless the results of a soil test show that phosphorus is indeed the limiting nutrient for turf growth. A typical mixture of salt and sand is used on the streets. The City is looking at alternative deicing products to reduce salt and sediment in stormwater and reduce street sweeping costs.
- Emergency fuel dumping from aircraft flying into the Minneapolis-St. Paul International airport is a potential source of pollution. Citizens in the past have reported strong jet fuel odors believed to be from fuel dumping. Fuel dumping is not known to be a frequent problem.
- Pet waste is recognized as a nuisance and a pollution source. Signs in parks instruct pet owners to clean up after their pets, as required by ordinance. Waste from geese is considered a serious problem. Geese use the City's lakes and ponds throughout the year.
- Failing septic systems are a potential source of pollution, although not perceived to be a problem at this time. Approximately 60 septic systems exist in the City. City ordinance requires inspections of the systems. The Mendota Heights ordinance that regulates septic systems is identical to that of Dakota County and meets all Metropolitan Council and MPCA requirements.
- Soil erosion along the bluffs and at construction sites is a potential source of pollution. The storm sewer system contains some hanging outfalls, and there is scour around some outfalls, most of which are on private property.

5.2.1.2 Clean Water Act Assessments

The portion of the Minnesota River that is within the City limits is listed in the state impaired waters list. Known as the 303(d) list from the applicable section of the federal Clean Water Act, these waters are ones that do not currently meet their designated use due to the impact of a particular pollutant or stressor. If monitoring and assessment indicate that a water body is impaired by one or more pollutants, it is placed on the list. At some point a strategy would be developed that would lead to attainment of the applicable water quality standard. The process of developing this strategy is commonly known as the Total Maximum Daily Load (TMDL) process and involves the following phases:

1. Assessment and listing
2. TMDL study
3. Implementation plan development and implementation
4. Monitoring of the effectiveness of implementation efforts

Responsibility for implementing the requirements of the federal Clean Water Act falls to the U.S. Environmental Protection Agency (USEPA). In Minnesota the USEPA delegates much of the program responsibility to the state Pollution Control Agency (MPCA).

Information on the MPCA program can be obtained at the following web address: http://www.pca.state.mn.us/water/tmdl/index.html. The following is an excerpt from the MPCA website describing the program and its need:

> The Clean Water Act requires states to publish, every two years, an updated list of streams and lakes that are not meeting their designated uses because of excess pollutants. The list, known as the 303(d) list, is based on violations of water quality standards and is organized by river basin. Environmental organizations and citizen groups have sued the EPA because states have not made adequate progress to meet Section 303(d) requirements. The EPA has been sued for various reasons. Over the past 10 years, lawsuits have been filed in 42 states and the District of Columbia. Of those, 22 have been successful. There is currently no such lawsuit in Minnesota. However, beyond the federal requirements, there are many reasons for us to move forward with the development of TMDLs. Foremost is the need to clean up our rivers, streams and lakes to maximize their contributions to the state's economy and quality of life and to protect them as a resource for future generations.
>
> For each pollutant that causes a water body to fail to meet state water quality standards, the federal Clean Water Act requires the MPCA to conduct a TMDL study. A TMDL study identifies both point and nonpoint sources of each pollutant that fails to meet water quality standards. Water quality sampling and computer modeling determine how much each pollutant source must reduce its contribution to assure the water quality standard is met. Rivers and streams may have several TMDLs, each one determining the limit for a different pollutant.

Table 5.1 lists the 303(d) impaired waters within the City of Mendota Heights.

Table 5.1
303(d) 2004 Final List of Impaired Waters
Within the City of Mendota Heights

Water Body	Year First Listed	Assessment Unit ID #	Affected Use	Pollutant or Stressor	TMDL start/ TMDL complete
Minnesota River	1994	07020012-505	Aquatic recreation	Fecal coliform	2008/2011
Minnesota River	1998	07020012-505	Aquatic life	Low oxygen	1992/2003
Minnesota River	1998	07020012-505	Aquatic consumption	Mercury, water column	1999/2011
Minnesota River	1998	07020012-505	Aquatic consumption	Mercury, FCA	1999/2011
Minnesota River	1998	07020012-505	Aquatic consumption	PCB FCA	1999/2011
Minnesota River	1996	07020012-505	Aquatic life	Turbidity	2008/2011

Notes: FCA stands for Fish Consumption Advisory and is thus not an independent pollutant or stressor.
Source: MPCA

The Mississippi River, downstream of the Mendota Heights city limits, is also listed (assessment unit ID # 07010206-505). This listing will potentially affect management of drainage that directly discharges to the River. The river's affected uses are aquatic consumption, aquatic recreation, and aquatic life and the pollutants or stressors that have been identified as causing these impairments are the following:

- Fecal coliform
- Low oxygen
- Mercury (water column and fish consumption advisory)
- PCB (fish consumption advisory)
- Turbidity

The absence of a waterbody from the 303(d) list does not necessarily mean the waterbody is meeting its designated uses. It may be that it has either not been sampled or there is not enough data to make an impairment determination. Additionally, where mercury is identified as a stressor, the TMDL approach will be regional in nature as mercury is most commonly an air-borne pollutant.

City of Mendota Heights Actions: It remains to be seen how the TMDL issues will be resolved for the Minnesota River and Mississippi River. Each river's basin encompasses a significant portion of the state of Minnesota. It remains to be seen whether the TMDLs for the rivers will be implemented basin-wide or along specific reaches. If a whole basin approach is implemented, the role of the City of Mendota Heights in addressing the TMDLs would be limited. But if the TMDLs are addressed on a reach by reach basis, such as the reach that flows through the City's boundaries, the role of the City would likely be more significant. It is likely that once TMDL plans are in place, this LSWMP will have to be amended to incorporate the requirements of the TMDLs.

5.2.1.3 Lower Mississippi River Watershed Management Organization (LMRWMO)

The LMRWMO has assessed the water quality of select lakes and ponds within its jursidiction. It was noted in the LMRWMO Watershed Management Plan (WMP) that, generally, additional water quality data needs to be collected. The LMRWMO WMP noted that water quality assessments should be performed on Roger's Lake in Mendota Heights. According to the WMP, this lake formerly supported a public swimming beach and is popular among local residents for panfish fishing. Water quality monitoring data should be collected to classify the lake and watch trends. No other Mendota Height's lakes or ponds were noted in the WMP for water quality assessment.

City of Mendota Heights Actions: St. Thomas Academy's environmental studies class has been monitoring Roger's Lake, and it gives annual presentations to the Mendota Heights City Council. The City will review the monitoring efforts of the environmental studies class and determine what modifications are necessary to be compatible with "survey level" monitoring as described in Section 5.2 of the LMRWMO plan. Modifications to the monitoring will be made as needed, but the intent is to continue using the students for this monitoring.

Review of the monitoring data will also allow the City and watershed to jointly develop action levels for Rogers Lake. Similarly, the City will be conducting, possibly in partnership with its watersheds, a function and values assessment of its wetlands as part of a 2008 update to this LSWMP to meet Met Council's policy statements of September, 2005.

5.2.1.4 Gun Club Lake Watershed Management Organization (GCLWMO)

The GCLWMO has identified Lake LeMay as having water quality problems. In order to assess this lake's water quality and guide implementation or corrective actions, the watershed wishes to initiate a diagnostic feasibility study for the lake. This feasibility study would establish a longer term management plan for the lake – one which will likely involve the City as a partner in implementation. It is the watershed's desire to partner with the City on this study.

City of Mendota Heights Actions: The City's actions and potential involvement with Lake LeMay will become clearer once the diagnostic feasibility study is complete. The City will begin discussions with the watershed on partnering on the study.

5.2.2 Water Quantity Assessments

5.2.2.1 City Assessments

Since the City prepared its 1993 Water Resources Management Plan, no new water quantity assessments have been conducted. This does not mean that the City has not been addressing new water quantity issues, only that these have not been significant enough in scope to warrant mention in this Plan.

5.2.2.2 Issues Identified in the 1993 Water Resources Management Plan

The 1993 WRMP indicated many problem areas associated with water quality and quantity problems. Section V of 1993 WRMP outlines these problems and is included as Appendix A of this report. The status of these previously identified problems follows:

Water Quantity Problems:

1.a. New culvert installed to prevent topping of Dodd Road.
1.b. City staff addresses this problem on an ongoing basis. Recently, no problems have occurred.
1.c. Improvements to correct the deficiencies were completed in 2005.
1.d. Culvert capacity has been increased.
1.e. Currently being studied by LMRWMO.
1.f. The worst cases of erosion around pipelines and sanitary sewer have been corrected, though correction of erosion issues is ongoing. No actions have been taken on the Friendly Marsh and Valley Marsh outlet restrictions or the Wentworth Park outlet structure modifications. At present no further actions are anticipated other than continuing to correct erosion as it occurs.

1.g. The problem was corrected in 2004.
2.a. A large project completed by 1994, successfully corrected this erosion problem.
3.a. The LMRWMO completed a project to address this issue.
3.b. No actions have been taken regarding Lilac Pond.
4.a. No actions have been taken regarding this flooding.
4.b. The flooding was corrected by construction of a storm pond in 1994.
4.c. As long as structures are not threatened and vegetation stabilizes the City does not envision providing outlets to landlocked basins.
4.d. These ponds were constructed.

Water Quality Problems

1.a. The latest water quality data on Rogers Lake suggests that lake water quality has stabilized and is currently fair. As yet, mitigation strategies for Rogers Lake water quality have not been studied. A thorough review of past monitoring (as identified above) will allow the City to confirm stabilization of Rogers Lake water quality.
1.b. Where feasible, the City will be implementing water quality improvements with its street reconstruction projects and requiring them of redevelopment and new development. In general, rainwater gardens and infiltration will be strongly considered in all such projects. Such retrofitting efforts, carried on over a long enough timeframe, will ultimately improve the quality of the runoff water leaving the City. In 2006 the City will be implementing rainwater gardens for the Somerset neighborhood.
2.a. As stated above, the City will be implementing water quality improvements with its street reconstruction projects and, in the near term, reconstruction of streets will occur within the Ivy Falls Creek watershed. As feasible, rainwater gardens and infiltration areas will likely occur with these near term reconstruction projects.
3.a. See 1.b. and 2.a. regarding the City's strategy for retrofitting water quality improvements into street reconstruction projects, redevelopment, and future development projects.
4. No specific action items have been undertaken or are proposed other than continued application of Best Management Practices as required by the City's NPDES permit and this LSWMP.
5. No specific action items other than the City's strategy to seek any and all feasible opportunities to retrofit water quality treatment into future projects.

5.2.2.3 Lower Mississippi River Watershed Management Organization (LMRWMO)

In its Watershed Management Plan, the LMRWMO assessed intercommunity surface water management issues that the watershed should resolve. Table 5.2 summarizes these issues, which are related to flooding and erosion.

Table 5.2
Erosion and Flooding Issues Related to the City of Mendota Heights

Name	Location	Issue	Status
Ivy Falls Creek	Thompson Avenue at Delaware Avenue. Watershed includes Mendota Heights and West St. Paul	Erosion, flooding	Thompson Avenue drainage to be diverted into Interstate Valley Creek subwatershed. Construction project anticipated in 2006.
Interstate Valley Creek Watershed	Marie Avenue and Dodd Road. Watershed includes Inver Grove Heights, Sunfish Lake, Mendota Heights, and West St. Paul	Erosion, flooding	Watershed is looking at baseflow restoration and bank stabilization.
Interstate Valley Creek Watershed	Interstate Valley Creek north of Marie Avenue. Watershed includes Inver Grove Heights, Sunfish Lake, Mendota Heights, and West St. Paul	Erosion	Ongoing issue which has been addressed in some select locations. Additional stream bank stabilization projects will likely be needed.

City of Mendota Heights Actions: Continue to work with the LMRWMO and other communities to resolve these issues.

5.2.2.4 Gun Club Lake Watershed Management Organization (GCLWMO)

The GCLWMO's assessment stated that flooding problems have been recognized at Lake Augusta. The GCLWMO defers to the City of Mendota Heights the responsibility of addressing the flooding problem. Furthermore, the GCLWMO requires that the flood problems be recognized for capital improvements in this LSWMP.

City of Mendota Heights Actions: While the City is committed to providing relief to flooding problems that endanger structures, roadways, and the like, the flooding at Lake Augusta affects vegetation only. The desire to provide outlets to landlocked basins must be weighed against the fact that increased discharge from any portion of the City may require the City to mitigate for these augmented discharges. The mechanism for the MPCA to require such mitigation might occur under proposed changes to the NPDES permit to include non-degradation analyses and mitigation plans or might occur through the TMDL process. Regardless of the mechanism, it is the City's position that the most prudent course would be to not outlet landlocked basins unless a clear hazard is present to structures or roadways or unless the flood levels encountered in the landlocked basin constitute a taking of upland property. In general, impacts to vegetation around landlocked basins tend to stabilize over time. The City's proposed action in regard to Lake Augusta is to begin discussing the Lake Augusta outlet issue with the watershed and come to some agreement with the watershed on the need for this outlet.

5.2.2.5 Lower Minnesota River Watershed District

Map 2 shows the Mendota Heights drainage system in some detail. One of the primary discharges from this system occurs through a 54-inch pipe into the MnDOT system adjacent to and under Trunk Highway 13. The highway system carries MnDOT and Mendota Heights runoff water into the Quarry Island fen, as indicated by the flow arrows on Map 2.

The Quarry Island fen lies within the jurisdiction of the Lower Minnesota River Watershed District and the district is considering whether to pursue a detailed assessment and monitoring program for this fen. Regardless of what the watershed does toward studying the area, it is highly likely that the watershed and DNR will pursue a project to reroute this drainage around the fen and into Gun Club Lake. The City and MnDOT are likely financial participants in this project when it becomes a reality. The City's share of the project cost could be substantial. Given this, the implementation section of this Plan includes an item for the Quarry Island fen storm drainage project with an unknown date for implementation.

5.3 System Description

This subsection describes the surface water management system for the City of Mendota Heights. The LSWMP area was organized into 4 major topographic watersheds, as follows:

- Interstate Valley Creek Watershed
- Ivy Falls Creek Watershed
- Mississippi River Bluffs Watershed
- Gun Club Lake Watershed

The Interstate Valley, Ivy Falls Creek, and Mississippi River Bluff topographic watersheds generally lie within the Lower Mississippi River Watershed Management Organization jurisdiction. The Gun Club Lake topographic watershed is in the Gun Club Lake Watershed Management Organization's jurisdiction, though a small part lies within the Lower Minnesota River Watershed District's jurisdiction.

Each major watershed was divided into drainage districts. The drainage districts are generally drawn to encompass all drainage to a particular pond, wetland or lake. The City's 1993 Plan identified 14 major drainage districts. In order to simplify the modeling nomenclature and ease cross referencing between the model and Map 2, drainage districts within this Plan carry suffix for one of the four major topographic watersheds. Table 5.3 provides a cross reference for the 1993 Plan's districts and the major watershed suffix used in this Plan.

Table 5.3
Drainage Districts
and Areas within the City of Mendota Heights

Drainage District	Abbreviation	Acres
Roger's Lake	IV	475
Southeast	IV	506
Friendly Marsh	IV	654
East Marie	IV	331
West Marie	IV	209
Lower Interstate Valley	IV	829
Ivy Falls Creek	IF	434
East Highway 13	MB	35
Central Highway 13	MB	121
West Highway 13	MB	228
Augusta Lake	GC	442
Minnesota River Bluffs	GC	176
Industrial Park	IP	473
I-494	GC	285
Highway 110	MB	206
South Highway 13	GC	131

The following sections describe each drainage district in detail. Appendix B includes areas for the subdistricts within each major watershed. Appendix C includes the pond data.

Interstate Valley Creek Watershed (IV)

The Interstate Valley Creek Watershed consists of all areas that drain to the point where T.H. 13 crosses Interstate Valley Creek. The watershed's total area is approximately 4224 acres, of which 3004 acres are in Mendota Heights, 414 acres are in West St. Paul, 676 acres are in the City of Sunfish Lake (including the 234 acre Sunfish Lake Watershed, which is landlocked), and 130 acres are in Inver Grove Heights.

Interstate Valley Creek is an intermittent stream that begins near the intersection of T.H. 110 and T.H. 149 (Dodd Road) at the outflow point of a large wetland (Friendly Marsh). The creek flows northward under T.H. 110 through a 72-inch RCP culvert. From T.H. 110 the creek flows 1.9 miles through Valley Park before discharging to the Mississippi River. The creek flows through culverts at Marie Avenue, at a bicycle path crossing downstream of Marie Avenue, and at Lilydale Road.

Because of its relatively large size, the portion of the Interstate Valley Creek Watershed within Mendota Heights is divided into six drainage districts.

Rogers Lake Drainage District

The Rogers Lake Drainage District is nearly fully developed. This district consists of Rogers Lake and the area draining to the lake. Rogers Lake is the district's major hydrologic feature. The lake consists of two basins which are divided by Wagon Wheel Trail. A 36-inch corrugated metal pipe (CMP) culvert connects the two basins. The outlet of Rogers Lake is via a 30-inch reinforced concrete pipe (RCP) that connects to a storm sewer system that discharges to the Friendly Marsh District, as shown on Map 2.

West of I-35E the land use is predominantly single-family residential, while east of I-35E a large part of the upland in this area consists of the Mendakota Country Club golf course. Single-family homes and schools exist in the district south and east of Rogers Lake. A small area south of the lake and adjacent to I-35E is undeveloped but planned for office/industrial land use.

Southeast Drainage District

The Southeast drainage district mostly consists of single-family homes. Within Sunfish Lake and Inver Grove Heights 693 acres are tributary to the Southeast Drainage District though 234 acres of this tributary area is actually landlocked by Sunfish Lake. This drainage flows from the City of Sunfish Lake into the Southeast Drainage District through two separate culverts under County Road 63 (Delaware Avenue). Drainage from this district flows to the Friendly Marsh Drainage District.

Friendly Marsh Drainage District

The Friendly Marsh Drainage District is generally located south of T.H. 110 and west of Delaware Avenue. Open space is a significant land use in this district due to the presence of the Dodge Nature Center. Single-family residential is the other predominant land use. This district receives drainage from approximately 301 acres in the cities of Sunfish Lake and West St. Paul via two culverts under Delaware Avenue. Water from the Rogers Lake and the Southeast drainage districts also discharges into the Friendly Marsh Drainage District. The district discharges to the Lower Interstate Valley Drainage District. Friendly Marsh is a ditched wetland that serves as the headwaters to Interstate Valley Creek.

West Marie Avenue Drainage District

This district is located along Marie Avenue, generally west of I-35E. The predominant land use is single- and multiple-family residential. This district discharges to the Lower Interstate Valley Drainage District.

