Appendix B

Oakdale • Minnesota

Second Generation

Surface Water Management Plan

April 2009

SEH No. A-OAKDA0402.00

O a k d a l e • M i n n e s o t a

Second Generation

Surface Water Management Plan

EXECUTIVE SUMMARY

The City of Oakdale (City) has completed this second generation Surface Water Management Plan (SWMP or Plan) to establish a more up-to-date guide for future surface water management activities throughout the City. This second generation Plan builds on the City's 1989 SWMP and addresses several key issues related to storm water management that the City is likely to encounter in the coming years. This executive summary provides a brief description of the purpose and basis for this updated Plan, followed by a presentation of the nine goals that were used to guide development of the Plan. This executive summary closes by highlighting the key issues the City intends to address through implementation of this Plan.

A. Purpose of the Plan

The purpose of this plan is to provide a guide and framework for the City to manage its wealth of surface water resources as development and redevelopment occur into the future. With this guidance specific to surface water as well as the broader guidance provide in the City's Comprehensive Plan, this Surface Water Management Plan will serve to:

- Provide for the use, management, improvement and protection of the City's surface water resources based on the best available information;
- Contribute to the quality of life by preserving and improving the high environmental quality of the community;
- Protect public investments and private property related to or affected by surface water;
- Recognize the larger context of surface water management issues;
- Balance environmental protection with community and economic needs and capabilities; and
- Meet regulatory requirements.

B. Regulatory Basis for the Plan

There are two primary programs that establish the regulatory need to update the City's initial Surface Water Management Plan (SEH, 1989). First, Minnesota Statutes, Sections 103B.201 to 103B.255 and Minnesota Rule, Chapter 8410 comprise the State's Metropolitan Surface Water Management Program (MSWMP). These Statutes and Rules require the preparation of watershed plans by watershed management organizations (WMOs) and the preparation of local water management plans that are consistent with the respective WMO plans. Second, upon adoption by Council, the policies and standards presented in this Plan become a part of the City's overall Comprehensive Plan.

The purpose of the MSWMP is that through policies and thoughtful program implementation, goals for proper water and wetland resource management can be realized and water quality can be protected. Through proper planning and implementation, informed decisions can be made which allow for the protection and/or enhancement of water quality, prevention of ground water degradation, and reduction of local flooding.

A third regulatory program, very much related to the goals, policies and standards of this Plan, is the National Pollutant Discharge Elimination System (NPDES) Phase II Storm Water Permit Program (Phase II Program). While this program is not directly a driving force for updating the City's Plan, similarities between the MSWMP and NPDES Phase II programs are such that the City intends to realize efficiencies in managing the two separate regulatory programs as a single implementation program.

The NPDES Phase II Storm Water Permit Program is a federal regulatory program that requires owners of Municipally Separate Storm Sewer Systems (MS4s) to prepare and implement a Storm Water Pollution Prevention Program (SWPPP) and apply for the permit with the administrative agency. The Minnesota Pollution Control Agency (MPCA) administers the Phase II MS4 program in the state. The City submitted its original permit application and SWPPP on March 10, 2003, and submitted an updated SWPPP in 2006 to comply with the MPCA program requirements. The City has completed its NPDES program in conformance to the SWPPP since submittal in 2003, including conducting annual public meetings at the City's Environmental Management Commission meetings. This SWMP incorporates by reference many of the best management practices (BMPs) that were identified in the City's 2006 SWPPP. This SWMP also identifies specific projects that are not specified in the City's NPDES Program SWPPP.

Surface water management programs throughout the country, state and locally have seen significant changes in recent years and are expected to continue evolving as the regulatory programs expand and/or change. For example, the impaired waters program and associated Total Maximum Daily Load (TMDL) studies reach as far downstream as Lake Pepin. Changes to the wetland conservation act and a shift towards lower impact development approaches will also likely have some impact on how Oakdale manages surface waters in the future. One local example is in the recent adoption of volume reduction and infiltration requirements by watershed organizations. While the basis for these new standards will help achieve the overall goals for water quality, the changes have created new challenges for developers and the City to shift their

approaches to development and street reconstruction projects. This can be especially challenging in areas where the site conditions are not suitable for infiltration practices.

C. Plan Overview

The Plan contains an introduction (Section I), a brief background and history and description of the existing physical environment (Section II); specific goals and policies (Section III) developed by the City; specific information regarding key water bodies within the City (Section IV) and an implementation plan summary to guide future projects and management activities for the protection and future enhancement of the City's water and wetland resources (Section V).

