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Bonestroo

December 10, 2007

Honorable Mayor and City Council
City of Dayton
12260 S. Diamond Lake Road
Dayton, MN 55327

Re: Local Surface Water Management Plan
City of Dayton
Bonestroo File No.: 174-05129-0

Honorable Mayor and City Council,

Transmitted herewith is the Local Surface Water Management Plan for the City of Dayton. The plan was prepared in accordance with Minnesota Rules 8410 and Metropolitan Council guidelines as outlined in the May 2005 Water Resources Management Policy Plan. Following their review, Elm Creek WMC approved this plan in December of 2007.

The trunk storm water system is presented on Map 2. Data regarding population, land use, and trunk storm water system design have been incorporated into the text and appendices of this report. A capital improvement program for the phased construction of the trunk storm water system has been developed.

We would be pleased to discuss the contents of this report and the findings of our study with the City Council and Staff or other interested parties at any mutually convenient time.

Respectfully submitted,

BONESTROO INC.

Mark Hanson, P.E.

Bob Barth

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Mark Hanson, P.E.

Date: December 10, 2007 Reg. No. 14260

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EXECUTIVE SUMMARY

This report provides the City of Dayton with a Local Surface Water Management Plan (LSWMP) that will serve as a guide to managing the surface water system throughout the City. This LSWMP is based on the City of Dayton's 2020 landuse plan. The City of Dayton is currently preparing its 2030 landuse plan which will likely expand urban uses over the 2020 plan. To the extent that new urban uses are designated in the 2030 landuse plan and these new urban uses fall within a pre 2020 development phase, then this LSWMP will be amended to include these areas. Otherwise, this LSWMP will carry Dayton through the end of 2016. Independent of landuse and phasing changes, periodic amendment to the LSWMP will occur in the intervening 10 years so that the Plan remains current to watershed plan amendments and revisions and current to the "state of the art" in surface water management.

The Dayton LSWMP will serve as a comprehensive planning document to guide the City in conserving, protecting, and managing its surface water resources. The Metropolitan Surface Water Management Act, passed by the Minnesota State Legislature in 1982, allowed the formation of watershed districts and preparation of watershed management plans. Following adoption of watershed management plans, cities are required to prepare Local Surface Water Management Plans. The purpose of this LSWMP is identical to the purpose of the Surface Water Management Act, which is to preserve and use natural water storage and retention systems to:

1) Reduce to the greatest practical extent the public capital expenditures necessary to control excessive volumes and rates of runoff;
2) Improve and preserve surface water quality;
3) Prevent flooding and erosion from surface flows;
4) Promote groundwater recharge;
5) Protect and enhance fish and wildlife habitat and water recreational facilities;
6) Preserve wetlands, lakes and streams;
7) Secure the other benefits associated with proper management of surface water.

The LSWMP was prepared in accordance with Minnesota Statute, Minnesota Rules 8410, the Metropolitan Council's Local Planning Handbook, and local watershed requirements.

Land and Water Resource Inventory

The City of Dayton is located southeast of the confluence of the Crow and Mississippi Rivers. The northern portion of the City that borders the Crow and Mississippi Rivers has steep terrain. The remainder of the City has flat to gently rolling topography. Land surface elevations range from roughly 980 in the southwest, between and French and Dubay Lakes, to 830 at the Mississippi River, which forms the northern border of the City. The City is located entirely within the Upper Mississippi River Basin. Drainage is generally from southwest to northeast and west to east.

A significant portion of the drainage within the City is carried overland into one of three well-defined stream systems: Diamond Creek, Rush Creek and Elm Creek. The remainder of the City's drainage flows directly to the Crow and Mississippi Rivers and to landlocked lakes and wetlands. Rush Creek and Diamond Creek are tributary to Elm Creek, which eventually drains to the Mississippi River. The northwestern area of the City drains directly to the Crow River just upstream of the confluence of the Mississippi. The north central and northeastern portion of the City's drainage is carried directly to the Mississippi River.

The City is situated entirely within the jurisdictional boundaries of the Elm Creek Watershed Management Commission.

Goals and Policies

The primary goal of Dayton's Local Surface Water Management Plan (LSWMP) is to plan for the management of stormwater as development occurs in the city. The plan provides guidance on how Dayton intends to manage surface water in terms of both quantity and quality.

The goals and policies are consistent with Minnesota Rules 8410 and local watershed requirements and reflect a commitment by the City to protect its natural resources and sustain a high quality of life for its residents. As with all planning tools, these goals and policies are meant to be dynamic and flexible and to evolve with changing conditions in the City. It should be noted that the numbering system of the goals and policies does not imply ranking by priority.

The goals and policies identified in Dayton's LSMWP are broad statements regarding the motivation and intent of the LSWMP. The policies that follow individual goals are specific items that promote attainment of the goal.

The City of Dayton has maintained its natural drainage patterns throughout most of its development thus far. The City's goal is to foster continued optimum use of that natural drainage system while enhancing the overall water quality entering wetlands, streams, and lakes. The intent is to prevent flooding while using identified best management practices (BMPs) to enhance surface water quality with minimal capital expenditures by the City. The following is a listing of the major subject areas and goals for Dayton's LSWMP. Specific policy statements are found in section 3.

Water Quantity - Protect, preserve, and manage natural surface and constructed retention systems to control excessive volumes and rates of runoff and prevent flooding.

Water Quality - Identify and plan for means to effectively protect and improve water quality.

Recreation and Fish and Wildlife - Protect and enhance fish and wildlife habitat and water recreational facilities.

Enhancement of Public Participation; Information and Education - Inform and educate the public concerning urban stormwater management and the problems pollutants cause if allowed to enter into our water resources.

Public Ditch Systems - Hennepin County is the Public Ditch Authority. Therefore the City of Dayton defers authority to Hennepin County for public ditch issues and management.

Groundwater - Enhance ground water recharge.

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

Erosion and Sediment Control - Prevent erosion of soil into surface water systems.

Dayton's NPDES Permit - Operate and manage the City's surface water system consistent with best current practices and the City's NPDES MS4 Permit's Storm Water Pollution Prevention Plan (SWPPP).

Mississippi River - Manage landuse, development, and stormwater discharge within the watershed of the Mississippi River.

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

Wetland Mapping and Management

Map 1 shows the National Wetland Inventory (NWI) and Public Waters Inventory (PWI) for the City of Dayton. The goal of the NWI and PWI mapping 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. Once the 2030 land use plan and phasing is complete, the current mapping will guide the City in conducting a function and values assessment for areas of near term development.

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

- Provide a map of wetlands and water resources based on the National Wetlands Inventory and Public Water Inventory.
- Provide stormwater protection standards for wetlands.

The wetland mapping only includes wetlands that could be identified using the National Wetland Inventory and Public Waters Inventory. Though not all wetlands are included in the mapping, all wetlands will be regulated by 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, *and*
2. Preparation of a MnRAM worksheet for the wetland.

There are many types of wetlands, each determined by its hydrology and vegetative composition. The two hydrologic alterations that affect 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. The relative susceptibility of a wetland to storm water for a given community type is provided in Table 4.1 as referenced from *Storm Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm Water and Snow Melt Runoff on Wetlands* (MPCA 1997). Some wetlands (e.g., hardwood swamps dominated by tree 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.

Wetland protection strategies depend upon the wetland community type. The mapping conducted for this LSWMP used existing data sources and aerial photographs. The existing data sources have limited field verification, if any. Consequently, the wetland community types identified in Map 1 are more informative than definitive. Furthermore, the management standards outlined in this chapter require, for their correct interpretation and implementation, a function and values assessment for each wetland. A phased approach to a function and values assessment is presented in the implementation section of this LSWMP.

The City is required by the Metropolitan Council to complete a Wetland Management Plan. The City is currently evaluating its next steps in order to meet this requirement. The City requires that projects with wetlands include preparation of a function and values assessment. If the City has previously performed a function and values assessment for a particular wetland, the project will not be required to do a function and values assessment for that particular wetland. The function and values assessment shall use the latest version of MnRAM and that this assessment be submitted to the City for review. This function and value assessment, once accepted by the City, becomes the basis for applying the protection standards outlined in Tables 4.2 and 4.3.

In the near future, the city intends to initiate one of the following strategies to complete a Wetland Management Plan including a functions and values assessment, as required by the Metropolitan Council. The goals of the plan are two-fold:

1. Develop a broad perspective on wetland quality and quantity within the city so the City can allocate its resources effectively.
2. Assessing wetlands prior to development. This ensures that wetlands will be protected from degradation by application of the appropriate standards.

There are two possible approaches to the Wetland Management Plan that the City may follow:

- Option 1
  Complete a function and values assessment on all wetlands within the city. Ideally, MnRAM would be conducted on all wetlands in the city at the time the wetland management plan is created. This option would provide the city with comprehensive wetland information for use in planning and development reviews. However, it is the most costly of the options.

- Option 2
  Use a phased approach to complete a functions and values assessment of all wetlands in the city.This would be accomplished by first assessing wetlands in areas likely to develop within the next 3 to 5 years, and then completing assessments on the remaining wetlands at some point in the future. Regardless of the time frame, wetlands would be evaluated prior to development. At the discretion of the City, wetlands not inventoried during the initial phase would be assessed either in a subsequent assessment of city wetlands, or at the time that development is proposed. MNRAM would be applied either by a wetland professional hired by the applicant, or by the city or its representative, at the city's discretion

System Assessment
Storm water facilities are an essential part of the development of any municipality. As an area develops from rural uses to urban uses, culverts and drainageways that were adequate for rural runoff become overloaded, causing flooding that frequently results in property damage. The primary functions of an urban storm water system are to protect the quality of a community's water resources and to reduce economic loss and inconvenience due to the periodic flooding of streets, buildings and low-lying areas. The desirable economic endpoint is reached when the cost of environmental impacts and damage attributable to storm flooding plus the cost of surface water facilities reaches a minimum. Economy is not the only consideration, since well-designed surface water facilities also improve aesthetics, wildlife habitat, and recreational opportunities. Additionally, there is a minimum level of surface water management mandated at the state and watershed level.

Frequently, the downstream reaches of a drainage basin develop earlier than the remainder of the basin. When this occurs, drainage structures installed as part of the earlier development may be sized for the current runoff. A proper surface water management plan takes the entire drainage area with future development into consideration. Therefore, costly revisions to replace undersized lines in developed areas can then be avoided.

If a planned program of storm drainage construction is established and implemented in the early development stages of a drainage area, the most economical storm water system will be achieved. The substantial cost of duplication and waste arising from storm sewer construction or reconstruction after an area is developed can also be avoided. Trunk storm sewers and ponding areas can then be incorporated into a developer's plan as required.

Chapter 5 serves the following purposes:

- Section 5.2 outlines recent assessments of surface waters and how these affect Dayton.
- Section 5.3 provides background to guide hydrologic analysis of Dayton's surface water system.
- Section 5.4 provides a description of Dayton's existing and future surface water system of ponds, pipe, and overland connections provided in Map 2, the technical appendicies, and Chapter 6.

Implementation Plan

This LSWMP provides a plan for expanding and managing the City's surface water system, and protecting key water resources in the City. The real measure of success of the LSWMP will be in its implementation. Implementation of the LSWMP covers a number of aspects, including:

- Administering regulations and programs
- Managing surface water as redevelopment and new development occur
- Implementing a public education program regarding storm water management
- Operating and maintaining the surface water system
- Constructing prioritized capital improvements
- Financing projects and programs
- Providing a process for future amendments to the LSWMP

It is the City of Dayton's intent that the Elm Creek WMC remain in its role as the review and approval authority for stormwater management in new development and redevelopment.

Some implementation activities that the City of Dayton is currently undertaking include:

NPDES MS4 Permit Program

In 2006, the City revised and submitted its application for its General Stormwater Permit for Small Municipal Separate Storm Sewer Systems to the Minnesota Pollution Control

Agency. The permit program's purpose is to minimize the discharge of stormwater runoff pollutants and to authorize stormwater discharge from the City's Municipal Separate Storm Sewer System (MS4).

Electronic Stormwater System Map

The City's NPDES SWPPP states that the City will develop an electronic map of the storm water conveyance system. The electronic map will be completed in 2008. The map will include the parts that make up the MS4 including items such as: ponds, streams, lakes, wetlands, structural pollution control devices, pipes and other conveyance systems, outfalls, groundwater discharge structures, overland discharge points, and other discharge points from the MS4. Discharge locations from diffuse flows will not be included on the electronic map.

Erosion and Sediment Control

As part of the NPDES MS4 permit requirements, the City is responsible to address the following erosion and sediment control items within the next 5 years:

1. Develop an ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under law.
2. Requirements for construction site operators to control waste, such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality.
3. Develop requirements for construction site operators to implement appropriate erosion and sediment control best management practices.
4. Develop procedures for site plan review which incorporate consideration of potential water quality impacts.
5. Update procedures for receipt and consideration of reports of noncompliance or other information on construction related issues submitted by the public.
6. Establish procedures for site inspection and enforcement of control measures.

Mississippi River Outstanding Resource Value Water Management

The Mississippi River along most of Dayton's northern border is designated an Outstanding Resource Value Water (ORVW). The portion of the Mississippi River that is designated as an ORVW starts from the County State-Aid Highway 7 bridge in the City of Saint Cloud to the northwestern city limits of Anoka. Communications with staff at the MPCA indicate that any discharge with the potential to impact an ORVW must be evaluated which would include all discharges to the ORVW no matter the distance from the ORVW.

As a starting point for managing discharges to the Mississippi River ORVW, BMP 7-3 of the City's SWPPP is to make an assessment of how the City's SWPPP can be altered to eliminate new or expanded discharges to the ORVW. The City will present the assessment, together with the proposed changes to the SWPPP, for public comment during the annual public comment period.

The System Assessment section identifies corrective actions for Hayden and Diamond Lakes. These corrective actions are to implement water quality improvements determined on the basis of water quality studies for these lakes. The Elm Creek WMP calls for the local community, in this case Dayton, to take the lead in performing these water quality studies and improvements. These corrective actions will be implemented as funding becomes available to the City and in conjuction with other studies of the Elm Creek WMC. After these studies are complete, the City will complete water quality improvements to address the findings and conclusions of the water quality studies. The extent of the water quality improvements will be dependent on the availability of funds to the City.

The City of Dayton has several lakes within its jurisdiction. The City has developed water quality goals for each of these lakes. These lakes will all share some basic general water quality goals; some lakes will have additional specific goals which may be more restrictive than the general goals.

The general water quality goals are as follows:

1. No increase in total phosphorous loading. This goal is expected to be attained with development standards that require no increase in P loading for post development conditions compared to existing conditions as provided in Standards section 6.3.3.
2. Reduction in TSS loading by requiring a minimum of 80% TSS reduction for BMPs for developments as required in the Standards section 6.3.3.
3. Support Elm Creek WMCs water quality goals.

Table 6.2 is a summary of the major lakes in Dayton along with their water quality goals. Four of the lakes have water quality studies as part of their water quality goals. After these studies are complete, the goals specific to that lake will likely be revised to address water quality issues identified in the studies. These revised goals will likely include water quality improvement implementation projects.

Recommendations

The following recommendations have been developed at part of this LSWMP:

1. The Surface Water Management Plan as presented herein be adopted by the City of Dayton.
2. Establish the ponding areas as shown on Map 2, and made a part of the Surface Water Management system with the peak flows controlled to the values provided in the appendicies.
3. Establish standard review procedures to ensure all new development or redevelopment within the City is in compliance with the grading and storm water management controls determined by this Plan.
4. Require detailed hydrologic analyses for all development and redevelopment activities.

5. Establish final high water levels governing building elevations adjacent to ponding areas and floodplains as development occurs or when drainage facilities are constructed.
6. Establish and maintain overflow routes to provide relief during extreme storm conditions, which exceed design conditions.
7. Perform a functions and values assessment on wetlands prior to development.
8. Develop a Wetland Management Plan for the City.
9. Develop an assessment for the ORVW Mississippi River per requirements of the NPDES MS4 permit, and for inclusion into the City's SWPPP.
10. Develop an electronic map of the City's storm water management system.
11. Establish a surface water system maintenance program to ensure the successful operation of the system.
12. Continue operating and maintaining the City's surface water system in accordance with this LSWMP.
13. Enforce the erosion and sedimentation control criteria for new developments.
14. Implement an education program for City residents, staff, and development community.
15. Adopt and implement amendments to the plan as warranted by future standards or regulations.

1. INTRODUCTION

1.1 Background

This report provides the City of Dayton with a Local Surface Water Management Plan (LSWMP) that will serve as a guide to managing the surface water system throughout the City. This LSWMP is based on the City of Dayton's 2020 landuse plan. The City of Dayton is currently preparing its 2030 landuse plan which will likely expand urban uses over the 2020 plan. To the extent that new urban uses are designated in the 2030 landuse plan and these new urban uses fall within a pre 2020 development phase, then this LSWMP will be amended to include these areas. Otherwise, this LSWMP will carry Dayton through the end of 2016. Independent of landuse and phasing changes, periodic amendment to the LSWMP will occur in the intervening 10 years so that the Plan remains current to watershed plan amendments and revisions and current to the "state of the art" in surface water management.

The City of Dayton is located in north central Hennepin County at the confluence of the Crow and Mississippi Rivers as shown on Figure 1. The City is currently a mix of rural residences, agricultural use, and suburban residences. Industrial and commercial activities dominate the southwest portion of the City adjacent to Interstate 94. However much of Dayton is still relatively undeveloped and is dominated by an agricultural landscape and the Elm Creek Park Reserve. The City is expecting to grow more rapidly than it has in the past as the metropolitan area of the Twin Cities continues to expand.

Table 1 provides City populations and population projections from 1980 through 2020. As the city continues to grow, the importance of adequate surface water management controls also grows. The intent of the Dayton LSWMP is to detail what these controls are and make the connection between these controls and the overall city goal of preserving and enhancing its natural resources and protecting its residents from flooding.

Table 1
Population and Households

Year	Population	Number of Households
1980	4,000	1,161
1990	4,392	1,359
2000	5,000	1,725
2010	8,600	2,950
2020	15,600	5,350

1.2 Purpose

The Dayton LSWMP will serve as a comprehensive planning document to guide the City in conserving, protecting, and managing its surface water resources. The Metropolitan Surface Water Management Act, passed by the Minnesota State Legislature in 1982, allowed the formation of watershed districts and preparation of watershed management plans. Following adoption of watershed management plans, cities are required to prepare Local Surface Water Management Plans. The purpose of this LSWMP is identical to the purpose of the Surface Water Management Act, which is to preserve and use natural water storage and retention systems to:

1) Reduce to the greatest practical extent the public capital expenditures necessary to control excessive volumes and rates of runoff;
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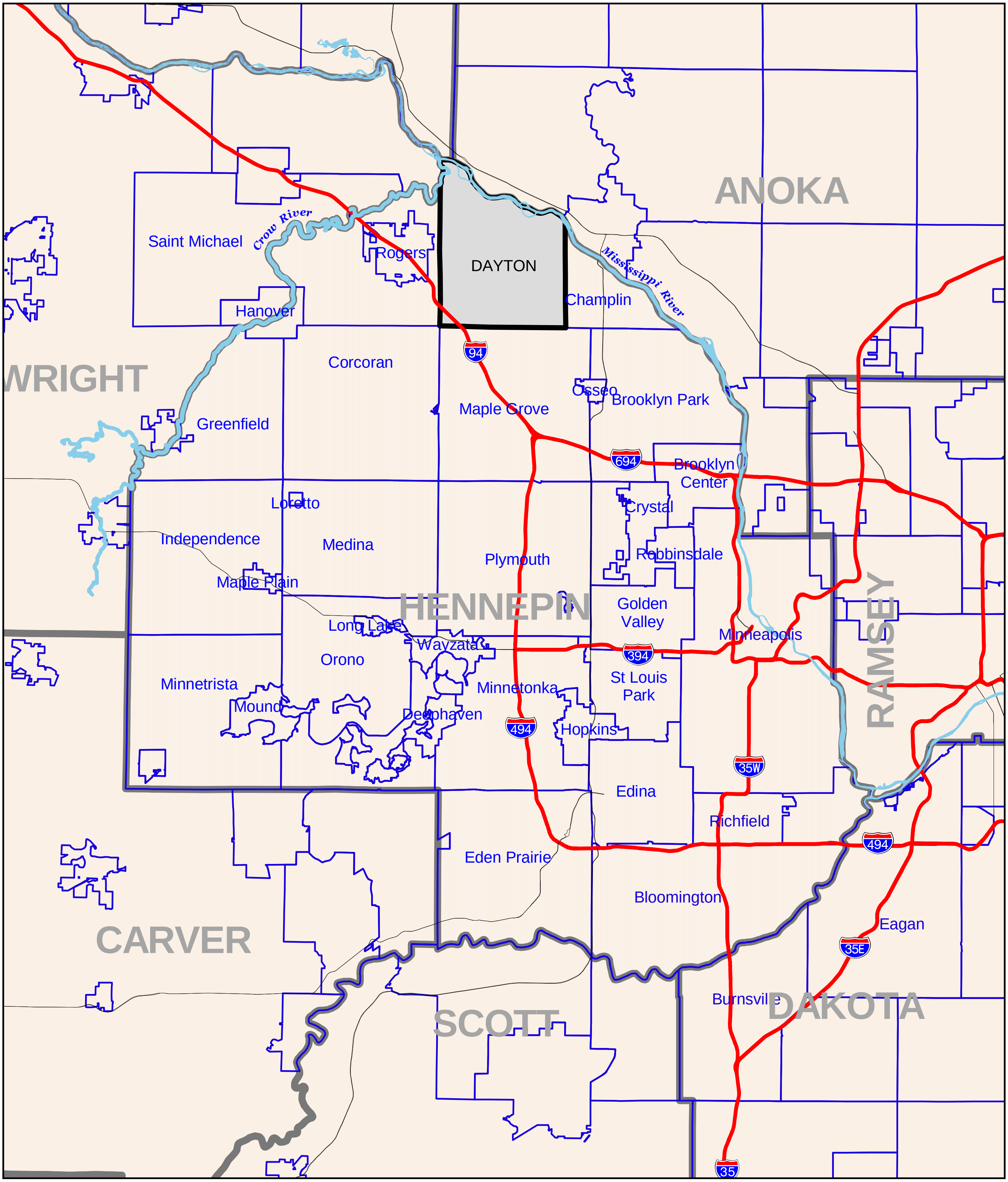
The LSWMP was prepared in accordance with Minnesota Statute, Minnesota Rules 8410, the Metropolitan Council's Local Planning Handbook, and local watershed requirements.



Bonestroo Rosene Anderlik & Associates
Engineers & Architects

City of Dayton

Local Surface Water Management Plan

LOCATION MAP

Figure 1

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February 2007

2. LAND AND WATER RESOURCE INVENTORY

2.1 Topography and Watersheds

The City of Dayton is located southeast of the confluence of the Crow and Mississippi Rivers. The northern portion of the City that borders the Crow and Mississippi Rivers has steep terrain. The remainder of the City has flat to gently rolling topography. Land surface elevations range from roughly 980 in the southwest, between and French and Dubay Lakes, to 830 at the Mississippi River, which forms the northern border of the City. The City is located entirely within the Upper Mississippi River Basin. Drainage is generally from southwest to northeast and west to east.

A significant portion of the drainage within the City is carried overland into one of three well-defined stream systems: Diamond Creek, Rush Creek and Elm Creek. The remainder of the City's drainage flows directly to the Crow and Mississippi Rivers and to landlocked lakes and wetlands. Rush Creek and Diamond Creek are tributary to Elm Creek, which eventually drains to the Mississippi River. The northwestern area of the City drains directly to the Crow River just upstream of the confluence of the Mississippi. The north central and northeastern portion of the City's drainage is carried directly to the Mississippi River.

The City is situated entirely within the jurisdictional boundaries of the Elm Creek Watershed Management Commission.

2.2 Soils

Soils information was obtained from the Hennepin County Soil Survey by the Natural Resource Conservation Service (NRCS), which was formerly called the Soil Conservation Service. The City of Dayton is dominated by four main soil associations:

- The Hayden-Cordova-Peaty Muck association.
- Hubbard-Isan-Duelm association
- Cordova-Hayden-Nessel Association
- Hayden-Peaty Muck association

The northeast portion of the city is dominated by the Hubbard-Isan-Duelm association which consists mainly of sands that are well drained and permeable. The majority of soils in this area are classified as NRCS Hydrologic Soil Group (HSG) Type A soils. The remaining portions of the city have soil types dominated by HSG type B with type C and D present as well. The type C and D soils tend to be present in depressional areas, drainageways, or areas that are poorly drained. The system design in this LSWMP assumed Type A soils for runoff calculations in the northeast portion of Dayton as this was the dominant soil type in this part of the City. Outside the northeast area of Dayton, Type B soils were assumed for runoff calculations, as this was the dominant HSG for the three other soil associations present in Dayton.

Poorly drained soils appear primarily within the existing depressional areas and drainageways. Because these soils are generally poor draining, many of the proposed storm water detention areas that utilize these depressions will likely have low infiltration rates.

2.3 Land Use

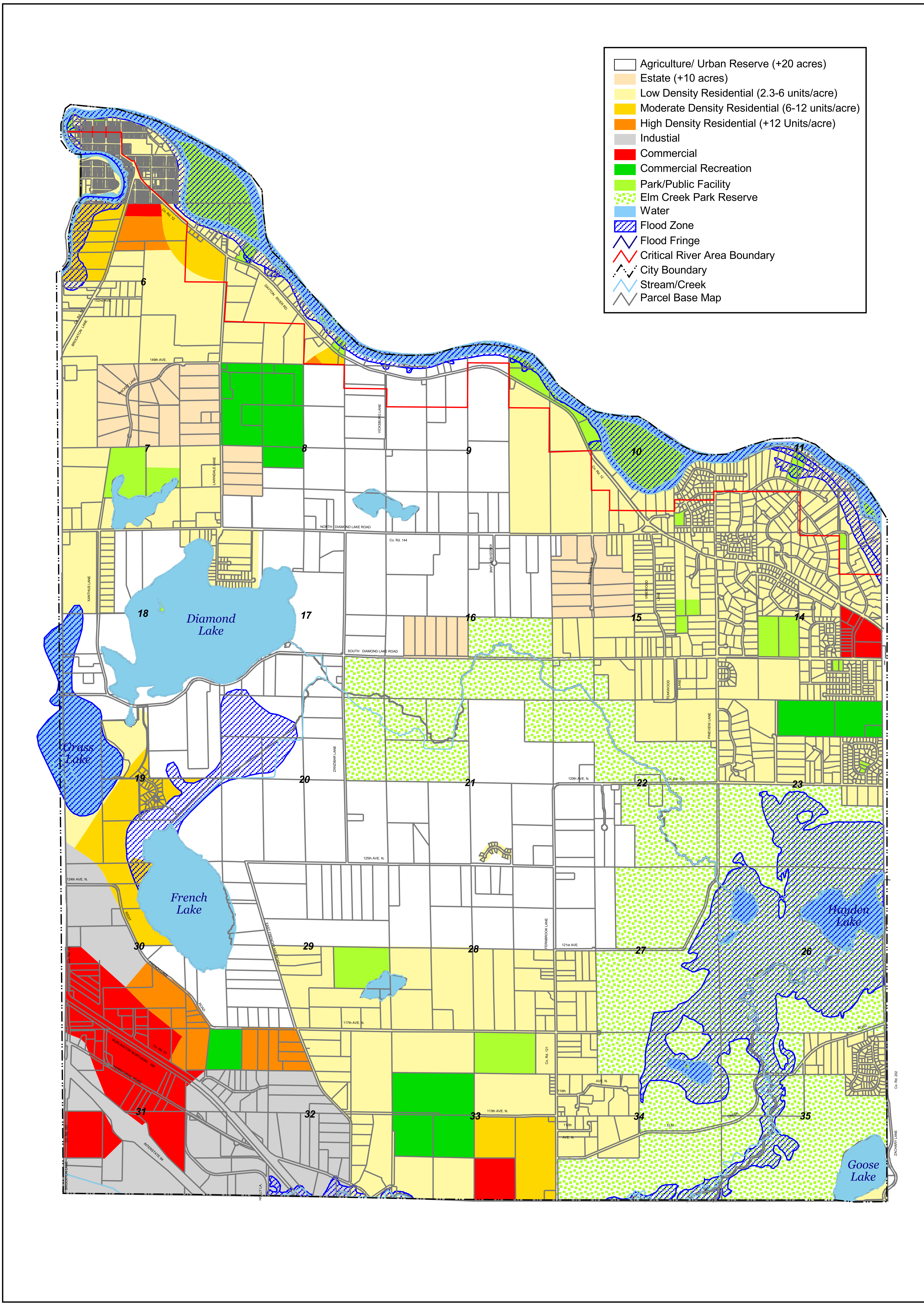
A map of the City's current land use plan, consistent with the 2020 Comprehensive Plan, is shown on Figure 2. For nearly the last century and a half, land use within the City has been dominated by agriculture. Approximately half of the City is projected to remain undeveloped as it is either part of the Elm Creek Park Reserve or has been designated as urban reserve in the 2020 Comprehensive Plan. These undeveloped areas consist mainly of agricultural fields or undeveloped woods and meadows.