East Marie Avenue Drainage District

The East Marie Avenue Drainage District is located along Marie Avenue east of Interstate Valley Creek. Marie Creek flows through this district. The predominant land use is single-family residential. Drainage from approximately 169 acres in West St. Paul is tributary to this drainage district. The stormwater runoff from the East Marie Avenue Drainage District discharges to the Lower Interstate Valley Drainage District.

Lower Interstate Valley Drainage District

Significant open areas exist along Interstate Valley Creek and at two golf courses. Drainage from 57 acres in West St. Paul enters this drainage district, as well as from the Friendly Marsh, West Marie Avenue, and East Marie Avenue drainage districts. The predominant drainage feature in this district is Interstate Valley Creek, which runs northward adjacent to I-35E. Interstate Valley Creek discharges to the City of Lilydale and then to the Mississippi River.

Ivy Falls Creek Watershed (IF)

The Ivy Falls Creek Watershed resides within the cities of Mendota Heights and West St. Paul. The City of West Paul has approximately 274 acres tributary to Ivy Falls Creek. The predominant land use is single-family residential. The northern portion of the Somerset Country Club golf course lies in this drainage district.

Ivy Falls Creek is an intermittent stream that begins in Somerset Golf Course. The streambed drops approximately 180 feet along its 3,000-foot length from Dodd Road to T.H. 13, including a 50-foot drop at Ivy Falls. Because of this steep gradient, erosion has occurred along the creek.

Mississippi River Bluffs Watershed (MB)

This watershed consists of the various small drainage routes along the Mississippi River bluffs. These drainage routes discharge water to culverts under T.H. 13 to the City of Lilydale. Areas that drain to either Interstate Valley Creek or to Ivy Falls Creek are not included in this watershed. The drainages in this watershed have similar features: they all include a small area above the bluffs which then drains down the bluffs to ditches and culverts along T.H. 13. Because of the steep slopes in this watershed, the water flows quickly and erosion and flooding problems exist in some of these drainage routes. The watershed is divided into four drainage districts, which are discussed below.

West Highway 13 Drainage District

The West Highway 13 Drainage District runs along the south side of Highway 13 from the City of Mendota Heights border with the City of Mendota east to I-35E. The drainage discharges through six culverts beneath T.H. 13 to Lilydale. Approximately 20 acres of this drainage district are in Lilydale.

Central Highway 13 Drainage District

The Central Highway 13 drainage district is located between the Ivy Falls Creek and Interstate Valley Creek watersheds, south of Highway 13. Discharge from this district occurs through two culverts beneath T.H. 13.

East Highway 13 Drainage District

The East Highway 13 Drainage District is located at the northern tip of Mendota Heights. Approximately 25 acres of West St. Paul is tributary to the district. The drainage from this district discharges to Lilydale through an 18-inch culvert under T.H. 13 (Sibley Memorial Highway).

Highway 110 Drainage District

The Highway 110 Drainage District drains through a series of ditches and ponds before discharging to the Mississippi River via a culvert that passes through the City of Mendota. The eastern extent of this drainage district is approximately at the intersection of Hwy. 110 and Victoria Road.

Gun Club Lake Watershed (GC)

This watershed is in the west part of the City and includes all of the area in Mendota Heights that is within the Gun Club Lake Water Management Organization (GCLWMO) and part of the area which is within the Lower Minnesota River Watershed District (LMRWD). This watershed has five drainage districts, which are described below.

Lake Augusta Drainage District

This district consists of land that drains to Lake Augusta. Open space is the predominant land use because of the presence of Resurrection Cemetery. Industrial/office and single-family land uses are also present. Lake Augusta is landlocked, so no surface discharge occurs from the lake. Mendota Heights and the Gun Club Lake WMO will work toward determining whether an outlet to Lake Augusta is necessary.

Industrial Park Drainage District

Most of the Industrial Park district is zoned for industrial/office land use. The 30-acre Lake LeMay is the district's only major water body and lies in the district's northwest portion. Lake LeMay discharges to the Industrial Park storm sewer system via a 30-inch pipe that crosses under Highway 55. The outlet pipe is designed such that when water levels in Lake LeMay are below the NWL, runoff collected by the 30-inch outlet pipe would flow to Lake LeMay and not to the Industrial Park. When water levels are above the NWL, flows are routed to the Industrial Park.

The water from the drainage district discharges through a 54-inch storm sewer to an open channel in a ditch. The ditch drains to a 66-inch culvert under Highway 13 where it again flows in an open channel, and ultimately discharges to Gun Club Lake. With the exception of Lake LeMay, little stormwater storage is available in the Industrial Park Drainage District.

Interstate 494 Drainage District

This district is located in the south central portion of the City. Included in this drainage district is the stretch of I-35E south of Wagon Wheel Trail. The major land use in the district is industrial/office. The runoff from this drainage district flows to the I-494 drainage system that ultimately discharges to the Minnesota River.

Minnesota River Bluff Drainage District

This district consists of land with several drainage routes that discharge into the Minnesota River. All surface drainage in this district discharges to culverts under the C&NW railroad tracks. There are approximately 22 culverts under the 1.5 miles of railroad track bordering the drainage district. Land use in this drainage district includes open space within Fort Snelling State Park, wooded bluff slope, industrial/office, highway, cemetery and single-family residential.

South Highway 13 Drainage District

This district is generally located along Highway 13 and Highway 55, between the Minnesota River Bluff and Industrial Park drainage districts. This district combines its discharge flow with flows from the Industrial Park drainage district at the MnDOT pond located near the intersection of Highway 13 and I-494. The discharge ultimately flows to Gun Club Lake.

5.4 System Design

5.4.1 Hydrologic Modeling Discussion

The purpose of the modeling effort was to convert the 1993 Water Resources Management Plan model to the more user friendly HydroCad modeling software, and to update the model to current conditions in the City.

Stormwater runoff is defined as that portion of precipitation which flows over the ground surface during, and for a short time after, a storm. The quantity of runoff is dependent on the intensity of the storm, the amount of antecedent rainfall, the length of the storm, the type of surface upon which the rain falls, and the slope of the ground surface.

The intensity of a storm is described by the amount of rainfall that occurs over a given time interval. Storms are typically characterized by their return frequency. A return frequency designates the average time span during which a single storm of a specific magnitude is expected to recur. Thus, the degree of protection afforded by storm sewer facilities is determined by selecting a return frequency for analysis.

For the Mendota Heights LSWMP the following return frequencies were used for the modeling effort:

- 100-year, 24 hour 1993 WRMP watershed model distribution for calibrating the HydroCad model to the 1993 WRMP model
- 100-year, 10-year, and 2-year for the SCS 24-hour, Type II distribution event for the updated HydroCad model

A 100-year, 24-hour frequency event (5.9 inches in 24 hours for Mendota Heights) has a 1% chance of occurring or being exceeded in any given year. This design rainfall return period is commonly used for flood control throughout Minnesota.

Besides the storm characteristics, the stormwater modeling requires determining landscape characteristics. These characteristics can be summarized into two parameters: the time of concentration and the land cover, as represented by the runoff Curve Number (CN).

The time of concentration is the time required for the runoff from a storm to become established and for the flow from the most remote point (in time, not distance) of the drainage area to reach the design point. The time of concentration will vary with the type of surface receiving rain and the slope of the surface.

The percentage of rainfall falling on an area that must be collected by a storm sewer facility is dependent on watershed variables such as:

- Soil perviousness
- Ground slope
- Vegetation
- Surface depressions
- Development type
- Antecedent rainfall

These factors are taken into account when selecting a runoff Curve Number (CN).
CN values depend on the type of soil, cover type and hydrologic condition. Under fully developed conditions, the values of CN will rise with increases in impervious area caused by street surfacing, building construction, and grading.

The 1993 WRMP model does not use curve numbers, but the new HydroCad model does. The 1993 WRMP model gave areas for pervious, impervious, and pond surfaces for each of the subdistricts. The 1993 WRMP model also had the times of concentration for each subdistrict. Therefore, the HydroCad model needed to be calibrated to the 1993 WRMP model by choosing the correct CN value. The CN value for impervious areas is uniformly a CN = 98; for ponds it is CN = 100. Therefore, the calibration of the model required the determination of the pervious curve number.

The calibration involved entering the 1993 WRMP model data into the HydroCad model. The storm event used for calibration was the 1993 WRMP 24-hour distribution for a 100-year event. Time of concentration, land area by land use type (pervious, impervious, or pond), and the "fixed" CN values for impervious and pond surfaces were all entered into the Hydrocad model.

Several comparative Hydrocad model runs using different pervious area curve numbers subsequently made. The best match to the 1993 WRMP model was obtained using a CN = 55 for the pervious area. Table 5.4 summarizes the model calibration results.

Table 5.4
Summary of HydroCad Model Calibration

	HydroCAD Model					1993 WRMP Model					
	Peak Flow rate Inflow cfs	Peak Flow rate Outflow cfs	Time to peak inflow	Volume ac-ft	Peak Elevation ft	Peak Flow rate Inflow cfs	Peak Flow rate Outflow cfs	Time to peak inflow	Volume ac-ft	Peak Elevation ft	Volume percent error
Interstate Valley Creek Watershed											
Southeast (pond IV24)	54.2	48.78	17.75	184.5	839.02	56.23	46.93	16.4	178.6	838.96	3.2%
Rogers Lake (pond IV39)	210.1	20.38	15.16	121.4	873.24	166.8	19	14.8	121.5	873.18	-0.1%
Friendly Marsh (reach IV Creek)	111.92	111.92	23.32	522.4	--	109.38	109.38	20.8	510.9	--	2.2%
East Marie (pond IV109)	101.52	101.51	15.77	86.75	814.45	105.77	105.77	15.6	83.6	814.57	3.6%
West Marie (pond IV134)	40.15	40.13	19.02	47.13	861.14	40.86	44.27	15.2	45.17	861.16	4.2%
West Marie (routing from pond IV134 to IV135 from INLIVX.hyd)						--	*12*	--	*45.09*	--	
Lower Interstate Valley	468.01	468.01	15.65	815.53	--	454.94	454.94	16	792.35	--	2.8%
Ivy Falls Creek Watershed											
Ivy Falls Creek	271.61	271.61	15.54	157.63	--	253.78	253.78	15.6	153.05	--	2.9%
Gun Club Lake Watershed											
Augusta Lake	116.53		15.51	88.2	834.55	130.3		15.2	90.53	834.6	-2.6%
Industrial Park											
Minnesota River Bluffs	91.01	91.01	15.03	41.6	--	87.73	87.73	15.2	40.6	--	2.4%
I-494	134.63	134.63	15.29	75.69	--	122.84	122.84	15.2	73.8	--	2.5%
Mississippi River Bluffs											
West Hwy. 13		67.94	15.05	34.55	--		71.06	15.2	33.59	--	2.8%
Central Hwy. 13		54.62	15.22	24.9	--		57.73	15.2	23.63	--	5.1%
East Hwy. 13		30.53	15.05	13.66	--		30.9	15.2	13.17	--	3.6%

The HydroCad model is simpler than the 1993 WRMP model in that the HydroCad model consolidates some drainage areas, reducing the number of nodes in the model. This consolidation is warranted in that the HydroCad model is not intended to model every culvert in the City, which is the method of the 1993 WRMP model. Instead the HydroCad model focuses on modeling storage basins that have significant storage. For a basin to appear in the HydroCAD model it meets one of the following criteria: the basin is shown on the City's Storm Water System Map, appears on an as-built drawing, or is apparent in an aerial photograph.

After calibration was performed, the HydroCad model was revised to reflect development that has occurred since 1993. Revisions (not included in this plan) were based on as-built drawings and updates to the City's Storm Sewer System Map as provided by the City.

Table 5.5 summarizes CN values and runoff coefficients used in the LSWMP modeling. To ensure consistency with this Plan future analyses, whether they be for development proposals or other city projects, should use the values contained within Table 5.5. For other types of land use not identified in the table, SCS Technical Release 55 (TR-55) Curve Numbers should be used. These CN values reflect Antecedent Moisture Condition II (AMC II), which is a typical assumption in hydrologic analyses.

AMC II simply implies that average soil moisture conditions apply prior to simulation of the design event.

Table 5.5
Curve Numbers

Land Use Type	CN Value
Pervious	55
Impervious	98
Ponds	100

HydroCAD stormwater runoff hydrographs are calculated in accordance with SCS TR-20 methodology. Hydrograph routing through channels and detention basins is performed using the Dynamic-Storage-Indication method.

A summary of the updated HydroCAD modeling results is shown in Appendix C. Also included in the summary in Appendix C, are the modeling results of the industrial park area. The industrial park was not modeled in HydroCAD (Industrial Park or "IP" drainage subdistricts). Rather, it was modeled using a different software program called XP-SWMM that better accounts for pressure in storm sewer pipe. A portion of the industrial park storm sewer relies on pressure release through backflow into the pond within subdistrict IP-12.

5.4.2 System Design Recommendations and Discussion

5.4.2.1 Conveyance and Storage System Concepts

Storm Sewer and Channels

In the Mendota Heights LSWMP stormwater model, a combination of storm sewer and channels has been used to transport simulated stormwater runoff. A complete system consists of a complex web of trunks, manholes, lateral lines, overland drainage ways, catch basin leads, catch basins, pond inlets and outlets and many other items.

Proper design of a storm sewer system requires that all sewer lines be provided with access through manholes for maintenance and repair operations. Generally, spacing of manholes should be no greater than 400 feet. Intervals on larger diameter lines can be increased when the pipes are sufficiently large for a person to physically enter the storm sewer pipe for maintenance operations. Regardless of sewer size, manholes should normally be provided at all junction points and at points of abrupt alignment or grade changes.

Although lateral systems are designed for the 10-year storm event, their performance must be analyzed for storms exceeding the design storm. Lateral and trunk pipes will surcharge when the design storm is exceeded. During surcharging, the pipes operate as closed conduits and become pressurized with different pressure heads throughout the system. Low areas that are commonly provided with catch basins become small detention ponds often performing like pressure relief valves with water gushing out of some locations. For this reason, it is extremely important to ensure that these low areas have an acceptable overland drainage route with proper transfer capacity.

At a minimum, ponding on streets must meet all of the requirements of the 100-year design criteria. For safety reasons, the maximum depth should not exceed two feet at the deepest point and the lowest ground at adjacent building elevation should be at least 1.5 foot above the elevation to which water could rise before overflowing through adjacent overland routes.

All storm sewer facilities, especially those conveying large quantities of water at high velocities, should be designed with efficient hydraulic characteristics. Manholes and other structures at points of transition should be designed and constructed to provide gradual changes in alignment and grade. Pond outlet control structures should be designed to allow water movement in natural flow line patterns, to minimize turbulence, to provide good self-cleaning characteristics, and to prevent damage from erosion.

Intake structures should be liberally provided at all low points where stormwater collects and at points where overland flow is to be intercepted. Inlet structures are of special importance, since it is a poor investment to have an expensive storm sewer line flowing partially full while property is being flooded due to inadequate inlet capacity. Intake grates and opening should be self-cleaning and designed to minimize capacity reduction when clogged with twigs, leaves and other debris.

Effective energy dissipation devices or stilling basins to prevent stream bank or channel erosion at all stormwater outfalls should be provided. The following recommendations should be kept in mind when designing an outlet:

- Inlet and outlet pipes of stormwater ponds should be extended to the pond normal water level whenever possible.
- Outfalls with velocities of less than 4 fps that project flows downstream into the channel in a direction 30 degrees or less from the normal channel axis generally do not require energy dissipators or stilling basins, but do require rip rap protection.
- Where an energy dissipator is used, it should be sized to provide an average outlet velocity of less than 4 fps, unless rip rap is also used. In the latter case, or when discharge occurs at NWL of a pond, the average outlet velocity should not exceed 6 fps.
- Where outlet velocities exceed 6 fps, the design should be based on the unique site conditions present. Submergence of the outlet or installation of a stilling basin approved by the City is required when excessive outlet velocities are experienced.
- In the case of discharge to channels, rip rap should be provided on all outlets to an adequate depth below the channel grade and to a height above the outfall or channel bottom. It should be placed over a suitably graded filter material and filter fabric to ensure that soil particles do not migrate through the rip rap and reduce its stability. Rip rap should be placed to a thickness at least 2.5 times the mean rock diameter so as to ensure that it will not be undermined or rendered ineffective by displacement. If rip rap is used as protection for overland drainage routes, grouting may be recommended.
- Overland drainage routes where velocities exceed 6 fps should be reviewed by the City Engineer and approved only when suitable stabilization measures are proposed.

Open channels and swales are recommended where flows and small grade differences prohibit the economical construction of an underground conduit and in areas where open channel type drainage will enhance the aesthetic qualities of a development. Whenever possible, a minimum slope of 2% should be maintained in unlined open channels and overland drainage routes. Slopes less than 2% and greater than 1% are difficult to construct and maintain and may require an underdrain system. Slopes less than 1% should not be allowed. Side slopes should be a maximum of 4:1 (horizontal to vertical) with gentler slopes being desirable. Where space permits, slopes should be cut back to match existing grade.

In general the flatter the channel side slopes and the more meandering the channel alignment the more natural the channel will appear. Natural looking channels use significantly more space than common ditches. One method of providing this space is to incorporate greenway corridors over the channel area.

Rock rip rap should be provided at all points of juncture between two open channels and where storm sewer pipes discharge into a channel. The design velocity of an open channel should be sufficiently low to prevent erosion of the bottom. Rip rap or concrete liners should be provided in areas where high velocities cannot be avoided. Periodic cleaning of an open channel is required to ensure that the design capacity is maintained. Therefore, all channels should be designed to allow easy access for equipment.

Sanitary sewer manholes that could be subject to temporary inundation, due to their proximity to ponds, channels, or roadway low points, should be equipped with watertight castings. Precautions should be taken during construction to prevent the entrance of stormwater into the sanitary sewer. When access is required at all times, sanitary manholes located near ponding areas should be raised above the 100-year high water level. If access is not required, water tight castings should be installed. Future storm drainage construction should include provisions for improving the water tightness of nearby sanitary sewer manholes. All newly constructed sanitary manholes in the vicinity of ponding areas and open channels described in this report should be waterproof.

Ponds

Stormwater ponding areas are an essential part of any storm drainage system. These areas provide locations where stormwater flows can be reduced to provide flood protection for downstream areas. The effective use of ponding areas enables the installation of outflow storm sewers and channels with reduced capacities, since the duration of the design storm is effectively increased over the total time required to fill and empty ponds. Smaller capacity trunk storm sewer and channels provide a cost savings to the City.

The use of ponds to control stormwater runoff rates is a recent phenomenon. Historically, older cities have piped stormwater directly to the nearest large receiving water or river. Continued use of this practice has both cost and regulatory implications. In terms of cost, few cities have the funds necessary to build pipes that provide 100-year protection to properties. In fact, the older cities that have historically piped all their stormwater find that the systems they constructed provide nowhere near the 100-year protection found in newer cities that have used ponds. In terms of the regulatory control, many direct discharges (without ponding) to waters of the state are precluded. At present, even direct discharges to wetlands that are not considered waters of the state are regulated through the NPDES construction permit.