Using the nine goals summarized in the following Table, the Plan is intended to guide surface water and water resource management activities over at least the next ten years. Though long term in focus, the Plan has numerous future decision points related to recommended capital improvements and ongoing inspection, maintenance and monitoring activities. The Plan was developed recognizing the need for proper land utilization and growth and, at the same time, emphasizing the need to prioritize management actions and decisions based on the assigned category of a receiving water body (i.e., lake or wetland).

Oakdale Storm Water Management Plan Goals

Goal Number	Goal
1	Water Quality
2	Water Quantity (Flooding)
3	Wetlands
4	Erosion Control
5	Groundwater
6	Recreation, Habitat and Shoreline Management
7	Public Participation, Information and Education
8	Maintenance and Inspection
9	Regulatory Responsibility

One of the larger efforts undertaken as a part of this Plan update is the City-wide hydrologic model Update. The overall goals of this modeling effort were to better predict and understand the urban hydrology within the City such that potential future flooding issues resulting from development or redevelopment could be addressed. By updating the City-wide model, reviewing proposed future development projects is also a more consistent process and the model is made available to developers to use as the basis of their work.

This updated SWMP addresses each of the required elements in Minnesota Statutes and Rules and is consistent with the Metropolitan Council's guidelines for Water Management Plans. The Plan is also consistent with the watershed districts (WDs) having jurisdiction in portions of Oakdale:

- Ramsey-Washington-Metro Watershed District (RWMWD)
- South Washington Watershed District (SWWD)
- Valley Branch Watershed District (VBWD)

The criteria set forth in this Plan, as a minimum, establish the degree of performance necessary to achieve the City's water quality and water quantity management goals and meet the applicable regulatory requirements. These criteria are not intended to dictate or preempt the design process, but rather provide guidelines to proper development and redevelopment.

D. Implementation Plan

The Implementation Plan is made of nine action-implementation Plans created for each of the nine Plan goals. The overall Plan includes a mixture of capital improvement projects, studies, ongoing maintenance, inspection, monitoring and other management activities recommended over approximately the next 10-15 years. Estimated planning level costs for significant items are provided which costs for most current actions are not provided. The City recognizes that planning-level cost estimates often can set unrealistic expectations of the actual costs of projects and/or activities.

The implementation plan is based on goal and policy-driven action-implementation plans. The process of developing the action and implementation plans is based on four steps:

- Development of goal statements consistent with Minnesota Rules Chapter 8410, the WMOs and Metropolitan Council;
- Identification of issues or problems related to achieving the goals;
- Identification of solutions corresponding to each of the issues; and
- Development of specific action steps, including identification of resources, measurement and anticipated schedules.

1. Implementation Priorities

The City's water bodies, wetlands and open spaces are exceptional resources for City residents. They offer a range of recreational opportunities and are generally in very good shape from a water quality perspective. The City's challenge in the years ahead will be to successfully implement this SWMP and the requirements of the NPDES Phase II program to maintain, and where feasible, improve these existing resources. Water Quantity, or flooding, issues are another key area for the City to focus efforts on in the coming years. While no significant issues exist, there are several areas throughout the City where localized flooding can be addressed by infrastructure improvements associated with street reconstruction and/or development projects.

The City's implementation priorities are listed in the following Table with references to the Plan section(s) and a planning level cost estimate where costs are not already included in the City's overall storm water management program budget. The City's highest priorities are to continue to manage their program in compliance with the NPDES MS4 permit program requirements and to take a more focused approach to meeting the recently adopted volume control requirements for much of the City.

Implementation Priorities

Activity Steps	Plan Section(s)	Estimated Cost	Target Date
1. Implement NPDES Permit Program.	• Table 6 – Water Quality	• NA	Annually
2. Update Post-Construction Runoff Control Ordinance and Erosion and Sediment Control Ordinance	• Table 6 – Water Quality • Table 12 – Erosion Control	• $5,000	2008
3. Complete a study/report of potential infiltration and volume reduction areas to support future street reconstruction projects	• Table 6 – Water Quality • Table 14 - Groundwater	• $15,000	2008 - 2009
4. Track List of Impaired Waters by MPCA	• Table 6 – Water Quality	• NA	Annually
5. Development of database for tracking and reporting storm water program activities	• Table 20 – Maintenance and Inspection	• $4,000 • $2,500	2008 Annually
6. Explore Grant Program opportunities to help fund water resources projects and initiatives.	• Table 22 – Regulatory Responsibility	• $2,000	Annually (Ongoing)

The financial goal for this Plan is to fit within the existing funding sources to pay for water resources management activities. Except for the items listed below, planning-level estimates of capital expenditures have not been made. The primary funding source for Plan activities is the City's Surface Water Management Fund. The Fund is anticipated to be supplemented by special assessments, grant and other available funding on a project specific basis. In consideration of recent municipal budget situations, a renewed focus will be placed on securing grants, enlisting regional watershed funding and investigating other innovative financing mechanisms.