The city is currently in the process of updating its landuse plan to 2030. Figure 3 shows the City's Concept Guide Plan which provides a guide to potential development in the absence of the 2030 landuse plan.

Within the remainder of the City, residential, commercial, and industrial development is present or is projected to occur mainly in three general areas: the northwest, the northeast, and the southwest. The oldest permanent development within Dayton is located in the extreme northwest corner of the City at the confluence of the Crow and Mississippi Rivers. This area consists of a mix of low density residential and commercial properties. Undeveloped land located between the confluence of the rivers and Laura Lake (see Map 1), currently agriculture, is projected to develop as primarily low density residential.

The northeast area of the City, bordered on the east by Champlin and the north by the Mississippi River, has experienced relatively recent development, consisting almost entirely of low density residential. Undeveloped areas are projected to develop in a similar manner.

The southwest area of the City, from French Lake to east of Fernbrook Lane, consists of residential and agricultural areas interspersed with commercial and industrial areas bordering Highway 169 and I-94. Undeveloped agricultural areas in the extreme southwest corner of the City, near Highway 169 and I-94, are projected to develop as commercial and industrial uses. The undeveloped land south of Dubay Lake, east of French Lake Road, and west of Fernbrook Lane is projected to develop primarily as low density residential.



City of Dayton

Local Surface Water Management Plan

2020 LAND USE

Figure 2

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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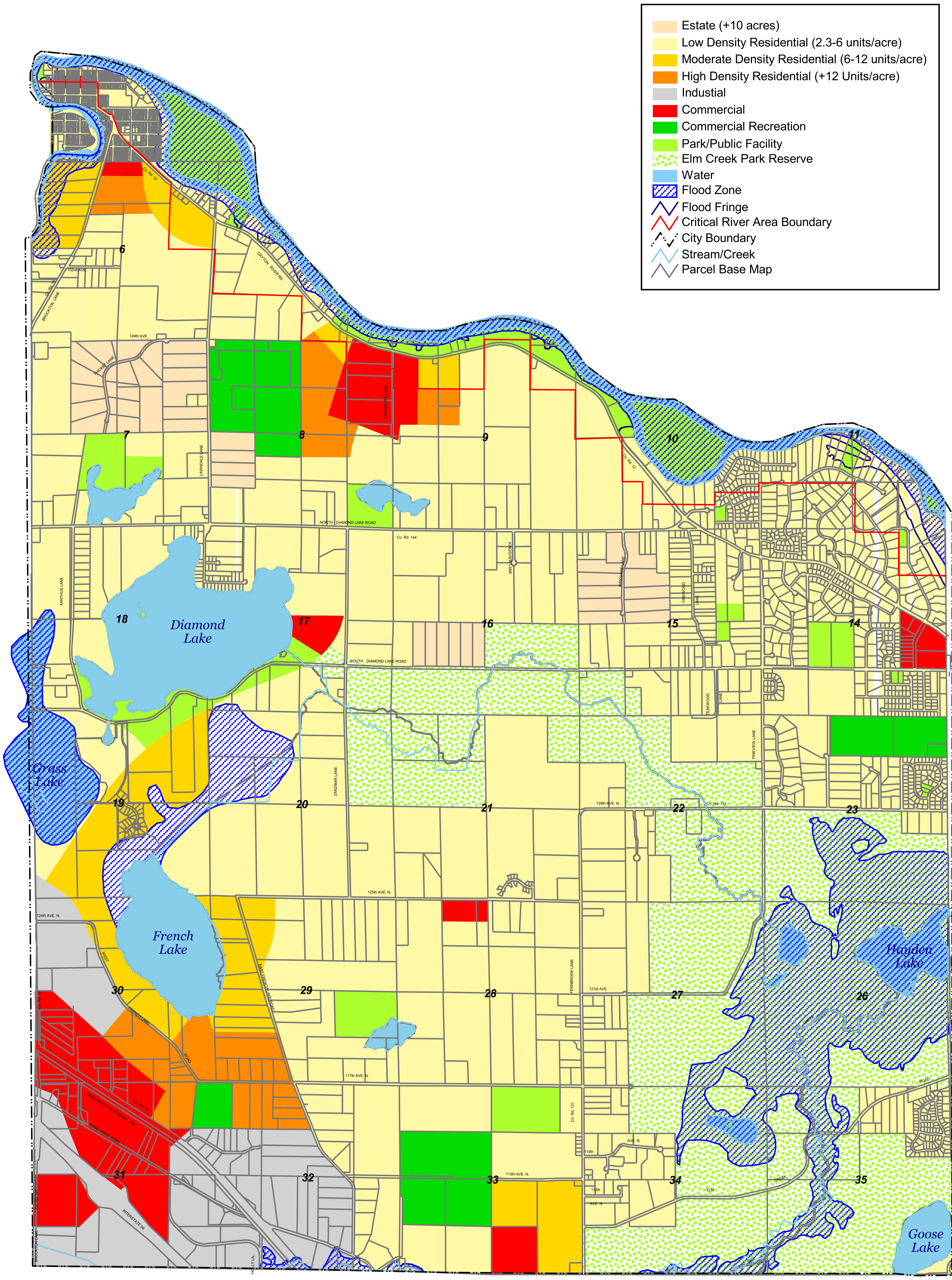
FEBRUARY 2007



City of Dayton

Local Surface Water Management Plan

CONCEPT GUIDE PLAN

Figure 3

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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FEBRUARY 2007

2.4 Key Water Resources

2.4.1 Wetlands

The study area contains a large, diverse mix of wetlands, and many of these remain in good condition, especially those located within the Elm Creek Park Reserve. Most of the wetlands identified within the study area show some alterations due to the agricultural practices. However, a number of sites have retained a diversity of native plant species and high quality habitat. The wetlands that have been more heavily altered tend to be much less diverse. These impacted wetland sites are less susceptible to further degradation and can provide mitigation and banking opportunities.

A mapping of the wetlands within the City has been completed as part of this LSWMP. The reader is referred to Chapter 4 for detailed information regarding the location and type of wetlands within the City.

2.4.2 Creeks

Diamond Creek, Rush Creek, and Elm Creek and their tributaries provide an efficient means to drain the majority of the City of Dayton. Because such a large portion of the study area drains to these creeks, it is important that the creeks be protected from the increase in runoff rates and volumes that would result from development.

2.4.2.1 Diamond Creek

Diamond Creek begins at French Lake, near the western border of the City, and flows to Elm Creek, just upstream of Hayden Lake. Most of the central portion of the City drains to Diamond Creek, including areas tributary to French Lake and Diamond Lake which outlet to the creek.

2.4.2.2 Rush Creek

North Fork Rush Creek flows across the southwest corner of the city, from Hassan Township to Maple Grove, where it empties into the main stem of Rush Creek. The main stem meanders along the Dayton-Maple Grove border before it joins Elm Creek south of Hayden Lake. Much of the southwestern and south central portion of the City drains directly to Rush Creek.

2.4.2.3 Elm Creek

Elm Creek flows north to Dayton from Maple Grove where it picks up flow from Rush Creek just north of the Dayton-Maple Grove border. It continues north to the confluence of Diamond Creek, where it turns east, flowing through Hayden Lake and Champlin, eventually emptying into the Mississippi River. Elm Creek directly drains much of the southeastern and eastern portion of the City.

2.4.3 Lakes

2.4.3.1 Diamond Lake (#27-125 P)

Diamond Lake directly feeds Diamond Creek and is located in the western portion of the City. The lake has an approximate surface area of 406 acres and a maximum depth of 8 feet. Diamond Lake receives much of its drainage from Hassan Township and Rogers via Grass Lake. Most of Diamond Lake is surrounded by agriculture, with some lakeshore homes on the north side of the lake.

2.4.3.2 French Lake (#27-127 P)

French Lake is a shallow lake located near the western border of the City, south of Grass and Diamond Lakes, in the headwaters of Diamond Creek. French Lake feeds Diamond Creek via a series of wetlands and agricultural ditches. The lake's drainage area is dominated by agriculture but does receive some commercial and industrial storm water runoff from the south. French Lake has an approximate surface area of 351 acres and is surrounded by a deep marsh.

2.4.3.3 Grass Lake (#27-135 P)

Grass Lake straddles the western border of the City and is situated between Diamond and French Lakes which are located to the north and south respectively. Grass Lake comprises an area of approximately 237 acres. It receives nearly all of its drainage from Hassan and Rogers though a few agricultural areas in Dayton drain to the lake from the south. Grass Lake drains east to Diamond Lake. The lake, containing little open water, is technically considered a deep water marsh and is dominated by vegetation.

2.4.3.4 Lake Laura (#27-123 P)

Lake Laura is a small lake in the northwestern portion of the City, approximately 36 acres in size, and is located to the north of Diamond Lake. Lake Laura drains to a large wetland (DNR #27-284W) on the Dayton-Hassan Township border. This wetland eventually flows to the Crow River. Lake Laura has a relatively small watershed area that is dominated by agriculture and rural residences.

2.4.3.5 Powers Lake (#27-130 P)

Powers Lake is considered a small, shallow marsh in the southeastern portion of the City. Powers Lake is located entirely within the Elm Creek Park southwest of Hayden Lake and drains directly to Elm Creek. The lake has a surface area of approximately 17 acres. The entire Powers Lake watershed is entirely undeveloped, except for some park facilities south of the lake, and consists of woods and marshes.

2.4.3.6 Goose Lake (#27-122 P)

Goose Lake is located in the southeast corner of the City and is situated entirely within the limits of the Elm Creek Park Reserve. The lake has an approximate surface area of 62 acres and is bordered on the east by Champlin and the south by Maple Grove. Goose Lake drains south, out of Dayton's city limits, to Mud Lake in Maple Grove.

2.4.3.7 Hayden Lake (#27-128 P)

Hayden Lake is a widening of Elm Creek that straddles the Champlin-Dayton border. The lake and its watershed are located entirely within the Elm Creek Park Reserve. Much of the lake is considered a deep marsh and has an open water area of approximately 95 acres.

2.4.3.8 Dubay Lake (#27-129 W)

Dubay Lake is a small, open water wetland, located in the center of the City, north of 117th Avenue, east of French Lake Road, and west of Fernbrook Lane. The lake is land locked and receives drainage from a relatively small area consisting entirely of agriculture. Dubay Lake has an approximate surface area of 17 acres.

2.4.4 Rivers

2.4.4.1 Mississippi River

The Mississippi River forms the northern border of the City. The river is the ultimate receiving water of all Dayton's surface water runoff. However, only a portion of the City drains directly to the river. The section of the Mississippi River from St. Cloud to the northwestern city limits of the City of Anoka, which includes the section bordering Dayton, was originally designated as a scenic and recreational river in 1976, pursuant to the Minnesota Wild and Scenic Rivers Act. Because of this classification, it is also considered an "outstanding resource value water" in MN Rule 7050.0180; it was designated an outstanding resource value water (ORVW) on November 5, 1984. This issue and its effect on the City are addressed more thoroughly in Chapter 6.

2.4.4.2 Crow River

The Crow River flows north along the northwestern border of the City and receives direct drainage from that area of Dayton. The mouth of the Crow, at the confluence of the Mississippi, is located at the extreme northwest corner of the City. A TMDL study addressing fecal coliform and turbidity is in progress for the Crow River and includes the reach adjacent to the City. The reader is referred to Chapter 5 for more information on other impaired waters within or bordering the City.

3. GOALS AND POLICIES

3.1 Purpose

The primary goal of Dayton's Local Surface Water Management Plan (LSWMP) is to plan for the management of stormwater as development occurs in the city. The plan provides guidance on how Dayton intends to manage surface water in terms of both quantity and quality.

The following are the City's goals and policies for Surface Water Management. The goals and policies are consistent with Minnesota Rules 8410 and local watershed requirements and reflect a commitment by the City to protect its natural resources and sustain a high quality of life for its residents. As with all planning tools, these goals and policies are meant to be dynamic and flexible and to evolve with changing conditions in the City. It should be noted that the numbering system of the goals and policies does not imply ranking by priority.

3.2 Goals and Policies

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 items that promote attainment of the goal.

The City of Dayton has maintained its natural drainage patterns throughout most of its development thus far. The City's goal is to foster continued optimum use of that natural drainage system while enhancing the overall water quality entering wetlands, streams, and lakes. The intent is to prevent flooding while using identified best management practices (BMPs) to enhance surface water quality with minimal capital expenditures by the City.

3.2.1 Water Quantity

Goal 1:

Protect, preserve, and manage natural surface and constructed retention systems to control excessive volumes and rates of runoff and prevent flooding.

Policy 1.1

Preserve and optimize where feasible the retention capacities of the present drainage systems by utilizing lakes, ponds, and wetlands for storing stormwater runoff, to the limits allowed by state and watershed requirements and the functions and values of existing wetlands and lakes.

Policy 1.2

New developments and redevelopments shall limit proposed runoff rates to the existing conditions rates or lower for the 2, 10, and 100-year 24 hour rainfall event. The existing condition is defined as pre-agricultural conditions

Policy 1.3

Establish 100-year event flood levels for natural and constructed water bodies on the basis of critical storm events. The storm events used for critical event analysis will be the 100-year 24-hour SCS Type II rainfall, the 100-year 10-day rainfall, and the 100-year 10-day runoff.

Policy 1.4

Pond detention basin facilities shall be designed for the 100-year critical storm event consistent with the standards of this plan.

Policy 1.5

Newly constructed detention basins shall meet the standards of this plan.

Policy 1.6

Storm sewer design shall be consistent with the standards of this plan and based on the 10-year storm event using the rational method and Intensity Duration Frequency curves from the MnDOT Drainage Manual.

Policy 1.7

Altering wetlands for the purposed of creating flood storage alone is discouraged. Alteration may be allowed on individual basis if the alteration can be accomplished within the regulations of all federal, state, county, and local agencies that have jurisdiction over the particular wetland, and if the alteration is part of a wetland restoration strategy.

Policy 1.8

All hydrologic studies and drainage design shall be based on ultimate development of the 2020 comprehensive plan. In some cases near term conditions should also be analyzed to determine whether unrestricted drainage from rural areas may lead to construction of interim facilities, or development of interim management strategies due to concern over interim high water levels or discharge rates.

Policy 1.9a – Freeboard requirements

The low floor elevation of all new structures will be a minimum 2 feet above the peak water surface elevation for the 100-year critical storm event. The low structure elevation will be at least 1 foot above the as-built emergency overflow elevation from any area where surface water is impounded during a flood event. The low structure elevation is defined as the lowest ground elevation adjacent to the structure. Under no circumstances shall the low floor elevation be below the planned normal water level of a stormwater basin or other naturally occurring water body or water course.

Policy 1.9b – Freeboard requirements for land-locked areas

Where structures are proposed below the overflow elevation for a land-locked basin, the low structure elevation will be a minimum of 2 feet above the peak water elevation as determined by the critical back-to-back 100-year storm event, or five feet above a critical single 100-year storm event.

Policy 1.10

This LSWMP utilizes the use of regional versus on-site basins for rate control and flood protection. Regional detention basins are used to manage peak flow rates and provide flood storage and flood retention. On-site detention basins are utilized when regional basins are not in place or are not feasible. Where flood and rate control basins are not feasible or desired (because of a preference for a regional approach, for instance) area charges to acquire and construct regional facilities will be collected. The mechanism for collecting such fees will be through the city's area charge structure outlined in section 6.

Policy 1.11

Implement infiltration BMPs on development sites amenable to infiltration to minimize runoff volumes that tend to increase with an increase in impervious area.

Policy 1.12

The City will work with developers to implement runoff volume control BMPs. If runoff volume control is used as a storm water BMP for a development or redevelopment project, then the runoff volume control BMP is required to be implemented on individual development and redevelopment sites rather than in regional facilities. The City promotes infiltration of 1.0 inch of runoff off a development's and redevelopment's new impervious surfaces wherever land is free of contamination, the soils are HSG A and B, and adequate separation can be maintained between the infiltration BMP and the groundwater elevation. Assumed infiltration rates are 0.50 in/hr for HSG A soils and 0.25 in/hr for HSG B soils.

Policy 1.13

Implement the use of overland versus pipe conveyance so that the benefits of natural channels and wetlands can be realized. These benefits include filtration, flow attenuation, infiltration, and other water quality and quantity benefits. The city encourages the use of natural vegetation within overland conveyance systems. This policy is not applicable to protecting from erosion the ravines along the Mississippi River.

Policy 1.14

The City of Dayton has adopted a Floodplain ordinance to regulate development and activities in flood hazard areas.

Policy 1.15

The City will work with developers to reduce impervious surfaces resulting from new and re-development projects. This policy will help preserve existing natural areas and reduce the total volume of runoff generated on a site, reducing the rate control burden on downstream streams and regional detention basins.

Policy 1.16

The City shall be responsible for removing deadfalls in creek channels as appropriate and when notified by adjacent landowners that these deadfalls have become a nuisance provided that the deadfall is no longer attached to the land. For deadfall that remains attached to the land, it is the responsibility of the landowner to remove the deadfall.

Policy 1.17

All developments shall, to an extent determined by the City, provide land, funding, or a combination of both for developing regional detention sites to achieve the existing rates as indicated in this plan.

Policy 1.18

The City of Dayton will work collaboratively with other municipalities and the Elm Creek WMC in addressing intercommunity drainage issues.

3.2.2 Water Quality

<u>Goal 2</u>

Identify and plan for means to effectively protect and improve water quality.

Policy 2.1

The Minnesota Stormwater Manual, the MPCA's manual "Protecting Water Quality In Urban Areas", and the Metropolitan Council's Minnesota Urban Small Site BMP Manual shall be used for implementing best management practices to control urban non-point source pollutants.

Policy 2.2

The City of Dayton has adopted a Shoreland Zoning ordinance to regulate the subdivision, use, and development of the shorelands of public water bodies.

Policy 2.3

The City shall implement standards for stormwater treatment practices to prevent degradation of lakes, streams, and wetlands.

Policy 2.4

The City recognizes the value of promoting infiltration practices in runoff volume control for water quality benefit.

Policy 2.5

Construct, where practicably feasible, storm water quality ponds which will serve not only new development, but also existing development where the situation arises to treat those areas that were established prior to detention pond criteria developed under EPA's Nationwide Urban Runoff Program (NURP).

Policy 2.6

The City encourages the implementation of conservation design principles into developments. The City recognizes the benefits to water quantity and quality provided by incorporating conservation design approaches. Conservation design seeks to accomplish three goals, as stated in the Minnesota Stormwater Manual:

1. Reduce the amount of impervious cover.
2. Preserve and incorporate existing natural areas into the site design.
3. Utilize the appropriate BMPs for effective stormwater treatment.

Policy 2.7

On-site treatment is the preferred method of implementing water quality as opposed to off-site. The more disperse the water quality system the longer lasting its performance. On-site treatment includes ponds, reduced imperviousness, direct discharge of impervious surface onto pervious and not directly into the storm sewer system, use of rainwater gardens and filtration devices, and other such techniques that have the net result of reducing runoff volumes.

Policy 2.8

The City of Dayton will work with interested stakeholders to develop numeric water quality goals for the following water bodies: French Lake, Dubay Lake, Diamond Lake, Hayden Lake, Goose Lake, Powers Lake, Laura Lake, and Grass lake.

3.2.3 Recreation and Fish and Wildlife

<u>Goal 3:</u>

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

Policy 3.1:

To the greatest possible extent, natural areas shall be preserved, especially when adjacent to wetland areas.

Policy 3.2:

Buffer zones of natural vegetation shall be maintained around lakes, ponds and wetlands.

Policy 3.3:

Coordinate with the Department of Natural Resources (DNR) to protect rare and endangered species.

Policy 3.4:

Enforce the Wetland Conservation Act of 1991 in order to protect wetlands.

3.2.4 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 to reduce storm water pollution based on the objectives and BMPs identified in the City's Storm Water Pollution Prevention Plan.

3.2.5 Public Ditch Systems

Policy 5.1:

Hennepin County is the Public Ditch Authority. Therefore the City of Dayton defers authority to Hennepin County for public ditch issues and management.

3.2.6 Groundwater

Goal 6:

Enhance ground water recharge.

Policy 6.1:

Implement the use of grassed waterways where practical to maximize infiltration.

Policy 6.2:

Provide a permanent ponding volume below the outlet or overflow in ponds and wetlands to promote ground water recharge.

Policy 6.3:

Maximize infiltration with the use of infiltration basins on development sites amenable to infiltration within all proposed developments following the best management practices guidelines. See policies 1.15 and 2.6.

3.2.7 Wetlands

Goal 7:

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

Policy 7.1

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

Policy 7.2

Discourage wetland disturbance. Wetlands must not be drained or filled, wholly or partially, unless replaced by restoring or creating wetland areas of at equal public value, as permitted by the Wetland Conservation Act. Wetland sequencing will be strictly followed where Dayton protects wetlands as follows:

- First priority is to avoid the impact.
- Where the impact cannot be avoided, then the impact must be minimized.
- Where the impact cannot be avoided, then the impact must be mitigated.

Policy 7.3

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. Refer to Chapter 6, Implementation, for further discussion on the City's plan for wetland buffer strips.

Policy 7.4

Establish for City use a wetland bank account to allow for wetland debits and credits.

Policy 7.5

Require that a wetland function and values assessment be prepared for any project that includes a wetland, regardless of whether a wetland impact is proposed by the project. If the City has previously performed a function and values assessment on a particular wetland, a second function and values assessment for the project will not be required.

Policy 7.6

The City will begin a phased function values assessment subsequent to finalizing its 2030 Land use and Phasing Plan. The intent of the function and values assessment is to inventory wetlands five years ahead of development.

3.2.8 Erosion and Sediment Control

Goal 8:

Prevent erosion of soil into surface water systems.

Policy 8.1:

Erosion and sediment control plans shall be required for all land disturbance activities, and they shall be consistent with the standards of this LSWMP and meet the requirements of the NPDES Construction

Policy 8.2:

Temporary sediment basins shall be constructed in areas of new development to prevent sediment from leaving the construction area.

Policy 8.3:

Streets and property adjacent to construction areas shall be kept free from sediment carried by construction traffic.

Policy 8.4:

The City may prohibit work in areas having steep slopes and high erosion potential. Whenever possible, slopes of twenty percent (20%) or greater should not be disturbed.

Policy 8.5:

The City shall maintain a street sweeping program to minimize sediment entering the drainage system. Streets will be swept twice yearly, once in the spring and once in the fall.

Policy 8.6:

Establishment of temporary and permanent vegetation shall be required to minimize the time that a graded area remains in an exposed condition.

Policy 8.7:

All existing storm drain inlets and conveyance systems shall be adequately protected from sedimentation.

3.2.9 Dayton's NPDES Permit

<u>Goal 9:</u>

Operate and manage the City's surface water system consistent with best current practices and the City's NPDES MS4 Permit's Storm Water Pollution Prevention Plan (SWPPP).

Policy 9.1:

Implement the City's NPDES Phase II Permit's SWPPP.

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 occur at intervals given in its SWPPP.

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.

3.2.10 Mississippi River

<u>Goal 10</u>

Manage landuse, development, and stormwater discharge within the watershed of the Mississippi River.

Policy 10.1

Manage landuse, development, and stormwater discharge within the Mississippi River Critical Area Corridor according to the City's Mississippi River Corridor Ordinance and other applicable state and federal laws and regulations.

Policy 10.2

Manage landuse, development, and stormwater discharge to meet the requirements for the Outstanding Resource Value Water designation of the Mississippi River.

3.2.11 Financial Management

<u>Goal 11:</u>

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

Policy 11.1:

The City will continue to update and apply area based charges so that the surface water related costs of development can be fairly borne by the development.

3.3 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.

3.3.1 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 some of the protected waters within the Dayton LSWMP study area.

If an area meets the jurisdictional criteria but is not on the state's inventory, it is not regulated. If it does not meet the statutory criteria but is listed on the inventory, it still is subject to MNDNR regulation. There is no mechanism presently for adding or deleting wetlands. 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. For this reason, permits needed in conjunction with private development work must be submitted by the City and must satisfy the public health, safety, and welfare criteria.

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

3.3.2 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.

3.3.3 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, Dayton 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.

3.3.4 Minnesota Pollution Control Agency

The USACE 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 Dayton'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).

3.3.5 Environmental Protection Agency

As it relates to surface water management within Dayton, 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, mandated by the EPA, also stem from the EPA's role as steward of the Clean Water Act.