Cost and regulatory considerations aside, well designed ponds:

1. Improve water quality
2. Recharge the groundwater table
3. Provide aesthetic, recreational and wildlife benefits

Ponds improve stormwater quality by allowing nutrients and sediments carried by runoff to settle before discharge to important receiving waters. Groundwater recharge is increased by restricting the outflow rate from a pond, thus allowing more water to infiltrate into the soil. Careful planning of ponds can enhance a development's appeal and still provide efficient stormwater management. In fact, lots with pond frontage command a higher price than lots without.

To provide proper protection for adjacent property, the design storm for ponding areas is the maximum flood elevation obtained from analyzing 100-year critical events of different duration. Regardless the duration of the critical event, a Type II, 24-hour, 100-year rainfall event must also be analyzed. The lowest exposed elevations of structures that are adjacent to ponds should be certified by the builder during basement construction to ensure adequate freeboard.

Runoff determinations for pond design vary from those for storm sewer calculations. The critical storm for storm sewer design is the short, high intensity storm, whereas the critical storm for pond design is often of longer duration, since water is being stored for longer periods of time and released at a slower rate.

The use of Hydrocad computer modeling in the analysis of the ponding system has allowed the efficient review of complicated routing patterns, each comprised of several ponds. The pond storage and outflow rates, adjusted by lag time, were determined by the Hydrocad program for all the ponds identified in this Plan. The lag time is significant as it represents the attenuation of peak flows at each pond and generally shows that the peaks are not occurring at the same time. This implies that the direct runoff to a pond has generally passed through to the downstream trunk system before the inflow of large volumes of runoff from upstream ponds.

5.4.2.2 Water Quality System Concepts

The only effective way to maintain high quality water bodies is to prevent sediment, nutrients and other materials from entering the storm drainage system. Complete interception of stormwater for treatment at the point of discharge is not currently feasible, though the City encourages the implementation of techniques such as rainwater gardens, infiltration areas, and filtration swales etc. that capture a portion of runoff at the point of generation. Application of these small-scale techniques should be on a site specific basis.

Pollutant Control

The three main sources for degradation of water quality are:

1. Solids and associated chemicals (including calcium chloride and salt) from erosion and street sanding,
2. Composted decay around ponds, and
3. Fertilizers and other chemicals from farming practices, impervious surfaces, or lawn care.

Identification of the source and implementation of reasonable control measures can minimize the degradation of Mendota Heights's waterbodies.

In areas where development is taking place, stormwater runoff frequently contains substantial quantities of solids. Most commonly, these sediments are carried by runoff into the storm sewer from large grading sites though fully developed areas also generate sediment loads particularly from winter sanding operations and in areas of structurally failing pipes. For developing areas, strict on-site erosion control practices are required to prevent sediments from entering downstream water bodies. Inspections should be conducted by the City to verify that the erosion control practices have been installed and maintained properly. Even with extensive erosion control practices, sediment and airborne particulates will continue to enter surface waters of the City.

The importance of erosion control measures during construction cannot be overemphasized. The Best Management Practices (BMPs) recommended in the Minnesota Pollution Control Agency's (MPCA) Protecting Water Quality in Urban Areas should be followed for all development. The Minnesota general National Pollutant Discharge Elimination System (NPDES) stormwater permit for construction activity requires a permit for construction activities that disturb one or more acres.

When disturbing 10 or more acres, developers are required to provide temporary settling ponds to treat the runoff from their grading sites. These ponds are intended to prevent the introduction of sediment and its associated pollution into the storm sewer system and are required to function, in their various forms, until grading has ceased and adequate cover has been established. At a minimum, these temporary sedimentation basins should meet the requirements set forth in the NPDES general permit for construction activities. When the outlet for a siltation basin, either permanent or temporary, is located below the normal water surface, the basin can also serve to confine floating solids that may otherwise enter a downstream pond or lake. This practice is typically referred to as skimming. If a hazardous material such as fuel oil were to spill, a skimmer structure would retain it within the basin and thus isolate it for easy access and prompt cleanup. Skimmer structures should be used for all constructed ponds upstream of wetlands, lakes, rivers and streams. For constructed ponds that discharge into other constructed ponds, skimmer structures are not as important.

Ideally, some sort of solids removal system should be installed wherever a storm sewer outlets into a pond. In certain cases, settling chamber (sump) type catch basins or manholes can be provided for storm sewers that discharge into ponds. These can provide effective removal of sand and gravel, which may be flushed into the storm sewer from streets and highways, but are ineffective in the removal of finer particles such as silts and clays. Use of this type of catch basin or manhole should be limited to those areas where regular maintenance is practical and to where the sump can be realistically expected to intercept sand from winter sanding operations and gravel from driveways and construction sites.

Of late a concern regarding West Nile virus and mosquito breeding habitat has called into question the use of sump manholes. The latest data suggests that many different breeding environments exist for the mosquitoes that carry the virus including ponds, wetlands, catch basins, and manholes. Obviously, eliminating these elements of the system is not feasible. Though they should be used sparingly, sump manholes should not be prohibited due to a concern over West Nile virus.

It bears repetition that a solids removal structure must be regularly maintained if it is to remain effective. Since maintenance is the controlling factor in the long term performance of sediment control measures, ponds are recommended over sump manholes. Sump manholes, if numerous, often go without maintenance. An individual pond requires more maintenance time than a sump, but system maintenance time goes down when ponds are the preferred method of sediment removal as long as pond slopes and benching allow access by maintenance equipment. For this reason sump manholes should be limited to storm sewer lines discharging directly to wetlands, lakes, rivers, streams, ravines, and constructed channels and should be avoided upstream of constructed ponds. In all cases, the location, type, and number of sediment control structures must be established at the time of final design of that portion of the storm sewer system. Maintenance of the system is discussed further in Section 6.

Even with the best and most expensive solids removal system, contamination of ponds and lakes will occur unless particular attention is paid to those activities that occur after development of a site. Developers must utilize the BMPs to minimize erosion during the mass grading phase of construction. But property owners must also use care in the development and maintenance of their lawns and open areas. Debris is frequently raked from lawns into gutters; from there, if it is not removed, it washes into the storm sewer system.

Generally speaking, water quality ponding within a development has to treat storm water to the level required by the downstream receiving water body and its attendant management strategy. This LSWMP calls for detention pond design according to the design program developed by William Walker. At a minimum, though, detention ponds should contain wet volume equivalent to the runoff from a 2.5 inch rainfall over their tributary area. Occasionally, with small plats (of 5 acres of less), water quality ponding cannot be constructed to the extent required by the LSWMP without severely hampering the site development or destroying other habitat such as upland grasslands and forests.

In such cases, it is within the City's discretion to reduce the required water quality ponding and/or require other methods such as filtration swales or filter beds.

Water Quality Modeling

When necessary for modeling a series of water quality ponds, the City uses the PondNet water quality management model. PondNet is an empirical model developed from data collected by the Environmental Protection Agency (EPA) Nationwide Urban Runoff Program (NURP). The model predicts the phosphorus removal efficiency of a large number of hydrologically connected ponds. Phosphorus is the primary nutrient modeled because it has been found to be the nutrient most likely to promote the growth of algae in lakes.

This LSWMP includes the PondNet modeling that was done for the 1993 Water Resources Management Plan. New modeling was not performed. The PondNet results are in Appendix D.

Computer models that predict concentrations and removal efficiencies for heavy metals are currently available. These models predict removal efficiency in terms of inflow particle distribution and the pond's ability to remove suspended solids. Based on a number of studies performed by various agencies, it can be assumed that wet detention ponds which remove 60 percent of phosphorus also remove high percentages of heavy metals. Table 5.6 shows the benefits of wet detention ponds as estimated by the DNR in Wisconsin.

Table 5.6
Benefits of Wet Detention Ponds

Pollutant	Average Reduction (%)
Lead	70
Zinc	70
Bacteria	70
Diazinon (pesticide)	17
Phthalate	80
Sediment	90

Based on these findings, it can be assumed that water quality ponds which reduce phosphorus loadings by 60% under standard runoff concentrations will also reduce heavy metal concentrations by 70% and sediments by 90%. For this reason it is sufficient to model for phosphorus and from those results infer removals of other pollutants according to the percentages in Table 5.6.

Actual modeling of water quality basins and their treatment capacities can be cumbersome for developers and their engineers. A simple criterion is that every water quality basin should provide wet volume (volume below the normal water level) equivalent to the post development site runoff for the 2.5-inch rainfall event. Ponds designed in this manner will meet 60% removal efficiency while providing excess volume for sediment storage.

The Lower Mississippi River Watershed Management Organization has conducted water quality modeling of certain Mendota Heights areas with the water quality model P8. P8 is a more diverse water quality model in that it quantifies the benefits of a variety of BMPs in the urban setting. In contrast PondNET is only used for wet detention ponds. It was the watersheds P8 modeling that was used to identify rainwater gardens as a feasible water quality retrofit in certain Mendota Heights neighborhoods. This work by the watershed was the precursor to the City's 2006 rainwater garden project in the Somerset neighborhood.

Local vs. Regional Water Quality

Water quality treatment is not considered a regional element but rather something to be installed with individual developments. Regional water quality treatment is considered less effective than local treatment and some analyses suggest that regional water quality basins can become pollutant sources rather than sumps.

The premise that water quality treatment is more effective at a smaller scale is based upon the general assumption that ponds in series are more effective than single, larger ponds even if equivalent wet volumes are involved. Additionally, when a water quality system consists of disperse elements the effect of any one component failing is relatively small. In contrast, if the water quality system consists of large centralized facilities the impacts of one component failing might be quite significant. Another argument for smaller and more numerous water quality ponds is maintenance. Many Cities maintain these ponds themselves and do not have access to equipment that can reach from a pond bank to the middle of a large pond. Additionally, by dispersing water quality to the local or neighborhood level, a wider range of techniques can be used such as:

- filtration swales
- infiltration swales
- infiltration basins
- structural units like swirl separators
- sand filters
- reducing impervious surface

The techniques above are best applied as near as possible to the point of runoff generation.

5.4.3 Design Standards

5.4.3.1 Submittal Requirements

All grading, erosion control, and site restoration work should be done in accordance with the most recent additions of the MnDOT Standard Specifications for Highway Construction and the Minnesota Pollution Control Agency's Protecting Water Quality in Urban Areas.

Erosion and Sediment Control plans are required to show the following:

1. The Developer shall obtain all regulatory agency permits and approvals including those from the Minnesota Pollution Control Agency for "General Storm Water Permit for Construction Activity".
2. Contact information for the engineering firm, developer, and owner.
3. Show City of Mendota Heights' project number on the Plan.
4. Signature of company responsible for erosion and sediment control plan preparation, implementation and maintenance.
5. Show all erosion control measures.
6. Show first floor and basement walkout elevations.
7. A location map indicating the vicinity of the site.
8. Two-foot contour information extending a minimum of 200 feet beyond the property boundary that shows features such as buildings, structures, walls, trees, fences etc and any hydrologic features such as wetlands, ponds, lakes, and streams that are wholly or partially encompassed by the project perimeter.
9. Two-foot contour information shall include the following:
    a. Existing contours
    b. Proposed contours
    c. Contour labeling
10. Directional arrows to indicate the site and lot drainage directions.
11. Details on existing wetlands, lakes, streams etc.
    a. Normal Water elevation (NWL) and 100-year design storm High Water Level (HWL)
    b. Ordinary high water level, if available, for wetlands within the site
    c. Whether waterbodies are DNR protected
    d. Wetland delineations for wetlands on the site
12. Information on individual lots including:
    a. Type of structure (i.e. walkout or rambler)
    b. Lowest ground elevation adjacent to building walkout and lookout window elevations
    c. Existing and proposed lot corner spot elevations
    d. Proposed mid-point side lot spot elevations
    e. Proposed spot elevations at any high points or drainage breaks
    f. Proposed spot elevations where drainage swales intersect lot lines
    g. Proposed spot elevations where drainage and utility easements intersect with lot lines

h. The benchmark utilized for elevation determination.

13. All easements and outlots existing and proposed.
14. All adjacent plats, parcels, property lines, section lines, streets, existing storm drains and appurtenances, and underground utilities (public and private).
15. Grading and clearing limits; details of topsoil removal, topsoil stockpiling and topsoil respreading.
16. Drawings showing existing and proposed drainage boundaries, including watersheds contributing runoff from off-site.
17. Emergency Overflow (EOF) elevations and directions of flow for all street and rear yard catch basins, parking areas, ponds, wetlands, lakes, streams, swales etc.
18. Hydrologic and hydraulic calculations for the 2-year, 10-year, and 100-year 24-hour (type II distribution) rainfall event and the critical 100-year event.
19. Provide detailed hydrologic/hydraulic calculations verifying location and capacity adequacy of all overland drainage routes. Consult the City's Local Surface Water Management Plan for further detail on design criteria.
20. If retaining walls are needed, submit detailed plans and specifications that show type and height of retaining wall. Retaining walls will not be allowed within the City's easements, unless approved with the overall subdivision grading plan.
21. Show removal of all trees and brush below the controlled water level that will be impacted from existing and newly created ponding areas.
22. Show or define access routes for maintenance purposes to all inlets or outlets at ponding areas (must be no more than 10% grade at 2% cross slope and no less than 10' wide).
23. Note for all silt fence to be installed by the contractor and inspected by the City prior to any site work.

Storm sewer projects and plans are required to show the following:

1. The developer shall obtain all regulatory agency permits and approvals necessary for the proposed construction; i.e. DNR, Army Corp. of Engineers, MPCA, etc.
2. Drainage calculations shall be submitted to show the sizing of pipe, ponds, emergency overflow spillways, and catch basin interception analysis.
3. Show or define access routes for maintenance purposes to all manholes outside the public right-of-way and inlets or outlets at ponding areas (8% maximum grade, 2% cross slope, and 10' wide). Access easements shall be dedicated at the time of final platting to provide this access.
4. The developer and/or engineer upon the completion of the construction of a designated ponding area is required to submit an as-built record plan of the ponding area certifying that the pond constructed meets all design parameters as set forth in this LSWMP and its updates.

5.4.3.2 Erosion and Sediment Control

As stated in the Implementation section of this plan, the City intends to adopt an erosion and sediment control ordinance that at a minimum will create a review, approval, and permit process, with some level of enforcement. Erosion and sediment control review will be comprehensive in that it will also include runoff management and will apply the submittal requirements and design standards outlined in this section of the Plan. Though the ordinance will specify a threshold over which disturbance required a permit, this threshold will be a maximum of one acre as required by Lower Mississippi River Watershed Management Organization and by the NPDES construction site permit.

In the interim period between approval of this Plan and adoption of the erosion and sediment control ordinance the City will utilize the MPCA's document Protecting Water Quality in Urban Areas as its source for BMP selection and runoff management, subject to more specific design standards as outlined in this Plan. Upon adoption of the erosion and sediment control ordinance, the MPCA's Protecting Water Quality in Urban Areas or the more recent State of Minnesota Stormwater Manual will likely be relied upon as a source for BMP selection until such time as the City specifically selects a preferred set of BMPs.

5.4.3.3 Stormwater Management

The term High Water Level (HWL), as used below, refers to the maximum water level generated by the critical 100-year event.

1. Storm water plans for the development shall comply with this LSWMP and its updates.
2. Storm water facilities shall be designed for a 10-year frequency storm for local pipe design and a 100-year frequency storm for ponding detention basin design and trunk facilities.
3. Storm water pipes shall be designed utilizing the rational method or hydrograph method (based on sound hydrologic theory) for pipe. Channel design shall be hydrograph method only. All methods are subject to the City Engineer's approval.
4. Storm water detention facilities constructed in the City of Mendota Heights shall be designed according to the standards reflected in the MPCA publication Protecting Water Quality in Urban Areas and the design criteria from the National Urban Runoff Program. At a minimum the permanent pool should be equivalent to the runoff from the 2.5-inch, 24-hour rainfall event unless the requirements of Table 4.3 call for increased treatment capacity.
5. Maximum allowed pond slopes are 3:1, though 4:1 slopes are preferred. Pond slopes steeper than 4:1 shall have erosion control blanket installed immediately after finish grading. In residential areas slopes no steeper than 4:1 shall be allowed. 3:1 slopes may be allowed in "maintained" areas as approved by the City Engineer. 3:1 slopes are not allowed for road fill sections adjacent to water bodies.

6. All constructed ponds and wetland mitigation areas shall have an aquatic of safety bench around their entire perimeter. The aquatic bench is defined as follows:
    a. Cross slope no steeper than 10:1
    b. Minimum width 10 feet
    c. Located from pond NWL to one foot below pond NWL
7. All constructed ponds and wetland mitigation areas shall have a maintenance access bench around sufficient perimeter to provide access to all inlets and outlets. At a minimum the maintenance bench should extend around 50% of the basin perimeter.
8. Elevation separations of buildings with respect to ponds, lakes, streams, and storm water features shall be designed as follows:
    a. The lowest ground elevation adjacent to homes and buildings must be a minimum of two feet above the calculated 100-yr HWL or 1.5 feet above the EOF, whichever criteria leads to the higher elevation.
    b. Landlocked lakes and wetlands require either 1) a five-foot separation between basin HWL and lowest ground elevation adjacent to building or 2) a three-foot separation between basin HWL for back to back 100-year storms and the lowest ground elevation adjacent to building or 3) three-foot separation between the highest known or recorded basin elevation in the case of large wetlands and lakes and lowest ground elevation adjacent to building. Whichever of the three methods yields the highest allowable ground at building elevation should be the one used.
    c. Drainage easements for ponds, lakes, wetlands, streams etc. shall encompass an area to one foot (vertical) above the calculated 100-year HWL.
9. Maximum pond depth is 6 feet.
10. All ponds shall have outlet skimming for up to the 5-year event.
11. All ponds shall be graded to one-foot below design bottom elevation. This “hold down” allows sediment storage until such time as site restoration is complete.
12. The top berm elevation of ponds shall be a minimum of 1.5 feet above the 100-year pond HWL.
13. Grading shall not block or raise emergency overflows from adjoining properties unless some provision has been made for the runoff that may be blocked behind such an embankment.
14. Minimum grade for lot drainage swales and lot grading shall be 2% or greater.
15. Maximum length for drainage swales shall be 300 feet or a total of eight lots draining to a point, or as approved by the City Engineer.
16. Utilization of existing wetlands for storm water management is subject to review by the appropriate regulatory agency in accordance with the “Wetlands Conservation Act”.
17. Restrict clearing and grading within 20’ of an existing wetland boundary to provide for a protective buffer strip of natural vegetation.
18. Seeding around ponds should be MnDOT standard mix 28B (328) or BWSR equivalent.