The City instituted a storm water utility fee in January 2003 to provide a dedicated funding source and to meet federally required storm water standards. This fee is charged to existing properties based on estimates of the surface water runoff they generate. The purpose of all derived funds is to serve as the primary funding source for the City's storm water program and specifically was intended to finance three primary categories:

- To meet federal and state mandated requirements to address water quality issues with storm water runoff (estimated annual costs $100,000);
- To conduct proper maintenance and repair of catch basins and the storm water collection systems (estimated annual costs $100,000); and

- To maintain and clean over 200 sediment basins and storm water treatment ponds (estimated annual costs $100,000).

Except for the activities that are taken from the City NPDES SWPPP, the Implementation Plan is not a hard and fast commitment to complete each and every activity in the time frame suggested. Rather, it is a suggested course of action that will accomplish the major goal of this plan, to accommodate in-fill development and redevelopment in the community while protecting and improving Oakdale's water resources. The Implementation Plan will be reviewed on an annual basis as part of the City's annual report to Council. At that time, proposed improvements and new activities are to be considered, City budgets adjusted if needed, and additional improvement projects or management activities added to, or removed from, the program.

Water Quantity, or flooding, issues are another key area for the City to focus efforts on in the coming years. While no significant issues exist, there are several areas throughout the City where localized flooding can be addressed by infrastructure improvements associated with street reconstruction and/or development projects. One project called for in the Valley Branch Watershed Plan was a review of the outlet on Mud (Acorn) Lake. This work was completed as part of this Plan update and is discussed in Section II under Goal B, Water Quantity.

2. Amendments to the Plan

The NPDES SWPPP activities will be reviewed and evaluated annually in a public meeting and the permit program itself is scheduled to be updated in 2011 and every five years after that. For this Plan to remain dynamic, an avenue must be available to implement new information, ideas, methods, standards, management practices, and any other changes which may affect the intent and/or results of the Plan. Amendment proposals can be requested any time by any person or persons either residing or having business within the City.

Proposed amendments are reviewed by staff, and if determined to be reasonable and necessary amendment the need for a public hearing shall be considered at a regular or special Council meeting. Council and the WDs have an opportunity to determine whether or not to approve of the proposed amendments.

3. Annual Report to Council

An annual report will be completed by City staff summarizing water resource management activities that have been completed over each calendar year. To the extent practicable, and to avoid duplication of efforts, the annual report will be coordinated with preparation of the Phase II NPDES program annual report that must be submitted to MPCA by June 30th of each year. The NPDES annual report includes a public notice, meeting and comment process prior to finalizing the annual report. The City will use this annual reporting process to evaluate the overall storm water management program.

Staff's intent is to revisit the goals, policies, tools and progress of the Plan on a three to five year basis. Water quality trends will be reviewed with input from the Watershed Districts, the effectiveness of regulatory programs will be evaluated, and the success of public improvement

projects will be assessed. Based on these subsequent reviews, the SWMP will be updated to produce a truly dynamic plan.

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I. INTRODUCTION

The City of Oakdale is located in west central Washington County. It is bounded to the west by Maplewood and North St. Paul, to the north by Mahtomedi and Pine Springs, to the east by Lake Elmo and to the south by Woodbury. Oakdale is split east and west by Interstate 694 and north and south by Minnesota State Trunk Highway 5 as illustrated in Figure 1.

The City of Oakdale (City) has completed this second generation Surface Water Management Plan (SWMP or Plan) to establish a more useful and up-to-date guide for future surface water management activities throughout the City. This second generation Plan builds on the City's 1989 SWMP and addresses several key issues related to storm water management that the City is likely to encounter in the coming years. This introductory section begins with a brief description of the purpose and basis for this updated Plan, followed by an outline of the major sections and the nine overriding goals that were used to guide development of the Plan.

A. Purpose of the Plan

The purpose of this plan is to provide a guide and framework for the City to manage its wealth of surface water resources as development and redevelopment occur into the future. With this guidance specific to surface water as well as the broader guidance provide in the City's Comprehensive Plan, this Surface Water Management Plan will serve to:

- Provide for the use, management, improvement and protection of the City's surface water resources based on the best available information;
- Contribute to the quality of life by preserving and improving the high environmental quality of the community;
- Protect public investments and private property related to or affected by surface water;
- Recognize the larger context of surface water management issues;
- Balance environmental protection with community and economic needs and capabilities; and
- Meet regulatory requirements.