3.3.6 Elm Creek Watershed Management Commission

The Elm Creek Watershed Management Commission updated its Watershed Management Plan in April 2003. The powers and duties of this Minnesota statutory authority include:

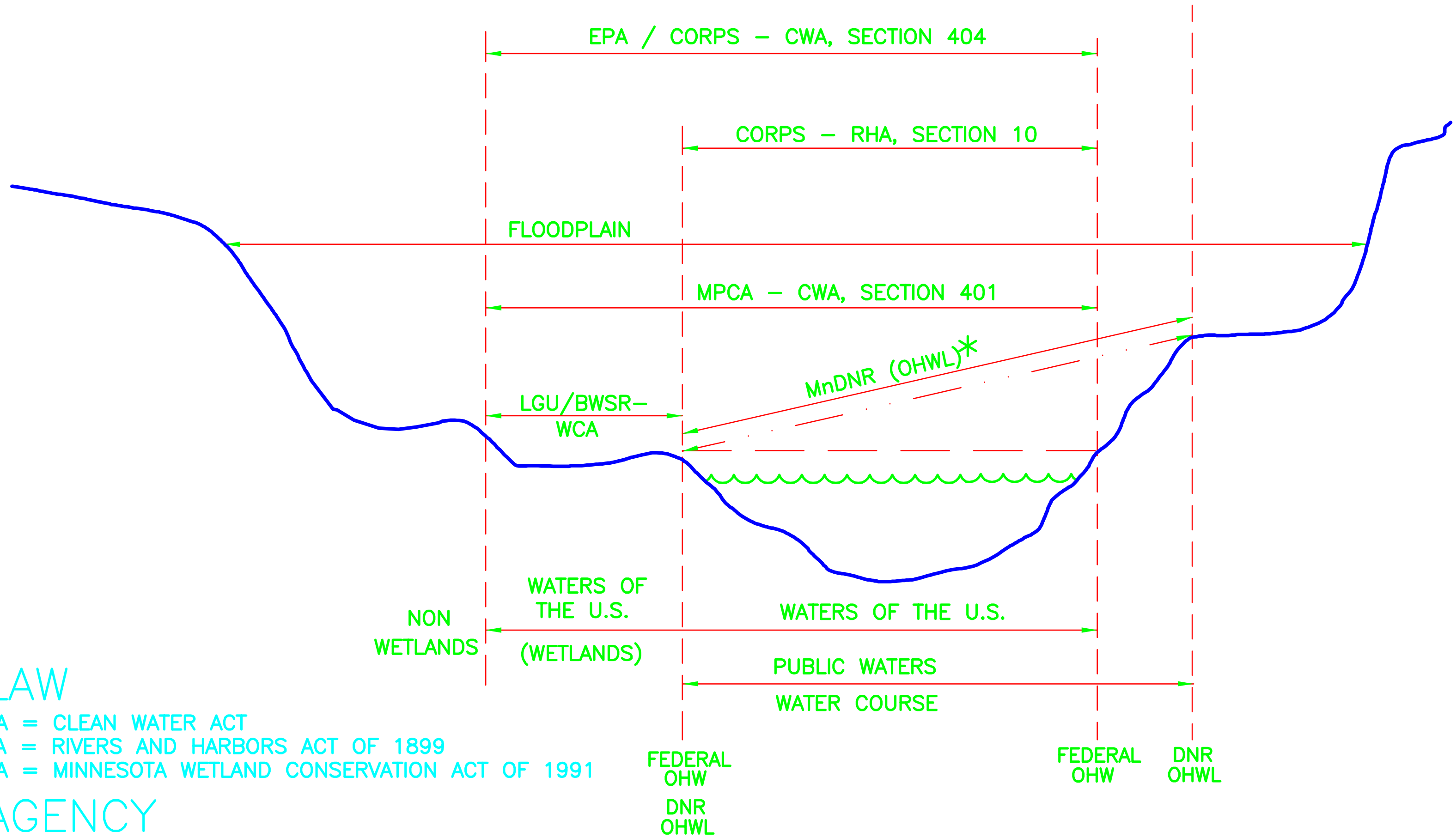
- Approval authority over local water management plans.
- Ability to develop rules regarding management of the surface water system.
- Ability to determine a budget and raise revenue for the purpose of covering administrative and capital improvement costs.
- Regulation of land use and development when 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.

3.3.7 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 hydrophylic (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.

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 DAYTON

LOCAL SURFACE WATER MANAGEMENT PLAN

FIGURE 4

Bonestroo
Rosene
Anderlik &
Associates

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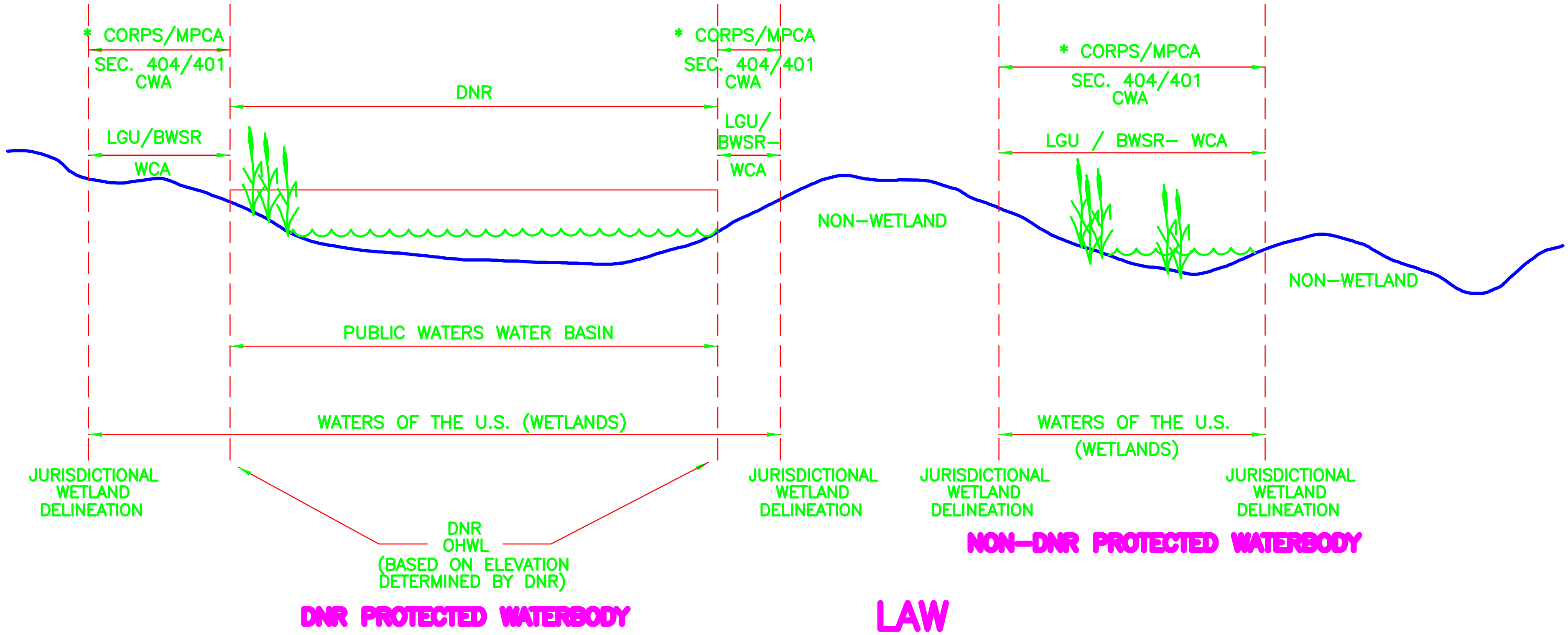
MINNESOTA STATE AND FEDERAL JURISDICTION OVER "WATERS"



LAW

CWA = CLEAN WATER ACT
WCA = MINNESOTA WETLAND CONSERVATION ACT

AGENCY

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

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

PUBLIC WATERS: WATER BASIN

CITY OF DAYTON

LOCAL SURFACE WATER MANAGEMENT PLAN

FIGURE 5

Bonestroo Rosene Anderlik & Associates

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3.4 Agency Contacts

The primary contacts for local regulating agencies described above are presented below. These contacts are accurate as of January 2007.

City of Dayton
City Engineer – Mark Hanson
City of Dayton
Bonestroo, Rosene, Anderlik & Associates
2335 West Highway 36
St Paul, MN 55113-3898

Public Works Superintendent – Rick Hass
City of Dayton
12260 S. Diamond Lake Road
Dayton, MN 55327-9655
(763) 427-3224

Elm Creek Watershed Management Commission
Administrative Services - Judie Anderson
3235 Fernbrook Lane
Plymouth, MN 55447
(763) 553-1144

Hennepin Conservation District
Chair – Kim Boyce
1313 5th St SE
Minneapolis, MN 55414
(612) 379-3932

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

Board of Water and Soil Resources
Board Conservationist
Board of Water and Soil Resources
One West Water Street, Suite 200
St. Paul, MN 55107
(651) 296-3767

3.5 Water Resource Management-related Agreements

Since May 1993, the City of Dayton has been party to a joint powers agreement establishing the Elm Creek Watershed Management Commission.

4. WETLAND MAPPING AND MANAGEMENT

4.1 Wetland Mapping Goals

Map 1 shows the National Wetland Inventory (NWI) and Public Waters Inventory (PWI) for the City of Dayton. The goal of the NWI and PWI mapping 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. Once the 2030 land use plan and phasing is complete, the current mapping will guide the City in conducting a function and values assessment for areas of near term development.

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

- Provide a map of wetlands and water resources based on the National Wetlands Inventory and Public Water Inventory.
- Provide stormwater protection standards for wetlands.

The wetland mapping only includes wetlands that could be identified using the National Wetland Inventory and Public Waters Inventory. Though not all wetlands are included in the mapping, all wetlands will be regulated by 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, *and*
2. Preparation of a MnRAM worksheet for the wetland.

4.2 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. Map 1 includes the wetland location, estimate of the wetland boundaries, and the wetland community type. Preliminary layouts for future development projects should consider the wetland boundaries on the map a guide and not an official wetland delineation.

A base map was produced that included placing the City boundary on a 2003 color aerial photograph (USDA, 2003). National Wetlands Inventory (NWI) and Public Waters Inventory polygons where then overlaid on the base map (USFWS, 1990). Using ArcView GIS, the NWI polygons were correlated with data from the Dayton Natural Resource Inventory and MLCCS Mapping (June 2005) to obtain the wetlands' classifications and plant community types. Polygons were also corrected, where possible, to reflect the current conditions in the City. For example, because the NWI polygons were created from 1980 aerial photographs, wetland polygons within existing roadways (obvious non-wetlands) were removed.

NWI classifies wetlands based on the *Classification of Wetlands and Deep Water Habitats of the United States* (Cowardin et al. 1979). In this system, wetlands in Minnesota are classified based on hydrology regime and vegetation types. In order to correlate the NWI classification to wetland community types, the NWI classification were associated with the wetland community types as given in Table 1 of *Wetland Plants and Plant Communities of Minnesota and Wisconsin* (Eggers and Reed 1997). For example: PEMC is equivalent to shallow marsh.

4.3 Wetland Protection

4.3.1 Stormwater Susceptibility

There are many types of wetlands, each determined by its hydrology and vegetative composition. The two hydrologic alterations that affect 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. The relative susceptibility of a wetland to storm water for a given community type is provided in Table 4.1 as referenced from *Storm Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm Water and Snow Melt Runoff on Wetlands* (MPCA 1997). Some wetlands (e.g., hardwood swamps dominated by tree 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.

Table 4.1
Relative Susceptibility of Wetlands to Stormwater Impacts

Highly Susceptible Wetland Types[1]	Moderately Susceptible Wetland Types[2]	Slightly Susceptible Wetland Types[3]	Least Susceptible Wetland Types
Hardwood Swamps	Shrub Swamp[a.] Wet Meadows [c.,e.] Shallow Marsh [d.,e.] Deep Marsh [d.,e.]	Wet Meadows [b.] Shallow Marshes [c.] Deep Marshes [c.] Open Water [d.]	Cultivated Hydric Soils

1. Special consideration must be given to avoid altering this wetland type. 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. Wet meadows which are dominated by reed canary grass.
c. Marshes dominated by reed canary grass, cattail, giant reed grass or purple loosestrife.
d. Some exceptions.
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)

Wetland protection strategies depend upon the wetland community type. The mapping conducted for this LSWMP used existing data sources and aerial photographs. The existing data sources have limited field verification, if any. Consequently, the wetland community types identified in Map 1 are more informative than definitive. Furthermore, the management standards outlined in this chapter require, for their correct interpretation and implementation, a function and values assessment for each wetland. A phased approach to a function and values assessment is presented in the implementation section of this LSWMP.

While the community types provided in Map 1 are not definitive like a field verified function and values assessment, cross referencing the wetland community types of Map 1 to the relative susceptibility indicated in Table 4.1 is a useful starting point in determining where wetland impacts are likely due to urbanization and where additional mitigative measures might be necessary to prevent degradation of wetland resources.

4.3.2 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 4.2 summarizes these pretreatment recommendations. BMPs can be used to accomplish the pretreatment requirements given in Table 4.2.

Table 4.2
Stormwater Protection Standards

Management Category	Stormwater Phosphorus Pretreatment Requirement
Highly Susceptible[1]	150 ppb[2]
Moderately Susceptible	200 ppb
Slightly Susceptible	200 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 4.2 are minimum treatment levels. For land uses that produce a high phosphorus loading rate that discharges into a susceptible wetland, the Table 4.2 treatment levels may be higher than that provided by the City's standard water quality sizing criteria outlined in Section 6. The standard that leads to the highest treatment capacity is the one required of any specific development.

4.3.3 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 4.3.

Table 4.3
Wetland Quantity Standards

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

4.3.4 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 additions, 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*
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

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

Setbacks of 10 feet between structures and the edge of the buffer are recommended by the Minnesota Pollution Control Agency (MPCA, 1997) to insure there is usable space between structures and buffers and to prevent encroachment of lawns into buffer areas.

Elm Creek Watershed Management Commission (ECWMC): The Elm Creek Watershed Management Plan (2003) encourages that a 20-ft native vegetation buffer be placed around all wetlands, lakes and streams.

4.4 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.

4.4.1 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.

4.4.2 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.

4.4.3 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.

4.4.4 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.

References:

Eggers, Steve D. and Reed, Donald M. 1997. *Wetland Plants and Plant Communities of Minnesota and Wisconsin*. Second Edition. U.S. Army Corps of Engineers, St. Paul District.

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. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*.

United States Fish and Wildlife Service National Wetlands Inventory Maps – Rogers and Anoka quadrangles. Published 1990, from May 1980 aerial photograph interpretation.

5. SYSTEM ASSESSMENT, ANALYSIS, AND DESIGN

5.1 General

Storm water facilities are an essential part of the development of any municipality. As an area develops from rural uses to urban uses, culverts and drainageways that were adequate for rural runoff become overloaded, causing flooding that frequently results in property damage. The primary functions of an urban storm water system are to protect the quality of a community's water resources and to reduce economic loss and inconvenience due to the periodic flooding of streets, buildings and low-lying areas. The desirable economic endpoint is reached when the cost of environmental impacts and damage attributable to storm flooding plus the cost of surface water facilities reaches a minimum. Economy is not the only consideration, since well-designed surface water facilities also improve aesthetics, wildlife habitat, and recreational opportunities. Additionally, there is a minimum level of surface water management mandated at the state and watershed level.

Frequently, the downstream reaches of a drainage basin develop earlier than the remainder of the basin. When this occurs, drainage structures installed as part of the earlier development may be sized for the current runoff. A proper surface water management plan takes the entire drainage area with future development into consideration. Therefore, costly revisions to replace undersized lines in developed areas can then be avoided.

If a planned program of storm drainage construction is established and implemented in the early development stages of a drainage area, the most economical storm water system will be achieved. The substantial cost of duplication and waste arising from storm sewer construction or reconstruction after an area is developed can also be avoided. Trunk storm sewers and ponding areas can then be incorporated into a developer's plan as required.

Chapter 5 serves the following purposes:

- Section 5.2 outlines recent assessments of surface waters and how these affect Dayton.
- Section 5.3 provides background to guide hydrologic analysis of Dayton's surface water system.

- Section 5.4 provides a description of Dayton's existing and future surface water system of ponds, pipe, and overland connections provided in Map 2, the technical appendicies, and Chapter 6.

5.2 System Assessment

5.2.1 Water Quality Assessments

5.2.1.1 Clean Water Act Water Quality Assessments

A number of water bodies within and bordering the City of Dayton are listed in the state impaired waters list. Known as the 303(d) list for the applicable section of the federal Clean Water Act, these waters do not currently meet their designated use due to the impact of a particular pollutant or stressor. If monitoring and assessment indicate that a waterbody 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 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 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 and bordering the City of Dayton.

Table 5.1
303(d) 2006 Final List of Impaired Waters
Within or Bordering the City of Dayton

Water Body	**Reach Description**	**Year Listed**	**DNR #**	**Affected Use**	**Pollutant or Stressor**	**TMDL start/ TMDL complete**
Crow River	South Fork of Crow River to the Mississippi River	2004	N/A	Aquatic Recreation	Fecal coliform	2006/2012
Crow River	South Fork of Crow River to the Mississippi River	2002	N/A	Aquatic Life	Fish IBI[1]	2008/2017
Crow River	South Fork of Crow River to the Mississippi River	2002	N/A	Aquatic Life	Turbidity	2006/2021
Elm Creek	Headwaters (Lake Medina) to Mississippi River	2004	N/A	Aquatic Life	Low Oxygen	2006/2009
Mississippi River	Crow River to Northwest City Limits of Anoka	2002	N/A	Aquatic Recreation	Fecal coliform	2008/2015
Mississippi River	Crow River to Northwest City Limits of Anoka	1998	N/A	Aquatic Consumption	Mercury, FCA[2]	1999/2011
Mississippi River	Crow River to Northwest City Limits of Anoka	2002	N/A	Aquatic Consumption	PCB[3], FCA[2]	2002/2015
Rush Creek	Headwaters to Elm Creek	2002	N/A	Aquatic Life	Fish IBI[1]	2006/2009
Diamond Lake	N/A	2006	27-0125	Aquatic Recreation	Excess Nutrients	2013/2016
French Lake	N/A	2004	27-0127	Aquatic Recreation	Excess Nutrients	2010/2014

Notes:
1. Index of Biotic Integrity (IBI) is a scientifically validated combination of measurements concerning fish communities.
2. Fish Consumption Advisory (FCA) is not an independent pollutant or stressor.
3. Polychlorinated Biphenyl (PCB) is any of a group of compounds often found in industrial waste.

The absence of a water body from the 303(d) list does not necessarily mean the reach or basin is meeting its designated uses. It may be that the waterbody has either not been sampled or there are 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.

Most likely the ECWMC will be the lead agency charged with developing a TMDL for Elm Creek, Rush Creek, and Diamond Lake. The French Lake watershed is entirely within the City of Dayton so the City may take the lead on the French Lake TMDL or the Elm Creek WMC may take the lead because French Lake is a tributary water to Elm Creek, and therefore potentially related to the Elm Creek TMDL. The TMDL approach for the Crow River and Mississippi River will likely be regional in nature, encompassing many water management organizations, as these reaches drain relatively large areas. It is probable that once a TMDL plan is in place for any of these water bodies this LSWMP will have to be amended to incorporate the requirements of the TMDL.

A TMDL study, "Crow River Watershed – Mainstem & Lower North Fork - Conventional Pollutants", began in 2006 for the Crow River. This TMDL will address fecal coliform and turbidity in the Crow River mainstem reach adjacent to the City of Dayton, listed previously in Table 5.1.

Few other TMDLs have been completed or are in process within Minnesota – only the Crow River TMDL is in progress among those identified within or bordering the City of Dayton. As shown in Table X.1 the first TMDL implementation plans are due in 2009 for low oxygen and fish IBI in Elm and Rush Creeks respectively.

5.2.1.2 Elm Creek Watershed Management Commission Water Quality Assessments

Through its own monitoring efforts and those of the Citizen Assisted Monitoring Program (CAMP) run by the Metropolitan Council, the ECWMC has been collecting water quality data in Dayton since 1980. Diamond, Dubay, and French Lakes have been monitored intermittently by either the ECWMC or CAMP. Historical water quality data, including parameters like temperature, Chlorophyll a, and Total Phosphorus concentration and Secchi transparency, are maintained by the ECWMC. Recent water quality data is summarized for these lakes in the ECWMC's annual reports.

Concern for the overall water quality of the following waterbodies within Dayton was acknowledged in the ECWMC's 2003 Elm Creek Watershed Management Plan (ECWMP):

- Hayden Lake
- Diamond Lake
- Goose Lake
- Elm Creek
- Crow River

These waterbodies of concern were identified based on City, ECWMC, and public input. The 2003 ECWMP outlines a number of corrective actions to address water quality issues within these waterbodies.

- For Hayden Lake and Diamond Lake, these corrective actions are to complete a water quality study for each lake and then complete water quality improvements for each based on the studies. Because these lakes are entirely within the City of Dayton, the ECWMP states that potential funding sources for these studies and improvements would come from the City of Dayton and grants with no funding coming from the ECWMC. The timeline for these corrective actions are based on funding availability. The City of Dayton would need to take the lead role in implementing the corrective actions outlined in the ECWMP.
- Goose Lake is within Dayton, Champlin, and Maple Grove. The corrective actions for this lake are to complete a water quality study and then complete water quality improvements for each based on the study. The ECWMP states that the funding for the study would come from ECWMC's general fund and grants. Potential funding for the water quality improvements would come from the ECWMC, the local communities, and the Three Rivers Park District. The timeline for these corrective actions are based on funding availability. The ECWMC shall undertake these corrective actions as funding becomes available.
- For Elm Creek, the ECWMP gives the following corrective actions: complete water quality improvement study, update study on erosion problems, and complete water quality improvements. Potential funding sources for these corrective actions are the ECWMC, grants, Three Rivers Park District, and local communities. The timeline for these corrective actions are based on funding availability. The ECWMC shall undertake these corrective actions as funding becomes available.

5.2.1.3 United States Geological Survey Water Quality Assessments

The United States Geological Survey (USGS) maintains a gauging station (Station No. 05287890) on Elm Creek within the City of Dayton. The gauge is located within the Elm Creek Park Reserve at the Elm Creek Road bridge crossing. Besides the water quantity data described below in Section 5.2.2.3, manual and automatic samples are taken near the gauging station during rain events and analyzed for a number of water quality parameters. This data is maintained by both the USGS and the ECWMC.

5.2.1.4 Minnesota Pollution Control Agency LUST Sites

The Elm Creek WMC plan identifies several leaking underground storage tank (LUST) sites within the City of Dayton. The MPCA has jurisdiction in management and enforcement of remediation investigations and actions towards LUST sites. A search of the MPCAs Underground Storage Tank Search website revealed seven LUST sites within the City of Dayton. Each of these seven sites have been granted complete site closure by the MPCA. According to the MPCAs guidance documents, site closure means that no further investigation and/or remediation is necessary to protect receptors, even though some petroleum contamination may remain.

5.2.2 Water Quantity Assessments

5.2.2.1 ECWMC Water Quantity Assessments

Elm, Diamond, and Rush Creek Erosion Problems

The ECWMC determined that bank stabilization and erosion control is a very high priority issue in its 2004 ECWMP and therefore funded the Elm Creek Channel Study that commenced in 2005 and is currently in progress. The ECWMC commissioned this study because there is concern that the current level of rate controls required for new development may not be adequate to protect the stream channels in the watershed from current and future development pressure.

One of the goals of this study is to determine stable bankfull flow conditions for reaches of Elm, Rush, and Diamond Creeks, many of which are in the City of Dayton. Bankfull flow is defined as the maximum amount of discharge that a stream channel can carry without overflowing and is often the discharge that has the most impact on channel stability.

A second goal of the study is to determine the actual rainfall events that create bankfull flow conditions. Based on this information, the study may recommend changes to current rate control requirements that could provide a better level of protection for stream stability within the ECWMC and the City.

Any recommended management changes borne of this study would likely address low flow rate control requirements for new developments. It is possible that this LSWMP would be amended to incorporate any new management changes required by the ECWMC that stem from the Elm Creek Channel Study.

The ECWMP states that erosion is a concern in Diamond Creek. The ECWMP lists as a CIP item to undertake a bank stabilization and erosion control project within Diamond Creek based on a study. The City will work collaboratively with the ECWMC and the Three Rivers Park District to assist in implementing this CIP item. The City anticipates that the ECWMC will take the lead on these projects.

Flood Studies

The ECWMC 2003 ECWMP also identified and assessed a number of water quantity issues for its member communities. The adequacy of water quantity related data was assessed and French and Diamond Lakes were identified as needing flood studies. Currently, the ECWMC would take the lead in searching for funding and prioritizing this work but the party or parties responsible for developing the data is unknown. As stated in the ECWMP:

> *this lack of data stems from a lack of funding to develop these information resources. The Commission will attempt to identify funding options and*

alternatives and prioritize this work as part of the implementation of this Plan. It is unknown which parties will be responsible for developing these data.

The City agrees with the Elm Creek WMC that a flood study be done to establish base flood elevations for the flood areas near French Lake, Diamond Lake, and the non-park areas of Diamond Creek. These flood areas are indicated as Zone A on the FEMA flood insurance rate maps. Whereas these Zone A flood areas are wholly within the City of Dayton, the drainage areas for these flood areas cover multiple jurisdictional entities such as the City of Dayton, Hassan Township, and the City of Rogers. Since the drainage area covers multiple jurisdictional areas, the City of Dayton will cooperate with the interjurisdictional agency that would lead the flood study for these areas.

In addition, most of this area is not scheduled to be developed before 2020 as provided in Dayton's 2020 Land Use Plan. However some areas on the west and north sides of French Lake are scheduled to be developed as residential areas by 2020. The City's current policy toward managing BFEs in Zone A flood areas is to require developers to submit CLOMR-F, LOMR-F, CLOMA, or LOMA applications for City review and acknowledgement. The developer is then responsible for submitting the application to FEMA for approval.

5.2.2.2 USGS Water Quantity Assessments

The USGS has maintained an Elm Creek gauging station in the Elm Creek Park Reserve since 1979. The gauge collects daily stream flow data including stage and discharge. Historical statistical data collected at this gauge are available from ECWMC and USGS publications. Real-time gauge readings are available from the USGS and can be found at the following web address: http://waterdata.usgs.gov/nwis/uv?05287890.

5.2.2.3 FEMA Flood Insurance Studies

A Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) was completed for Hennepin County, including the City of Dayton, in 2004. This report identifies the boundaries of basin floodplains and channel floodways and floodplains within the City including the Mississippi River, the Crow River, Elm Creek, Rush Creek, and Diamond Creek. Copies of the FIS and Flood Insurance Rate Maps (FIRMs) are available from the City or from FEMA.

5.2.2.4 Hennepin Conservation District Study

The report title Flood Characteristics of Upland Storage Areas and Lakes by the Hennepin Conservation District identified three upland storage areas within the City of Dayton. These upland storage areas are, according to the report, "important for preservation in order to minimize the potential increase in flood discharges and elevation along the downstream tributaries." These areas have significant temporary flood storage potential. The areas are identified as Upland Storage Areas 1, 2, and 4 in the report. The locations of these areas are indicated on Map 2 of this LSWMP. Table 5.2 provides the flood storage volume that must be maintained to provide the flood protection that these areas provide.

Table 5.2
Flood Characteristics of Upland Storage Areas*

Upland Storage Area	100-yr, 10-day Snow Melt Event			
	Elevation (ft)	Storage (ac-ft)	Discharge (cfs)	Time to Peak (hrs)
1	880.4	449	248	146
2	870.4	54	261	146
4	973.6	292	45	138

*Data from Flood Characteristics of Upland Storage Areas and Lakes; Hennepin Conservation District.

5.3 System Modeling Discussion

As part of this LSWMP, a citywide hydrologic and hydraulic model was constructed to guide City planning for its future storm sewer infrastructure. Trunk storm sewer, regional ponds, and lift stations were preliminarily sized, sited, and priced with information produced by the model. Preliminary storm sewer infrastructure design will ensure that the City can plan for sufficient funding to safely route future flood flows.

Storm water 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.

The Dayton LSWMP used return frequency of the 100-year, 24-hour (type II distribution) event for overland drainage and pond storage design.

A 100-year, 24-hour frequency event (5.9 inches in 24 hours for Hennepin County) 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.

As development occurs in Dayton, actual storm sewer design should use the rational method and a 10-year minimum recurrence for lateral, or local, systems in residential and commercial areas. This implies that no street, parking lot, or backyard ponding would occur for the 10-year design event. Trunk facilities should be analyzed and designed to accommodate the 100-year ponded discharges plus 10-year rational flows from areas that enter the trunk to be carried to the next storage area downstream.

In general, complete protection against large, infrequent storms with return intervals greater than 100 years is only justified for important flood control projects. For most developing areas like Dayton, the cost of constructing a large capacity storm drainage system (for events greater than the 100-year) is much greater than the amount of property damage that would result from flooding caused by a larger than 100-year event occurring in a system designed for the 100-year event.