5.4.3.4 Storm Sewer Design

1. Provide for overflow routes to drain low points along streets or lot lines to ensure a freeboard of 2’ from the lowest ground adjacent to building and the calculated 100-year storm HWL elevation. Design criteria verifying the adequacy of the overland drainage route capacity is required.
2. The storm sewer alignment shall follow the sanitary sewer and watermain alignment where practical with a minimum of 10’ of separation. Storm sewer placed along the curb alignment shall be along the curb opposite the watermain to maintain the 10’ separation.
3. Catch basins shall be located on the tangent section of the curb at a point 3’ from the point of curve. Mid-radius catch basins will not be allowed. Also, catch basins shall be designed to collect drainage on the upstream side of the intersection.
4. The maximum spacing between manholes is 400’.
5. Manhole steps will be aligned and over the downstream side of the manhole. Steps within manholes will be:
    a. 1” +/- Horizontal Alignment
    b. 1” +/- Vertical Alignment per latest OSHA Standards
6. Any connections to existing manholes or catch basins shall be core drilled or the opening cut out with a concrete saw. No jack hammering or breaking the structure with a maul is permitted. Also, all connections to an existing system will require a manhole for access.
7. To the greatest extent possible, manholes shall be placed in paved surfaces outside of wheel paths, (3’ and 9’ off centerline) or other readily accessible areas.
8. Minimum pipe size shall be 12” diameter.
9. Aprons or flared end sections shall be placed at all locations where the storm sewer outlets a ponding area. All inlet/outlet flared end sections shall be furnished with hot dipped galvanized trash guards. All trash guard installations will be subject to approval by the City Engineer. The last three pipe joints from the flared end section shall be tied together.
10. Riprap and filter blanket shall be placed at all outlet flared end sections. The placement of the riprap shall be by hand. The minimum class of riprap shall be MnDOT 3601.2, Class III. A design criterion justifying the size and amount of riprap is required. Geotextile material is not allowed for filter aggregate where ice action along the shore line may tear the geotextile.
11. The invert elevations of the pond inlet flared end sections shall match the NWL of the pond. Submerged outlets will only be allowed at the discretion of the City Engineer.
12. If the storm sewer is to be installed less than 10’ deep within private property, the easement shall be a minimum of 20’ wide with the pipe centered in the easement. If the storm sewer is 10’ deep or greater, then the easement shall be twice as wide as the depth or as required by the City.
13. Junction manholes should be designed to limit the hydraulic head increase by matching hydraulic flow lines and by providing smooth transition angles.

14. In the development of any subdivision or ponding area, the developer and/or property owner is responsible for the removal of all significant vegetation (trees, stumps, brush, debris, etc.) from any and all areas which would be inundated by the designated controlled Normal Water elevation (NWL) of any required ponding easement as well as the removal of all dead trees, vegetation, etc., to the High Water Level (HWL) of the pond.
15. Outlet control structures from ponding areas are required as directed by the City. Location and appearance of outlet structures shall be subject to City approval and may require landscape screening.
16. Sump manholes with 3-foot sumps shall be constructed as the last structure that is roadway accessible prior to discharge to any waterbody.
17. Inlets should be placed and located to eliminate overland flow in excess of 1,000 feet on minor streets, or a combination of minor streets and swales, and 600 feet on collector streets and arterials. Additionally, inlets should be located such that 3 cfs is the maximum flow at the inlet for the 10-year design storm.
18. Refer to Section 5.4.2.1 for standards for energy dissipation and protection of channels.

6. IMPLEMENTATION PLAN

6.1 General

The Implementation Plan section of the Mendota Heights LSWMP describes those activities and programs the City might develop toward improving its surface water management program. Since Mendota Heights is largely developed, capital outlay for the trunk sewer system has already occurred so future outlay will be for upgrades and replacement. Typically, costs for upgrade and replacement would be borne by either the stormwater utility fund or would be recovered through direct assessment. Given this, a typical financing mechanism developed in most LSWMPs, an area charge, is not a part of the Mendota Heights LSWMP.

Section 6 also includes:

- An overview of the City's NPDES permit
- A discussion of operation and maintenance procedures and strategies
- An outline of an education program
- Financial considerations for the stormwater utility
- A section referencing applicable design standards for stormwater management
- A section on Watershed implementation priorities
- Implementation priorities for the City
- A discussion of the process for amending this plan and an annual report to council

6.2 NPDES Permit

In 2003, the Minnesota Pollution Control Agency (MPCA) required the City to submit an NPDES Permit Application to minimize the discharge of stormwater runoff pollutants and authorize stormwater discharge from the City's Municipal Separate Storm Sewer System (MS4).

The MPCA also required the City to prepare and submit a Storm Water Pollution Prevention Program (SWPPP). The SWPPP identifies a combination of storm water Best Management Practices (BMPs), including education, maintenance, control techniques, system design and engineering methods, and such other practices, both existing and planned, determined appropriate to meet the NPDES permit requirements.

The Mendota Heights SWPPP includes 48 BMPs in the following categories or Minimum Control Measures:

- Public Education and Outreach
- Public Participation and Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-Construction Runoff Control
- Pollution Prevention/Good Housekeeping

Each year of the 5-year permit cycle, the City must conduct an Annual Public Meeting and submit an Annual Report to the MPCA which summarizes:

1. the status of compliance with permit conditions;
2. assessment of the appropriateness of the BMPs;
3. progress towards achieving the measurable goals for each of the minimum control measures;
4. stormwater activities planned for the next reporting cycle;
5. a change in any BMP or measurable goals for any of the minimum control measures; and
6. a notice that the City is relying on another entity to satisfy some of the permit obligations (if applicable).

The BMPs listed in the SWPPP are a legally enforceable part of the Permit. The City must complete the tasks and milestones to remain authorized to discharge stormwater into waters of the state. The LSWMP - Implementation Plan provides assistance and guidance for specific BMP implementation.

6.3 Operation and Maintenance

6.3.1 Activities

A stormwater system is a major investment for the City of Mendota Heights – both in terms of initial capital cost and in terms of ongoing maintenance costs – with meeting ongoing maintenance costs being the City's current challenge. Typically, system maintenance is funded by the city's stormwater utility and through the general fund.

The City's stormwater system maintenance responsibilities include the following:

- Street sweeping
- Cleaning of sump manholes and catch basins
- Repair of catch basins and manholes
- Assessing pipe condition (typically by televising)
- Inspection of storm sewer inlet and outlet structures
- Pond mowing and other vegetation maintenance
- Excavation of accumulated sediments from ponds

The City has maintained its pipe system for decades and staff has a strong grasp on the costs associated with this. As new development brings more ponds (and other BMPs) into the system, city staff will find that maintenance becomes an increasingly large portion of both staff time and the overall maintenance budget. It is important to quantify the extent of this future commitment so that the funds necessary for pond maintenance activities can be collected via the city's storm water utility.

Table 6.1 provides a typical maintenance schedule for wet ponds.

Table 6.1
Wet Pond Maintenance Schedule

Activity	Schedule
Inspect regional pond outlets for clogging.	After significant rainfalls
Inspect for damage. Note for signs of oil, gasoline, or grease build up. Monitor for sediment accumulation in the facility and forebay. Examine to ensure that inlet and outlet devices are free of debris and operational.	Annual inspection
Repair undercut or eroded areas.	As needed
Mow slopes.	Twice annually
Remove sediments from forebay.	5 to 7 year cycle
Remove sediment accumulated in main pool.	20 to 30 year cycle

Adapted from Watershed Management Institute. 1997. Operation, Maintenance, and Management of Stormwater Management Systems.

The management of stormwater ponds is facilitated by creation of a GIS database for all stormwater system infrastructure. The City is in the initial stages of mapping its system in this software and the LSWMP mapping, by providing pond numbering and locations in a GIS format, represents a strong step toward an interactive mapping system. Ultimately, via its stormwater management database the city could reference - via interactive mapping – its maintenance records, videotapes, and maintenance costs for the stormwater system. The City's NPDES permit calls for an incremental approach to mapping the existing storm sewer system with approximately 25% to be completed each year.

6.3.2 Stormwater Basins

Stormwater basins represent a sizable investment in the City's drainage system. General maintenance of these facilities helps ensure proper performance and reduces the need for major repairs. Periodic inspections are performed to identify possible problems in and around the basin. Inspection and maintenance cover the following:

- Basin outlets
- Basin inlets
- Side slopes
- Illicit dumping and discharges
- Sediment buildup

Basin Outlets

A key issue with stormwater basins is ensuring that the outlets perform at design capacity. Inspection and maintenance of basin outlets address the following:

- The area around outlets is kept free and clear of debris, litter, and heavy vegetation.
- Trash guards are installed and maintained over all outlets to prevent clogging of the downstream storm sewer.
- Trash guards are inspected at least once a year, typically in the spring, to remove debris that may clog the outlet. Problem areas are addressed more frequently, as required.
- Emergency overflow outlets are provided for all ponds when possible. These are kept clear of debris, equipment, and other materials and properly protected against erosion.

Basin Inlets

Inspection and maintenance of basin inlets address the following:

- Inlets are inspected for erosion.
- Where erosion occurs near an inlet, energy dissipaters or riprap are installed.
- Inlets are inspected for sediment deposits, which can form at the inlets due to poor erosion practices upstream.
- Where sediment deposits occur, these are removed to ensure design capacities of storm sewers entering the basin are maintained.

Side Slopes

Inspection and maintenance of basin side slopes address the following:

- Side slopes are kept well-vegetated to prevent erosion and sediment deposition into the basin. Severe erosion along side slopes can reduce the quality of water discharging from the basin and require dredging of sediments from the basin.
- Noxious weeds are periodically removed from around basins.
- Some basins in highly developed areas require mowing. If mowing is performed, a buffer strip of 20 feet or more adjacent to the normal water level is typically maintained. This provides filtration of runoff and protects wildlife habitat.

Illicit Dumping and Discharges

Inspection and maintenance of illicit dumping and discharges into basins address the following:

- Basins are periodically inspected for evidence of illicit dumping or discharges. The most common of these is dumping of yard waste into the basin.

- Where found, illicit material is removed, and signs are posted as needed prohibiting the dumping of yard waste.
- Water surfaces are inspected for oil sheens. These can be present where waste motor oil is dumped into upstream storm sewers.
- Skimmer structures are installed as needed at outlet structures to prevent oil spills and other floatable material from being carried downstream.
- Skimmer structures are periodically inspected for damage, particularly from freeze-thaw cycles.

Sediment Buildup

Inspection and maintenance of sediment buildup in basins address the following:

- Basins are inspected to determine if sediment buildup is causing significant loss of storage capacity from design levels. Excessive sediment buildup significantly reduces the stormwater treatment efficiency of water quality ponds.
- Sediment removal is performed where excessive sediment buildup has occurred. As a general guideline, ponds require dredging every 15 to 20 years. When effective forebays are provided these may require more frequent cleaning (approximately 5 to 7 year cycles) but would tend to produce less material and would have the effect of extending the maintenance cycle of ponds to as much as 30 years.

6.3.3 Sump Manholes and Sump Catch Basins

Sump manholes and sump catch basins are included in storm sewer systems to collect sediments before they are transported to downstream waterbodies. These structures keep sediments from degrading downstream waterbodies. Once sediments are transported to a lake or pond, they become much more expensive to remove.

Sediments originate primarily from road sanding operations, although construction activity and erosion can also contribute. Since these structures are designed to collect these sediments, they are routinely cleaned to provide capacity for future sedimentation. Suction vacuum equipment is typically used.

6.3.4 Storm Sewer Inlet Structures

To fully utilize storm sewer capacity, inlet structures are kept operational in order to get runoff into the system. All efforts are made to keep catch basins and inlet flared ends free of debris and sediments so as not to restrict inflow and cause flood damage. Leaf and lawn litter are the most frequent cause of inlet obstructions. On a routine basis, City staff visually inspects inlet structures to ensure they are operational.

6.3.5 Open Channels and Ravines

Overland flow routes constitute an important part of the surface water drainage system. Open channels are typically vegetated and occasionally lined with more substantial materials. The lined channels typically require little or no maintenance. Vegetated channels are periodically inspected and maintained, as high flows can create erosion within the channel.

Eroded channels can contribute to water quality problems in downstream waterbodies as the soil is continually swept away. If not maintained, the erosion of open channels would accelerate and the repair would become increasingly more costly. The erosions of channels are accelerated when these are at steep gradients and are used for conveying urban stormwater.

6.3.6 Piping System

The storm sewer piping system constitutes a multimillion-dollar investment for the City. The City performs a comprehensive maintenance program to maximize the life of the facilities and optimize capital expenditures. The following periodic inspection and maintenance procedures are followed:

- Catch basin and manhole castings are inspected and are cleaned and replaced as necessary.
- Catch basin and manhole rings are inspected and are replaced and/or regrouted as necessary.
- Catch basin and manhole structures are inspected and are repaired or replaced as needed. Pipe inverts, benches, steps (verifying integrity for safety), and walls are checked. Cracked, deteriorated, and spalled areas are grouted, patched, or replaced.
- Storm sewer piping is inspected either manually or by television to assess pipe condition. Items looked for include root damage, deteriorated joints, leaky joints, excessive spalling, and sediment buildup. The piping system is programmed for cleaning, repair, or replacement as needed to ensure the integrity of the system.

6.3.7 De-Icing Practices

Minnesota receives approximately 54 inches of snow during a typical year. This requires a large amount of de-icing chemicals (primarily salt) to be applied to roads and sidewalks each winter.

Estimates indicate that 80 percent of the environmental damage caused from de-icing chemicals is a result of inadequate storage of the material (MPCA 1989). Improper storage as well as overuse of salt increases the risk of high chloride concentrations in runoff and groundwater. High chloride concentrations can be toxic to fish, wildlife, and vegetation.

The following procedures are used for storing de-icing chemicals in the City:

1. De-icing material and sand is stored in waterproof sheds. When and where this is not possible, stockpiles are covered with polyethylene and placed on impervious surfaces.
2. Road de-icing stockpiles are not located near municipal well areas or in other sensitive groundwater areas.
3. Runoff from stockpiles is not allowed to flow directly into streams or wetlands where environmental damage can occur.

Mendota Heights has established a detailed "snow and ice removal policy" to address winter maintenance needs. Street conditions are assessed for each individual event and ice control material application is adjusted accordingly. Equipment is maintained in good working order to place ice control material on roadways and is properly calibrated to prevent excessive application.

6.3.8 Street Sweeping

Street sweeping is an integral part of the City's effective surface water management system. It greatly reduces the volume of sediments that have to be cleaned out of sump structures and downstream waterbodies. The City has a "street sweeping policy" that includes at least one sweeping operation per year. Spring sweeping begins either late March or early April after the risk of later snowfall has passed and targets sand left from winter sanding operations. Occasional fall sweeping occurs after leaf fall.

Mendota Heights does not allow residents to rake leaves into the street for municipal pick up. Dakota County and the City encourage residents toward composting their yard waste. If residents desire to have yard waste removed by their private hauler then compostable bags or reusable containers are required. Alternately, there are composting sites within Dakota County where yard waste can be brought for a fee. Overall the City's approach to minimizing organic matter entering its stormwater system greatly reduces the incidence of inlet blockages and protects the water quality of downstream waterbodies.

The objective of the City's street sweeping and de-icing programs is to minimize impacts from leaf litter, sand, salt and other debris on the surface waters of the City.

6.3.9 Detection of Illicit Connections

As presented in the goals section Mendota Heights will modify its ordinance to prohibit the dumping of hazardous material into the stormwater system. During routine inspection for inlet grates, outfalls, and other portions of the stormwater system, City staff also looks for evidence of illicit discharge, dry weather flow (indicating possible sanitary sewer connections), sedimentation and other non-point source pollution problems.

The City has started the process of mapping its storm sewer outfalls and integrating this mapping with inspection data. This effort will be concurrent with the overall storm sewer mapping effort required by the City's NPDES permit.

6.4 Education and Outreach

6.4.1 General

Education can play an important role in any effort to implement a stormwater management program like the one outlined in this LSWMP. The objectives of an education effort are different, depending on the target audience. In general, the target audience for this education program is City staff, City residents, and the development community. The following sections describe why education of each of these groups is important and presents educational methods that may be used for each audience.

One of the more important aspects of education and outreach is close coordination with watershed organizations so that redundant efforts are avoided. The City should also work to raise the profile of its watershed organizations by including articles on watershed activities in its informational materials. One simple step toward stronger city/watershed partnership is providing a link to each watersheds website on the city website.

6.4.2 City Staff

City Staff have a wide range of responsibilities for implementing this plan.
These include:

- Implementing street sweeping and spill response programs.
- Maintaining detention basin/stormwater management pond performance and system operability.
- Planning for and management of projects to enhance pollutant removal performance, wetland quality, etc.
- Carrying out grounds maintenance of City-owned lands/facilities in a way that sets a good example for residents.
- Utilizing BMPs in application of ice control material.
- Application of Best Management Practice policies and regulations to new and redevelopment projects.
- Planning and delivering education programs.
- Working out cooperative arrangements with regulatory and non-regulatory organizations to achieve LSWMP objectives.
- Assisting the City Council in the application of the LSWMP policies.

Because these responsibilities involve many different levels of City staff, City staff members are trained to have a basic understanding of the LSWMP, including:

- A description of the major stormwater management issues (including known stormwater management problem areas, stormwater management expectations for new and re-development projects, and incorporation of stormwater mitigation into capital improvement projects, and regulatory jurisdictions).
- The objectives of the LSWMP and the general approach outlined in the LSWMP for resolution of these issues.
- The responsibilities of the different work units in implementing the LSWMP.
- The information the LSWMP provides.
- Identification of in-house experts.

This information is disseminated in presentations at staff meetings, coverage in internal newsletters, and issuance of internal memos.

As part of its NPDES permit the City has also made a commitment to continuing education for staff in stormwater management. This will take the form of attendance at conferences and workshops. As part of the LSWMP effort staff will also be trained in using the City's stormwater management model.

6.4.3 City Residents

In order to obtain the necessary political and economic support for successful LSWMP implementation, it is vital to inform City residents about basic stormwater management and water quality concepts, policies and recommendations in the LSWMP, and the progress of stormwater management efforts.

Through the City's quarterly newsletter, the Heights Highlites, the City keeps residents informed of stormwater and other environmental issues particularly regarding volunteer opportunities, proper lawn care practices, and recycling and hazardous waste management information. The City website is a clearing house for information on stormwater management and will be updated to provide stormwater management articles and contact numbers for reporting illicit discharges and other stormwater related complaints. In the near term, the City will also be providing educational brochures for residents in the City Hall lobby. These brochures will most often be from other organizations but may also be produced by the City.

The City has incorporated innovative stormwater management practices into both municipal and private development projects. In the future the City will use these projects to highlight the benefit of certain stormwater management practices. It is important that residents know about these projects (including how they were funded) so that they develop an awareness that the City is being responsive to the public interest in protecting high priority resources and that dedicated financial resources such as revenue from the stormwater utility are being put to work.

The City and Dakota County co-sponsor a Wetland Health Evaluation Program which samples and documents the plant, frog and invertebrate communities found in local wetlands following techniques developed by the Minnesota Pollution Control Agency (MPCA). Information from this survey is available to City residents on the MPCA website.

6.4.4 Developers

The LSWMP is designed to provide the official policy direction that City staff and the City Council desire to guide stormwater mitigation for new and redevelopment projects. New construction in Mendota Heights in limited since there is limited land left to develop. Redevelopment, though, will likely occur on a regular basis.

The information contained within this plan is disseminated to developers and their consulting engineers as early as possible in the development review process. In this way, developers know what is expected of them and can consider the requirements in their initial assessments of the site as well as incorporate the necessary BMPs in any subsequent designs. Much of the necessary information is disseminated to the developers in an information packet in the development submittal information they receive from the City.

While dissemination of information is valuable, there is no substitute for a meeting between key City staff and the developer as early as possible in the review process. This helps define expectations for submittals, clarify regulatory compliance issues, and provide additional detailed guidance. Developers are encouraged to do this as soon as possible after they have reviewed the LSWMP information and thought about how it applies to their site.

6.5 Financing and the Stormwater Utility

6.5.1 Current Status - Summary

The City of Mendota Heights implemented a stormwater utility in 1993. The current quarterly residential charge is $3.50 per residential unit and according to Table 6.2 for other land uses. The quarterly residential charge is expected to increase to $5.00 per residential unit in 2006.

Table 6.2
Storm Water Utility Rates

Property Type	Current Rate $/Acre
Business/Industrial	42.00
Cemetery/Golf	3.50
Institutional	14.00
R-3 Properties	28.00

Annual revenue from the stormwater utility has grown as shown in Table 6.3.

Table 6.3
Storm Water Utility Revenue

Year	Annual Revenue ($)
1997	141,837
2004	147,500

Generally, revenue has shrunk due to inflation to the point where current funding is approximately $126,600 in 1997 dollars. In contrast, since 1997 the need for funding has grown.

6.5.2 The Stormwater Utility into the Future

In order that Storm Water Utility (SWU) funding keeps pace with increase in municipal maintenance responsibilities, the city should plan for the costs to conduct periodic pond maintenance. Limited data on maintenance activities has been developed by watershed management organizations. A review of this data suggests an annual maintenance budget of $1,250 per acre-foot of wet volume or $4,350 per acre of surface at NWL. Either parameter is relatively easy to track. This $1,250 per acre-foot maintenance item can be translated into a per household cost by virtue of the fact that one acre-foot is sufficient pond wet volume for 20 acres of residential development. Assuming 2.5 units per gross acre, then $1,250 per year is spread among 50 units - $25 per unit per year.

The current residential rate is $14 per unit per year. The current charges provide approximately $150,000 per year in revenue of which only a fraction has been used for pond maintenance. As the City's maintenance responsibilities grow the stormwater utility funding also needs to grow to keep pace.

Mendota Heights is a regulated MS4 under the Phase II NPDES Permit. There is a cost associated with preparing an NPDES permit and the associated Storm Water Pollution Prevention Plan (SWPPP). Some estimate cities the size of Mendota Heights will spend $50,000 every five years for permit preparation. For Mendota Heights it is reasonable to assume that $10 per household will be spent every five years – adding $2 per year to the individual household's stormwater utility bill.

The NPDES permit and SWPPP commit the city to certain activities, including capital projects, for the purpose of improving the quality of the City's stormwater discharge. The U.S. EPA has estimated that the financial commitments that city's will make may total $10 per household per year. Others place this figure at $20. Since many of the activities identified by the SWPPP may already be funded (like street sweeping and pond maintenance) the $20 figure is probably too high. For the purposes of planning increases in SWU collection the $10 per year figure should be used. Table 6.4 summarizes the additional stormwater utility charges identified above.

Table 6.4
Future Storm Water Utility Funding

Item	Annual Charge to Single Residential Unit	Quarterly Charge to Single Residential Unit
Current commitments	$14.00	$3.50
Future pond maintenance	$25.00	$6.25
NPDES permit and SWPPP	$2.00	$0.50
NPDES permit compliance	$10.00	$2.50
Total	**$51.00**	**$12.75**

Costs for non-residential properties would likewise have to increase to meet future demands upon the City. The estimate of stormwater utility funding needs does not include City participation in TMDL (see Section 5.2.1 for explanation of terminology) processes nor does it include preparation by the City of a non-degradation analysis as currently required of some Cities in the draft of the new Phase II NPDES Permit. If the non-degradation portion of the new permit withstands current court and administrative challenges then it is likely that Mendota Heights will be dragged into this requirement sometime in the near future. And the estimate of funding needs does not include any mitigation that may occur due to the TMDL or non-degradation processes.

A $51.00/residential unit charge would be close to one of the highest rates among Metro Area cities – similar to what is currently charged in a couple like Burnsville and Savage. It should be noted though that the unfunded mandates from the federal level through the Minnesota Pollution Control Agency are driving the need for this funding.

Currently, the City is not in the position of being able to pass a resolution to fund the utility to the extent identified above. The intent of this overview is to suggest that the City begin increasing stormwater utility funding at a rate greater than that of inflation so that when the time comes that mandated programs fall upon the City, it is prepared to respond.

6.6 Design Standards

Design standards for stormwater management pertain to design and analysis of the stormwater system. As typically conceived they cover the following areas:

- Submittal Requirements
- Erosion and Sediment Control
- Stormwater Management
- Storm Sewer Design

The City does not have a public works design manual and it is recommended that one be developed in conjunction with other activities, such as ordinance implementation discussed in the following section. Design standards can be more readily updated in the context of a public works design manual than in a Local Surface Water Management Plan since the design manual might be updated every couple years while the LSWMP might be on a five to ten year cycle. In the near term the content of this plan will serve for the purposes of defining design standards.

Section 5 contains the design standards to be used for the City of Mendota Heights. Design standards are also imbedded into the outline of the City's goals and policies in Section 3.

6.7 Ordinance Implementation

The City of Mendota Heights, through its NPDES permit, has made a commitment to implementing the following ordinance:

- Erosion and Sediment Control
- Illicit Discharge
- Stormwater Management Ordinance
- Shoreland Management

According to the City's NPDES permit the ESC ordinance was to be completed in year 2 of the current permit, which ended in March 2005. The City delayed implementation of this ordinance until the LSWMP could be completed, since portions of the LSWMP might be referenced as part of the ordinance writing. The ESC ordinance will be the City's method of instituting a site review and permitting process and this process will involve the submittal requirements outlined in the design standards section of this Plan. Additionally, the ESC ordinance will stipulate the preconstruction meeting and inspection and enforcement of erosion control measures as well as post construction requirements, all these as stipulated in the City's permit. By incorporating site review and comment into the ESC process, there is no need to have a separate grading permit and/or stormwater management permit. Grading and stormwater review can occur in the context of the ESC review and permitting process.

As the City develops its ESC ordinance it must choose from among various enforcement options. These include:

- Tickets (i.e. misdemeanor)
- Requiring financial security
- Warning letters
- Stop work orders
- Stop inspection orders

As the ordinance is developed the police, public works, and building inspection departments as well as the City Attorney should all be involved in determining the appropriate means of enforcement.

The illicit discharge ordinance is intended to prohibit the following:

- Illicit connections from the sanitary sewer to the storm sewer
- Dumping of listed chemicals into the stormwater system
- Illegal dumping

Illegal dumping may already be covered under an existing City nuisance ordinance. The illicit discharge ordinance is due by the end of year three (March, 2006) in the current city permit cycle.

The stormwater management ordinance will put in ordinance form many of the design standards referenced in this Plan and any future public works design manual. It may also make requirements of some of the wetland buffer suggestions offered in Section 4, Wetland Management Plan. Wetland buffers are an implementation item in the City's NPDES permit – scheduled as an activity for years 3 through 5.

6.8 Watershed Implementation Priorities

6.8.1 Lower Mississippi River Watershed Management Organization

<u>Ivy Falls Creek, Interstate Valley Creek, and West/Central/East Highway 13 Watersheds</u>
Key scope items: Ivy Hills Pond, Golf Course Pond, diversion to wetlands at Ivy Falls Creek and Interstate Valley Creek mouths, Dodge Nature Center wetland modifications, erosion problems north of Marie Avenue, Highway 110 and Dodd Road redevelopment, include benefits of Mayfield Heights diversion.

1. Water quality modeling was completed in 2003.
2. Feasibility study was completed in 2004.
3. Design and construction, based on results of feasibility study; start 2006-2010.

<u>Interstate Valley Creek and Ivy Falls Creek Watersheds</u>
Key scope items: Diversion of Thompson Avenue drainage into Ivy Falls Creek Watershed – Thompson Avenue at Delaware Avenue. Scheduled for 2006. The City of Mendota Heights is implementing this project.

<u>Interstate Valley Creek</u>
Key scope item: Baseflow restoration and channel stabilization.

1. Feasibility study; start in 2006.
2. Design and construction, based on results of feasibility study; start in 2008 or later.

Key scope item: Address erosion problems in Interstate Valley Creek, north of Marie Avenue.

1. Feasibility study; project is to start in 2005.
2. Design and construction, based on results of feasibility study; start in 2006.

6.8.2 Gun Club Lake Watershed Management Organization

Lake Augusta District
Key scope item: Undertake or assist in the evaluation and selection of alternatives for protection/management of Augusta Lake. Implement the selected corrective/protective actions identified for the lake. The project was to start in 2000. See Section 5.2 for Mendota Heights actions in regard to this implementation item.

6.8.3 Lower Minnesota River Watershed District

In its report Guidance to Implementation, the watershed district has refocused and prioritized the implementation items from its 1999 Management Plan. Of medium priority is possible future work related to Gun Club Lake. Also of importance and likely to affect Mendota Heights is rerouting of stormwater around the Quarry Island Fen.

6.9 City of Mendota Heights Implementation Priorities

Table 6.5 lists the implementation priorities for the City of Mendota Heights.
A tentative timetable is included with the table.

Table 6.5
Implementation Priorities

Implementation Priority	Tentative Year for Implementation
Ordinance	
ESC Ordinance (includes site review process)	2007
Illicit Discharge Ordinance	2007
Stormwater Management Ordinance	2007
Revisions to Title 12, Chapter 2 (wetland ordinance)	2007
Shoreland Ordinance	2007
Assessment	
Function and Values Assessment, part of phased approach and depending on Met Council guidance	2007
Evaluate Rogers Lake monitoring program, make revisions as necessary	2007
Lake LeMay diagnostic feasibility study partnering discussions	2006
Lake Augusta outlet discussions	2006
Wetlands	
Wentworth Park Wetland Enhancements	Schedule to be determined
Friendly Hills Park Wetland Enhancements	
Valley Park Wetland Enhancements	
Training and Education	
Staff Stormwater Modeling Training	2006
City Website Stormwater Page	2006
Public Works Design Manual	2007
Stormwater Educational Brochures (available at City Hall, already some are available)	2008
Storm Sewer System Mapping	2008
Financial	
Increase in Storm Water Utility Funding (greater than the rate of inflation)	Annually
Water Quality Retrofits	
Somerset neighborhood rainwater gardens	2006
Future rainwater garden implementation projects with street reconstruction projects	Biannually

Mendota Heights received a Metropolitan Council MEP grant for retrofitting rainwater gardens into the Somerset neighborhood. The grant provides cost sharing on the implementation of approximately 13 rainwater gardens in this neighborhood. Construction of these gardens will likely occur in 2006.

Proposed modifications to the City's wetland ordinance include:

- Reference to the new wetland map
- Expansion of ordinance protections to unmapped wetlands
- Revision to design and analysis requirements
- Revisions to require MnRAM submittals
- Writing buffer and susceptibility requirements similar to those outlined in Section 4.

Table 6.6 outlines projected costs for many of the items in Table 6.5.

Table 6.6
Cost Projections ($)

	2006	2007	2008	2009	2010
Somerset Rainwater Gardens	$48,000				
Ordinance Review & Revision		$8,000			
Function & Values Assessment		$4,000	$4,000	$4,000	$4,000
Storm Sewer Mapping			$1,500		
Annual Stormwater System Maintenance	$45,000	$45,000	$45,000	$45,000	$45,000
Future Rainwater Garden Projects			$45,000		$45,000
Wetland Enhancements		$15,000		$15,000	
NPDES Compliance	$10,000	$3,500	$3,500	$3,500	$3,500
TOTALS	$103,000	$75,500	$99,000	$67,500	$97,500

6.10 Official Controls

Implementation items include ordinance as well as projects. One of the requirements of local plans is that they outline official controls, lines of responsibility, and mechanisms for enforcement in certain areas. Table 6.7 shows how existing controls and future implementation items address the need for these official controls.

Table 6.7
Official Controls

Official Control	Responsibility	Mechanism
Wetlands	City as LGU, Dakota County SWCD as member of TEP.	WCA review; Title 12, Chapter 2 of the City Code regulates wetland impacts and requires a permit for certain activities. The Wetland ordinance is recommended for minor modifications to conform better with the content of this LSWMP.
Erosion Control	Dakota County for NPDES construction permit. City by future ordinance.	MPCA pilot project for Dakota County SWCD. ESC ordinance implementation for City.
Shoreland	City	Shoreland Ordinance
Floodplain	City, FEMA and DNR for FEMA regulated floodplain. City in non FEMA regulated areas.	Title 12 of the City Code provides for the regulation of land within floodway and floodplain districts.
Grading	City	Through site review process defined in the LSWMP. In the future through the ESC ordinance and Public Works Design Manual.
Drainage	City	Through the site review process and through the requirements of this LSWMP. In the future through the ESC ordinance and the Public Works Design Manual.

6.11 Amendment Procedures

The Mendota Heights LSWMP is intended to extend through the year 2015. For the plan to remain dynamic, an avenue must be available to implement new information, ideas, methods, standards, management practices and any other changes that may affect the intent and/or results of the LSWMP. The amendment procedure for the LSWMP is presented below.

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

Staff review of Amendment
A decision is made as to the validity of the request. Three options exist: 1) reject the amendment, 2) accept the amendment as a minor issue, with minor issues collectively added to the plan at a later date, or 3) accept the amendment as a major issue, with major issues requiring an immediate amendment. In acting on an amendment request, City staff shall recommend to City Council whether or not a public hearing is warranted. Major amendments to the Plan will have to be submitted to the watersheds for review and approval prior to formal action by the council.

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

Watershed Review and Approval
All amendments should receive a cursory review from the watershed organizations. In the case of minor amendments such as updates to projected costs and implementation items watershed review and comment is appropriate.
Major amendments require watershed approval just as a new plan would.

Public Hearing and Council
This step allows for public input based on public interest. Council shall determine when the public hearing should occur in the process. Based on the public hearing, the City Council could approve the amendment.

Council Adoption
Final action on an amendment is City Council adoption. However, prior to the adoption, an additional public hearing could be held to review the plan changes and notify the appropriate stakeholders.

6.12 Annual Report to Council

A brief annual report will be made by City staff summarizing development changes, capital improvements, and other water management-related issues that have occurred over the past year. The review will also include an update on available funding sources for water resource issues. Grant programs are especially important to review since they may change annually. These changes do not necessarily require individual amendments. The report can, however, be considered when the plan is brought up to date.
The annual report should be completed by July 1st to allow implementation items to be considered in the normal budget process.

The City's LSWMP will remain in effect through 2015. The City will then review the LSWMP for consistency with current water resource management methods. At that time, all annual reports and past amendments will be added to the document. Depending on the significance of changes, a new printing of the LSWMP may be appropriate.

6.13 Future Surface Water Planning Efforts

The Metropolitan Council's 2030 development framework must be addressed by Cities within the Metropolitan Area through comprehensive plan updates that are due in the Fall of 2008. Included in Met Council's Water Resources Management Policy Plan are new requirements that must be addressed in Surface Water Management Plans. These new requirements include:

- Thermal pollution and spill containment strategies
- A Wetland Management Plan that includes a Function and Values Assessment
- Information relating to compliance with TMDLs
- Information relating to compliance with NPDES Phase 2 MS4 permit
- Goals and policies for attaining non degradation

Meeting these requirements will likely necessitate only a small amendment to the 2006 Mendota Heights LSWMP.

7. SUMMARY AND OUTCOMES

7.1 Summary

The Mendota Heights LSWMP will serve as a comprehensive planning document to guide the City in conserving, protecting, and managing its surface water resources. The LSWMP meets requirements as established in Minnesota Rules 8410. In addition, the Plan reflects the requirements of the watersheds with jurisdiction within the City.

The Mendota Heights LSWMP has its own particular emphasis, which includes:

- Collecting and compiling the efforts of agencies and organizations including the City, its departments and residents. This includes past reports and studies, management plans, monitoring studies, as well as completed and proposed improvement projects.
- Reviewing the current state of the City's surface water resources in the context of goals and policies, ordinances, operations and maintenance, flood mitigation, and achievement of targeted water quality levels in its surface water bodies.
- Establishing reasonable, achievable and affordable goals, and supports them by a strong regulatory and management culture. Developing an implementation plan that includes projects and processes that derive from a thorough assessment of current City problem areas and current City surface water regulations and controls.
- Recommending ordinance implementation to cover gaps between goals and actual practice.
- Reviewing the Stormwater Utility funding in light of current and future responsibilities.
- Updating the hydrologic model from the 1993 Water Resources Management Plan (WRMP). The 1993 WRMP model was converted to HydroCad modeling software to facilitate its use by City staff.
- Providing a more accurate wetland map that reflects current conditions and is geographically accurate.

The review of the City's surface water resources begins with an evaluation of its surface water management goals and policies. Section 3 of the Plan provides the City's current goals and policies to achieve these goals. Some new policies have been developed to reflect the changing regulatory climate while other new policies have been developed to simply improve the City's management strategy.

The Mendota Heights LSWMP also included wetland inventory and mapping components. The goal of the wetland inventory is to identify wetland and water resources that currently exist within the city. A GIS-based wetland map has been developed for the City to use as a planning tool for future projects that may affect wetlands. The inventory of wetlands also allows the City to set up priority areas within city-owned lands.

The wetland map and the management discussions of this section of the LSWMP are intended to provide the following benefits:

- Provide a more detailed inventory of wetlands and water resources than that provided by the National Wetlands Inventory
- Enhance wildlife values of wetlands
- Provide and enhance recreational values of wetlands
- Designate wetland restoration/enhancement opportunities
- Protect wetlands and adjacent resources that provide valuable ecological support
- Provide stormwater protection for wetlands

It should be noted that this wetland inventory has been created for planning purposes only. Regulation of activities potentially impacting individual wetlands will be based on a site-specific delineation of the wetland boundary as part of a proposed project.