The excess runoff caused by storms greater than the 10-year will be accommodated by transient street ponding and overland drainage routes prior to discharge to a pond. Providing areas for this short-term flooding and overland drainage reduce flood damage due to larger than design events. Provisions should be made to provide or preserve overland drainage routes for emergency overflows.

A number of methods have been developed to determine the expected maximum rate of runoff from a known area for a specific design storm, given land use and soil moisture conditions. The preliminary trunk storm sewer and storm water basin design presented in this plan is based on the HydroCad computer program. HydroCAD storm water 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. All analyses performed within the context of this report have been conducted using Type II storm distributions.

The modeling involves the selection or computation of a time of concentration and a runoff coefficient. 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. As the storm water runoff enters the system, the flow time in the storm sewer is then added to the time of concentration, resulting in a longer time of concentration and thus lower average rainfall intensity as the flow moves downstream from the initial design point.

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) for use in HydroCad. The CN varies from 58 for parks to 98 for asphalt and concrete surfaces. 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.

Table 5.3 provides 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 5.3. For other types of land use not identified in the table, SCS Technical Release 55 (TR-55) curve numbers should be used.

As noted earlier, the predominant hydrologic soil group (HSG) within the study area is HSG B with HSG A dominating in the northeast area of the City. Pockets of HSG C and D exist in low areas and drainage ways outside the northeast area. Table 5.3 CN values reflect HSG A and B. The HydroCad modeling of this plan assumed a HSG A or B for the entire developable portion of the City because of developable portions of the City would likely be located outside low areas and drainage ways. To the extent that soils fall into the C or D categories they should be modified accordingly. The CN values also 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 5.3
Typical Curve Numbers

Land Use Type	CN Value	
	HSG A	HSG B
Wetland or Woods/grass	32	58
Park	39	61
Low Density Residential (30% impervious)	57	72
Medium Density Residential (65% impervious)	77	85
Commercial (85% impervious)	89	92
Industrial (72% impervious)	81	88
Ponds	100	100

5.4 Limitations to Discharge of Storm Water

5.4.1 Potential Non-Degradation Requirements

Nondegradation requirements for discharges to all waters of the state are regulated by Minnesota Rule 7050.0185, and it is being brought into the NPDES MS4 Permit for 30 cities (called “selected MS4s”) with most of them in the Twin Cites Metropolitan area. These cities are required to perform a nondegradation review, and must show no significant increase in storm water runoff and pollutant loading since 1988, or must demonstrate what past, present, and future best management practices will be reasonably required to return storm water runoff to 1988 levels. As part of this effort, these MS4 cities are required to complete an assessment so that the MPCA can determine if the requirements of the nondegradation rules are being met.

The City of Dayton is currently not required to perform a nondegradation review as part of its NPDES MS4 Permit. However, nondegradation requirements could be extended to Dayton's NPDES MS4 Permit sometime in the near future. If this would be the case, the City would be required to complete a nondegradation review to assess all significant new or expanded discharges since 1988. After such a review the City of Dayton may find more stringent storm water discharge requirements for the entire city with respect to pollutant loading and runoff volume so as to meet the requirements of nondegradation for new or expanded discharges to all waters. The system design in this LSWMP does not address nondegradation review requirements as required for selected MS4s since it is not required at this time under Dayton's NPDES MS4 permit.

5.4.2 Outstanding Resource Value Water – Mississippi River

The City of Dayton is required to meet storm water discharge requirements for the portion of the Mississippi River designated as an Outstanding Resource Value Water (ORVW). The discharge requirements rest on the basic premise that new or expanded discharges are not allowed to be discharged to the Mississippi River ORVW unless there are no prudent and feasible alternatives to the discharge. New discharge means a discharge that was not in existence on the effective date the ORVW was designated as such. Expanded discharge means a discharge that changes in volume, quality, location, or any other manner after the effective date the ORVW was designated as such. The drainage districts that drain directly to the ORVW are given in the section 5.5 System Description.

The determination of new or expanded discharges is an activity that the City will need to pursue as an implementation item related to their Storm Water Pollution Prevention Plan as discussed in Chapter 6, Implementation. With respect to the system design, this LSWMP describes a flood control and flood routing system that is independent of ORVW considerations. The design storm for this trunk system is the 100-year 24-hour rainfall event which has a 1% probability occurrence interval. The effect of 100-year rainfall event on an average annual runoff volume and pollutant loading is relatively insignificant.

Landlocked basins were analyzed differently. In cases where landlocked regional basins currently exist, the allowable discharge for a proposed regional pond was modeled to be from storm events with probability occurrences less than the 10-year event. Landlocked basins would not discharge to the Mississippi River ORVW for rainfall events with probability of occurrence greater than the 10-year event.

The design storm event criteria for ORVW discharges for landlocked basins will be assessed as part of the assessment required by Dayton's NPDES MS4 permit, as discussed in Chapter 6, Implementation.

5.5 System Description

The surface water management system proposed for development has been designed on the basis of the 2020 landuse plan as provided in the 2001 Comprehensive Plan. The City of Dayton was divided into 5 watersheds, each with their specific abbreviation:

- Crow River - CR
- Diamond Creek - DC
- Elm Creek - EC
- Mississippi River - MR
- Rush Creek - RC

These watersheds were further divided into drainage districts which generally were grouped according to location within a particular watershed, such as east, west, north, south, etc. or the proximity to a water body such as a lake or river. The drainage districts and their abbreviations are indicated in Table 5.4.

Table 5.4
Drainage Districts

Drainage District	Abbreviation
Crow River	CR
Diamond Creek – Diamond Lake*	DC-DL
Diamond Creek – French Lake	DC-FL
Diamond Creek – Central	DC-C
Elm Creek – West	EC-W
Elm Creek – South	EC-S
Elm Creek – East	EC-E
Elm Creek – North	EC-N
Elm Creek – Central	EC-C
Mississippi River – Northwest	MR-NW
Mississippi River – North	MR-N
Mississippi River – Northeast	MR-NE
Mississippi River – Shoreline	MR-SL
Mississippi River – Landlocked	MR-LL
Rush Creek – West*	RC-W
Rush Creek – North	RC-N
Rush Creek – East	RC-E
Rush Creek – Landlocked	RC-LL

*Includes drainage areas located in Hassan Township

Each of the drainage districts is further divided into catchments, which are numbered to differentiate them from other catchments. For example, RC-N4 would be catchment #4 of the North drainage district of the Rush Creek watershed. In some instances, catchments are further divided as indicated by a decimal extension of the catchment number. For example RC-W1.3 would be subcatchment 3 of catchment 1 of the West drainage district of the Rush Creek watershed.

The areas of all catchments are presented in Appendix A and their boundaries are shown on Map 2. Trunk storm sewer locations and ponding areas are also shown on Map 2. Proposed constructed regional ponds are indicated by a triangle on Map 2. Existing basins, whether natural or constructed, are indicated as a triangle within a blue outline.

Trunk storm sewer is defined in this plan as storm pipe that carries discharge from a regional pond or storm sewer that drains one catchment into another upstream of a regional pond. Therefore, trunk piping is not typically shown in individual catchments that are located in the uppermost reaches of a drainage district. The intention of this LSWMP is for the developer to provide the required storm sewer and conveyance for routing to a regional pond for a particular catchment. Catchments were sized to be on the order of approximately 100 acres. Exceptions to this general criterion were necessary in some circumstances, such as the presence of large wetland complexes or as dictated by topography and drainage patterns. The catchment size of 100 acres was deemed a reasonable and typical area to provide the level of detail appropriate to this LSWMP.

Regional ponds were located in the downstream area of catchments that provided a point of focused drainage so that the regional pond would collect all the drainage from the catchment. Proposed constructed regional ponds and trunk discharge pipe were sized to provide a four to five foot bounce for the 100-year event. Bounce for regional ponds utilizing existing natural basins was designed to be less than four feet with consideration given to the wetland type.

In those catchments that did not allow for the location of a single regional pond, a regional pond and trunk pipe is not shown. In such a case, the developer shall be required to provide the necessary conveyance and storage to meet the requirements and standards of this plan. This situation typically arises in catchments that encircle a large wetland area or a lake, or in catchments that parallel and encompass a section of stream.

It should be understood that the wetland protection standards of this LSWMP, as well as state and watershed guidelines, will limit the use of individual wetlands for flood storage. So, while it is the method of this LSWMP to preliminary size and site regional storage within wetland areas, limitations to this practice most certainly will occur. The exact limitations to this practice cannot be determined based on the wetland information summarized in Map 1. In the future, exact limitations to this practice will be determined through a function and values assessment of each wetland. These function and values assessment may determine that only a portion of the LSWMP storage can be provided for a particular catchment. In such cases the storage not obtained in the wetland shall be constructed in other locations, usually upland areas adjacent to and upstream of the wetland.

For those catchments that would rely on individual developer ponds rather than rely upon regional ponding as indicated in this plan, discharge rates of the developed condition should be limited to those rates that would be generated from land cover conditions that were typical of pre-agriculture conditions, such as a woods/grass combination (CN = 58 for HSG B). In no case shall the 100-year discharge rate shall not exceed 0.55 cfs/acre for

the 100-year, 24-hour rainfall event because the trunk system design in this plan assumes that a pre-agriculture discharge rate would not exceed this normalized rate.
For those catchments in the model that rely on non-regional development ponds rather than discharge to a regional pond, the HydroCad model in this plan simulates local pond discharge rates by lengthening the time of concentration to account for the lag time associated with a detention pond or multiple detention ponds. The time of concentration was adjusted to meet the 0.55 cfs/acre discharge rate criterion.

Limiting discharge rates from catchments to pre-agriculture conditions is consistent with other runoff management initiatives and requirements such as no increase in volume and discharge rate for the Outstanding Resource Value Water of the Mississippi River (Minnesota Rule 7050.0180) and nondegradation requirements for all waters (Minnesota Rule 7050.0185), as discussed earlier. Furthermore, limiting discharge rates to pre-agricultural conditions will help to achieve the ECWMCs primary goal of improving stream conditions within Elm Creek, Rush Creek, and Diamond Creek.

The trunk storm sewer conveyance system is broken into segments. Each segment is bounded a pond or a node. These points identify the addition of flow into the system from pond outflows or catchments. The points are identified in the same manner as the catchments, but add the letter P (for pond) or N (for node) at the end of the particular catchment designation.

The design flow and size of the existing and proposed trunk storm sewers are presented in Appendix B. The pipe sizes and design flows that are indicated for each segment of the proposed system are based on an assumed pipe grade. While the pipe size and grade can be changed in the final design, the required design flow of each segment should only be changed after additional engineering analysis.

Pond data, including tributary area, storage volume, normal and high water levels, peak outflow rate, and pond area, are presented in Appendix C. Peak pond outflow rates given in Appendix C are based on discharge through either a pipe or special outlet control structure with the pond at the High Water Level (HWL). The storage volume and outflow rate of a pond are attributes that are important to preserve in order to successfully maintain the integrity of the storm drainage system. To best suit a proposed development, a final design may alter the pond areas and water levels, while maintaining specified rates and volumes. When wetlands are utilized to provide rate control, adjustments to the existing outlet elevation, maximum bounce, and inundation period must be in compliance with the standards established in the Chapter 4 of this plan, Wetland Management Plan.

Appendix D lists the proposed pond and storm sewer costs for each drainage district. Refer to the Map 2 at the end of the report for trunk storm sewer, pond locations, and drainage districts boundaries. The following sections describe each drainage district in detail.

Diamond Creek (DC) Watershed

<u>Diamond Creek - Diamond Lake (DC-DL) Drainage district</u>
The Diamond Creek – Diamond Lake (DC-DL) drainage district occupies the west central area of the City and is approximately 2,591 acres in size. The DC-DL drainage district, including an area approximately 1,278 acres west of the City limits in Hassan Township and Rogers, drains to Diamond Lake directly or via Grass Lake. Diamond Lake directly feeds Diamond Creek which flows southeast into Elm Creek near the east central portion of the City. This drainage district is currently dominated by agriculture with small pockets of rural residences and homes along the north side of Diamond Lake.

The area in Rogers that drains to Grass Lake are nearly fully developed with a mix of industrial, commercial, and low density residential landuses. The area in Hassan Township that drains to Grass Lake is predominantly agricultural.

Some undeveloped areas of the DC-DL drainage district are projected to develop as low and medium density residential near Diamond and Grass Lake by 2020. Other undeveloped areas are designated urban reserve, and will develop after 2020. The hydrologic modeling and appendicies of this LSWMP assume existing landuse conditions for Hassan Township in catchments DC-DL2 and DC-DL3. The HWLs reported in the appendicies for Grass Lake and Diamond Lake reflect this existing landuse condition in Hassan Township. However, if development would occur in Hassan Township in the future, potential hydrologic effects in Dayton could be an increase in discharge rate from the surface outlet of Grass Lake to Diamond Lake and an increase in the HWL of Grass Lake and Diamond Lake. An increase in HWL of Diamond Lake could cause an increase in discharge rate to Diamond Creek. If development does occur in Hassan Township, these developments will be required to meet the requirements and standards of the Elm Creek Watershed Management Commission which should help prevent these potential hydrologic effects within Dayton.

<u>Diamond Creek – French Lake (DC-FL) Drainage district</u>
The Diamond Creek – French Lake (DC-FL) drainage district is located in the west central area of the City and occupies approximately 921 acres. This drainage district drains directly to French Lake. French Lake discharges north to Diamond Creek via a series of large wetlands and drainage ditches south of Diamond Lake. The existing area consists primarily of agriculture, wetlands, and a trailer park along I-94.

By 2020, the undeveloped areas of the DC-FL drainage district are projected to develop as commercial, industrial and medium density residential north of I-94 and medium density residential to the west and north of French Lake. The land bordering French Lake to the east will remain undeveloped as urban reserve.

<u>Diamond Creek – Central (DC-C) Drainage district</u>
The Diamond Creek – Central drainage district, located in the center of the City, occupies approximately 2,494 acres and drains directly to Diamond Creek. Diamond Creek flows eastward and eventually discharges to Elm Creek at the eastern end of the DC-C drainage

district. The DC-C drainage district is almost completely undeveloped and is dominated by the Elm Creek Nature Preserve and includes agriculture, wetlands and a small portion of rural residential landuse.

By 2020, a very small portion of the drainage district is projected to develop as low density residential. The large majority of the DC-C drainage district is designated as urban reserve and will remain undeveloped in the current to 2020 timeframe.

Rush Creek (RC) Watershed

Rush Creek – West (RC-W) Drainage District
The Rush Creek – West drainage district is approximately 917 acres and is situated in the southwest corner of the City, including a small area to the west of the City in Hassan Township. The drainage district is bisected by I-94 and Highway 169. The western portion of the drainage district drains directly overland and via a series of small wetlands to the North Fork of Rush Creek as it flows southeast from Hassan Township, across the southwest corner of the City, to Maple Grove. A small portion of the southwestern watershed drains through a ditch along I-94 to Maple Grove, eventually draining the North Fork of Rush Creek. The majority of the eastern portion of the drainage district drains to Maple Grove, and eventually Rush Creek as it flows east, through a large wetland on the Dayton-Maple Grove border. A drainage ditch collects outflow from this wetland, in addition to direct drainage from other small areas, and flows through Maple Grove to Rush Creek as it flows east.

The majority of the existing land use consists of agricultural fields interspersed with industrial and commercial developments north of I-94 that front the south side of Highway 169. Most of the existing undeveloped agricultural land within the drainage district is projected to develop as either commercial or industrial areas by 2020.

Rush Creek – North (RC-N) Drainage District
The approximately 671 acre Rush Creek – North drainage district is located in the south central area of the City, bordering Maple Grove on the south. The entire drainage district drains south to Rush Creek as it runs east towards the confluence of Elm Creek.

Rural residences border French Lake Road, which runs north and south through the drainage district. The remainder of the drainage district consists of large wetlands, agricultural fields and the Sundance Golf and Bowl golf course. The majority of the undeveloped land east of French Lake Road is projected to develop as low density residential by 2020. The undeveloped land to the west of French Lake Road is projected to develop by 2020 primarily as industrial with a large tract of medium density residential in the northwest. Another large tract of agricultural fields in the northwest corner of the drainage district, southeast of French Lake, will remain undeveloped as it is designated urban reserve up to the year 2020.

Rush Creek – East (RC-E) Drainage district
The Rush Creek – East drainage district is approximately 286 acres and is located along the Dayton-Maple Grove border. The RC-E drainage district occupies the center third of this border. Drainage from the drainage district flows overland to Maple Grove, eventually into Rush Creek as it flows east.
To the west of Fernbrook Lane, the drainage district is currently dominated by agricultural fields and woods. Land use in this area is projected to develop as a mix of low and medium density residential and commercial adjacent to Fernbrook Lane. The drainage district is occupied by the Elm Creek Park Reserve to the east of Fernbrook Lane and consists of woods and marshlands.

Rush Creek – Landlocked (RC-LL) Drainage Districts
The Rush Creek – Landlocked drainage district consists of a single 59 acre drainage area (RC-LL1). RC-LL1 is located south of the EC-W and north of the RC-N drainage districts. RC-LL1 drains overland directed to Dubay Lake, a land locked basin (PWI# 27-129). The drainage area consists of and is surrounded by agricultural fields. East and south of Dubay Lake, the drainage area is projected to develop as low density residential. The drainage area is projected to develop as parkland northwest of Dubay Lake.

Elm Creek (EC) Watershed

Elm Creek – South (EC-S) Drainage District
The approximately 414 acre Elm Creek - South drainage district is located in the south central region of the city. The drainage district drains east overland to a large wetland in Elm Creek Park Reserve that empties into Elm Creek.

The east central portion of the drainage district, comprising approximately one third of the drainage district area, consists of existing low density residential land use. The remainder of the existing drainage district is occupied by agricultural fields in the north and west and the Elm Creek Park Reserve in the south. The undeveloped agricultural areas outside of the Elm Creek Park Reserve are projected to develop as low density residential by 2020.

Elm Creek – West (EC-W) Drainage District
The Elm Creek – West drainage district comprises approximately 1474 acres in the center of Dayton, west of Hayden Lake. The drainage district drains directly to Elm Creek both overland and via large wetlands. Elm Creek flows into Hayden Lake directly downstream of the drainage district outlet.

The vast majority of the drainage district consists of agricultural fields interspersed with wetlands. Small pockets of low density residential areas currently occupy the southern portion of the drainage district. By 2020, the southern half of the watershed is projected to develop as low density residential. The remaining northern half is designated as urban reserve and will remain undeveloped in the current to 2020 timeframe.

Elm Creek – East (EC-E) Drainage District

The Elm Creek – East drainage district is approximately 280 acres and is situated in the southeastern corner of the City, bordered on the east by the City of Champlin and the south by the City of Maple Grove. The southern three quarters of the watershed drains directly to Goose Lake. Goose Lake drains south to Mud Lake which feeds Elm Creek south of the City in Maple Grove. The north quarter drains overland directly to Elm Creek within the Elm Creek Park Reserve.

The north quarter of the EC-E drainage district is currently occupied by a mix rural residential, low density residential, and agricultural land uses. Those undeveloped areas within the northern quarter are projected to develop as low density residential by 2020. The southern three quarters of the drainage district consist of the Elm Creek Park Reserve.

Elm Creek – North (EC-N) Drainage District

The Elm Creek – North drainage district is approximately 966 acres and is situated in the northeast portion of the City. This drainage district drains south, overland and via a large wetland, to Hayden Lake, which eventually outlets to Elm Creek.

Compared to most of the City, the EC-N drainage district is relatively well developed. The existing land use north of French Lake Road is dominated by low density residential interspersed with a few undeveloped tracts containing agricultural fields and woods. By 2020, the remaining undeveloped portions are projected to develop as low density residential. Hayden Hills Executive Golf Course and Dayton Elementary School are also situated in the drainage district north of French Lake Road.

Most of the drainage district south of French Lake Road is undeveloped woodlands occupied by Elm Creek Park Reserve. A small portion lies outside the park reserve but is designated as urban reserve and will remain undeveloped up to 2020.

There are many currently landlocked subcatchments of catchment EC-N3. The basins of these subcatchments are proposed to be routed to pond EC-N3.6P, where a lift station eventually discharges storm water to EC-N9P. Emergency overflow routing and freeboard standards will be crucial factors in the design and layout of developments for the subcatchments of EC-N3. These factors should be evaluated at the time of development design and review.

EC-N4P was designed as an infiltration basin. The basin is predicted to have sufficient capacity to retain the 100-year 24-hour storm event (SCS Type II) with zero surface discharge. Storm water improvements with respect to EC-N4P have been approved by the Elm Creek Watershed Management Commission as part of the Northeast Dayton Utility and Street Improvements project. Construction for the project is planned to start in late spring 2007.

Pond EC-N5P has been sized in this LSWMP to receive runoff from the golf course within the EC-N5 catchment. If this golf course were to develop in the future, the pond sizing will require redesign to accommodate the additional runoff from development of the golf course. Furthermore, the developer will bear the costs of the additional pond upsizing and trunk costs associated with development of the golf course. Pond EC-N5P has been oversized to accommodate a smaller bounce of the HWL because of the shallow grades in this part of Dayton and the invert elevation of the existing culvert that discharges from DNR wetland 27-223W to Elm Creek Park Reserve under French Lake Rd (129^{th} Ave. N.).

EC-N7.1P is a landlocked basin. To provide a means to drain this pond, a lift station with a forcemain has been designed to discharge to basin EC-N4P. These storm water improvements have been approved by the Elm Creek Watershed Management Commission as part of the Northeast Dayton Utility and Street Improvements project. Construction for the project is planned to start in late spring 2007.

The 2020 landuse for catchment EC-N7.2 is planned to be low density residential. Currently the catchment is rural residential. This LSWMP assumes that this catchment will develop as low density, as given on the 2020 landuse plan. Pond EC-N7.2P has been oversized to accommodate a smaller bounce of the HWL because of the shallow grades in this part of Dayton and the invert elevation of the existing culvert that discharges to Elm Creek Park under French Lake Road (129^{th} Ave. N.).

Elm Creek – Central (EC-C) Drainage District

The approximately 1557 acre Elm Creek – Central drainage district is located in the southeast quadrant of the City. The eastern part of the drainage district drains directly to Hayden Lake and to Elm Creek upstream of Hayden Lake. The western portion drains directly to Powers Lake which outlets to Hayden Lake.

The vast majority of the EC-C drainage district is located within the Elm Creek Park Reserve. A relatively smaller area on the eastern edge of the watershed is located outside of the Park Reserve and is projected to develop as low density residential by 2020.

Crow River (CR) Watershed and Drainage District

The Crow River Watershed is located in the northwest corner of the City and is approximately 718 acres in size. It consists of one drainage district. The northern area of this watershed is located at the confluence of the Crow and Mississippi Rivers and drains overland directly to the Crow. This northern area is fully developed with a mix of residential and commercial areas.

The southern portion of the CR Watershed drains overland west to Hassan Township and later the Crow River. Parts of the southern area of the watershed drain to Lake Laura which outlets overland to a large wetland area within sub-watershed CR-5 that also eventually drains to Hassan Township and the Crow River. The southern area of the CR Watershed is currently dominated by a mix of agricultural and rural residential land use.

The undeveloped areas of the CR Watershed are projected to develop primarily as low and medium density residential by 2020.

Mississippi River (MR) Watershed

Mississippi River – Northwest (MR-NW) Drainage District

The Mississippi River – Northwest drainage district, located in the northwest area of the City, southeast of the confluence of the Crow River and the Mississippi River, occupies approximately 1026 acres. The MR-NW drainage district drains to the Mississippi River overland and via a network of small channels. This district drains directly to the portion of the Mississippi River which is designated as an ORVW. The land use within the drainage district is currently a mix of rural residential, golf course, and agriculture.

By 2020, much of the MR-NW drainage district's agricultural land is projected to develop as low density and medium density residential. The existing golf course and rural residential areas will retain their current land use. In addition, the southeast area of the drainage district will remained undeveloped as urban reserve in the current to 2020 timeframe.

Mississippi River – Shoreline (MR-SL) Drainage District

The Mississippi River – Shoreline drainage district occupies approximately three quarters of the City's frontage along the Mississippi River. The MR-SL drainage district drains directly to the Mississippi River and is approximately 687 acres. The northwestern area of the drainage district, near the confluence of the Crow and Mississippi Rivers, is an older portion of the City and consists of a mix of low density residential and commercial areas. The area immediately adjacent to the Mississippi River, north of Dayton River Road, is a mix of low density and rural residential areas. Relatively large areas of agricultural land use exist south of Dayton River Road. This district drains directly to the portion of the Mississippi River which is designated as an ORVW.

Most of the development within the MR-SL drainage district is projected to occur to the south of Dayton River Road within the existing agricultural areas by 2020. These areas will develop primarily as low density residential. Scattered development of small, undeveloped parcels along the Mississippi River to low density residential is projected to occur. A sizeable portion of the southeast area of the district, including existing agricultural areas along the Mississippi, will remain undeveloped as urban reserve in the current to 2020 timeframe.

Mississippi River – North (MR-N) Drainage District

The Mississippi River – North drainage district, consisting of approximately 622 acres, occupies part of the north central region of the City. This drainage district is drained by an agricultural ditch to a culvert beneath Dayton River Road. This culvert empties down a steep grade to the Mississippi River. The upland region is sparsely occupied by large wetlands that provide temporary storm water storage before draining to the agricultural ditch. The existing land use in the drainage district is dominated by agriculture with intermittent wetland areas and tree lined property boundaries. This district drains directly to the portion of the Mississippi River which is designated as an ORVW.

The eastern half of the drainage district is projected to develop as low density residential by 2020. The western half is designated as urban reserve and will remain undeveloped in the current to 2020 timeframe. A very small area of the drainage district, adjacent to the river, which straddles Dayton River Road, is projected to develop as park by 2020.

Mississippi River – Northeast (MR-NE) Drainage District

The Mississippi River – Northeast drainage district occupies the northeastern corner of the City and borders the southern bank of the Mississippi River. The drainage district drains directly either overland or via storm sewer to the Mississippi. The eastern edge of the drainage district borders Champlin and drains overland through that city before discharging to the river. This district drains directly to the portion of the Mississippi River which is designated as an ORVW, with some exceptions. Catchments MR-NE5.1, MR-NE5.2, MR-NE5.3, and MR-NE9 do not drain to the ORVW portion of the Mississippi River because they discharge downstream of the ORVW.

The majority of the drainage district is developed as low density residential with small pockets of agriculture remaining. A small undeveloped area on the Champlin border is projected to develop as commercial by 2020. The balance of the scattered undeveloped agriculture land is projected to develop as low density residential by 2020.

The design and routing for basins MR-NE5.2P, and MR-NE5.3P were previously approved by the Elm Creek Park Commission as part of the Northeast Dayton Utility and Street Improvements project. However, this LSWMP provides expansion for MR-NE5.2P to account for additional development above what was anticipated in the Northeast Dayton Utility and Street Improvement project. In this LSWMP, the drainage area of MR-NE5.2P was modeled as fully developed according the 2020 landuse plan. This LSWMP has designed MR-NE5.2P to provide discharge rates for the 2-, 10-, and 100-year events to be the same or less than existing rates, just as was done for MR-NE-5.2P in the Northeast Dayton Utility and Street Improvements project.

It should be noted that basin MR-NE5.3P was referred to as EC-N4.4P in the Northeast Dayton Utility and Street Improvements project. The reason for the change was to reflect the watershed of which the catchment or basin resides for the proposed condition.