This System Assessment and Design section of the Mendota Heights Local Surface Water Management Plan (LSWMP) serves two functions. The system assessment portion catalogues the various assessments of problems that the Plan must address. The intent is to identify the source of problems and specific actions the City will take to address these problems either independently or in collaboration with some other organization – most commonly one of the watershed management organizations.

The system design portion of this section describes the City's surface water management system. This system is shown on Map 2. The map indicates the major drainage divides, storage areas, conveyance (including pipe and channels), wetlands and lakes that have been incorporated into the Mendota Heights LSWMP hydrologic model.

Finally, this plan develops implementation priorities for the City. The Implementation Plan section of the Mendota Heights LSWMP describes those activities and programs the City might develop toward improving its surface water management program. Since Mendota Heights is largely developed, capital outlay for the trunk sewer system has already occurred so future outlay will be for upgrades and replacement. Typically, costs for upgrade and replacement would be borne by either the stormwater utility fund or would be recovered through direct assessment. Given this, a typical financing mechanism developed in most LSWMPs, an area charge, is not a part of the Mendota Heights LSWMP.

Section 6 also includes:

- An overview of the City's NPDES permit
- A discussion of operation and maintenance procedures and strategies
- An outline of an education program
- Financial considerations for the stormwater utility
- A section referencing applicable design standards for stormwater management
- A section on Watershed implementation priorities
- Implementation priorities for the City
- A discussion of the process for amending this plan and an annual report to council

7.2 Outcomes

The Mendota Heights Local Surface Water Management Plan, once adopted by the City Council, will accomplish the following:

1. Bring the City into statutory compliance and compliance with watershed organization plans thus maintaining the legitimacy of City permitting authority.
2. Set forth an implementation schedule for ordinance, waterbody assessments, wetland restoration, training and education, and retrofitting projects.
3. Establish standard review procedures to ensure all new development or redevelopment within the City is in compliance with the grading and stormwater management controls determined by this Plan.
4. Provide a justification for future increases in stormwater utility funding.

Appendix A

Section V of 1993 Water Resources Management Plan

Section V: Problem Areas

The section describes current and projected (assuming full development according to Figure 6) water quantity and water quality problems based on the analysis described in Section IV, meetings with City staff, and review of the overall plans of the three water management organizations. The problems are organized by the four major watersheds within the City of Mendota Heights. Section VIII presents the recommended capital improvements to correct many of these problems.

A. Water Quantity Problems

1. Interstate Valley Creek Watershed (see Figures 8 and 9)

a. Subwatershed IV-79--Lower Interstate Valley Drainage District

The outlet to this subwatershed is an 18-inch corrugated metal pipe (CMP) which discharges under Dodd Road and into Subwatershed IV-110 in the Lower Interstate Valley Drainage District. The capacity of the culvert is approximately 11 cfs. During the full development 100-year event, this subwatershed receives overflow drainage from Subwatershed IV-63 that normally discharges to the south under T.H. 110. The peak discharge for the 100-year, 1-hour event is approximately 70 cfs. Therefore, Dodd Road will be overtopped during the 100-year critical event.

b. Wetlands IV-50 (Friendly Marsh Drainage District) and IV-112 (Lower Interstate Valley Drainage District) Beaver Activity

There is frequent beaver activity downstream of these two wetlands areas. Water backs up behind the beaver dams and occasionally submerges the outlet structures to one or both of these wetlands areas, and reduces the amount of detention storage available in these areas. The City staff have broken the dams and removed the beavers on several occasions but have been unsuccessful in keeping beavers away for the long-term. The hydrologic modeling performed for this Plan assumed that the beaver dams were not in place.

c. **Somerset Golf Course Ponds (IV-113 and IV-114)--Lower Interstate Valley Drainage District)**

The LMRWMO has proposed to divert approximately 60 acres of area in West St. Paul from the Ivy Falls Creek watershed into a series of ponds in the south part of Somerset Golf Course. This diversion is part of the overall plan to reduce erosion along Ivy Falls Creek.

Because the diversion increases both flood discharge rates and volumes, the storage volumes may have to be increased in the ponds in IV-113 and IV-114 subwatersheds. The existing outlets to these ponds should also be changed so that flows from smaller intensity storms (less than 10 year event) will be controlled effectively. These improvements are necessary so that the diversion of water will not increase flow rates downstream of these ponds. The ponds should be surveyed so that an accurate elevation-storage relationship can be developed. If the volume of storage given for these ponds in Table 8f is not available, additional storage should be developed.

In the hydrologic analyses, it was found that the 30-inch culvert under Dodd Road (IV-15, Table 9f) does not have the capacity to handle the 10- or 100-year flows from the existing pond and conveyance system for this area. The outlet design for the Somerset Golf Course Ponds should be modified to reduce the discharges into the Dodd Road culvert.

d. **IV-87 Subwatershed--(East Marie Avenue Drainage District)**

The outlet from this subwatershed is a 15-inch RCP under Willow Valley Lane which discharges to Subwatershed IV-103. The capacity of the culvert is approximately 9 cfs while the peak discharge for the 10- and 100-year, 1-hour events anticipated for full development conditions is approximately 24 and 55 cfs, respectively. Therefore, Willow Valley Lane will be overtopped during both the 10- and 100-year events. No damage to property is expected from the road overtopping except for inconvenience to traffic.

e. **Marie Avenue/Dodd Road Area (East Marie Avenue Drainage District)**

The culverts draining subwatershed IV-100 under the intersection of Dodd Road and Marie Avenue has inadequate capacity to convey the peak discharge from the 10- and 100-year events. The current capacity of the two 36-inch RCP culverts (which discharge into a 4′ x 5′ masonry arch) is approximately 140 cfs while the estimated peak discharges from the 10- and 100-year, 1-hour events for full development conditions are approximately 190 and 400 cfs, respectively. The water is discharged to a creek bed ("Marie Avenue Creek") on the southwest corner of the intersection. Stormwater from the 32-acre Subwatershed IV-101 also discharges to the masonry arch and into the creek bed. Because of high flows and velocities, some bank erosion has occurred downstream in the creek bed.

Marie Avenue Creek discharges to a 45 x 73-inch arch culvert under Wachtler Road (Subwatershed IV-106) approximately 1,400 feet west of the Dodd Road-Marie Avenue intersection. The capacity of the culvert is approximately 165 cfs while the 10- and 100-year peak discharges are approximately 275 and 580 cfs, respectively. Therefore, Wachtler Road would also be overtopped during both the 10- and 100-year critical event.

To reduce the rate of discharge through this area, detention storage should be provided upstream, with the highest priority given for storage in subwatersheds IV-90 and IV-91. Outlet control structures should also be placed in the ponding areas of subwatersheds IV-89, IV-92, IV-93 and IV-98 so that detention storage can be developed in these areas to help reduce discharge rates around the Marie Avenue/Dodd Road intersection. (See Table 9e for required storage and discharge information.) Enhancing these detention storage areas will reduce the peak 10 and 100-year peak discharge at the two 36-inch RCP culverts under the Marie Avenue/Dodd Road intersection to approximately 80 and 160 cfs, respectively. Therefore, the existing outlet would be able to convey the 10-year event without overtopping the intersection and would reduce the peak 100-year discharge so that it would be very close to the capacity of the existing 36-inch RCP pipes.

The additional storage also reduces the full development 10- and 100-year peak discharges at Subwatershed IV-106 to approximately 195 and 380 cfs, respectively. The road would still be overtopped during both the 10- and 100-year events, but would be a at a smaller depth and lower velocity. To prevent the road from being overtopped during the 10-year event, approximately 30 cfs of additional capacity is needed under Wachtler Road.

f. Interstate Valley Creek Erosion

Bank erosion is evident along much of Interstate Valley Creek, north of Marie Avenue. Many utility lines run through the valley, including fuel products and propane pipelines and sanitary sewer. The fuel products pipeline which runs adjacent to the creek was exposed during the July 23, 1987, storm. Culverts along the creek, north of Marie Avenue have also been washed out (and subsequently replaced). Erosion has also been noted along storm sewer and culvert outfalls from I-35E. All of the creek in the reach between Marie Avenue and Lilydale Road is in City park land (Valley Park).

Because of the potential for damage to the utility lines and the subsequent threat to safety and the environment along the creek and the Mississippi River, measures should be taken to reduce the potential for erosion along the creek. Steps that could be taken include: bank stabilization, utilizing upstream detention storage to reduce discharge rates (this would also aid in reducing the flood levels upstream of the Lilydale Road Embankment), channelization/piping, and developing check dams to reduce the effective creek slope and reduce velocities in the creek.

The development of a feasibility plan for this area is recommended to determine the combination of measures that are both cost-effective and fit into the natural setting of the area. A cost-effective method to reduce erosion in the channel may be to improve existing ponds to develop additional detention storage. Examples of utilizing more detention storage in existing basins include restricting existing outlets or constructing berms and outlet structures at storage areas which lack them. Development of detention storage at existing storage areas, including those discussed in the Dodd Road/Mendota Heights Road interchange area, would help to reduce flows in Interstate Valley Creek. Three additional improvements to stormwater detention sites, not covered in the Dodd Road/Mendota Heights Road section, are discussed below:

Friendly Marsh (IV-68) Outlet Restriction -- Friendly Marsh is an approximately 60-acre wetland southeast of the Dodd Road and T.H. 110 intersection (part of MDNR Protected Water 103P). The wetland is drained by a series of ditches which flow to a 72-inch RCP under T.H. 110. The invert elevation of the 72-inch RCP outlet is 824.8 feet, while the average elevation of the wetland is approximately 835 feet (from the City's 1974 topographic map). The 72-inch RCP pipe has been observed to be approximately one-third plugged during field inspections by City staff. The pipe was assumed to not be plugged in the hydrologic analysis. Because of the large difference in elevation of the wetland and the outlet, very little of the storage in Friendly Marsh is utilized during storm events. The 100-year flood level, assuming full development conditions with the existing outlet is Elevation 835.3 feet with approximately 60 acre-feet of storage and a peak discharge of approximately 360 cfs. Much of the storage used is within the ditched areas of the wetland.

Friendly Marsh can be used to help control the peak discharges in Interstate Valley Creek. The potential stormwater detention storage in Friendly Marsh is not effectively being used. It is recommended that the 72-inch RCP outlet from the Friendly Marsh be restricted so that the peak discharge from the Marsh is reduced to 110 cfs during the 100-year event. This could be done by constructing an outlet restriction, such as an orifice, on the existing outlet. An overflow structure would also be provided for storm events with a return period greater than 100-years.

With a peak discharge of 110 cfs from IV-68, approximately 120 acre-feet of detention storage will be used in the 100-year event and the 100-year flood level would be approximately 836.6 feet. Therefore, the bounce in most of the wetland would be approximately 1.6 feet during the 100-year event. The 1 year bounce, as shown on Table 2C is 0.1 feet. Therefore, the outlet restriction would produce a wetland bounce which is acceptable for wildlife habitat (GCLWMO, 1989). Due to beaver activity in this area, some type of beaver control may be necessary.

Valley Marsh (IV-110) Outlet Restriction -- The existing outlet to this wetland area (Valley Marsh, Subwatershed IV-110 in Figure 9) south of Marie

Avenue is two 55-inch by 88-inch RCP arches under Marie Avenue. It is recommended that one of these arch pipes be made ineffective up to the estimated 100-year elevation. Because of the proposed outlet restriction on Friendly Marsh, the 100-year level of Valley Marsh will actually be slightly lower than under existing drainage conditions with this improvement. The 100-year level, assuming full development conditions and existing drainage conditions is Elevation 817.8 with a peak discharge of 675 cfs, while it would drop to Elevation 817.5 with a peak discharge of 325 cfs when the outlet restriction is constructed for both IV-68 and IV-110.

The IV-110 outlet restriction should not be constructed until the modification to the IV-68 outlet has been completed.

Wentworth Park Pond (IV-118) Outlet Structure Changes -- The existing outlet from this pond consists of a gabion structure with three 8-inch steel pipes as an outlet. With the current outlet configuration, the hydrologic model indicates that the pond overtops the gabion structure during both the 10-year and 100-year events. The existing outlet 100-year peak discharge (with full development conditions) is approximately 200 cfs due to the release of uncontrolled flows over the gabion structure. It is recommended that the existing structure be replaced by a earth or concrete structure and a 48-inch RCP outlet be provided. The outlet structure should be raised from an existing overflow level of Elevation 879.0 to at least the estimated 100-year level of 881.3 feet. The estimated 100-year level increases approximately 0.3 feet over the existing conditions 100-year level of 881.0 with this improvement. The peak discharge from an 100-year event is reduced to approximately 90 cfs.

Another improvement that should be implemented at this site is a two-stage outlet, one to control flows during more common runoff events and a higher, second outlet for controlling flows resulting from major runoff events.

g. Lilydale Road Embankment (IV-139)

Lilydale Road crosses Interstate Valley Creek approximately 400 feet south of T.H. 13. Lilydale Road consists of an embankment approximately 43 feet high with a 60 inch RCP culvert at its base. The creek slope immediately upstream of the culvert averages approximately 3.5 percent. During the 100-year, 1-hour event, it is estimated, for full development and existing drainage conditions, that the creek will head up upstream of the culvert approximately 40 feet, nearly reaching the overflow point which is approximately 5 feet higher. The 100-year peak discharge through the culvert is approximately 750 cfs.

During a field check of the area, several large trees were scattered at the upstream end of the culvert. These trees were evidently uprooted by high velocities in the creek and/or were previously fallen trees that were floated to the outlet by the high water level. There were also trees and branches plugging much of the inlet to this

culvert, which would substantially reduce the flows through the culvert. The area was modeled assuming the trees were not plugging the culvert.

The embankment and culvert should be studied to determine their stability with this high of headwater and discharge. Discharge in the creek can be reduced substantially by increasing the volume of detention storage upstream (see Interstate Valley Erosion discussion). Reducing the discharge may reduce the risk of problems at the Lilydale Road embankment. The culvert should be provided with a inlet structure that would provide protection against plugging.

2. Ivy Falls Creek Watershed (see Figure 10)

a. Ivy Falls Creek Erosion

Ivy Falls Creek suffered erosion damage during the series of storms that occurred between July 20-24, 1987. There was severe erosion damage in the "Ivy Hill Park Reach" of the creek. Erosion control measures taken following a heavy storm in August 1977 substantially improved the resistance to damage of the main stem of the creek upstream of Sylvandale Road. However, the intensity and duration of the July 1987, storm resulted in some damage even in the main stem. The erosion damage done to Ivy Falls Creek during the July 1987, storm left the channel in an unstable condition so that another major storm could be expected to cause significant damage to property along the creek.

Because the erosion problem is an intercommunity issue, a drainage and feasibility study was performed by the Lower Mississippi River Watershed Management Organization. The results and recommendations contained in this study are incorporated into Table 10a of this Plan. Included in the recommendations is the expansion of the detention storage area in Ivy Park Pond (Subwatershed IF-21).

3. Mississippi River Bluffs Watershed (see Figure 11)

a. Lexington Avenue Flooding

This problem area is within the West Highway 13 Drainage District and has been identified as a intercommunity drainage issue by the LMRWMO. Runoff flowing down the east side of Lexington Avenue flows in an open ditch northeast along T.H. 13 to a culvert under the highway which discharges into the City of Lilydale. Approximately 60 percent of the watershed draining to the culvert is within Mendota Heights and the remainder is in the City of Lilydale. There is no defined drainageway for the stormwater flow at the point where the culvert discharges into the City of Lilydale. The water discharges adjacent to tennis courts, crosses the lawn of the Lexington Riverside Complex, tumbles down a rock bank to a driveway and flows along a pathway cut into the bedrock along the side of the complex's garages and over

the bluff to the Mississippi River. There is a potential for damage to the Lexington Riverside Complex because of this drainage pattern. The Mississippi River bluffs may also be damaged by continuation of this drainage pattern.

Drainage problems have also been identified along T.H. 13 west of Lexington Avenue. Some localized flooding has occurred in the vicinity in the past.

The LMRWMO completed in a study of these problems and their recommendations have been incorporated into Table 11a of this Plan.

b. Lilac Pond in Subwatershed MB-8 (West Highway 13 Drainage District)

The storage area for this 33-acre subwatershed consists of a depression in a residential area. The depression has no outlet so that the water must rise approximately 10 feet before it will overflow. The storage area will overflow to the north at a low point in James Road. The water then runs in a swale between houses and down the bluff to Subwatershed MB-9. It is expected that this storage area would overflow for 10- and 100-year long duration rainfall and runoff events. The pond did not overflow during the July 23, 1987 storm. However, as time passes, siltation can be expected to reduce the seepage capacity of the depression. Little damage is expected by the pond overflowing except for inconvenience to traffic along the street and to residents adjacent to the overflow point.

4. Gun Club Lake Watershed (see Figure 13)

a. Flooding in the City of Mendota

A small portion of the City of Mendota Heights is tributary to the City of Mendota. A problem occurs because the City of Mendota has an incomplete stormwater drainage system and is essentially landlocked. The proposed T.H. 110 improvements will pick up much of the area within Mendota Heights which currently drains to Mendota. A rate control detention basin ("Culligan Pond") has been constructed in a ravine in Subwatershed GC-65 which discharges into the City of Mendota. This basin reduces the peak discharge from this subwatershed from approximately 15 cfs to approximately 3 cfs.

b. Industrial Park Erosion and Flooding

The Industrial Park Drainage District is drained by a 54-inch RCP which discharges to a ravine that runs down the bluff to T.H. 13. With the exception of LeMay Lake, the Drainage District has very little detention storage capacity. There has been significant channel erosion in the ravine. Flooding has also occurred in some areas of the industrial park, particularly in and near the intersection of Mendota Heights and Pilot Knob Roads where there are adjacent office buildings that may be within the 100-year flood area. There is currently no overflow route ("secondary

capacity") available which would prevent the ponding at the intersection from flooding the adjacent buildings.

There has also been significant channel erosion in the ravine downstream of the 54-inch storm sewer outlet. Appendix I contains the surface water management plan for the Industrial Park area. This plan addresses the problems discussed above.

c. Landlocked Basins in Augusta Lake Drainage District

Several areas in the Lake Augusta Drainage District are currently landlocked, including Lake Augusta. As these landlocked areas develop and outlets provided to basins tributary to Lake Augusta, the flood levels of Lake Augusta are expected to rise. The water level in the lake during the mid-1980s was high enough to kill many of the trees adjacent to the lake. It is estimated from 1985 aerial photos that the water level reached to approximately Elevation 836.0 feet. The Natural Ordinary High Water Level (NOHW) determined by the Minnesota Department of Natural Resources (MDNR) is Elevation 832.5 feet.

The MDNR allows the outletting of a landlocked lake 1.5 feet below its NOHW. Therefore, the City would be able pump from the lake when the lake reaches Elevation 831.0 feet. A pump with a capacity of approximately 1.9 cfs (850 gallons/minute) would be required to keep the lake from rising above the 836.0 elevation reached in 1985 in a 100-year, 30-day snowmelt event. Additional pump capacity would be needed if additional areas, not currently in the Lake Augusta Drainage District, were drained to the lake. A MDNR permit will be required before an outlet is constructed.

The water from Lake Augusta would be pumped to LeMay Lake, which will be provided with an outlet during the construction of the T.H. 55 and T.H. 13 improvements. The flood levels for LeMay Lake were calculated assuming a 1.9 cfs pump outlet is provided from Lake Augusta.

d. City Detention Ponds Tributary to Proposed T.H. 13 Alignment

The Minnesota Department of Transportation (MnDOT) has designed a drainage system to handle flows within the new T.H. 13 right-of-way and areas tributary to it. To reduce the City's cost in the construction of this drainage system, the City plans to construct three detention ponds to reduce the rate of discharge into the MnDOT system. Two of these ponds are located near the Acacia Road crossing over T.H. 55 (in Subwatersheds GC-49a and GC-49b) and a third will be near the intersection of Mendota Heights Road and T.H. 13 (in Subwatershed GC-49e). The locations of these ponds are shown on Figure 13. The size and discharge rates are tabulated in Table 12c.

B. Water Quality Problems

Limited data are available on the quality of the water resources within Mendota Heights. A summary of existing and potential water quality problems in the City is given in this section. The water quality of each of the four main watersheds is discussed first. The overall state of water quality within the City is then discussed.

1. Interstate Valley Creek Watershed

a. Rogers Lake

Rogers Lake, located within the Interstate Valley Creek watershed is a significant resource for the City of Mendota Heights (see Figure 12). Rogers Lake is separated into an upper and lower lake by a culvert under Wagon Wheel Trail. The lake is shallow (mean depth 6.5 feet) and has observed water quality typical of eutrophic lakes in the metropolitan area. The City historically operated a swimming beach and park on the south basin of the lake. The swimming beach was closed after continual complaints of swimmers itch and other water quality problems.

The United States Geological Survey (USGS) did extensive testing on the quality of the lake during in 1976 to 1978. This study was done in cooperation with MnDOT to provide baseline information to aid in assessing the impact of the construction of I-35E on the water quality of the lake (USGS, 1980). The study found that both the upper and lower lakes were eutrophic and dominated by blue-green algae year around.

b. Phosphorus and Sediment Removal

Table 13 summarizes phosphorus removal efficiencies for the major drainage districts within the Interstate Valley Creek watershed. The overall phosphorus removal for the Interstate Valley Creek watershed was 42 percent. The removal efficiencies calculated using PONDNET for drainage districts within this watershed ranged from 5 percent for the East Marie Avenue Drainage District to 81 percent removal for the Rogers Lake Drainage District (this includes the estimated removal in Rogers Lake itself). The estimated total phosphorus removal in runoff from areas tributary to Rogers Lake is 31 percent. A phosphorus removal rate of approximately 47 to 68 percent would be expected for watersheds with ponds that meet EPA NURP criteria. Districts and watersheds with low removal percentage of phosphorus should be further evaluated to determine areas where wet detention sites could be developed.

2. Ivy Falls Creek Watershed

The Ivy Falls Creek watershed (see Figure 10) has very few natural wetlands and ponding areas. The general relief consists of steep wooded slopes and eroded ravines. Urbanization within the watershed has led to increased runoff discharge rates. During the July 1987 storm, severe stream bank erosion occurred causing water quality and public safety concerns. Recommendations from studies conducted by the LMRWMO have been incorporated into this Plan. These recommendations include rehabilitating the stream bank to provide a safe and erosion resistant conduit for stormwater flows, diversion of some flows to another drainage district, and to increase detention storage (Barr Engineering Co., November 1992).

a. Phosphorus and Sediment Removal

The PONDNET water quality modeling of the watershed indicates that very little wet detention exists to remove phosphorus from stormwater runoff. The overall phosphorus removal for the entire watershed is estimated to be approximately 30 percent. This value indicates that marginal phosphorus and sediment removal facilities exist with the watershed. Efforts should be made to increase wet detention within the watershed in order to facilitate increased phosphorus and sediment removal. The reduction of phosphorus in this watershed may become more important as the City of St. Paul develops Lilydale Park in lower Lilydale. Ivy Falls Creek discharges into Pickerel Lake which is within the proposed park.

3. Gun Club Lake Watershed

a. Lakes

LeMay and Augusta lakes are within this watershed (see Figure 13). The watersheds to these lakes are not fully developed. Lemay Lake has a mean depth of 3 feet (MnDOT, 1982) and has observed water quality typical of hyper-eutrophic lakes in the metropolitan area. Septic systems have been identified as a water quality problem for this lake. The City is providing residences along and near the lakeshore with city sewer which should mitigate the water quality problems associated with the septic systems.

Lake Augusta has a mean depth of 15 feet and greatest depth of 28 feet (MnDOT, 1982) and has observed water quality typical of eutrophic lakes in the metropolitan area, although there are no records of water quality complaints concerning Augusta Lake, the lake is totally within the Resurrection Cemetery property and has no public access.

As development occurs in the lakes' watersheds, special attention should be made in providing dead storage requirements meeting NURP criteria to help mitigate the effects of development on the water quality of these lakes.

b. Phosphorus and Sediment Removal

Tables 5a through 5d summarizes phosphorus removal efficiencies for the major drainage districts within the Gun Club Lake watershed. The overall phosphorus removal for the Gun Club Lake watersheds is estimated to be approximately 20 percent. The phosphorus removal estimates in drainage districts within this watershed ranges from 14 percent for the Minnesota River Bluffs Drainage District, which has little storage, to 41 percent for the Lake Augusta Drainage District (including the removal in Lake Augusta). Drainage districts and watersheds with low removal percentage of phosphorus less than approximately 50 percent (watersheds that do not have ponds that meet NURP requirements) should be further evaluated to determine areas where wet detention sites could be developed, especially in areas tributary to LeMay and Augusta Lakes.

Developed areas which have little potential in developing additional storage should consider having increased street sweeping activities and other best management practices (BMPs) in order to remove sediment and litter before it enters the stormwater conveyance system. Various BMPs are described in Appendix G.

4. Mississippi River Bluffs Watersheds

The Mississippi River Bluffs watersheds (see Figures 10 and 11) consist of steep wooded ravines with a high potential for erosion. Many of the watersheds have rate control ponds that reduce the discharge rates of stormwater flows, which will reduce the potential for stream bank erosion as a water quality concern. There is little available area for development of wet detention basins to remove phosphorus and sediment. Increased street sweeping activities and other best management practices within these watersheds would benefit water quality by removing sediment and litter from the stormwater conveyance system.

5. Potential for Water Quality Degradation Throughout Mendota Heights

The process of lake or pond degradation is called eutrophication. It is the process whereby lakes and ponds accumulate nutrients from their watersheds. Over time, a lake or pond naturally becomes more fertile, and is converted from "oligotrophic" (nutrient poor) to a "eutrophic" (nutrient rich) status. The sediment and internal biological production fill the lake's basin, the lake successively becomes a pond, a marsh and, ultimately, a terrestrial site. The rate of this eutrophication process can be greatly accelerated by human activity. The conversion of land from its natural state to industrial, agricultural and urban land uses can greatly increase the rate and amount of nutrients which will run off a watershed. This process is called cultural eutrophication.

Many of Mendota Heights lakes and ponds are in danger of continued eutrophication at a increased rate due to the conversion of much of the City from rural to urban land use.

While wetlands are recognized as important areas for improving urban stormwater quality, utilizing naturally occurring wetlands and ponds for sedimentation and water quality basins exclusively can result in degraded wildlife and aesthetic values of these wetlands. Maintenance activities which are generally required of constructed sedimentation and water quality basins such as dredging are more difficult and expensive to perform in natural wetlands. Efforts should be made to incorporate sedimentation basins upstream of wetlands in order to facilitate maintenance and protect values of existing wetlands.

Appendix B

Drainage Areas

APPENDIX B
DRAINAGE AREAS

Subdistrict	Drainage Area (acre)
GUN CLUB LAKE	
GC-1	80.9
GC-5C	44.3
GC-8	12.7
GC-9	86.3
GC-10C	183.0
GC-11	21.0
GC-12	5.1
GC-13	8.3
GC-15	6.5
GC-39C	45.0
GC-41	19.3
GC-42	119.6
GC-43	9.3
GC-49a	72.0
GC-49b	51.9
GC-50C	81.0
GC-51	47.2
GC-56	56.5
GC-56a	5.9
GC-57	9.4
GC-58	6.3
GC-59	15.3
GC-60C	50.6
GC-62	12.9
INDUSTRIAL PARK	
IP-1	125.3
IP-2	47.1
IP-3	28.6
IP-4a	11.5
IP-4b	7.3
IP-5a	10.4
IP-5b	23.4
IP-6	13.1
IP-7	4.6
IP-8	5.3
IP-9	6.4
IP-10	4.4
IP-11	4.2
IP-12	16.3
IP-13	2.6
IP-14	2.0
IP-15	18.8

Subdistrict	Drainage Area (acre)
MISSISSIPPI RIVER BLUFFS	
MB-1C	35.3
MB-3C	98.3
MB-5	9.3
MB-6	31.0
MB-7	5.0
MB-8	34.2
MB-9C	40.1
MB-10	22.2
MB-12C	24.6
MB-14C	19.3
MB-16	4.1
MB-17	15.6
MB-18	31.7
MB-21	13.4
MB-31	62.6
MB-32	7.2
MB-33	60.9
MB-35	24.3
MB-34,34m	31.6
FROM WEST ST. PAUL TO MISSISSIPPI R.	
Pickerel Lake	25.2
INDUSTRIAL PARK	
IP-16	8.4
IP-17	90.7
IP-18	26.8
IP-19a & b	13.8
IP-20	8.2

Subdistrict	Drainage Area (acre)
IVY FALLS CREEK	
IF-1	27.0
IF-2C	73.7
IF-6C	34.4
IF-7C	48.7
IF-12C	35.8
IF-13C	107.7
IF-15	10.7
IF-16C	19.3
IF-18	22.0
IF-24C	26.4
IF-25	10.2
IF-28	17.6
FROM WEST ST. PAUL TO IVY FALLS CREEK	
WSP	199.4
IF-C	74.6

APPENDIX B
DRAINAGE AREAS

Subdistrict	Drainage Area (acre)
INTERSTATE VALLEY CREEK	
IV-1C	11.0
IV-3	8.9
IV-4	36.8
IV-5	9.7
IV-6	18.3
IV-7	11.1
IV-8	16.2
IV-9	16.3
IV-10C	22.5
IV-11	30.0
IV-12C	25.0
IV-15	31.7
IV-16	34.0
IV-17	35.4
IV-18	78.2
IV-19	20.9
IV-21a	16.4
IV-21C	63.9
IV-23C	19.8
IV-26	33.1
IV-27C	58.8
IV-30	44.2
IV-32	6.5
IV-33	18.1
IV-34C	252.9
IV-35	14.1
IV-36	47.4
IV-43C	40.4
IV-44C	95.3
IV-51	82.3
IV-52C	154.6
IV-58C	33.1
IV-61C	41.3
IV-64	17.7
IV-67C	263.6
IV-69C	61.9
IV-74	6.2

Subdistrict	Drainage Area (acre)
INTERSTATE VALLEY CREEK	
IV-75	16.9
IV-76C	28.8
IV-79C	77.4
IV-81	17.3
IV-82C	33.1
IV-84C	97.0
IV-88C	17.8
IV-90	37.1
IV-91	15.5
IV-92C	57.9
IV-94C	11.7
IV-96	49.4
IV-98	11.8
IV-100	8.1
IV-104	24.3
IV-111	34.7
IV-112	8.2
IV-113	12.2
IV-114	25.3
IV-115C	134.8
IV-116	12.5
IV-119C	50.4
IV-124	13.4
IV-125	16.9
IV-126	23.8
IV-127	50.9
IV-128	36.9
IV-129a	4.0
IV-129C	40.3
IV-132	76.8
IV-133	23.9
IV-134	27.3
IV-135C	25.2
IV-138	25.3
IV-139	44.0
IV-140	35.6

Subdistrict	Drainage Area (acre)
FROM WEST ST. PAUL TO INTERSTATE VALLEY CR.	
Thompson Ave diversion	56.6
Marie Ave.	169.3
Deleware/110	235.1
FROM SUNFISH LAKE TO INTERSTATE VALLEY CR.	
MHa	66.3
MHb	28.4
MHc	430.9

Appendix C

Pond Data and Modeling Results

APPENDIX C
POND DATA AND MODELING RESULTS

Pond Number, or Routing	Drainage Area			2-Year Discharge Rate	10-Year Discharge Rate	100-Year Event		Modeled NWL
	Direct	Ponded	Total			Discharge Rate	Modeled HWL	
	(ac)	(ac)	(ac)	(cfs)	(cfs)	(cfs)	(ft)	(ft)
GUN CLUB LAKE								
GC-P1	80.9	0.0	80.9	5.3	10.4	15.7	892.6	891.7
GC-P5	44.3	80.9	125.2	14.0	32.2	99.0	881.4	875.0
GC-P8	12.7	0.0	12.7	23.2	44.9	72.6	881.2	880.0
GC-P9	87.2	12.7	99.9	4.5	9.5	13.8	866.5	859.0
GC-P10	182.1	259.5	441.6	0.0	0.0	0.0	834.6	832.5
GC-P11	22.0	0.0	22.0	0.0	0.0	0.0	867.0	862.0
GC-P12	4.1	22.0	26.1	0.0	0.0	0.0	866.1	862.0
GC-P13	8.3	26.1	34.4	0.0	0.0	0.0	861.4	856.7
GC-P15	6.5	0.0	6.5	0.0	0.0	0.0	841.5	840.0
GC-P41	19.3	0.0	19.3	3.1	4.9	6.5	845.4	832.0
GC-P43	9.3	0.0	9.3	1.2	5.9	10.9	826.4	824.0
GC-P49a	72.0	0.0	72.0	7.3	11.4	15.0	849.2	841.0
GC-P51	47.2	0.0	47.2	15.8	27.2	36.5	857.3	852.0
GC-P56	56.5	5.9	62.4	25.9	36.7	44.6	872.0	858.0
GC-56a	5.9	0.0	5.9	5.5	6.8	8.1	878.6	873.5
GC-P57	9.4	0.0	9.4	0.8	4.5	11.5	894.9	894.4
GC-P58	6.3	9.4	15.7	0.6	2.1	3.6	894.9	894.0
GC-P59	15.3	15.7	31.0	2.8	12.7	27.3	886.6	885.8
GC-P62	12.9	62.4	75.3	36.9	63.0	75.6	857.4	852.0
To Eagan	131.6	153.5	285.1	136.5	296.1	489.1	--	--
To Minnesota R.	216.5	100.6	317.2	149.7	397.3	751.7	--	--

APPENDIX C
POND DATA AND MODELING RESULTS

Pond Number, or Routing	Drainage Area			2-Year Discharge Rate	10-Year Discharge Rate	100-Year Event		Modeled NWL
	Direct	Ponded	Total			Discharge Rate	Modeled HWL	
	(ac)	(ac)	(ac)	(cfs)	(cfs)	(cfs)	(ft)	(ft)
INTERSTATE VALLEY CREEK								
From W. St. Paul: Thompson Ave.	--	--	56.6	20.1	65.0	132.9	--	--
From W. St. Paul: Marie Ave.	--	--	169.3	1.8	15.0	43.8	--	--
From W. St. Paul: Deleware/110	--	--	235.1	33.9	95.1	177.9	--	--
From Sunfish L.: MHa	--	--	66.3	1.7	6.6	8.4	--	--
From Sunfish L: MHb	--	--	28.4	2.8	21.0	43.8	--	--
From Sunfish L: MHc	--	--	430.9	1.6	3.5	6.6	--	--
IV-P2	11.0	0.0	11.0	0.4	1.0	2.0	893.7	892.8
IV-P3	8.9	11.0	19.9	0.5	1.4	2.8	892.0	891.0
IV-P4	46.5	19.9	66.4	0.6	1.8	3.5	874.2	872.9
IV-P5	9.7	0.0	9.7	0.7	2.9	6.9	891.4	890.0
IV-P6	18.3	66.4	84.7	0.5	1.8	3.7	872.7	871.8
IV-P7	11.1	0.0	11.1	0.3	1.1	2.5	877.6	877.0
IV-P8	27.3	0.0	27.3	1.1	2.4	4.2	876.0	875.0
IV-P9	16.3	0.0	16.3	0.6	2.2	4.8	879.8	878.8
IV-P11	30.0	0.0	30.0	1.9	7.6	19.3	866.5	864.2
IV-P12	25.0	0.0	25.0	0.3	0.7	1.2	872.5	872.0
IV-P15	31.7	25.0	56.7	0.2	0.9	2.3	855.8	854.7
IV-P16	34.0	77.6	111.6	0.6	1.7	3.6	855.1	854.0
IV-P17	35.4	542.5	577.9	1.2	3.9	8.0	852.2	850.7
IV-P18	100.7	764.6	865.3	2.7	9.9	82.3	880.9	839.0
IV-P19	20.9	0.0	20.9	0.0	0.1	0.3	855.2	854.8
IV-P21a	16.4	0.0	16.4	9.5	14.5	19.0	859.8	854.0
IV-P22	63.9	16.4	80.3	5.0	15.3	46.7	846.5	845.0
IV-P24	19.8	945.6	965.4	7.0	17.5	44.5	838.9	837.0
IV-P26	33.1	0.0	33.1	4.8	13.3	26.2	890.7	888.0
IV-P32	6.5	0.0	6.5	0.6	4.2	11.1	874.6	874.5
IV-P33	18.1	0.0	18.1	3.4	12.9	28.2	875.3	875.0
IV-P35	14.1	0.0	14.1	1.0	5.9	17.0	874.6	874.0
IV-P36	47.4	0.0	47.4	3.0	11.7	18.8	876.1	872.9
IV-P39	355.9	119.2	475.1	6.9	13.1	21.3	873.3	872.2
IV-P44	40.4	0.0	40.4	2.4	3.0	3.7	882.8	879.0
IV-P50	95.3	515.5	610.8	25.0	78.8	166.7	834.1	832.0
IV-P51	82.3	0.0	82.3	28.0	69.7	104.6	906.8	900.0
IV-P57	183.2	355.1	538.3	29.1	127.4	306.8	851.6	850.0
IV-P63	41.3	50.4	91.7	46.2	94.6	110.4	858.7	854.0
IV-P64	17.7	0.0	17.7	1.5	54.9	110.7	837.5	828.6