Catchment MR-NE6 is currently landlocked. This catchment is proposed to have a piped outlet from MR-NE6P that discharges to catchment MR-NE8 which then discharges to the Mississippi River ORVW. MR-NE6P is designed as an infiltration basin in this SWMP to take advantage of HSG type A soils in this area. MR-NE6P would only discharge via its pipe outlet for rainfall events with probability of occurrence less than the 10-year 24-hour rainfall event. MR-NE6P would not discharge to MR-NE8 for rainfall events with probability of occurrence greater than the 10-year event. MR-NE6P is assumed to be designed as an infiltration basin. Soil surveys indicate HSG A soils for catchment MR-NE6. An assumed infiltration rate of 0.5 inches per hour was chosen to be conservative. Emergency overflow routing and freeboard standards will be crucial factors in the design and layout of developments for MR-NE6 and catchments upstream of MR-NE6. These factors should be evaluated at the time of development design and review.

Mississippi River – Landlocked (MR-LL) Drainage District

The Mississippi River – Landlocked drainage district is separated into four separate drainage areas: MR-LL1, MR-LL2, MR-LL3, and MR-LL4. All four drainage areas are in the northern area of the City, south of the Mississippi River. MR-LL2, MR-LL3 and MR-LL4 are adjacent to one another while MR-LL1 is geographically isolated. These catchments would drain directly to the ORVW portion of the Mississippi River if their surface overflow routes would be overtopped. Catchments MR-LL2, -LL3, and –LL4 are not planned to be developed until after 2020 so they are not expected to have new or expanded discharges to the ORVW up to 2020.

Located in the north central area of the City northeast of Diamond Lake, drainage areas MR-LL4, approximately 99 acres, and MR-LL3, approximately 117 acres, drain to a single land locked basin (PWI # 27-124) that is bisected by North Diamond Lake Road and connected hydraulically via a culvert under the roadway. The basin has an area of approximately 18 acres south of Diamond Lake Road and an area of approximately 27 acres north of Diamond Lake Road. Drainage areas MR-LL3 and MR-LL4 are entirely comprised of agricultural fields and woods surrounding the basin. These drainage areas are designated as urban reserve and will remained undeveloped at least until 2020.

MR-LL2 is approximately 65 acres and located immediately north of MR-LL3. MR-LL2 drains to a land locked basin (PWI # 27-215) approximately 6 acres in size. The MR-LL2 drainage area consists entirely of agriculture and is designated as urban reserve until 2020.

MR-LL1 is located in the northwest area of the City, is approximately 88.2 acres in size, and is bordered on the north by Dayton River Road. MR-LL1 drains to a land locked basin (PWI # 27-287) approximately 7 acres in size. The MR-LL1 drainage area contains small areas of low density residential in the northern and southern areas. The remaining central area consists of agriculture. The undeveloped agricultural areas of the MR-LL1 drainage area are projected to develop as low density residential by 2020.

If the projected development occurs in MR-LL1, it is probable that a pipe outlet will have to be constructed to drain the currently land locked basin to the Mississippi River ORVW. This would be necessary to prevent flooding of nearby homes. In this LSWMP, MR-LL1 would only discharge via its pipe outlet for rainfall events with probability occurrences less than the 10-year 24-hour rainfall event. MR-LL1 would not discharge to the Mississippi River for rainfall events with probability occurrences greater than the 10-year event. The routing given on Map 2 shows the discharge pipe crossing Dayton River Road and then discharging to the Mississippi River. An alternate routing would route the discharge pipe to east of the MR-LL1P and keep to the south of Dayton River Road, where the pipe would eventually discharge into MR-NW8P. This alternate routing would have the advantages of not creating a new discharge point to the Mississippi River ORVW and preventing a new crossing under Dayton River Road. The disadvantage is that it would involve additional infrastructure and associated costs such as additional length of trunk pipe and a larger pond MR-NW8P to accommodate the extra flow volume.

5.6 Flooding Concerns within the City

Under existing conditions, MR-NE5.2 experiences flooding at the intersection of 133rd Avenue and Arrowood Lane. During large storm events, MR-NE5.2 bypasses overland to the south to the golf course in the eastern portion of EC-N5, flooding yards in the process. The eastern portion of EC-N5 is a landlocked catchment, and has no outlet. Another flooding area occurs in the central portion of EC-N4 where yards have occasionally became flooded. Another area of concern is the occassional flooding in the ditch at the intersection of South Diamond Lake Road and Evergreen Lane.

The City is making efforts to remedy these flooding concerns. Storm sewer will be provided to alleviate the flooding at the intersection of 133rd Avenue and Arrowood Lane by routing catchment MR-NE5.2 north to basin MR-NE5.2P. The flooding in the central portion of EC-N4 will be reduced by improvements to the drainage swale that drains to EC-N4P. To drain the ditch at the intersection of S. Diamond Lake Road and Evergreen Lane, a culvert will be installed to drain to the south to a new storm water detention pond, MR-NE5.3P. This pond will discharge to basin MR-NE5.2P.

Another area of flooding concern is the basin EC-N7.1P. The existing basin has no surface outlet, and it has occasionally flooded backyards of homes during the spring melt period and exceptionally heavy rains during the summer. On outlet will be provided for this basin by installing a lift station. A lift station will provide the means to regulate the basin water level for smaller storm events, and provide a way to draw down the basin for large storm events. The discharge point for the lift station's forcemain will be routed to the storm water basin EC-N4P.

The above remedies to the identificed flooding concerns will be implemented as part of the Northeast Dayton Utility and Street Improvements project which was previously approved by the Elm Creek Watershed Management Commission. The construction for the project started in spring 2007.

6. IMPLEMENTATION PLAN

6.1 General

This LSWMP provides a plan for expanding and managing the City's surface water system, and protecting key water resources in the City. The real measure of success of the LSWMP will be in its implementation. Implementation of the LSWMP covers a number of aspects, including:

- Administering regulations and programs
- Managing surface water as redevelopment and new development occur
- Implementing a public education program regarding storm water management
- Operating and maintaining the surface water system
- Constructing prioritized capital improvements
- Financing projects and programs
- Providing a process for future amendments to the LSWMP

6.2 Regulatory Administrative Responsibilities

It is the City of Dayton's intent that the Elm Creek WMC remain in its role as the review and approval authority for stormwater management in new development and redevelopment.

6.2.1 NPDES MS4 Permit Program

In 2006, the City revised and submitted its application for its General Stormwater Permit for Small Municipal Separate Storm Sewer Systems to the Minnesota Pollution Control Agency. The permit program's purpose is to minimize the discharge of stormwater runoff pollutants and to authorize stormwater discharge from the City's Municipal Separate Storm Sewer System (MS4).

Also in 2006, the City revised and submitted its Stormwater Pollution Prevention Program (SWPPP). The SWPPP identifies a combination of stormwater 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 City of Dayton SWPPP includes 56 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.

6.2.2. Electronic Stormwater System Map

BMP 3-1 of the City's SWPPP states that the City will develop an electronic map of the storm water conveyance system. The electronic map will be completed in 2008. The map will include the parts that make up the MS4 including items such as: ponds, streams, lakes, wetlands, structural pollution control devices, pipes and other conveyance systems, outfalls, groundwater discharge structures, overland discharge points, and other discharge points from the MS4. Discharge locations from diffuse flows will not be included on the electronic map.

6.2.3 Erosion and Sediment Control

As part of the NPDES MS4 permit requirements, the City is responsible to address the following erosion and sediment control items within the next 5 years:

1. Develop an ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under law.
2. Requirements for construction site operators to control waste, such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality.
3. Develop requirements for construction site operators to implement appropriate erosion and sediment control best management practices.

4. Develop procedures for site plan review which incorporate consideration of potential water quality impacts.
5. Update procedures for receipt and consideration of reports of noncompliance or other information on construction related issues submitted by the public.
6. Establish procedures for site inspection and enforcement of control measures.

6.2.4 Mississippi River Outstanding Resource Value Water Management

As stated in Chapter 2, the Mississippi River along most of Dayton's northern border is designated an Outstanding Resource Value Water (ORVW). The portion of the Mississippi River that is designated as an ORVW starts from the County State-Aid Highway 7 bridge in the City of Saint Cloud to the northwestern city limits of Anoka. Communications with staff at the MPCA indicate that any discharge with the potential to impact an ORVW must be evaluated which would include all discharges to the ORVW no matter the distance from the ORVW. The implications for the MPCA's view are that it is conceivable that discharges to the Crow River may be considered a discharge to the ORVW of the Mississippi River. MPCA staff stated the MPCA is committed to working with communities to determine whether the MPCA believes a discharge could be affecting ORVW waters.

As a starting point for managing discharges to the Mississippi River ORVW, BMP 7-3 of the City's SWPPP is to make an assessment of how the City's SWPPP can be altered to eliminate new or expanded discharges to the ORVW. An expanded discharge means a discharge that changes in volume, quality, location, or any other manner after January 1, 1988 or the effective date an ORVW was designated as described in Minn. R. 7050.0460 and 7050.0470. New discharge for an ORVW means a discharge that was not in existence on the effective date the ORVW was designated as described in Minn. R. 7050.0460 and 7050.0470. Even though ORVW was designated in 1984, the assessment must be developed for New or Expanded discharges produced from 1988 to 2020, as defined in the NPDES MS4 permit Part IX Appendix C, Section B.2.c.

The City will present the assessment, together with the proposed changes to the SWPPP, for public comment during the annual public comment period, prior to the first annual report required under Part VI.D. During the MPCA review, notice, and preliminary determination processes, the City will work with the MPCA, if appropriate, to respond to comments and/or revise the submittal materials to prepare them for final approval. After final determination by the MPCA, the City will modify and implement the SWPPP as per the approved submittal materials and as needed to meet the restricted discharge requirements for the ORVW. The end result of the assessment and SWPPP revisions is to establish standards for eliminating new and expanded discharges to the Mississippi River ORVW.

6.2.5 Preliminary and Final Platting Process

The City has established and fully implemented both a preliminary and final platting process. The implementation of applicable Goals and Policies (Chapter 3) are addressed throughout the preliminary platting process.

The preliminary platting process is outlined as follows:

1. Filing and Review of Application
2. Submission of Application to Planning Commission
3. Report of Planning Commission
4. Council Action, Approval or Denial

The final platting process is outlined as follows:

1. Filing of Application
2. Review of Application
3. Standard Form and Content Review
4. Certification and Financial Guarantee for Improvement Completion
5. Council Action, Approval or Denial
6. Recording (if approved)
7. Plat print to City Clerk/Treasurer
8. Record Plans

6.2.6 Floodplain Ordinance

The City has a current Floodplain Management Ordinance (Section 1001.08b). This ordinance states that the City is responsible for floodplain regulation within the City.

6.2.7 Shoreland Ordinance

The City has a current Shoreland Zoning Ordinance (Section 1001.08). This ordinance allows the City to regulate the subdivision, use, and development of the shorelands of public water within the City.

6.2.8 Mississippi River Corridor Ordinance

The City has a current Mississippi River Corridor Ordinance (Section 1001.07). According to the ordinance's language "The Mississippi River Corridor shall be managed as a multi-purpose public resource by continuing use of the river channel for transportation, by conserving the scenic, environmental, recreational, mineral, economic, cultural, and historic resources and functions of the river corridor, and by providing for the continuation and the development of a variety of urban uses within the river corridor where appropriate."

Requirements for the management, development, zoning, use, and site planning for land within the Mississippi River Critical Area Corridor are defined by this ordinance and the following: the Critical Areas Act of 1973; the Minnesota Wild and Scenic Rivers Act; the

Minnesota Environmental Policy Act of 1973; the standards and guidelines of Executive Order No. 79-19(as amended) dated February 26, 1979; and pursuant to Minnesota Statutes, chapter 103F and 116G and other applicable state and federal laws.

6.3 Design Standards

The City recognizes its responsibility to protect property and priority resources from adverse impacts due to new development and redevelopment. In order to minimize these impacts, the following design guidelines have been developed.

These design guidelines are consistent with the standards of the ECWMC as documented in the Elm Creek Watershed Management Plan (ECWMP). Amendments to the design standards contained within ECWMP may necessitate an update to the City of Dayton LSWMP. The City will review changes to the ECWMP design standards to determine when a LSWMP amendment is necessary.

6.3.1 Stormwater Conveyance Standards

The capacity of a storm sewer is dependent on the pipe slope, pipe diameter, and roughness of the inner surface of the pipe. Computations for storm sewer capacity have been based on Manning's equation. For the purposes of storm sewer design, a Manning's roughness coefficient (n) of 0.013 should be used for concrete storm sewer pipe and 0.024 for corrugated metal pipe. These roughness coefficients take into account typical losses due to bends and manholes in the system as well as the roughness of the inner pipe surface. Proposed trunk storm sewers shown on Map 2 and in Appendix B are designed to convey ponded flow only. Where local flows are added to the system, the cost for upsizing the pipe should be borne by the area contributing the additional flows.

Proper design of a storm sewer system requires that all pipes be provided with access through manholes for maintenance and repair operations. Spacing of manholes should be no greater than 400 feet for storm sewer lines 24-inches or less in diameter and 500 feet for storm sewer lines 24-inches to 30-inches in diameter. Intervals on larger diameter lines can be increased since the pipes are sufficiently large for a person to physically enter the storm sewer pipe itself for maintenance operations. Regardless of storm 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 10-year storm events, their performance must be analyzed for storms exceeding the design storm. It should be anticipated that surcharging of the system will occur when the design storm is exceeded. During surcharging, the system works as a closed conduit and the pipe network becomes 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 in 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.

The design of multiple low points on streets is desirable to reduce catch basin bypass and distribute street ponding. Ponding on streets must meet all of the requirements of the 100-year design criteria as a minimum. For safety reasons, the maximum depth should not exceed two feet at the deepest point, and the lowest exposed building elevation should be at least two feet above the high water level. The high water level for temporary street ponding is defined as the elevation to which water rises 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. Inlets should be placed and located to eliminate overland flow in excess of 400 feet on all streets or a combination of streets and swales. Additionally, inlets should be located such that 3 cfs is the maximum flow at the inlet for the 10-year design storm.

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

1. Inlet and outlet pipes of stormwater ponds should be extended to the normal water level whenever possible.
2. 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 dissipaters or stilling basins, but do require riprap protection.
3. Outfalls with velocities between 4 and 6 fps should include a designed riprap energy dissipation outlet.
4. 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.
5. Riprap should be provided at 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 riprap and reduce its stability. Riprap 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.
6. Overland drainage routes where velocities exceed 4 fps should be reviewed and approved by the City.

Open channels and swales are recommended where flows and small grade differences prohibit the economical construction of an underground conduit and in areas where an open channel will enhance the aesthetic qualities of an area. Whenever possible, a minimum slope of 2.0% should be maintained in unlined open channels and overland drainage routes. Slopes of less than 1.5% are difficult to construct and maintain and will require an underdrain system. 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.

Bioengineered reinforcement 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. Bioengineered reinforcement should be provided in areas where high velocities cannot be avoided. Where ditches are maintained, periodic cleaning is required to ensure that the design capacity is maintained. Therefore, all channels should be designed to allow easy access for equipment.

Both storm drainage facilities and sanitary sewer lines are designed to take advantage of natural draws and usually follow a ravine, creek or gully. As more area develops in the City, the total runoff in natural drainage ways may increase, and correspondingly peak water levels may rise. In certain areas, water could enter the sanitary sewer system, causing capacity problems and added costs for the treatment of stormwater.

Sanitary sewer manholes that could be subject to temporary inundation should be equipped with watertight castings, and precautions should be taken during construction to prevent the entrance of stormwater. Sanitary manholes located near ponding areas should be raised above the 100-year high water level and the adjacent areas filled when access is required at all times. If access is not required, watertight castings should be installed. Future storm drainage construction should include provisions for improving the watertightness of nearby sanitary sewer manholes. All newly constructed sanitary manholes in the vicinity of ponding areas and open channels should be waterproof.

6.3.2 Stormwater Ponding Standards

Stormwater ponding areas are an essential part of any storm drainage system. These areas provide locations where ponding caused by restricted flow can be allowed, thereby minimizing flood damage. Numerous natural depressions found throughout Dayton have been incorporated into the Surface Water Management Plan as ponding areas. Other ponding sites utilize existing or proposed roads that cross drainage routes to detain runoff and reduce peak flows downstream. The effective use of ponding areas enables the installation of outflow storm sewers with reduced capacities, since the duration of the design storm's runoff is effectively increased over the total time required to fill and empty the ponds.

This LSWMP focuses on the development of regional water quantity ponds to be located within both existing low areas and natural drainageways. The goals for regional ponds are as follows:

1. To utilize existing low areas and drainageways for water quantity ponding.
2. To reduce the necessity for every development to construct on-site water quantity ponds.
3. To focus the construction of ponds and their maintenance within the City.
4. To provide an environmental and recreational benefit to the community by protecting the natural stream systems within the City.
5. To focus funding of water quantity/quality ponds for the environmental and recreational benefit of the entire community.

Where feasible, local and regional water quality ponds should be designed "off-line" from the upstream watershed rather than "on-line". This is to prevent the flushing of water quality ponds prior to "treatment" with water from the upstream watershed that has already passed through water quality ponds. The residence time of water within a water quality pond is important to achieve sedimentation and allow for biological uptake of nutrients between storm events.

The incorporation of Conservation Design techniques such as reducing impervious area and conserving natural open space will help to reduce the size of regional stormwater detention facilities by reducing runoff volumes. Additional information regarding Conservation Design practices can be found in the Minnesota Stormwater Manual.

<u>Critical Duration Storm Event</u>

Storm water ponds will be required to accommodate the 100-year critical duration event. The critical duration storm event is defined as being the 100-year, 24-hour NRCS Type II storm distribution, the 100-year, 10-day runoff, and the 100-year, 10-day snowmelt.

<u>Pond Outlets</u>

Due to rate control requirements, particularly for 2-year storm events, flow restriction smaller than a 12-inch pipe will be needed on several ponds. Where pipe less than 12-inches in diameter is called for, a grated emergency overflow (EOF) manhole should be provided at or above the 100-year HWL. A change in pipe size should occur at the EOF manhole to provide added pipe capacity. When an orifice is used as a 2-stage outlet, the top of the baffle wall containing the orifice should be set at the 5-year pond HWL. To prevent short-circuiting, the distance between major inlets and the normal outlet shall be maximized.

Pond outlet structures shall be designed to skim the surface flow to remove floatables for up to the 2-year event. Skimmers can prevent some pollutants and floating debris from moving downstream. The design velocity of water flowing through the skimmer opening should be no greater than 1.5 fps for the 5-year, 24-hour storm event to prevent suction of bottom sediment or floating debris.

Landlocked depressions that presently do not have a defined outlet and do not typically overflow may be allowed a positive outlet provided the downstream impacts are addressed and applicable requirements are met such as those in the NPDES MS4 permit, the City of Dayton's SWPPP, and state and federal rules and regulations.

Pond Grading and Buffer

The side slopes of any pond should be no steeper than 4' horizontal to 1' vertical (4:1). Where possible, a 10-foot maintenance bench at a 10:1 slope should be placed beginning 1-foot above the pond's outlet elevation. This bench should be tied into an access path connecting to a street, parking lot, or other point of entry for maintenance vehicles. A 10-foot aquatic bench should be placed just below the outlet elevation around the entire perimeter of the pond. The bench should be placed at a 10:1 slope to provide a flat slope for safety and a place to plant emergent vegetation. In areas where sandy soils and infiltration are expected, limiting the maximum pond slopes to 5:1 and seeding the slopes with native vegetation is recommended. This will improve the aesthetics around the pond and "mask" fluctuating water levels.

A protective buffer strip of vegetation surrounding the pond shall be required. The minimum width of the buffer shall be 25 feet or as required by the City Engineer.

Pond Morphology

- The permanent pool volume ("dead storage") below the normal outlet shall be greater than or equal to the runoff from a 2.5 inch storm over the entire contributing drainage area assuming full development. The permanent pool average depth (basin volume/basin area) shall be > 4 feet, with a maximum depth of < 10 feet.
- The bottom of ponds should be over-excavated to compensate for erosion and sedimentation.
- To prevent short circuiting, the distance between major inlets and the normal outlet shall be maximized.

Pond Bounce

Pond bounce is defined in this LSWMP as the elevation difference between the pond NWL and 100-year HWL. The maximum allowable pond bounce is 10 feet, although it is more desirable to provide less pond bounce to minimize the period of inundation for surrounding vegetation. Additional restrictions apply to bounce in wetlands according to their susceptibility category as determined by a functions and values assessment.

Pond Freeboard

The following freeboard criteria apply to all stormwater facilities including those with emergency overflows and landlocked areas, as well:

- The low floor elevation of all new structures will be a minimum 2 feet above the peak water surface elevation for the 100-year critical storm event. The low structure elevation will be at least 1 foot above the as-built emergency overflow elevation from any area where surface water is impounded during a flood event.

The low structure elevation is defined as the lowest ground elevation adjacent to the structure. Under no circumstances shall the low floor elevation be below the planned normal water level of a stormwater basin or other naturally occurring water body or water course.

- Freeboard requirements for land-locked areas - Where structures are proposed below the overflow elevation for a land-locked basin, the low structure elevation will be a minimum of 2 feet above the peak water elevation as determined by the critical back-to-back 100-year storm event, or five feet above a critical single 100-year storm event.

6.3.3 Water Quality Standards

1. Phosphorus loadings from new or redeveloped sites shall not exceed predevelopment phosphorus levels. The following phosphorus export coefficients shall be used to calculate predevelopment and post-development land use phosphorus loadings:
   a. Pre-developed land use
      i. Woodland or wetlands: 0.1 pounds/acre/year
      ii. Grasslands, meadows, open space: 0.4 pounds/acre/year
      iii. Cropland: 1.0 pound/acre/year
      iv. Pasture: 2.0 pounds/acre/year
      v. Urban (applicable for redevelopment): See Post-development land use
   b. Post-development land use (to be used with runoff volumes)
      i. Industrial/Commercial: 600 parts per billion
      ii. Single-family residential: 450 parts per billion
      iii. Multi-family residential: 500 parts per billion
2. A 60% phosphorus removal efficiency shall be required for stormwater treatment systems. The PondNet model (Walker, 1987) or model approved by the City of Dayton as equally applicable shall be used to determine the removal efficiency of the stormwater treatment system based on a 2.5-inch rainfall. This standard can be achieved through the use of ponding, Low Impact Development techniques, reduction in impervious surfaces, or other Best Management Practices.
3. The City of Dayton requires that developments and redevelopments implement BMPs that will reduce TSS and TP by 80% and 50% respectively. These may be achieved by implementing best management practices as outlined in Section 6.4

6.3.4 General Standards

1. Discharge rates from new development and redevelopment sites shall be no greater than the existing condition discharge rates for the 2-, 10-, and 100-year 24-hour SCS Type II rainfall events. The existing condition is defined as the land cover condition prior to the introduction of agriculture in Dayton. A CN value of 58 shall be used in HSG B soils and a CN value of 32 shall be used in HSG A soils for existing condition analyses.

2. Per NPDES Construction Permit requirements for discharges to special waters, such as the ORVW of the Mississippi River, permanent storm water management systems must be designed such that pre and post project runoff rate and volume from the 1-year and 2-year 24 hour precipitation events remain the same.
3. Emergency overflow routes shall be provided to drain low points along streets or lot lines to ensure a freeboard of two feet from the lowest opening elevation and the calculated 100-year critical storm event HWL elevation.
4. Minimum pipe cover in paved areas shall be 2.5 feet. In unpaved areas, the minimum pipe cover shall be 2.0 feet.
5. A 50-foot native vegetation buffer is required along Elm Creek, Rush Creek, North Fork Rush Creek, and Diamond Creek for new development. This same standard is encouraged for redevelopment projects.
6. The City of Dayton requires developers to complete a wetland delineation and a function and values assessment by a trained wetland professional to identify the location and extent of any wetlands present within the development site. Refer to Section 6.4 for further information.
7. The City of Dayton prohibits activities that impact the storage volume within the 100-year floodplain unless compensatory floodplain mitigation is provided at a 1:1 ratio by volume and it is demonstrated that the 100-year floodplain will not be impacted. In addition, no filling within the designated floodway shall be allowed. Suitable calculations must be submitted and approved demonstrating that filling in the flood fringe will not impact the 100-year flood profile. The 100-year floodplain is defined as that area associated with a storm event that has a 1 percent chance of being equaled or exceeded any year.
8. Easements are required for all inletted and outletted basins, swales, ditches, and overflow routes to the basin's or conveyance route's 100-year critical duration storm HWL elevation.

6.3.5 Submittal Standards

1. A development plan review by the City of Dayton is required for the following projects:
    a. Residential development or redevelopment on sites 8 acres or more, or
    b. Residential development or redevelopment on sites 5 acres or more with a density of more than 2 units per acre, or
    c. Commercial and industrial development or redevelopment on sites of one acre or more, or
    d. Road projects that result in a net increase in impervious surface area of one acre or more.
    e. Development or redevelopment if any part of the development is within a 100-year floodplain or upland flood storage area and/or the project changes the timing, storage, or carrying capacity of any tributaries of the 100-year floodplain.
2. The City of Dayton shall review plans for conformance with Best Management Practices with respect to sediment and erosion control for the following developments:
    a. Residential development or redevelopment greater than 1 acre in size, or

   b. Commercial/industrial development or redevelopment, or
   c. Any road, street, or highway project that result in a net increase in impervious surface.
3. Sediment and erosion control plans shall be consistent with the general criteria set forth by the most recent versions of the Minnesota Stormwater Manual, the Minnesota Construction Site Erosion Control Handbook, practices outlined in the Minnesota Pollution Control Agency "Protecting Water Quality in Urban Areas", the Metropolitan Council's Minnesota Urban Small Sites BMP Manual, and the NPDES Construction site permit.
4. Plans must be submitted to the City of Dayton for any proposed alteration of waterways, culvert or bridge installations or replacements in waterways. Plans must show the location of installation, diameter, length and type of culverts, proposed invert elevations, bridge details, etc. along with pertinent hydrologic computations.
5. All submitted development plans must be in conformance with this Local Surface Water Management Plan.
6. A plan shall be submitted for review to the City for development or redevelopment if any part of the development is within a 100-year floodplain or upland flood storage area and/or the project changes the timing, storage, or carrying capacity of any tributaries of the 100-year floodplain. The 100-year floodplain is defined as that area associated with a storm event that has a 1 percent chance of being equaled or exceeded any year.

6.3.6 Post Construction

The City encourages the practice of re-establishing the pre-development characteristics of the on-site soils that have been compacted during the grading and construction phase of the project. This re-establishment of on-site soils consists of deep ripping compacted soils to a depth of 12-inches, with a maximum distance of two feet between rips.

A pond as-built survey is required to determine if the constructed pond meets the approved design volumes. If the survey indicates that the pond volumes are less than the design volumes, the developer is required to regrade the pond per the design standards prior to the release of the letter of credit.

6.3.7 Design Criteria

Additional design criteria, including runoff coefficients for stormwater quantity analysis and design are presented in Chapter 5

6.4 Wetland Management Implementation

The City is required by the Metropolitan Council to complete a Wetland Management Plan. The City is currently evaluating its next steps in order to meet this requirement.

6.4.1 Function and Values Assessment and Wetland Management Plan

The City requires that projects with wetlands include preparation of a function and values assessment. If the City has previously performed a function and values assessment for a particular wetland, the project will not be required to do a function and values assessment for that particular wetland. The function and values assessment shall use the latest version of MnRAM and that this assessment be submitted to the City for review. This function and value assessment, once accepted by the City, becomes the basis for applying the protection standards outlined in Tables 4.2 and 4.3.