APPENDIX C
POND DATA AND MODELING RESULTS

Pond Number, or Routing	Drainage Area			2-Year Discharge Rate	10-Year Discharge Rate	100-Year Event		Modeled NWL
	Direct	Ponded	Total			Discharge Rate	Modeled HWL	
	(ac)	(ac)	(ac)	(cfs)	(cfs)	(cfs)	(ft)	(ft)
INTERSTATE VALLEY CREEK								
IV-P68	263.6	2132.2	2395.8	78.6	98.9	110.8	836.8	824.8
IV-P74	6.2	0.0	6.2	2.2	4.7	6.7	825.1	820.5
IV-P75	16.9	0.0	16.9	3.3	6.0	24.2	826.5	820.5
IV-P81	17.3	0.0	17.3	0.3	0.7	1.3	927.0	926.4
IV-P83	50.4	0.0	50.4	13.7	42.9	78.4	869.4	867.0
IV-P89	17.8	0.0	17.8	0.6	1.7	3.1	942.5	941.0
IV-P90	37.1	184.8	221.9	2.5	8.5	21.9	933.4	932.0
IV-P91	71.9	112.9	184.8	4.3	15.0	37.6	958.1	956.0
IV-P93	57.9	17.8	75.7	0.9	2.5	4.2	933.6	931.0
IV-P98	11.8	0.0	11.8	0.3	1.4	3.4	912.1	911.0
IV-P100	8.1	0.0	8.1	0.5	2.2	4.3	897.8	896.0
IV-P104	24.3	0.0	24.3	2.9	9.1	17.5	827.3	824.7
IV-P109	158.1	341.8	499.9	48.9	186.7	386.9	816.3	810.1
IV-P110	201.2	2510.6	2711.8	197.9	373.4	516.4	815.9	809.6
IV-P111	34.7	0.0	34.7	0.7	2.4	5.4	860.0	857.4
IV-P112	8.2	34.7	42.9	5.0	15.8	32.5	806.3	806.0
IV-P113	68.8	0.0	68.8	2.2	4.1	33.5	959.3	954.2
IV-P114	25.3	68.8	94.1	2.6	8.8	37.6	940.1	938.3
IV-P116	12.5	0.0	12.5	0.3	1.0	2.1	926.6	926.0
IV-P118	134.8	106.6	241.4	11.3	37.3	69.8	880.4	876.5
IV-P125	16.9	0.0	16.9	1.6	5.2	9.3	848.1	845.0
IV-P126	23.8	16.9	40.7	1.1	1.5	5.7	809.7	804.0
IV-P128	36.9	0.0	36.9	1.8	5.7	12.2	883.9	882.0
IV-P129a	4.0	0.0	4.0	0.5	1.6	3.3	885.3	883.9
IV-P132	76.8	0.0	76.8	1.7	5.9	9.6	863.5	859.2
IV-P133	64.2	117.7	181.9	9.6	16.7	17.0	863.9	858.9
IV-P134	27.3	181.9	209.2	5.1	11.1	13.4	860.6	855.0
IV-P139	209.2	3705.2	3914.4	297.2	575.3	705.4	751.8	723.0
Interstate Valley Cr. To Mississippi R.	35.6	3955.1	3990.7	313.7	592.8	733.8	--	--

APPENDIX C
POND DATA AND MODELING RESULTS

Pond Number, or Routing	Drainage Area			2-Year Discharge Rate	10-Year Discharge Rate	100-Year Event		Modeled NWL
	Direct	Ponded	Total			Discharge Rate	Modeled HWL	
	(ac)	(ac)	(ac)	(cfs)	(cfs)	(cfs)	(ft)	(ft)
MISSISSIPPI RIVER BLUFFS								
From W. St. Paul: Pickerel Lake	--	--	25.2	19.1	52.7	101.2	--	--
MB-P8	34.2	0.0	34.2	0.0	0.0	1.7	845.0	835.4
MB-P10	22.2	0.0	22.2	0.9	1.1	1.3	853.9	847.9
MB-P16	4.1	0.0	4.1	1.6	2.0	2.2	888.5	880.2
MB-P17	15.6	0.0	15.6	3.1	7.4	47.5	893.5	888.9
MB-P31	62.6	0.0	62.6	3.4	10.4	18.5	864.1	860.0
MB-P32	7.2	62.6	69.8	3.6	10.7	17.4	862.3	859.0
MB-P33	60.9	69.8	130.7	4.4	14.2	28.2	790.8	788.0
MB-1C to Mississippi R.	60.5	0.0	60.5	36.3	105.2	206.3	--	--
MB-3C, 5, 21 to Mississippi R.	121.0	0.0	121.0	40.6	125.9	254.2	--	--
MB-34, 34m, 35 to Minnesota R.	55.9	130.7	186.6	39.5	108.1	211.7	--	--
MB-6 thru MB 18 to Lilydale	151.7	76.1	227.8	85.6	251.7	536.8	--	--
IVY FALLS CREEK								
From W. St. Paul: IF-C	--	--	74.6	33.6	90.8	173.2	--	--
From W. St. Paul: WSP	--	--	199.4	76.5	219.0	427.8	--	--
IF-P1	184.0	42.4	226.4	57.1	95.4	115.5	963.7	957.4
IF-P4	73.7	226.4	300.1	32.5	103.8	200.3	921.7	917.0
IF-P15	10.7	0.0	10.7	2.7	6.7	9.0	947.5	942.0
IF-P16	19.3	10.7	30.0	2.8	6.2	7.4	929.1	925.0
IF-P18	22.0	0.0	22.0	1.8	5.2	10.6	970.8	968.1
IF-P21	182.3	52.0	234.3	39.3	142.2	191.0	900.0	892.0
Ivy Falls Cr. To Mississippi R.	173.1	534.4	707.5	102.5	338.4	739.2	--	--
INDUSTRIAL PARK								
IP-P1	125.3	6.5	131.8	1.0	3.1	4.1	836.8	835.4
IP-P2	47.1	0.0	47.1	32.9	44.5	50.4	845.2	840.0
IP-P4	18.8	0.0	18.8	7.9	10.0	24.7	856.4	848.7
IP-P5	33.8	0.0	33.8	15.3	24.9	28.4	846.5	842.0
IP-P12	30.1	0.0	30.1	90.6	126.5	303.5	831.6	819.4
IP-P16	8.4	0.0	8.4	40.8	38.4	92.8	836.9	832.0
To Gun Club Lake	--	--	485.7	250.3	289.9	339.0	--	--

Appendix D

PondNet Model Summary

APPENDIX D
PONDNET MODEL SUMMARY

Pond	Mean Depth (Feet)	Surface Area at Normal Level (Acres)	Wet Pond Volume (Ac-Ft)	Direct Watershed T.P. Removal (%)
INTERSTATE VALLEY CREEK DISTRICT				
Westview Pond (IV - P2)	2.2	0.8	1.7	59
Hazel Pond (IV - P3)	1.5	0.8	1.2	43
U. Bridgeview (IV - P4)	5.8	4.1	23.6	68
L. Bridgeview (IV - P6)	1.5	3.2	4.8	35
Arbor Pond (IV - P7)	0.0	0.0	0.0	0
Brookfield Pond (IV - P8)	1.5	2.5	3.8	54
Lockwood Pond (IV - P9)	1.5	0.6	0.9	50
Kensington Park (IV - P11)	1.0	0.3	0.3	33
Southeast Ponds (IV - P12)	1.5	0.6	0.9	41
Owens Pond (IV - P15)	5.9	2.1	12.4	65
King Pond (IV - P16)	4.1	5.2	21.3	52
Delaware Pond 1 (IV - P17)	4.0	6.9	27.6	52
Copperfield Pond (IV - P18)	3.1	9.4	29.5	45
Hagstrom Pond (IV - P19)	3.7	1.8	6.7	66
Friendly Hills (IV - P22)	3.0	1.9	5.7	55
Darsow Pond (IV - P24)	2.7	6.9	18.5	30
Golf Course (IV-P32)	0.8	0.4	0.3	27
N. Wagon Wheel (IV-P33)	1.5	0.9	1.4	48
Rogers Park (IV-P35)	2.5	0.4	1.0	59
35-E Pond (IV-P36)	2	0.5	1	43
N. Rogers Lake (IV-P39)	3.4	18.5	62.5	54
S. Rogers Lake (IV - P39)	6.5	56.6	365.1	68

APPENDIX D
PONDNET MODEL SUMMARY

Pond	Mean Depth (Feet)	Surface Area at Normal Level (Acres)	Wet Pond Volume (Ac-Ft)	Direct Watershed T.P. Removal (%)
INTERSTATE VALLEY CREEK DISTRICT				
Mendakota Pond (IV - P44)	0.8	1.5	1.1	38
F.M. Pond (IV - P50)	2.5	1.0	2.5	12
Sibley H.S. Pond (IV - P51)	0.5	0.8	0.4	16
Dodge N.C. Pond (IV - P57)	3.0	5.3	15.9	50
McDonalds Pond (IV - P64)	0	0	0	0
Friendly Marsh (IV - P68)	0.0	0.0	0.0	0
L. Crown Point (IV - P74)	0.0	0.0	0.0	0
U. Crown Point (IV - P75)	0.0	0.0	0.0	0
Warrior Pond (IV - P81)	3.0	4.0	12.0	66
Marie Marsh (IV - P89)	0.0	0.0	0.0	0
Marie Marsh (IV - P90)	0.0	0.0	0.0	0
Marie Marsh (IV -P93)	0.5	0.8	0.4	31
-- (IV - P98)	0.5	0.5	0.3	34
Sutton/Marie P. (IV - P104)	2.5	0.4	1.0	49
Valley Marsh (IV - P110)	0.0	0.0	0.0	0
Bachelor Ave. P/ (IV - P111)	2.0	0.5	1.0	49
Valley Park P. (IV - P112)	3.3	0.6	2.0	37
-- (IV - P113)	2.0	0.5	1.0	42
-- (IV - P114)	2.0	0.9	1.8	37
Wentworth Pond (IV - P116)	2.0	1.3	2.6	60
Wentworth Park (IV - P118)	4.0	0.4	1.6	27
Park Place Pond (IV - P125)	2.0	0.4	0.8	52

APPENDIX D
PONDNET MODEL SUMMARY

Pond	Mean Depth (Feet)	Surface Area at Normal Level (Acres)	Wet Pond Volume (Ac-Ft)	Direct Watershed T.P. Removal (%)
INTERSTATE VALLEY CREEK DISTRICT				
Cherry Hills P. (IV - P126)	0.5	0.6	0.3	21
Lex./Marie Ave. (IV - P128)	2.3	0.4	0.9	52
Burrows Pond (IV - P132)	2.5	2.9	7.1	55
Marie Pond (IV - P133)	4.0	0.6	2.4	30
Victoria Pond (IV - P134)	2.5	0.4	1.0	14
IVY FALLS CREEK DISTRICT				
Sommerset #1 (IF - P1)	2.0	2.0	4.0	40.0
Sommerset #2 (IF - P4)	2.0	2.4	4.8	31.0
Sutcliff Pond (IF - P15)	0.0	0.0	0.0	0.0
MnDOT 13 Pond (IF - P16)	0.0	0.0	0.0	0.0
Ivy Park Pond (IF - P21)	2.0	0.3	0.6	17.4
MISSISSIPPI RIVER BLUFFS DISTRICT				
Lilca Lane Pond (MB - P8)	0	0	0	0
Mayfield Heights (MB - P10)	0	0	0	0
Kingsley Pond (MB - P16)	0	0	0	0
Val's Addition (MB - P17)	0	0	0	0
GUN CLUB LAKE DISTRICT				
City Hall Pond (GC - P2, east)	3.3	1.5	5.0	57
City Hall Pond (GC - P2, west)	0.5	2.1	1.1	36
Yorkton Pond (GC - P5)	2.0	0.7	1.4	26
Lex. Apt. Pond (GC - p8)	1.5	0.2	0.3	38
Cemetery Pond (GC - P9)	2.5	1.8	4.5	50
Lake Augusta (GC - P14)	15.0	41.0	615.0	(4)

APPENDIX D
PONDNET MODEL SUMMARY

Pond	Mean Depth (Feet)	Surface Area at Normal Level (Acres)	Wet Pond Volume (Ac-Ft)	Direct Watershed T.P. Removal (%)
GUN CLUB LAKE DISTRICT				
-- (GC - P15)	2.0	0.1	0.2	35
-- (GC - P17)	3.0	21.0	63.0	64
Freeway Inter. (GC - P51)	1.0	1.3	1.3	39
Towsignant Pond (GC - P56)	1.5	1.9	2.9	43
-- (GC - P57)	0.5	0.1	0.1	32
-- (GC - P58)	0.8	0.7	0.5	40
Visitation Pond (GC - P59)	1.0	0.3	0.3	31
-- (GC - P62)	3.0	0.8	2.4	35
INDUSTRIAL PARK DISTRICT				
-- (IP - P2)	2.5	0.8	2.0	43
Warehouse Pond (IP - P5)	3.0	1.4	4.2	66
Business Park (IP - P16)	4.0	0.3	1.2	64

City of
Mendota Heights

Surface Water Management Plan

Wetlands

Map 1

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

N W E S

Feet
1100 0 1100 2200

I - V	Wetland Category Updated From 1993 Water Resources Management Plan
NA	Wetland Not Part of 1993 Plan Inventory
	Wetlands
	DNR Public Waters
	City Park
	City-Owned Property
	City Boundary
	Parcel Base Map

January 2006
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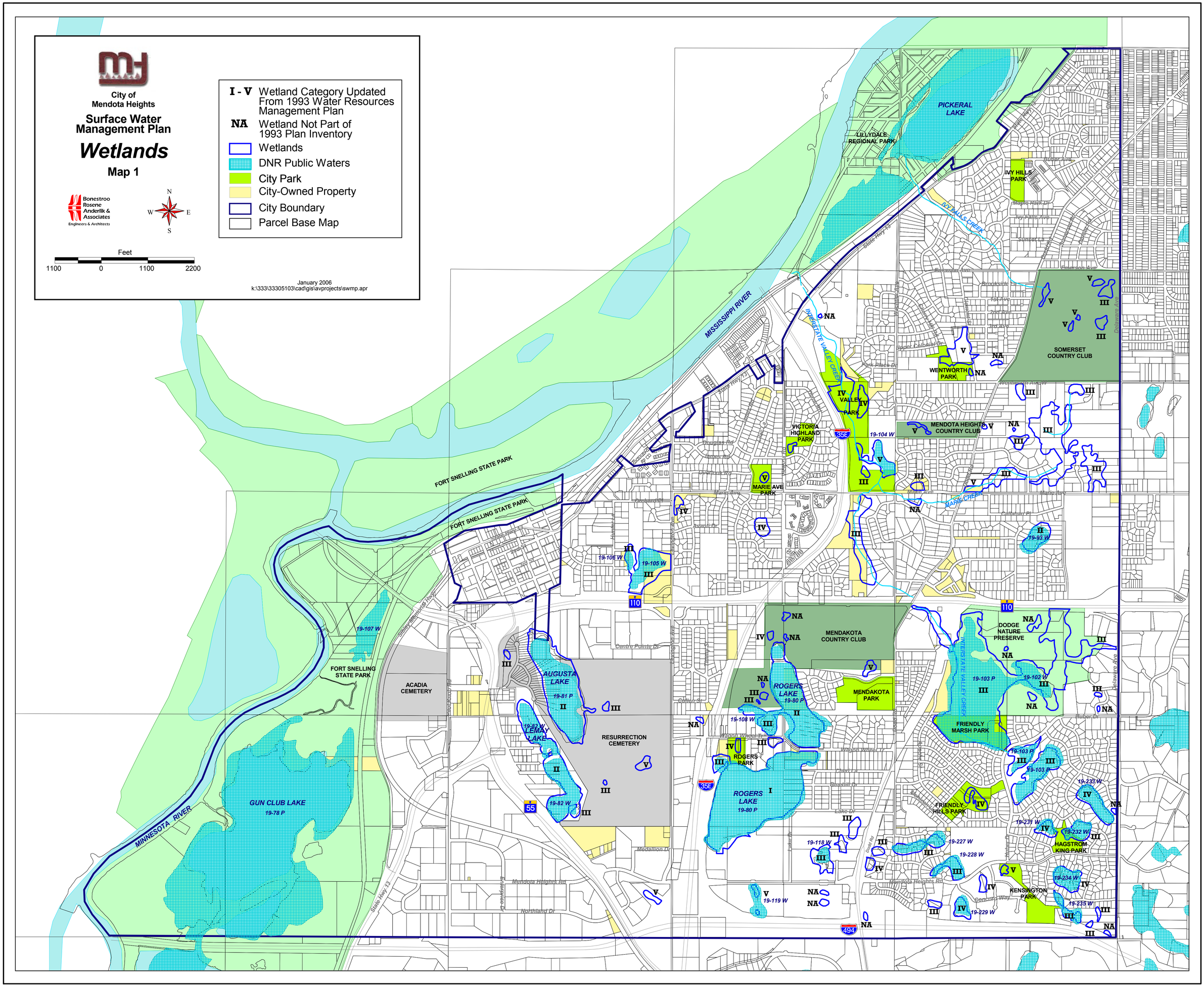

City of
Mendota Heights
SURFACE WATER
MANAGEMENT PLAN
Map 2
Bonestroo
Rosene
Anderlik &
Associates
Engineers & Architects
N
W
E
S
Feet
600
0
600
1200
Storm Ponds
IV-15
Drainage District Boundary/ID
Flow Routing - General
Waterbodies
Pipes
Surface Conveyance
City Boundary
January 2006
k:\333\33305103\cad\gis\svprojects\swmp.apr
LAKE AUGUSTA
LAKE LEMAY
ROGER'S LAKE
West St. Paul
Pikard Lake
West St. Paul
IF-C
West St. Paul
WSP
West St. Paul
Hennepin Ave
Diversion
Marie
(West St. Paul)
Delaware Ave
(West St. Paul)
MHC
(Sunfish Lake)
MHC
(Sunfish Lake)
MHC
(Sunfish Lake)
State Hwy 13
Dodd Rd
Lexington Ave
Victoria Rd
Marie Ave
Mendota Heights Rd
Centre Pointe Dr
Acacia Blvd
Lemay Lake Rd
Silver Memorial Hwy
Northland Dr
Mendota Rd
Huber Dr
Cappenfield Dr
Concord Way
Abbey Way
Chevyenne Ln
Bluebell Dr
Lake Dr
Medallion Dr
Emerson Ave
Brookside Ln
Maple Park Dr
Butler Ave
Staples Ave
Winston Ct
Wentworth Ave W
Everdream Rd
Douglas Rd
Overlook Rd
Made Ave
Mary Adele Ave
Furlong Ave
Kendon Ave
Lakeview Ave
Waters Dr
Enterprise Dr
Mendota Heights Rd
Ridge Pl
Dover Ave
Kaiser Ln
Wallace Ln
Warrior Dr
Delaware Ave
Dodd Rd
Lexington Ave
Victoria Rd
Marie Ave
Mendota Rd
Huber Dr
Cappenfield Dr
Mendota Heights Rd
Concord Way
Abbey Way
494
55
110
35E