In the near future, the city intends to initiate one of the following strategies to complete a Wetland Management Plan including a functions and values assessment, as required by the Metropolitan Council. The goals of the plan are two-fold:

1. Develop a broad perspective on wetland quality and quantity within the city so the City can allocate its resources effectively.
2. Assessing wetlands prior to development. This ensures that wetlands will be protected from degradation by application of the appropriate standards.

There are two possible approaches to the Wetland Management Plan that the City may follow:

- Option 1
  Complete a function and values assessment on all wetlands within the city. Ideally, MnRAM would be conducted on all wetlands in the city at the time the wetland management plan is created. This option would provide the city with comprehensive wetland information for use in planning and development reviews. However, it is the most costly of the options.

- Option 2
  Use a phased approach to complete a functions and values assessment of all wetlands in the city.This would be accomplished by first assessing wetlands in areas likely to develop within the next 3 to 5 years, and then completing assessments on the remaining wetlands at some point in the future. Regardless of the time frame, wetlands would be evaluated prior to development. At the discretion of the City, wetlands not inventoried during the initial phase would be assessed either in a subsequent assessment of city wetlands, or at the time that development is proposed. MNRAM would be applied either by a wetland professional hired by the applicant, or by the city or its representative, at the city's discretion

6.4.2 Buffer Strips

Recommendations for buffer strips for wetlands are provided in Wetland Mapping and Management chapter of this LSWMP. The City will establish wetland buffer requirements during the preparation of the Wetland Management Plan as discussed above. Wetland buffer requirements will be incorporated into the future Wetland Management Plan.

6.4.3 Implementation Schedule

Regardless of which option the City may choose in its approach to the Wetland Management Plan, the Wetland Management Plan will be competed. The implementation schedule for the Wetland Management Plan is anticipated to be as follows:

- The Wetland Management Plan budget and scope of work will be submitted as a 2008 budget item to the City Council by the fall of 2007.
- Assuming approval by the City council in the fall of 2007, the assessment portion of the plan would be expected to commence in 2008 and the completion of the final Wetland Management Plan would be expected to be completed by early 2009.

6.5 Best Management Practices

Best Management Practices (BMPs) are techniques, methods, and measures that prevent or reduce water pollution from runoff. These practices may include regulations, structural features, and operation/maintenance procedures. The protection of existing waterbodies and the correction of existing water quality problems require the use of appropriate planning principles and the consistent application of BMPs to new developments. In the context of this SWMP, the BMPs address the following issues:

- The control of urban non-point source pollutants.
- Site planning principles for the control of erosion, pollution, and sedimentation.
- Surface water management practices for the control of water quality.

The City of Dayton encourages the use of any number of structural BMPs to meet City water quality requirements, such as:

Bioretention – small vegetated depressional areas utilizing infiltration, filtration, and/or vegetative uptake to provide pollutant removal.

Filtration – basins/depressions designed to improve water quality treatment by routing runoff through a filter media, typically located in areas where infiltration is not feasible.

Infiltration – basins/depressions located in areas containing permeable soils designed to capture runoff and allow it to percolate into the soil, reducing pollutant loads and runoff volumes.

Wet Ponding – detention basins designed to remove pollutants by means of physical settling and biological uptake.

Stormwater Wetlands – constructed basins designed to function like natural wetlands, removing pollutants by means of vegetative interaction and settling.

Structural Treatment Devices – specially designed tank units that use certain hydraulic principles to remove suspended particles in stormwater runoff. Typically, the types of devices are used in conjunction with other BMPs to meet City water quality requirements.

Further information regarding the BMPs mentioned above can be found in the MPCA's *Protecting Water Quality in Urban Areas* (2000), the Metropolitan Council's *Minnesota Urban Small Sites BMP Manual* (2001), and the *Minnesota Stormwater Manual* (2005). This LSWMP adopts and supports the recommendations outlined in these and any future revisions to these documents.

6.6 Education

6.6.1 General

Education plays 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 vary, depending on the target audience. In general, the target audience for this education program is City staff, elected and appointed officials, City residents, and the development community. The following sections describe why education of each of these groups is important and presents educational methods for each that the City is or may begin using.

6.6.2 City Staff, Elected and Appointed Officials

City staff and elected and appointed officials have a wide range of responsibilities for implementing this plan. These include:

- Implementing street sweeping and spill containment cleanup programs.
- Maintaining stormwater 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 BMP policies and regulations to new and redevelopment projects.
- Develop and effective erosion and sediment control program.
- Planning and delivering education programs.
- Working out cooperative arrangements with regulatory and non-regulatory organizations to achieve LSWMP objectives.

Because these responsibilities include many different levels of involvement, City staff members and elected and appointed officials 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 redevelopment projects, 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.

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

6.6.3 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.

This information is presented to the public through the City newsletter, the City's website, press releases to local papers, and at public meetings as appropriate. Periodic updates on the progress of LSWMP implementation and information on specific improvement projects is also provided to the public. Again, the City newsletter and press releases to local papers are good methods by which this information is disseminated.

Education projects focused on stormwater quality have received increasing attention and interest from the public over the last decade. Specific education projects that have been used successfully in the Metro area and are being considered by the City include the following:

<u>Catch Basin Stenciling/Door Hanger Distribution</u>
The objective of this activity is to provide recognition of the direct connection between the City storm drainage system and many of the community's creeks and wetlands. The door hangers further explain this connection and why it is important to keep vegetative material, fertilizer, pet litter, and chemicals off hard surfaces and out of the storm drainage system. Scout troops often participate in catch basin stenciling.

<u>Web Site</u>
The existing City web site currently includes many volunteer opportunities related to minimizing the effects of stormwater runoff and also raises awareness of the individual practices which can be taken to help minimize runoff contamination and nutrient loading.

<u>Lawn Soil Testing</u>
This activity involves the collection and analysis of soil samples from lawns throughout the City to determine whether additional phosphorus in fertilizer is needed for good turf growth. The results would be helpful in determining to what degree low and no-phosphorus fertilizer use should be promoted in the City.

<u>No-phosphorus Fertilizer Sales</u>
If soil test results generated elsewhere in the Twin Cities are any indication, it is likely that a significant percentage of lawn soils tested will indicate no additional phosphorus is necessary for good turf growth.

The City may work with lawn and garden retailers to encourage the supply of zero phosphorus fertilizers. In addition, there will be a need to continue to educate the residents on the statewide fertilizer legislation passed by the 2002 Legislature that went into effect in 2004.

Brochures

There are numerous excellent brochures available that could easily be customized for the City. Distribution could be accomplished through direct mailings, as a fold-in to the City newsletter, a door-to-door distribution by volunteers, etc.

Annual Stormwater Public Meeting

Each year, the City conducts an annual stormwater public meeting as required by the NPDES Phase II MS4 Permit. For each meeting, City staff provides residents with a brief description of the stormwater impacts of municipal runoff and identify the actions taken by the City. Time is available during the meeting to allow residents the opportunity to comment on the adequacy of the City's stormwater program and provide any helpful comments for future management.

The City will join efforts with the ECWMC to develop and execute educational activities in order to increase the cost-efficiency of the program, avoid duplication of effort, and ensure delivery of consistent messages across the City.

6.6.4 Development Community

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. The information about mitigation requirements will be disseminated to developers and their consulting engineers as early as possible in the development review process. In this way, developers will 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.

Additional information will be disseminated to the developers in an information packet in the development submittal information they receive from the City. The information packet will contain:

- Information on the regulatory administrative responsibilities for developments within the major watersheds covering the City.
- Information regarding stormwater mitigation requirements.
- Any information on areas of the City where special regulations may apply because of the existence of overlay districts.

6.7 Operation and Maintenance

6.7.1 Activities

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
- Excavation of accumulated sediments from ponds

As new development brings more trunk stormwater facilities into the system, City staff will find that system maintenance becomes an increasingly large portion of both staff time and maintenance budget. It is important to quantify the extent of this future commitment so that the funds necessary for system maintenance activities can be collected via the City's stormwater utility and the general fund. In a separate study, the City should quantify the cost of system maintenance and evaluate its stormwater utility fee and other funding on an annual basis. Table 6.1 provides the City's stormwater system maintenance schedule.

Table 6.1 Stormwater System Maintenance Schedule

Activity	Schedule
Inspect and clean-out catch basins and sumps	Twice annually
Stormwater pond inspection, including inlets, outlets and identifying any illicit discharges	Twice annually and after heavy rainfalls or large snow melt events
Trunk storm sewer inspection	Twice annually during catch basin inspection and clean-out
Repair undercut or eroded channels.	As needed
Remove sediment accumulated in stormwater ponds	5 to 25 year cycle or as needed
Street sweeping	Twice annually or as needed

6.7.2 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

<u>Basin Outlets</u>

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.
- 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.

As part of the NPDES Phase II SWPPP, the City is implementing a local spill containment cleanup plan. Additional information regarding the City's spill containment plan can be found in the 2006 SWPPP.

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 25 years.

6.7.3 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.

6.7.4 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.

6.7.5 Open Channels

Overland flow routes constitute an important part of the surface water 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.

6.7.6 Piping System

The storm sewer 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.

6.7.7 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. Stockpiles of de-icing materials 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.

6.7.8 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 two sweeping operations in a year, with additional operations as needed. Spring sweeping begins in either late March or early April after the risk of later snowfall has passed. Fall sweeping commences in mid-August and is typically completed by Labor Day weekend. Stormwater quality areas are swept on a priority basis throughout the year.

6.8 Water Quality Improvement Items

The System Assessment section identified corrective actions for Hayden and Diamond Lakes. These corrective actions are to implement water quality improvements determined on the basis of water quality studies for these lakes. The Elm Creek WMP calls for the local community, in this case Dayton, to take the lead in performing these water quality studies and improvements. These corrective actions will be implemented as funding becomes available to the City and in conjuction with other studies of the Elm Creek WMC. After these studies are complete, the City will complete water quality improvements to address the findings and conclusions of the water quality studies. The extent of the water quality improvements will be dependent on the availability of funds to the City.

For Hayden Lake, the City will implement the water quality study in conjuction with the study for Goose Lake which the Elm Creek WMC is expected to lead. Goose Lake is within the watershed of Hayden Lake so it stands to reason for these two studies to be linked and coordinated in a collaborative manner. Similarly, the city will implement the water quality improvements for those areas in its jurisdiction in conjuction with the improvements for Goose Lake.

The water quality study for Diamond Lake will occur in conjunction with the TMDL study for this lake which is scheduled by the MPCA to begin in 2013. The Elm Creek WMC would likely take the lead on the TMDL study for Diamond Lake. Since the water quality study could be used as an important resource for the TMDL study for the lake, it stands to reason that the water quality study and TMDL study be performed in conjunction with each other. The City will implement the water quality improvements for Diamond Lake for those areas in its jurisdiction in conjuction with the findings of the TMDL study.

6.9 Water Quality Goals for Specific Water Bodies

The City of Dayton has several lakes within its jurisdiction. The City has developed water quality goals for each of these lakes. These lakes will all share some basic general water quality goals; some lakes will have additional specific goals which may be more restrictive than the general goals.

The general water quality goals are as follows:

1. No increase in total phosphorous loading. This goal is expected to be attained with development standards that require no increase in P loading for post development conditions compared to existing conditions as provided in Standards section 6.3.3.
2. Reduction in TSS loading by requiring a minimum of 80% TSS reduction for BMPs for developments as required in the Standards section 6.3.3.

3. Support Elm Creek WMCs water quality goals.

Table 6.2 is a summary of the major lakes in Dayton along with their water quality goals. Four of the lakes have water quality studies as part of their water quality goals. After these studies are complete, the goals specific to that lake will likely be revised to address water quality issues identified in the studies. These revised goals will likely include water quality improvement implementation projects.

Table 6.2
Water Quality Goals for Specific Water Bodies

Water Body (DNR #)	Designated Use	Impaired Water?	Elm Creek WMC Water Quality Goals	Multi-Jurisdictional Watershed?	City Water Quality Goals
French Lake (27-127)	Aquatic life and recreation	Yes	None specific to this lake.	No	General water quality goals. Revise water quality goals after completion of TMDL study which is scheduled to start in 2010.
Diamond Lake (27-125)	Aquatic life and recreation	Yes	Perform water quality study followed by implementation of water quality improvements. (city leads)	Yes	General water quality goals. City performs water quality study in conjunction and in support of TMDL study for Diamond Lake starting in 2013. The TMDL study is expected to be lead by an inter-jurisdictional agency. Revise water quality goals after completion of TMDL study.
Dubay Lake (27-129w)	Aquatic life and recreation	Not Listed	None specific to this lake.	No	General water quality goals.
Laura Lake (27-123)	Aquatic life and recreation	Not Listed	None specific to this lake.	No	General water quality goals.
Goose Lake (27-122)	Aquatic life and recreation	Not Listed	Perform water quality study followed by implementation of water quality improvements. (Elm Creek WMC leads)	Yes	General water quality goals. Cooperate with the Elm Creek WMC in their water quality study and improvement projects for Goose Lake. Revise water quality goals after completion of the Goose Lake study.
Hayden Lake (27-128)	Aquatic life and recreation	Not Listed	Perform water quality study followed by implementation of water quality improvements. (city leads)	Yes	General water quality goals. City performs water quality study in conjunction with Elm Creek WMC's study of Goose Lake. Revise water quality goals after completion of the Hayden Lake study.
Grass Lake (27-135)	Aquatic life and recreation	Not Listed	None specific to this lake.	Yes	General water quality goals.
Powers Lake (27-130)	Aquatic life and recreation	Not Listed	None specific to this lake.	No	General water quality goals.

6.10 Trunk Surface Water System Costs

The proposed surface water system in the City is presented in Map 2. Surface water facilities will be constructed in conjunction with new development, redevelopment and street construction. One of the basic objectives of this report was to determine the cost of completing the City of Dayton's Surface Water System and at the same time determine trunk area charges that will ensure availability of sufficient funds for the required construction. The cost of the trunk surface water system is $31,500,00. A detailed breakdown of the costs included in the total can be found in Appendix D. The cost estimates are for construction, legal, engineering, and administrative costs. Generally, the total cost of the trunk system is comprised of three sub-costs:

1. Regional conveyance system costs – this cost includes storm sewer, manholes, installation, restoration, and stream rehabilitation.
2. Regional pond construction costs – this cost includes pond excavation, berming, and restoration and the pond outlet structure.
3. Regional pond land costs – this cost includes land acquisition to contain the pond 100-year HWL within an outlot.

The total cost of the trunk surface water system does not include the cost of providing water quality treatment necessary to meet City standards. The City requires that the cost of providing water quality treatment within new developments to meet City standards and volume control to meet ORVW and other requirements will be borne by developers.

Pipe unit cost estimates are based on December 2006 costs. Future updates can be based on an ENR cost index of 7888. Future changes in this index are expected to fairly accurately describe cost changes in the proposed facilities. Between LSWMP updates the ENR cost index can be used to update the City's proposed system cost.

6.11 Financing

Several methods of financing the proposed projects and programs in this LSWMP are available. Some of these are as follows:

- Area and Connection Charges: These are fees charged to developments on an area (cost per acre) and/or connection (cost per unit) basis. These charges are frequently used in developing communities to ensure that new development pays for facilities required to serve it. Charges could be levied against redevelopment in a similar manner. An area charge calculation based on a cost per acre is included in Table 6.3 below. The area charges for the land use types more dense than single family residential are higher because these land uses have a higher percentage of impervious surface and thus generate more runoff.
- Special Assessments: Assessments against benefiting or responsible properties can be used to finance surface water improvements.
- Stormwater Utility: This is a fee charged to existing properties based on an estimate of runoff generated and discharged to the City's system. The revenues

collected are dedicated to the surface water system. They are frequently used to pay for operation and maintenance of the system.

- Grants: Though subject to budgetary constraints, a number of state and other grant programs are available for surface water management.

For this LSWMP, area charges were developed to pay for the completion of the City's surface water system. As mentioned above, the area charges cover the cost of the stormwater quantity (rate control and conveyance) improvements associated with the trunk stormwater system. The cost for providing water quality treatment is not included in the area charges, as the City requires that this cost is to be funded solely by development. The area charges are presented in Table 6.3.

Table 6.3 Area Charges

Land Use	Developable Acreage	Runoff Depth 10-yr, 24-hr Event [2]	Land Use Factor[3]	Equivalent Area[4]	Area Charge[5]	
	(acres)	(inches)		(acres)	($/acre)	($/sq ft)
Low Density Residential	4,248	1.75	1	4,248	$4,988	$0.115
Medium Density Residential	246	2.05	1.2	295	$5,986	$0.137
Commercial / Industrial[1]	985	3.11	1.8	1,773	$8,978	$0.206
Total	5,479					
Total Cost[6]		$31,500,100				
Cost per Equivalent Acre		$4,988				

[1]Commercial/Industrial land use incorporates areas on Figure 2 identified as commercial, commercial/industrial, and mixed commercial/industrial.
[2]Runoff depth from a 10-year storm event used to weight the amount of runoff generated by each land use (based on City storm sewer design event)
[3]Land use factor is calculated by dividing the 10-year runoff depth for the given land use by the 10-year runoff depth generated by Low density residential.
[4]Equivalent area calculated by multiplying the developable acreage for a given land use by associated the land use factor.
[5]The area charge ($/acre) is calculated by multiplying the cost per equivalent acre by a specified land use factor.
[6]Total Cost includes regional conveyance system costs, regional pond construction costs, and regional pond land costs (see Appendix D).

6.12 Capital Improvement Program

The summary of costs for the Capital Improvement Program based on estimated trunk sanitary sewer construction phasing is presented in Table 6.4. This table includes three time frames: present to 2010, 2010 to 2020, and beyond 2020. Sanitary sewer construction phasing was used as the basis for trunk storm water system construction phasing because trunk storm sewer would likely occur as land develops as driven by availability of sanitary sewer service. The trunk sanitary sewer construction phasing was based on the sanitary sewer phasing plan in Dayton's December 2005 Comprehensive Sanitary Sewer Plan.

Table 6.4
Capital Improvement Summary

Watershed	2007-2010	2010-2020	2020+	Total
Diamond Creek	$3,533,600	$0	$0	**$3,533,600**
Rush Creek	$6,438,800	$1,305,200	$0	**$7,744,000**
Elm Creek	$1,188,600	$8,059,600	$0	**$9,248,200**
Crow River	$1,504,300	$800,900	$0	**$2,305,200**
Mississippi River	$4,218,400	$1,590,800	$2,859,900	**$8,669,100**
Total	**$16,883,700**	**$11,756,500**	**$2,859,900**	**$31,500,100**

6.13 Amendment Procedures

The LSWMP is intended to extend through the year 2016. 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.

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

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.

Watershed District Approval
All proposed amendments must be reviewed by the watershed districts prior to final adoption of the amendments.

Council Adoption
Final action on an amendment, following approval by the watershed districts, 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.

6.14 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 2016. 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.

7. SUMMARY AND RECOMMENDATIONS

7.1 Summary

The Dayton Local Surface Water Management Plan has a dual purpose: it will serve as a guide for the construction of storm drainage facilities and provide a basis for a consistent approach to water resource protection. The following themes have been incorporated into this LSWMP:

1. Division of the City into drainage districts and catchments;
2. Determination of storm water runoff under 2020 land use conditions;
3. General layout and sizing of trunk storm sewers and open channels;
4. Tributary areas, storage volumes, and high water levels of all required ponding areas;
5. Development of wetland management policies to ensure compliance with local, state, and federal wetland regulations;
6. Estimated construction and implementation costs of the Local Surface Water Management Plan; and
7. Trunk storm water system financing;
8. Recommendations for education of City residents, staff, and development community.
9. Operation and maintenance of the storm water system;
10. Regulatory responsibilities.

The primary function of an urban surface water system is to minimize economic loss and inconvenience due to periodic flooding of streets and other low-lying areas. Adequately designed storm drainage facilities provide flood control, minimize the hazards and inconvenience associated with flooding, and protect or enhance water quality.

The trunk storm sewer system alignments shown in this LSWMP are conceptual in nature since future development will determine the exact location of channels or storm sewers. The lines shown as future alignment follow natural drainageways and the existing slope of the terrain wherever possible; therefore, variations from proposed alignments should be kept to a minimum. Pipe sizes and channel widths are also general since they are based on an assumed slope.

It is extremely important that each area be reevaluated at the time of final design to confirm the criteria used in this study and to make any changes that a proposed development may dictate. Special consideration must be given to areas that develop differently than shown in the Land Use Plan, especially when a higher runoff coefficient is likely to result from development.

All storm sewer facilities, especially those conveying large quantities of water at high velocities, should be designed with efficient hydraulic characteristics. Special attention should be given during final design to those lines, which have extreme slopes and create high hydraulic heads. The Best Management Practices (BMPs) outlined and referenced in this LSWMP should be followed wherever necessary.

7.2 Recommendations

The following recommendations have been developed at part of this LSWMP:

1. The Surface Water Management Plan as presented herein be adopted by the City of Dayton.
2. Establish the ponding areas as shown on Map 2, and made a part of the Surface Water Management system with the peak flows controlled to the values provided in the appendicies.
3. Establish standard review procedures to ensure all new development or redevelopment within the City is in compliance with the grading and storm water management controls determined by this Plan.
4. Require detailed hydrologic analyses for all development and redevelopment activities.
5. Establish final high water levels governing building elevations adjacent to ponding areas and floodplains as development occurs or when drainage facilities are constructed.
6. Establish and maintain overflow routes to provide relief during extreme storm conditions, which exceed design conditions.
7. Perform a functions and values assessment on wetlands prior to development.
8. Develop a Wetland Management Plan for the City.
9. Develop an assessment for the ORVW Mississippi River per requirements of the NPDES MS4 permit, and for inclusion into the City's SWPPP.
10. Develop an electronic map of the City's storm water management system.
11. Establish a surface water system maintenance program to ensure the successful operation of the system.
12. Continue operating and maintaining the City's surface water system in accordance with this LSWMP.
13. Enforce the erosion and sedimentation control criteria for new developments.
14. Implement an education program for City residents, staff, and development community.
15. Adopt and implement amendments to the plan as warranted by future standards or regulations.

Appendix A – Drainage Areas

APPENDIX A
DRAINAGE AREAS

Subdistrict	Drainage Area (ac)
DIAMOND CREEK - FRENCH LAKE	
DC-FL1	127.5
DC-FL2	101.0
DC-FL3	665.4
Total	**893.9**
DIAMOND CREEK - DIAMOND LAKE	
DC-DL1	484.6
DC-DL2	132.5
DC-DL3	660.6
DC-DL4	178.4
DC-DL5	113.6
DC-DL6	86.2
DC-DL7	813.3
DC-DL8	111.4
Total	**2580.7**
DIAMOND CREEK - CENTRAL	
DC-C1	102.7
DC-C2	558.1
DC-C3	168.8
DC-C4	327.8
DC-C5	131.2
DC-C6	235.5
DC-C7	187.2
DC-C8	281.7
DC-C9	157.6
DC-C10	380.6
Total	**2531.1**

Subdistrict	Drainage Area (ac)
RUSH CREEK - WEST	
RC-W1.1	62.3
RC-W1.2	19.4
RC-W1.3	79.9
RC-W1.4	2.4
RC-W1.5	5.1
RC-W1.6	17.0
RC-W1.7	21.7
RC-W1.8	5.7
RC-W2	89.1
RC-W3	69.1
RC-W4	28.7
RC-W5	25.9
RC-W6	44.8
RC-W7	102.5
RC-W8	48.2
RC-W9	103.6
RC-W10	82.2
RC-W11	21.9
RC-W12	25.6
RC-W13	57.1
Total	**912.2**
RUSH CREEK - NORTH	
RC-N1	115.4
RC-N2	22.4
RC-N3	65.7
RC-N4	46.6
RC-N5	82.2
RC-N6	106.0
RC-N7	90.3
RC-N8	147.1
Total	**675.6**
RUSH CREEK - EAST	
RC-E1	83.0
RC-E2	59.3
RC-E3	144.0
Total	**286.2**
RUSH CREEK - LAND LOCKED	
RC-LL1	58.7

Subdistrict	Drainage Area (ac)
ELM CREEK - NORTH	
EC-N1	79.7
EC-N2	22.5
EC-N3.1	10.5
EC-N3.2	26.7
EC-N3.3	34.5
EC-N3.4	27.9
EC-N3.5	26.8
EC-N3.6	46.0
EC-N3.7	34.2
EC-N4	41.6
EC-N5	130.7
EC-N6	48.5
EC-N7.1	24.3
EC-N7.2	41.2
EC-N7.3	8.2
EC-N8	30.0
EC-N9	108.1
EC-N10	169.5
Total	**910.8**

Subdistrict	Drainage Area (ac)
ELM CREEK - SOUTH	
EC-S1	75.7
EC-S2	65.6
EC-S3	42.4
EC-S4	56.8
EC-S5	74.0
EC-S6	99.5
Total	**413.9**
ELM CREEK - WEST	
EC-W1	65.3
EC-W2	155.3
EC-W3	173.1
EC-W4	91.9
EC-W5	147.4
EC-W6	70.1
EC-W7	60.8
EC-W8	100.4
EC-W9	155.4
EC-W10	178.9
EC-W11	173.5
EC-W12	101.5
Total	**1473.6**
ELM CREEK - EAST	
EC-E1	57.2
EC-E2	186.8
EC-E3	46.5
Total	**290.5**
ELM CREEK - CENTRAL	
EC-C1	289.6
EC-C2	275.3
EC-C3	981.3
Total	**1546.2**

APPENDIX A
DRAINAGE AREAS

Subdistrict	Drainage Area (ac)
MISSISSIPPI RIVER - NORTHWEST	
MR-NW1	113.1
MR-NW2	146.6
MR-NW3	56.1
MR-NW4	113.6
MR-NW5	136.1
MR-NW6	100.5
MR-NW7	115.1
MR-NW8	90.7
MR-NW9	75.8
MR-NW10	37.3
MR-NW11	41.0
Total	**1025.9**
MISSISSIPPI RIVER - NORTH	
MR-N1	97.3
MR-N2	103.2
MR-N3	40.6
MR-N4	95.8
MR-N5	43.8
MR-N6	44.8
MR-N7	92.1
MR-N8	104.3
Total	**621.9**
MISSISSIPPI RIVER - LAND LOCKED	
MR-LL1	88.2
MR-LL2	65.0
MR-LL3	116.6
MR-LL4	99.4
Total	**369.1**

Subdistrict	Drainage Area (ac)
MISSISSIPPI RIVER - NORTHEAST	
MR-NE1	85.1
MR-NE2	66.6
MR-NE3	118.5
MR-NE4	74.0
MR-NE5.1	10.8
MR-NE5.2	45.8
MR-NE5.3	31.1
MR-NE6	42.8
MR-NE7.1	25.4
MR-NE7.2	284.3
MR-NE8	54.4
MR-NE9	141.0
Total	**979.7**
MISSISSIPPI RIVER - SHORELINE	
MR-SL1	30.7
MR-SL2	47.1
MR-SL3	36.5
MR-SL4	54.4
MR-SL5	23.8
MR-SL6	51.8
MR-SL7	83.2
MR-SL8	39.1
MR-SL9	75.1
MR-SL10	44.8
MR-SL11	66.5
MR-SL12	29.8
MR-SL13	16.0
MR-SL14	70.4
MR-SL15	43.0
MR-SL16	17.29
Total	**729.5**

Subdistrict	Drainage Area (ac)
CROW RIVER	
CR1	28.7
CR2	48.3
CR3	96.4
CR4	142.3
CR5	82.0
CR6	179.0
CR7	43.7
CR8	97.3
Total	**717.7**

Total Area within Dayton = 15,682 acres

Appendix B – Trunk Storm Sewer Data

APPENDIX B
TRUNK STORM SEWER DATA

Flow From	Flow to	Drainage Area			100-year Design Capacity	Pipe Size			Comments
		Direct	Ponded	Total		Existing or Proposed	Diameter	Length	
		(ac)	(ac)	(ac)	(cfs)		(in)	(ft)	
DIAMOND CREEK - DIAMOND LAKE									
DC-DL8P	DC-DL4N1	111.4	0.0	111.4	15.6	Proposed	21	400	
DC-DL6P	DC-DL7P	86.2	0.0	86.2	7.1	Proposed	18	1650	
DIAMOND CREEK - FRENCH LAKE									
DC-FL1P	DC-FL1N1	130.5	0.0	130.5	27.9	Proposed	24	200	
DC-FL2P	DC-FL2N1	101.0	0.0	101.0	15.3	Proposed	21	300	
RUSH CREEK - WEST									
RC-W1.1P	RC-W1.3P	0.0	62.3	62.3	13.1	Proposed	18	100	
RC-W1.1N1	RC-W1.3P	--	--	57.1	22.5	Existing	Surface	1150	Surface conveyance along I94 ditch.
RC-W1.2P	RC-W1.3P	0.0	19.4	19.4	34	Existing	24	100	
RC-W1.4P	RC-W1.6N1	0.0	2.4	2.4	3.1	Existing	24	1200	
RC-W1.5P	RC-W1.6N1	0.0	5.1	5.1	6.1	Existing	12	17	Short pipe discharging to surface conveyance ditch.
RC-W1.6N1	RC-W1.3P	17.0	7.5	24.5	11.0	Proposed	24	1200	
RC-W1.7P	RC-W1.3P	0.0	21.7	21.7	4.6	Proposed	12	200	
RC-W1.3P	RC-W2P	0.0	264.9	264.9	36.2	Proposed	30	1350	
RC-W2P	N. Fk. Rush Cr	0.0	335.0	335.0	48.9	Proposed	36	600	
RC-W3P	N. Fk. Rush Cr	0.0	69.2	69.2	6.6	Proposed	15	500	
RC-W4P	RC-W4N1	0.0	28.7	28.7	3.5	Proposed	12	500	RC-W4N1 drains to Maple Grove.
RC-W6P	RC-W6N1	0.0	44.8	44.8	4.3	Proposed	12	250	RC-W6N1 drains to I94 ditch.
RC-W1.8P	RC-W5P	0.0	5.8	5.8	6.0	Existing	12	42	Short pipe discharging to surface conveyance ditch.
RC-W5P	RC-W9P	0.0	11.7	11.7	5.1	Proposed	12	100	Pipe discharges to ditch to culvert under CSAH 81.
RC-W8P	RC-W9P	0.0	48.2	48.2	15.6	Existing	12	83	
RC-W9P	RC-W7.1P	0.0	183.4	183.4	40.8	Existing	30	113	Culvert under Cty 81 dischares to surface convey.
RC-W7P	RC-W7.1P	0.0	87.7	87.7	34.9	Existing	24	229	
RC-W7.1P	Rush Cr.	0.0	288.4	288.4	70.0	Existing	36	65	
RC-W10P	Rush Cr.	0.0	82.2	82.2	15.1	Proposed	21	300	
RUSH CREEK - NORTH									
RC-N4P	RC-N5N1	0.0	46.6	46.6	5.7	Proposed	15	625	RC-N5N1 drains to DNR wetland 27-238W.
RC-LL1	RC-N5N3	0.0	58.7	58.7	15.0	Proposed	24	1000	RC-N5N3 drains to DNR wetland 27-238W.
RC-N1P	RC-N5N2	0.0	115.4	115.4	11.3	Proposed	18	200	RC-N5N2 drains to DNR wetland 27-238W.
RC-N2P	RC-N6N1	0.0	22.4	22.4	1.9	Proposed	12	400	RC-N6N1 drains to NWI wetland.
RC-N3P	RC-N6N2	0.0	65.7	65.7	6.0	Proposed	18	350	RC-N6N2 drains to NWI wetland.
RUSH CREEK - EAST									
RC-E1P	Rush Cr.	0.0	83.0	83.0	8.8	Proposed	18	800	
RC-E2P	Rush Cr.	0.0	60.0	60.0	13.5	Proposed	21	500	
ELM CREEK - SOUTH									
EC-S1P	EC-S6N1	75.7	0.0	75.7	7.2	Proposed	18	1200	
EC-S2P	EC-S6P	0.0	65.6	65.6	2.6	Proposed	12	500	

APPENDIX B
TRUNK STORM SEWER DATA

Flow From	Flow to	Drainage Area			100-year Design Capacity	Pipe Size			Comments
		Direct	Ponded	Total		Existing or Proposed	Diameter	Length	
		(ac)	(ac)	(ac)	(cfs)		(in)	(ft)	
EC-S3P	EC-S4P	42.4	0.0	42.4	9.5	Proposed	18	2400	
EC-S4P	EC-S6N1	56.8	42.4	99.2	16.0	Proposed	18	200	
EC-S5P	EC-S5N1	0.0	29.6	29.6	4.5	Proposed	12	200	
EC-S6P	EC-S6N2	0.0	165.1	165.1	8.1	Proposed	15	200	EC-S6N2 drains to DNR water 27-130P.
EC-S6N1	EC-S6N2	0.0	174.9	174.9	23.1	Proposed	30	1950	EC-S6N2 drains to DNR water 27-130P.
ELM CREEK - WEST									
EC-W6P	EC-W9P	70.1	0.0	70.1	3.3	Proposed	12	700	
EC-W7P	EC-W8P	60.8	0.0	60.8	7.3	Proposed	15	1600	
EC-W8P	EC-W9P	100.4	60.8	161.2	24.8	Proposed	24	900	
EC-W12P	EC-W9P	101.5	0.0	101.5	8.8	Proposed	18	700	
EC-W9P	EC-W11N1	0.0	1002.6	1002.6	47.9	Proposed	30	100	EC-W11N1 drains to DNR water 27-231P.
ELM CREEK - EAST									
EC-E3P	EC-E3N1	0.0	46.5	46.5	4.7	Proposed	12	200	EC-E3N1 drains to Elm Cr. Park Reserve.
ELM CREEK - NORTH									
EC-N1P	EC-N2P	0.0	79.7	79.7	6.6	Proposed	18	700	
EC-N2P	EC-N9P	0.0	102.2	102.2	7.1	Proposed	18	1000	
EC-N3.2P	EC-N3.4P	0.0	26.7	26.7	0.0	Proposed	Surface	600	Outlet is a swale.
EC-N3.3P	EC-N3.6P	0.0	34.5	34.5	2.0	Proposed	24	1050	
EC-N3.4P	EC-N3.6P	0.0	54.7	54.7	1.9	Proposed	24	900	
EC-N3.5P	EC-N3.6P	0.0	26.8	26.8	2.3	Proposed	24	700	
EC-N3.7P	EC-N3.6P	0.0	34.2	34.2	1.8	Proposed	24	1400	
EC-N3.6P	EC-N9P	0.0	196.2	196.2	5.4	Prop. FM	16	1800	
EC-N5P	EC-N9P	0.0	130.7	130.7	4.1	Proposed	12	100	
EC-N7.1P	EC-N4P	0.0	38.7	38.7	2.0	Exist FM	8	3400	
EC-N7.2P	EC-N10N1	0.0	35.2	35.2	3.0	Proposed	12	200	
EC-N4P	EC-N9P	0.0	80.3	80.3	--	Existing	Surface	600	Outlet is a swale.
EC-N8P	EC-N9P	0.0	30.0	30.0	6.9	Proposed	15	200	
EC-N9P	EC-N10N2	0.0	691.2	691.2	9.2	Existing	18	80	EC-N10N2 drains to Elm Cr. Park Reserve.
CROW RIVER									
CR3P	Crow R.	96.4	0.0	96.4	10.4	Proposed	18	300	
CR4P	Crow R.	142.3	0.0	142.3	15.0	Proposed	21	300	
CR5P	CR8P	82.0	0.0	82.0	3.7	Proposed	15	400	
CR6P	CR8P	82.0	0.0	179.0	--	Existing	Surface	1050	
CR7P	CR7N1	97.3	0.0	97.3	7.7	Proposed	15	200	
MISSISSIPPI RIVER - LAND LOCKED									
MR-LL1P	Miss. R.	0.0	88.2	88.2	2.8	Proposed	24	1000	10-yr discharge rate from MR-LL1P = 0 cfs.
MISSISSIPI RIVER - NORTHWEST									
MR-NW3P	MR-NW4N1	0.0	56.8	56.8	7.4	Proposed	18	700	
MR-NW5P	MR-NW6N1	0.0	136.1	136.1	9.5	Proposeed	24	1000	10-yr discharge rate from MR-NW5P = 0 cfs.

APPENDIX B
TRUNK STORM SEWER DATA

Flow From	Flow to	Drainage Area Direct (ac)	Drainage Area Ponded (ac)	Drainage Area Total (ac)	100-year Design Capacity (cfs)	Pipe Size Existing or Proposed	Pipe Size Diameter (in)	Pipe Size Length (ft)	Comments
MR-NW8P	MR-NW7N1	0.0	90.7	90.7	9.0	Proposed	18	500	
MR-NW9P	MR-NW11N1	0.0	74.9	74.9	3.7	Proposed	12	300	
MISSISSIPPI RIVER - NORTH									
MR-N1P	MR-N2P	97.3	0.0	97.3	8.0	Proposed	18	2300	
MR-N2P	MR-N5N1	103.2	97.3	200.5	18.4	Proposed	24	1400	
MR-N3P	MR-N5N1	40.6	0.0	40.6	5.4	Proposed	15	500	
MR-N8P	MR-N4P	104.3	0.0	104.3	2.3	Proposed	12	750	
MR-N4P	MR-N7N1	95.8	104.3	200.1	2.7	Proposed	15	850	
MR-N6P	MR-N7N2	44.8	0.0	44.8	4.3	Proposed	12	300	
MISSISSIPI RIVER - NORTHEAST									
MR-NE1P	MR-NE3P	0.0	85.1	85.1	3.3	Proposed	12	1450	
MR-NE2P	MR-NE3P	0.0	66.6	66.6	4.4	Proposed	12	650	
MR-NE3P	MR-NE6N1	0.0	270.1	270.1	13.8	Proposed	24	1000	
MR-NE4P	MR-NE6N1	0.0	73.9	73.9	3.8	Existing	15	950	
MR-NE6N1	MR-NE6P	0.0	343.9	343.9	18.0	Proposed	30	600	
MR-NE6P	Mississippi R.	0.0	386.9	386.9	11.5	Proposed	18	300	10-yr discharge rate from MR-NE6P = 0 cfs.
MR-NE5.1P	MR-NE5.1N1	0.0	10.8	10.8	15.0	Existing	30	800	
MR-NE5.3P	MR-NE5.1N1	0.0	31.1	31.1	3.4	Existing	18	446	
MR-NE5.1N1	MR-NE5.2P	0.0	41.9	41.9	21.0	Existing	36	580	
MR-NE5.2P	Champlin	0.0	87.8	87.8	11.5	Existing	18	195	
MISSISSIPPI RIVER - SHORELINE									
MR-SL4P	Miss. R.	0.0	51.8	51.8	1.3	Proposed	18	600	
MR-SL6P	Miss. R.	0.0	70.4	70.4	7.2	Proposed	24	750	
MR-SL10P	MR-SL11P	0.0	44.8	44.8	5.0	Proposed	12	1000	
MR-SL11P	Miss. R.	0.0	132.4	132.4	13.5	Proposed	21	900	
MR-SL14P	Miss. R.	0.0	70.4	70.4	9.4	Proposed	18	300	

Existing basin storage and elevations are based on GIS database and 10 feet topographic information. This information may differ from that on as-built records. In such cases as-built records should be relied upon.

Design capacity of pipe is based on HWL of upstream pond (surcharged pipe).

Appendix C – Pond Data

APPENDIX C
POND DATA

Pond Number	Drainage Area			Modeled NWL	Modeled HWL	Area @ NWL	Area @ HWL	Proposed Flood Storage	Proposed 100-Year discharge	100-Year discharge per acre	DNR Protected Waters Inventory	Comments
	Direct	Ponded	Total									
	(ac)	(ac)	(ac)			(ac)	(ac)	(ac-ft)	(cfs)	(cfs/ac)		
DIAMOND CREEK - DIAMOND LAKE												
DC-DL8P	111.4	0.0	111.4	910.0	914.6	5.2	6.2	26.4	15.6	0.14		
DC-DL4P	1089.0	596.0	1685.0	908.0	909.2	228.0	236.8	293.1	29.0	0.02	27-135P	Grass Lake
DC-DL6P	86.2	0.0	86.2	910.0	914.5	2.8	3.4	14.0	7.1	0.08		
DC-DL7P	822.2	1771.1	2593.3	904.7	905.4	397.0	411.1	292.6	27.1	0.01	27-125P	Diamond Lake
DIAMOND CREEK - FRENCH LAKE												
DC-FL1P	130.5	0.0	130.5	996.0	1000.4	4.8	5.6	22.8	27.9	0.21		
DC-FL2P	101.0	0.0	101.0	996.0	1000.5	5.0	5.9	24.4	15.3	0.15		
DC-FL4P	697.1	231.5	928.6	904.1	904.7	215.0	234.2	192.4	40.7	0.04	27-127P	French Lake
RUSH CREEK - WEST												
RC-W1.1P	62.3	0.0	62.3	925.0	928.8	4.0	4.7	16.6	13.1	0.21		
RC-W1.2P	19.4	0.0	19.4	933.4	939.4	0.2	0.6	2.5	34	1.75		
RC-W1.4P	2.4	0.0	2.4	956.2	957.6	0.2	0.4	0.4	3.1	1.29		
RC-W1.5P	5.1	0.0	5.1	951.0	953.1	0.4	0.6	1.0	6.1	1.20		
RC-W1.7P	21.7	0.0	21.7	930.0	934.3	0.8	1.2	4.4	4.6	0.21		
RC-W1.3P	264.9	0.0	264.9	920.0	924.0	2.5	14.5	35.9	36.2	0.14		
RC-W2P	335.0	0.0	335.0	909.0	913.1	4.3	5.1	19.1	48.9	0.15		
RC-W3P	69.2	0.0	69.2	909.0	913.2	3.6	4.4	16.7	6.6	0.10		
RC-W4P	28.7	0.0	28.7	909.0	913.2	1.4	1.8	6.6	3.5	0.12		
RC-W6P	44.8	0.0	44.8	915.0	919.3	2.8	3.4	13.3	4.3	0.10		
RC-W1.8P	5.8	0.0	5.8	948.0	951.0	0.3	0.5	1.0	6.0	1.05		
RC-W5P	11.7	0.0	11.7	935.0	939.5	0.4	0.7	2.4	5.1	0.43		
RC-W8P	48.2	0.0	48.2	930.0	933.9	0.1	6.6	11.7	15.6	0.32		
RC-W9P	103.6	79.8	183.4	923.0	928.5	1.2	12.7	9.7	40.8	0.22	27-240W and 27-241W	
RC-W7P	87.7	0.0	87.7	920.0	926.3	2.3	3.3	17.5	34.9	0.40		
RC-W7.1P	17.3	271.1	288.4	908.6	913.4	0.3	7.1	15.9	70.0	0.24	27-242W	
RC-W10P	82.2	0.0	82.2	900.0	904.4	4.2	5.1	20.4	15.1	0.18		
RUSH CREEK - NORTH												
RC-N4P	46.6	0	46.6	928.0	932.6	1.6	2.1	8.5	5.7	0.12		
RC-LL1P	58.7	0.0	58.7	916.0	917.0	16.5	17.9	17.4	0.0	0.00	27-129W	
RC-N1P	115.4	0	115.4	920.0	924.3	2.2	2.8	10.9	11.3	0.10		
RC-N2P	22.4	0	22.4	910.0	911.1	4.0	4.3	4.7	1.9	0.09	27-279W	
RC-N3P	65.7	0	65.7	910.0	912.4	4.6	5.1	11.8	6.0	0.09		
RUSH CREEK - EAST												
RC-E1P	83.0	0.0	83.0	920.0	924.5	2.5	3.1	12.6	8.8	0.11		
RC-E2P	90.0	0.0	90.0	925.0	929.1	3.5	4.2	15.7	13.5	0.15		

APPENDIX C
POND DATA

Pond Number	Drainage Area			Modeled NWL	Modeled HWL	Area @ NWL	Area @ HWL	Proposed Flood Storage	Proposed 100-Year discharge	100-Year discharge per acre	DNR Protected Waters Inventory	Comments
	Direct	Ponded	Total									
	(ac)	(ac)	(ac)			(ac)	(ac)	(ac-ft)	(cfs)	(cfs/ac)		
ELM CREEK - SOUTH												
EC-S1P	75.7	0	75.7	903.0	907.5	3.8	4.6	18.7	7.2	0.09		
EC-S2P	75.7	0	65.6	880.0	882.0	5.2	5.6	10.8	2.6	0.04	27-244W	
EC-S3P	42.4	0	42.4	929.0	933.2	1.3	1.7	6.1	9.5	0.22		
EC-S4P	56.8	42.4	99.2	910.0	914.3	1.8	2.3	8.7	16.0	0.16		
EC-S5P	29.6	0	29.6	900.0	904.2	0.8	1.2	4.3	4.5	0.15		
EC-S6P	99.5	65.6	165.1	870.0	874.4	3.0	3.8	15.1	8.1	0.05		
ELM CREEK - WEST												
EC-W6P	70.1	0	70.1	888.0	892.3	1.0	1.4	5.1	3.3	0.05		
EC-W7P	60.8	0	60.8	900.0	904.4	1.5	2.0	7.7	7.3	0.12		
EC-W8P	100.4	60.8	161.2	880.0	884.3	3.0	3.7	14.2	24.8	0.15		
EC-W12P	101.5	0	101.5	873.0	877.0	3.0	3.6	13.4	8.8	0.09		
EC-W9P	155.4	332.8	488.2	869.0	871.6	20.4	48.5	110.2	47.9	0.10	27-236W	Outlet is a 30" culvert under Fernbrook Lane.
ELM CREEK - EAST												
EC-E3P	46.5	0.0	46.5	865.0	869.5	1.2	1.7	6.5	4.7	0.10		
ELM CREEK - NORTH												
EC-N1P	79.7	0.0	79.7	866.0	867.3	9.3	13.1	14.2	6.6	0.08	27-222W	
EC-N2P	22.5	79.7	102.2	862.0	863.8	1.2	2.3	3.2	7.1	0.07		
EC-N3.2P	26.7	0.0	26.7	854.0	857.7	0.1	2.0	3.6	0.0	0.00		
EC-N3.3P	34.5	0.0	34.5	854.0	857.6	0.3	2.0	3.3	2.0	0.06		
EC-N3.4P	54.7	0.0	54.7	854.0	857.6	0.2	1.5	2.5	1.9	0.03		
EC-N3.5P	26.8	0.0	26.8	854.0	856.6	0.7	1.1	2.2	2.3	0.09		
EC-N3.7P	34.2	0.0	34.2	854.0	855.6	0.7	2.1	2.2	1.8	0.05		
EC-N3.6P	19.3	176.9	196.2	852.0	854.0	2.1	2.4	4.4	5.4	0.03		
EC-N5P	0.0	130.7	130.7	857.0	859.5	3.7	4.2	9.9	4.1	0.03		
EC-N7.1P	38.7	0.0	38.7	853.0	858.1	0.4	2.3	6.4	2.0	0.05		
EC-N7.2P	35.2	0.0	35.2	857.0	859.3	1.0	1.2	2.6	3.0	0.09		
EC-N4P	80.3	0.0	80.3	855.5	856.9	2.6	4.5	5.0	0.0	0.00		EC-N4P was designed as an infiltration basin.
EC-N8P	30.0	0.0	30.0	858.0	861.4	1.0	1.3	4.0	6.9	0.23		
EC-N9P	152.0	539.3	691.2	856.0	857.7	45.2	65.9	99.6	9.2	0.01	27-227W	
CROW RIVER												
CR3P	96.4	0.0	96.4	900.0	904.8	3.3	4.0	17.4	10.4	0.11		
CR4P	137.6	0.0	137.6	850.0	854.9	4.3	5.2	22.8	15.0	0.11		
CR5P	82.0	0.0	82.0	890.0	894.8	2.5	3.2	13.8	3.7	0.05		
CR7P	43.7	0.0	43.7	980.0	984.0	1.3	1.7	5.8	7.7	0.18		
CR6P	179.0	0.0	179.0	897.1	898.2	35.9	43.2	45.1	0.0	0.00	27-123P	
CR8P	97.3	261.0	358.3	884.7	886.6	4.9	22.7	26.5	2.2	0.01	27-284W	

APPENDIX C
POND DATA

Pond Number	Drainage Area			Modeled NWL	Modeled HWL	Area @ NWL	Area @ HWL	Proposed Flood Storage	Proposed 100-Year discharge	100-Year discharge per acre	DNR Protected Waters Inventory	Comments
	Direct	Ponded	Total									
	(ac)	(ac)	(ac)			(ac)	(ac)	(ac-ft)	(cfs)	(cfs/ac)		
MISSISSIPPI RIVER - LANDLOCKED												
MR-LL1P	88.2	0.0	88.2	871.7	874.9	5.8	10.2	25.2	2.8	0.03	27-287W	Landlocked.
MISSISSIPPI RIVER - NORTHWEST												
MR-NW3P	56.8	0.0	56.8	890.0	894.5	1.5	2.0	7.7	7.4	0.13		
MR-NW5P	136.1	0.0	136.1	880.0	884.8	3.6	4.5	19.5	9.5	0.07		Basin is landlocked.
MR-NW8P	90.7	0.0	90.7	860.0	864.8	2.8	3.6	15.3	9.0	0.10		
MR-NW9-P	74.9	0.0	74.9	950.0	953.7	3.0	3.6	12.9	3.7	0.05		
MISSISSIPPI RIVER - NORTH												
MR-N1P	97.3	0.0	97.3	902.0	904.0	4.7	11.8	16.3	8.0	0.08	27-216W	
MR-N2P	103.2	97.3	200.5	885.0	889.1	3.2	3.9	14.7	18.4	0.09		
MR-N3P	40.6	0.0	40.6	878.0	882.2	1.3	1.7	6.1	5.4	0.13		
MR-N8P	104.3	0.0	104.3	878.0	879.0	12.6	23.0	18.5	2.3	0.02		
MR-N4P	95.8	104.3	200.1	870.0	871.3	16.2	17.8	22.4	2.7	0.01		
MR-N6P	44.8	0.0	44.8	860.0	864.2	1.5	2.0	7.3	4.3	0.10		
MISSISSIPPI RIVER - NORTHEAST												
MR-NE1P	85.1	0.0	85.1	876.0	877.3	13.9	16.5	19.1	3.3	0.04	27-218W	
MR-NE2P	66.6	0.0	66.6	863.9	867.5	2.8	3.3	10.9	4.4	0.07		
MR-NE3P	118.4	151.7	270.1	856.0	858.3	6.4	19.6	29.1	13.8	0.05		
MR-NE4P	73.9	0.0	73.9	860.0	864.2	2.8	3.4	12.9	3.8	0.05		
MR-NE6P	42.8	344.0	386.9	850.0	855.6	4.1	5.2	25.8	11.5	0.03		Designed as an infiltration basin. Landlocked.
MR-NE5.1P	10.8	0.0	10.8	860.0	861.2	0.1	0.8	0.5	3.2	0.30		
MR-NE5.3P	31.1	0.0	31.1	854.5	856.7	1.2	1.4	2.8	3.4	0.11		
MR-NE5.2P	45.9	41.9	87.8	849.5	856.3	0.5	1.8	10.2	11.5	0.13		Designed as an infiltration basin.
MISSISSIPPI RIVER - SHORELINE												
MR-SL4P	54.4	0.0	54.4	868.1	869.9	2.5	10.5	11.7	1.3	0.02		
MR-SL6P	52.0	0.0	52.0	870.0	874.5	2.0	2.6	10.4	7.2	0.14		
MR-SL10P	44.8	0.0	44.8	873.3	876.3	0.6	4.0	7.8	5.0	0.11	27-1104	
MR-SL11P	87.6	44.8	132.4	855.0	859.0	3.3	4.0	14.8	13.5	0.10		
MR-SL14P	70.4	0.0	70.4	950.0	954.2	2.5	3.1	11.6	9.4	0.13		

Appendix D – Stormwater System Costs

APPENDIX D
STORM WATER SYSTEM COSTS

Point		Existing or Proposed	Size	Length	Unit Cost	Pond Area at HWL	Pond Excavation Volume	City Trunk Costs				
								Construction	Easement Acquisition	Cont., Eng., Admin., Fiscal	Total Cost	
From	To		(in)	(ft)	($)	(ac)	(cy)	($)	($)	($)	($)	
DIAMOND CREEK - DIAMOND LAKE												
DC-DL8P		Proposed				6.2	42,539	212,694	621,100	125,918	959,712	
DC-DL4P		Existing				236.8	NA	0	0	0	0	
DC-DL6P		Proposed				3.4	22,532	112,659	340,000	67,798	520,457	
DC-DL7P		Existing				411.1	NA	0	0	0	0	
DC-DL8P	DC-DL4N1	Proposed	21	400	85			34,054	4,591	10,675	49,321	
DC-DL6P	DC-DL7P	Proposed	18	1,650	73			120,689	18,939	38,100	177,728	
DIAMOND CREEK - FRENCH LAKE												
DC-FL1P		Proposed				5.6	36,784	183,920	561,500	111,326	856,746	
DC-FL2P		Proposed				5.9	39,365	196,827	590,000	118,048	904,875	
DC-FL4P		Existing				234.2	NA	0	0	0	0	
DC-FL1P	DC-FL1N1	Proposed	24	200	97			19,425	2,296	6,057	27,778	
DC-FL2P	DC-FL2N1	Proposed	21	300	85			25,541	3,444	8,007	36,991	
RUSH CREEK - WEST												
RC-W1.1P		Proposed				4.7	26,781	133,907	470,000	87,172	691,079	
RC-W1.2P		Existing				0.6	NA	0	0	0	0	
RC-W1.4P		Existing				0.4	NA	0	0	0	0	
RC-W1.5P		Existing				0.6	NA	0	0	0	0	
RC-W1.7P		Proposed				1.2	7,066	35,332	121,000	22,700	179,032	
RC-W1.3P		Existing				14.5	NA	0	0	0	0	
RC-W2P		Proposed				5.1	30,815	154,073	510,000	97,222	761,295	
RC-W3P		Proposed				4.4	26,965	134,826	437,000	84,148	655,974	
RC-W4P		Proposed				1.8	10,567	52,837	180,000	33,851	266,688	
RC-W6P		Proposed				3.4	21,377	106,883	341,000	66,165	514,048	
RC-W1.8P		Existing				0.5	NA	0	0	0	0	
RC-W5P		Proposed				0.7	3,824	19,118	67,000	12,435	98,553	
RC-W8P		Existing				6.6	NA	0	0	0	0	
RC-W9P		Existing				12.7	NA	0	0	0	0	
RC-W7P		Existing				3.3	28,217	0	0	0	0	See Note #8.
RC-W7.1P		Existing				7.1	NA	0	0	0	0	
RC-W10P		Proposed				5.1	32,912	164,560	507,000	100,068	771,628	
RC-W1.1P	RC-W1.3P	Proposed	18	100	73			7,314	1,148	2,309	10,771	
RC-W1.1N1	RC-W1.3P	Existing	Surface conveyance					0	0	0	0	
RC-W1.2P	RC-W1.3P	Existing	24	100	97			0	0	0	0	
RC-W1.4P	RC-W1.6N1	Existing	24	1,200	97			0	0	0	0	
RC-W1.5P	RC-W1.6N1	Existing	Surface conveyance					0	0	0	0	

APPENDIX D
STORM WATER SYSTEM COSTS

Point		Existing or Proposed	Size	Length	Unit Cost	Pond Area at HWL	Pond Excavation Volume	City Trunk Costs				
								Construction	Easement Acquisition	Cont., Eng., Admin., Fiscal	Total Cost	
From	To		(in)	(ft)	($)	(ac)	(cy)	($)	($)	($)	($)	
RC-W1.6N1	RC-W1.3P	Proposed	24	1,200	97			116,552	13,774	36,343	166,669	
RC-W1.7P	RC-W1.3P	Proposed	12	200	53			10,552	2,296	3,395	16,243	
RC-W1.3P	RC-W2P	Proposed	30	1,350	174			234,722	15,496	71,966	322,184	
RC-W2P	N. Fk. Rush Cr	Proposed	36	600	199			119,429	6,887	36,518	162,834	
RC-W3P	N. Fk. Rush Cr	Proposed	15	500	64			31,776	5,739	10,107	47,622	
RC-W4P	RC-W4N1	Proposed	12	500	53			26,380	5,739	8,488	40,607	
RC-W6P	RC-W6N1	Proposed	12	250	53			13,190	2,870	4,244	20,304	
RC-W1.8P	RC-W5P	Existing	12	42	53			0	0	0	0	
RC-W5P	RC-W9P	Proposed	12	100	53			5,276	1,148	1,698	8,121	
RC-W8P	RC-W9P	Existing	12	83	53			0	0	0	0	
RC-W9P	RC-W7.1P	Existing	30	113	174			0	0	0	0	
RC-W7P	RC-W7.1P	Existing	24	229	97			0	0	0	0	See Note #8.
RC-W7.1P	Rush Cr.	Existing	36	65	199			0	0	0	0	See Note #8.
RC-W10P	Rush Cr.	Proposed	21	300	85			25,541	3,444	8,007	36,991	
RUSH CREEK - NORTH												
RC-N4P		Proposed				2.1	13,647	68,236	213,400	41,811	323,447	
RC-LL1P		Existing				17.9	NA	0	0	0	0	
RC-N1P		Proposed				2.8	17,566	87,830	283,700	54,719	426,249	
RC-N2P		Existing				4.3	NA	0	0	0	0	
RC-N3P		Proposed				5.1	18,989	94,945	509,600	79,443	683,988	
RC-N4P	RC-N5N1	Proposed	15	625	64			39,720	7,174	12,633	59,527	
RC-LL1	RC-N5N3	Proposed	24	1,000	97			97,126	11,478	30,286	138,891	
RC-N1P	RC-N5N2	Proposed	18	200	73			14,629	2,296	4,618	21,543	
RC-N2P	RC-N6N1	Proposed	12	400	53			21,104	4,591	6,790	32,486	
RC-N3P	RC-N6N2	Proposed	18	350	73			25,601	4,017	8,082	37,700	
RUSH CREEK - EAST												
RC-E1P		Proposed				3.1	20,296	101,479	314,000	61,844	477,322	
RC-E2P		Proposed				4.2	25,313	126,566	418,000	79,770	624,336	
RC-E1P	Rush Cr.	Proposed	18	800	73			58,516	9,183	18,473	86,171	
RC-E2P	Rush Cr.	Proposed	21	500	85			42,568	5,739	13,344	61,651	
ELM CREEK - SOUTH												
EC-S1P		Proposed				3.8	30,223	151,113	377,600	83,094	611,807	
EC-S2P		Existing				5.2	NA	0	0	0	0	
EC-S3P		Proposed				1.3	9,816	49,078	125,000	27,223	201,301	
EC-S4P		Proposed				1.8	13,976	69,882	180,000	38,964	288,846	
EC-S5P		Proposed				0.8	6,905	34,525	83,000	18,658	136,183	

APPENDIX D
STORM WATER SYSTEM COSTS

Point		Existing or Proposed	Size	Length	Unit Cost	Pond Area at HWL	Pond Excavation Volume	City Trunk Costs				
From	To		(in)	(ft)	($)	(ac)	(cy)	Construction ($)	Easement Acquisition ($)	Cont., Eng., Admin., Fiscal ($)	Total Cost ($)	
EC-S6P		Proposed				3.0	24,297	121,484	304,000	66,845	492,329	
EC-S1P	EC-S6N1	Proposed	18	1,200	73			87,773	13,774	27,709	129,257	
EC-S2P	EC-S6P	Proposed	12	500	53			26,380	5,739	8,488	40,607	
EC-S3P	EC-S4P	Proposed	18	2,400	73			175,547	27,548	55,419	258,514	
EC-S4P	EC-S6N1	Proposed	18	200	73			14,629	2,296	4,618	21,543	
EC-S5P	EC-S5N1	Proposed	12	200	53			10,552	2,296	3,395	16,243	
EC-S6P	EC-S6N2	Proposed	15	200	64			12,710	2,296	4,043	19,049	
EC-S6N1	EC-S6N2	Proposed	30	1,950	174			339,043	22,383	103,951	465,377	
ELM CREEK - WEST												
EC-W6P		Proposed				1.4	8,297	41,487	140,000	26,446	207,933	
EC-W7P		Proposed				2.0	12,419	62,097	201,000	38,729	301,826	
EC-W8P		Proposed				3.7	22,979	114,894	369,200	71,388	555,482	
EC-W12P		Proposed				3.6	21,611	108,053	364,600	68,876	541,529	
EC-W9P		Existing				48.5	NA	0	0	0	0	
EC-W6P	EC-W9P	Proposed	12	700	53			36,932	8,035	11,883	56,850	
EC-W7P	EC-W8P	Proposed	15	1,600	64			101,683	18,365	32,341	152,390	
EC-W8P	EC-W9P	Proposed	24	900	97			87,414	10,331	27,257	125,001	
EC-W12P	EC-W9P	Proposed	18	700	73			51,201	8,035	16,164	75,400	
EC-W9P	EC-W11N1	Proposed	30	100	174			17,387	1,148	5,331	23,865	
ELM CREEK - EAST												
EC-E3P						1.7	10,551	52,756	171,000	32,927	256,683	
EC-E3P	EC-E3N1	Proposed	12	200	53			10,552	2,296	3,395	16,243	
ELM CREEK - NORTH												
EC-N1P		Existing				13.1	NA	0	0	0	0	
EC-N2P		Proposed				2.3	5,163	25,813	230,000	30,744	286,557	
EC-N3.2P		Proposed				2.0	5,808	29,040	200,000	28,712	257,752	
EC-N3.3P		Proposed				2.0	5,324	26,620	200,000	27,986	254,606	
EC-N3.4P		Proposed				1.5	4,033	20,167	150,000	21,050	191,217	
EC-N3.5P		Proposed				1.1	3,549	17,747	110,000	16,324	144,071	
EC-N3.7P		Proposed				2.1	3,549	17,747	210,000	26,324	254,071	
EC-N3.6P		Proposed				2.4	7,099	35,493	240,000	34,648	310,141	
EC-N5P		Proposed				4.2	15,891	79,457	415,000	65,337	559,794	
EC-N7.1P		Existing				2.3	NA	0	0	0	0	
EC-N7.2P		Proposed				1.2	4,130	20,651	121,000	18,295	159,946	
EC-N4P		Existing				4.5	NA	0	0	0	0	See Note #8.
EC-N8P		Proposed				1.3	6,389	31,944	131,000	22,683	185,627	

APPENDIX D
STORM WATER SYSTEM COSTS

Point		Existing or Proposed	Size	Length	Unit Cost	Pond Area at HWL	Pond Excavation Volume	City Trunk Costs				
								Construction	Easement Acquisition	Cont., Eng., Admin., Fiscal	Total Cost	
From	To		(in)	(ft)	($)	(ac)	(cy)	($)	($)	($)	($)	
EC-N9P		Existing				65.9	NA	0	0	0	0	
EC-N1P	EC-N2P	Proposed	18	700	73			51,201	8,035	16,164	75,400	
EC-N2P	EC-N9P	Proposed	18	1,000	73			73,145	11,478	23,091	107,714	
EC-N3.2P	EC-N3.4P	Proposed	Surface	600	#N/A			0	0	0	0	
EC-N3.3P	EC-N3.6P	Proposed	24	1,050	97			101,983	12,052	31,800	145,835	
EC-N3.4P	EC-N3.6P	Proposed	24	900	97			87,414	10,331	27,257	125,001	
EC-N3.5P	EC-N3.6P	Proposed	24	700	97			67,988	8,035	21,200	97,223	
EC-N3.7P	EC-N3.6P	Proposed	24	1,400	97			135,977	16,070	42,400	194,447	
EC-N3.6P	EC-N9P	Prop. FM	16	1,800	64			114,393	20,661	36,384	171,439	
EC-N5P	EC-N9P	Proposed	12	100	53			5,276	1,148	1,698	8,121	
EC-N7.1P	EC-N4P	Exist FM	8	3,400	0			0	0	0	0	See Note #8.
EC-N7.2P	EC-N10N1	Proposed	12	200	53			10,552	2,296	3,395	16,243	
EC-N4P	EC-N9P	Existing	Surface	600	#N/A			0	0	0	0	See Note #8.
EC-N8P	EC-N9P	Proposed	15	200	64			12,710	2,296	4,043	19,049	
EC-N9P	EC-N10N2	Existing	18	80	73			0	0	0	0	
Lift station @ EC-N3.6P		Proposed						530,494	0	159,148	689,642	
CROW RIVER												
CR3P		Proposed				4.0	28,090	140,449	404,500	82,585	627,533	
CR4P		Proposed				5.2	36,855	184,275	516,300	106,912	807,487	
CR5P		Proposed				3.2	22,225	111,126	321,800	65,518	498,444	
CR7P		Proposed				1.7	9,433	47,166	167,300	30,880	245,346	
CR6P		Existing				43.2	NA	0	0	0	0	
CR8P		Existing				22.7	NA	0	0	0	0	
CR3P	Crow R.	Proposed	18	300	73			21,943	3,444	6,927	32,314	
CR4P	Crow R.	Proposed	21	300	85			25,541	3,444	8,007	36,991	
CR5P	CR8P	Proposed	15	400	64			25,421	4,591	8,085	38,097	
CR6P	CR8P	Existing	Surface	1,050	#N/A			0	0	0	0	
CR7P	CR7N1	Proposed	15	200	64			12,710	2,296	4,043	19,049	
MISSISSIPPI RIVER - LANDLOCKED												
MR-LL1P		Existing				10.2	NA	0	0	0	0	
MR-LL1P	Miss. R.	Proposed	24	1,000	97			97,126	11,478	30,286	138,891	
MISSISSIPPI RIVER - NORTHWEST												
MR-NW3P		Proposed				2.0	12,439	62,194	201,800	38,838	302,832	
MR-NW5P		Proposed				4.5	31,444	157,219	448,000	91,966	697,185	
MR-NW8P		Proposed				3.6	24,742	123,710	356,000	72,713	552,424	
MR-NW9-P		Proposed				3.6	20,859	104,294	360,000	67,288	531,582	

APPENDIX D
STORM WATER SYSTEM COSTS

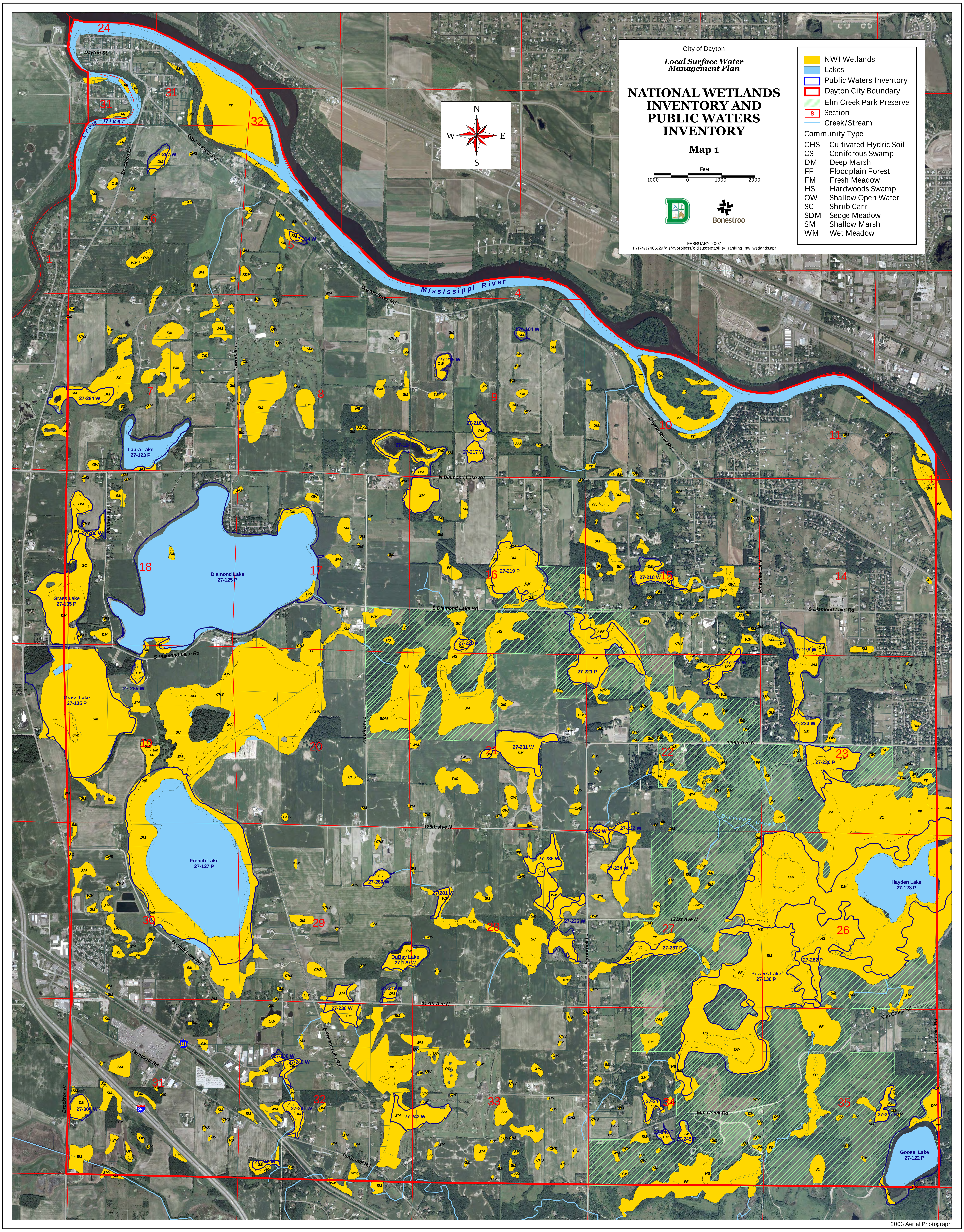
Point		Existing or Proposed	Size	Length	Unit Cost	Pond Area at HWL	Pond Excavation Volume	City Trunk Costs				
								Construction	Easement Acquisition	Cont., Eng., Admin., Fiscal	Total Cost	
From	To		(in)	(ft)	($)	(ac)	(cy)	($)	($)	($)	($)	
MR-NW3P	MR-NW4N1	Proposed	18	700	73			51,201	8,035	16,164	75,400	
MR-NW5P	MR-NW6N1	Proposeed	24	1,000	97			97,126	11,478	30,286	138,891	
MR-NW8P	MR-NW7N1	Proposed	18	500	73			36,572	5,739	11,546	53,857	
MR-NW9P	MR-NW11N1	Proposed	12	300	53			15,828	3,444	5,093	24,364	
MISSISSIPPI RIVER - NORTH												
MR-N1P		Existing				11.8	NA	0	0	0	0	
MR-N2P		Proposed				3.9	23,682	118,411	392,600	74,783	585,794	
MR-N3P		Proposed				1.7	9,872	49,360	169,100	31,718	250,178	
MR-N8P		Existing				23.0	NA	0	0	0	0	
MR-N4P		Existing				17.8	NA	0	0	0	0	
MR-N6P		Proposed				2.0	11,714	58,572	198,700	37,442	294,714	
MR-N1P	MR-N2P	Proposed	18	2,300	73			168,232	26,400	53,110	247,743	
MR-N2P	MR-N5N1	Proposed	24	1,400	97			135,977	16,070	42,400	194,447	
MR-N3P	MR-N5N1	Proposed	15	500	64			31,776	5,739	10,107	47,622	
MR-N8P	MR-N4P	Proposed	12	750	53			39,570	8,609	12,732	60,911	
MR-N4P	MR-N7N1	Proposed	15	850	64			54,019	9,757	17,181	80,957	
MR-N6P	MR-N7N2	Proposed	12	300	53			15,828	3,444	5,093	24,364	
MISSISSIPPI RIVER - NORTHEAST												
MR-NE1P		Existing				16.5	NA	0	0	0	0	
MR-NE2P		Proposed				3.3	17,634	88,169	330,500	59,501	478,169	
MR-NE3P		Existing				19.6	NA	0	0	0	0	
MR-NE4P		Proposed				3.4	20,860	104,302	339,000	65,191	508,493	
MR-NE5.1P		Proposed				0.8	823	4,114	80,000	9,234	93,348	
MR-NE5.3P		Existing				1.4	NA	0	0	0	0	
MR-NE5.2P		Proposed expansion of existing pond.				0.6	6,821	34,106	64,500	16,682	115,288	See Note #9.
MR-NE6P		Proposed				5.2	41,656	208,281	518,000	114,284	840,566	
MR-NE1P	MR-NE3P	Proposed	12	1,450	53			76,502	16,644	24,615	117,761	
MR-NE2P	MR-NE3P	Proposed	12	650	53			34,294	7,461	11,034	52,789	
MR-NE3P	MR-NE6N1	Proposed	24	1,000	97			97,126	11,478	30,286	138,891	
MR-NE4P	MR-NE6N1	Existing	15	950	64			0	0	0	0	See Note #8.
MR-NE6N1	MR-NE6P	Proposed	30	600	174			104,321	6,887	31,985	143,193	
MR-NE6P	Mississippi R.	Proposed	18	300	73			21,943	3,444	6,927	32,314	
MR-NE5.1P	MR-NE5.1N1	Existing	30	800	174			0	0	0	0	See Note #8.
MR-NE5.3P	MR-NE5.1N1	Existing	18	446	73			0	0	0	0	See Note #8.
MR-NE5.1N1	MR-NE5.2P	Existing	36	580	199			0	0	0	0	See Note #8.
MR-NE5.2P	Champlin	Existing	18	195	73			0	0	0	0	See Note #8.

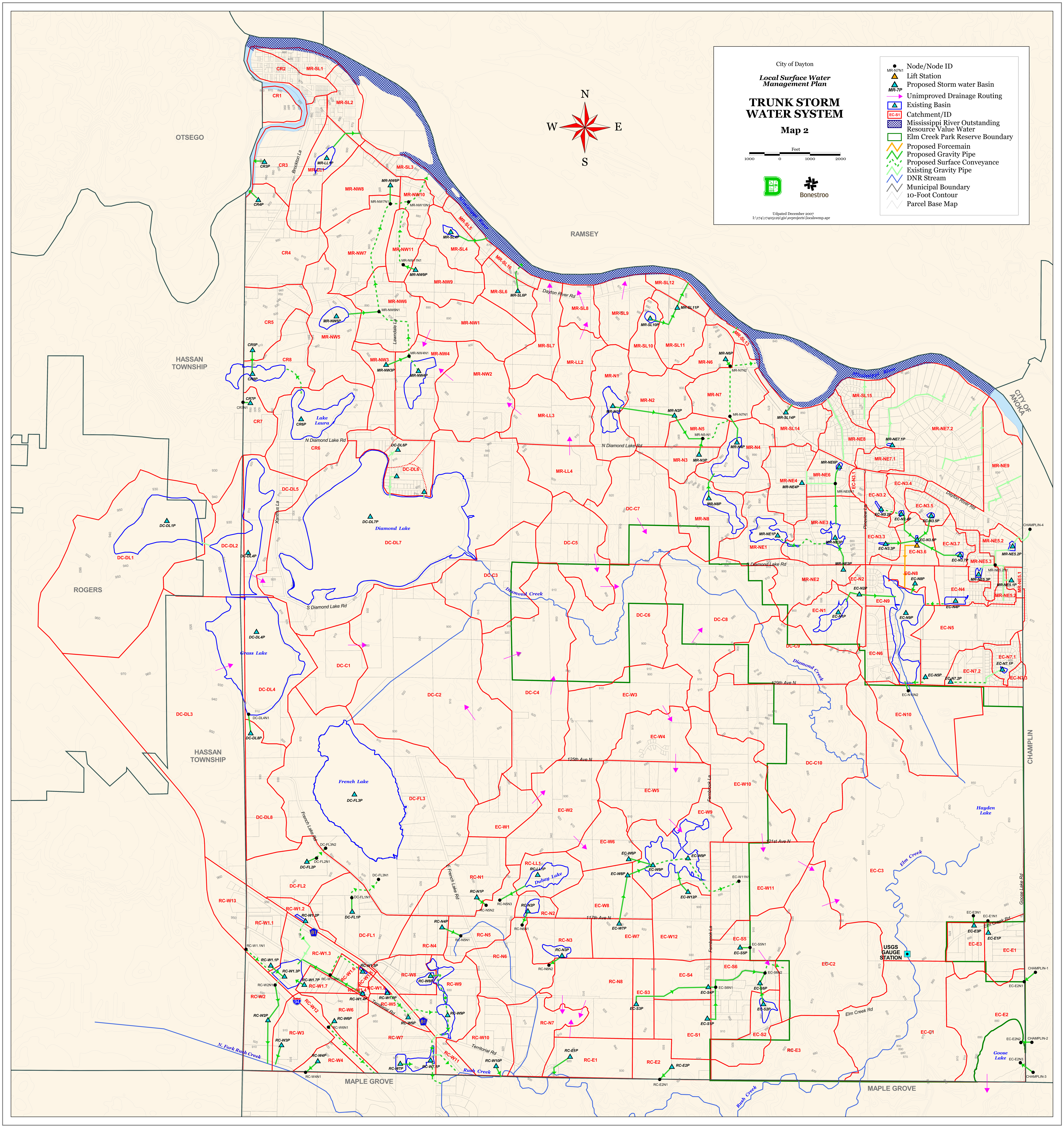
APPENDIX D
STORM WATER SYSTEM COSTS

Point		Existing or Proposed	Size	Length	Unit Cost	Pond Area at HWL	Pond Excavation Volume	City Trunk Costs			
								Construction	Easement Acquisition	Cont., Eng., Admin., Fiscal	Total Cost
From	To		(in)	(ft)	($)	(ac)	(cy)	($)	($)	($)	($)
MISSISSIPPI RIVER - SHORELINE											
MR-SL4P		Existing				10.5	NA	0	0	0	0
MR-SL6P		Proposed				2.6	16,779	83,893	260,000	51,168	395,061
MR-SL10P		Existing				4.0	NA	0	0	0	0
MR-SL11P		Proposed				4.0	23,877	119,387	400,000	75,816	595,203
MR-SL14P		Proposed				3.1	18,715	93,573	310,000	59,072	462,645
MR-SL4P	Miss. R.	Proposed	18	600	73			43,887	6,887	13,855	64,629
MR-SL6P	Miss. R.	Proposed	24	750	97			72,845	8,609	22,714	104,168
MR-SL10P	MR-SL11P	Proposed	12	1,000	53			52,760	11,478	16,976	81,214
MR-SL11P	Miss. R.	Proposed	21	900	85			76,622	10,331	24,020	110,972
MR-SL14P	Miss. R.	Proposed	18	300	73			21,943	3,444	6,927	32,314

STORMWATER SYSTEM TOTAL $31,500,147

Note:
1) Pipe unit cost estimates are based on November 2003 construction costs (ENR cost index 6578) adjusted to December 2006 costs (ENR cost index 7888).
2) Engineering, Contingencies, Administration, and Fiscal at 30% applied to construction and 10% applied to land costs.
3) Pond volume assumed to be same as flood storage volume.
4) Proposed lift station locations currently have existing easement available; easement costs assumed to be zero.
5) 25% land costs for pipe easements because of retention of partial use of land within the easement.
6) Land costs for easements assumed = $100,000 /acre
7) Pond construction costs (includes excavation, berming, and restoration) = $5 /cy
8) This pond or pipe segment is, as of February 2007, in process of construction.
9) This pond, as of Feb. 2007, is in process of construction. The costs shown are to expand the pond for future development. Additional area for future expansion = 0.6 ac @ HWL; Additional volume for future expansion = 4.2 ac-ft.


City of Dayton
Local Surface Water Management Plan
NATIONAL WETLANDS INVENTORY AND PUBLIC WATERS INVENTORY
Map 1
Feet
1000 0 1000 2000
Bonestroo
FEBRUARY 2007
I:/174/17405129/gis/avprojects/old susceptability_ranking_nwi wetlands.apr
NWI Wetlands
Lakes
Public Waters Inventory
Dayton City Boundary
Elm Creek Park Preserve
8 Section
Creek/Stream
Community Type
CHS Cultivated Hydric Soil
CS Coniferous Swamp
DM Deep Marsh
FF Floodplain Forest
FM Fresh Meadow
HS Hardwoods Swamp
OW Shallow Open Water
SC Shrub Carr
SDM Sedge Meadow
SM Shallow Marsh
WM Wet Meadow
Mississippi River
Crow River
Diamond Lake 27-125 P
Laura Lake 27-123 P
Grass Lake 27-135 P
French Lake 27-127 P
Hayden Lake 27-128 P
Powers Lake 27-130 P
DuBay Lake 27-129 W
Goose Lake 27-122 P
2003 Aerial Photograph


City of Dayton
Local Surface Water Management Plan
TRUNK STORM WATER SYSTEM
Map 2
Feet
1000 0 1000 2000
Bonestroo
Udpated December 2007
I:\174\17405129\gis\avprojects\localswmp.apr
Node/Node ID
MR-N7N1
Lift Station
Proposed Storm water Basin
MR-7P
Unimproved Drainage Routing
Existing Basin
EC-S1
Catchment/ID
Mississippi River Outstanding Resource Value Water
Elm Creek Park Reserve Boundary
Proposed Forcemain
Proposed Gravity Pipe
Proposed Surface Conveyance
Existing Gravity Pipe
DNR Stream
Municipal Boundary
10-Foot Contour
Parcel Base Map
N
S
W
E
OTSEGO
RAMSEY
HASSAN TOWNSHIP
ROGERS
CITY OF ANOKA
CHAMPLIN
MAPLE GROVE
Diamond Lake
French Lake
Grass Lake
Lake Laura
Dubay Lake
Hayden Lake
Goose Lake
Diamond Creek
Elm Creek
Rush Creek
N. Fork Rush Creek
USGS GAUGE STATION
N Diamond Lake Rd
S Diamond Lake Rd
Dayton River Rd
125th Ave N
129th Ave N
121st Ave N
117th Ave N
French Lake Rd
Fernbrook La
Territorial Rd
Elm Creek Rd
Goose Lake Rd
Brockton La