B. Regulatory Basis for the Plan

There are two primary programs that establish the regulatory need to update the City's initial Surface Water Management Plan (SEH, 1989). First, Minnesota Statutes, Sections 103B.201 to 103B.255 and Minnesota Rule, Chapter 8410 comprise the State's Metropolitan Surface Water Management Program (MSWMP). These Statutes and Rules require the preparation of watershed plans by watershed management organizations (WMOs) and the preparation of local water management plans that are consistent with the respective WMO plans. Second, upon adoption by Council, the policies and standards presented in this Plan become a part of the City's overall Comprehensive Plan.

A third regulatory program, very much related to the goals, policies and standards of this Plan, is the National Pollutant Discharge Elimination System (NPDES) Phase II Storm Water Permit Program that is administered in the State by the Minnesota Pollution Control Agency (MPCA) (http://www.pca.state.mn.us). While this program is not directly a driving force for updating the City's Plan, similarities between the MSWMP and NPDES Phase II programs are such that the City intends to realize efficiencies in managing the two separate programs as a single program. Additional information on the purposes and background for each of the three programs follows.

Surface water management programs throughout the country, state and locally have seen significant changes in recent years and are expected to continue evolving as the regulatory programs expand and/or change. For example, the impaired waters program and associated Total Maximum Daily Load (TMDL) studies reach as far downstream as Lake Pepin. Changes to the wetland conservation act and a shift towards lower impact development approaches will also likely have some impact on how Oakdale manages surface waters in the future.

One local example of a shift in the type of storm water management practices that are encouraged or required is in the recent adoption of volume reduction and infiltration requirements by watershed organizations. While the basis for these new standards will help achieve the overall goals for water quality, the changes have created new challenges for developers and the City to shift their approaches to development and street reconstruction projects. This can be especially challenging in areas where the site conditions are not suitable for infiltration practices. These volume reduction practices are not entirely new, but they are new enough that even storm water professionals do not fully understand the long-term function of the systems to remove pollutants and what the needs are for long-term maintenance to fully realize the intended results. The City's proposed development standards include provisions for designs of infiltration systems and requirements for the construction process to help address these issues. The Plan appendix also includes an example maintenance agreement that can be used to assign the long-term expectations for operation and maintenance of a given storm water practice.

1. Metropolitan Surface Water Management Program (MSWMP)

The purpose of the MSWMP is that through policies and thoughtful program implementation, goals for proper water and wetland resource management can be realized and water quality can be protected. Such a program requires cooperation with neighboring communities, the County,

state agencies and WDs. Through proper planning and implementation, informed decisions can be made which allow for the protection and/or enhancement of water quality, prevention of ground water degradation, and reduction of local flooding.

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

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

2. Watershed Management Organizations (WDs)

Under the MSWMP (http://www.bwsr.state.mn.us), the City is required to submit their updated SWMP to WDs having jurisdiction within the City. Oakdale is located in three Watershed Districts (WD) having jurisdiction over surface water management activities in the City: the Ramsey-Washington-Metro WD; the Valley Branch WD and the South Washington WD. Figure 2 illustrates the watershed boundaries from a hydrologic perspective. In practice, the watershed districts have slightly different administrative boundaries than the hydrologic boundaries show in Figure 2.

Ramsey-Washington-Metro WD (RWMWD), Valley Branch WD (VBWD) and South Washington WD (SWWD) have reviewed the City's Plan to evaluate consistency with their respective Plans. All three watersheds completed updates to their plans in 2006. This updated SWMP addresses each of the required elements in Minnesota Statutes and Rules and is consistent with the Metropolitan Council's guidelines for Water Management Plans. The Plan is also consistent with the Watershed District Plans. The criteria set forth in this Plan, as a minimum, establish the degree of performance necessary to achieve improvement in water quality and water quantity management. These criteria are not intended to dictate or preempt the design process, but rather provide guidelines to proper development and redevelopment.

This Plan represents a unique combination of resource management, regulatory controls and public works management. As discussed above, State Statutes and Rules require that a plan be prepared for each watershed in the seven county metropolitan area. Local (i.e., City) plans must

also be prepared and approved by the applicable watersheds and the Metropolitan Council. Once approved, the Plan becomes part of the City's overall Comprehensive Plan.

3. NPDES MS4 Storm Water Permit Program

The NPDES Phase II MS4 Storm Water Permit Program is a federal regulatory program that requires owners of Municipally Separate Storm Sewer Systems (MS4s) to prepare and implement a Storm Water Pollution Prevention Program (SWPPP) and apply for the permit with the administrative agency. The Minnesota Pollution Control Agency (MPCA) administers the Phase II MS4 program in the state. The City submitted their original permit application and SWPPP in 2003 and submitted an updated SWPP in 2006 to comply with the MPCA program requirements. The City has completed their NPDES program in conformance to the SWPPP since submittal in 2003, including conducting annual public meetings at the City's Environmental Management Commission meetings. This SWMP incorporates by reference many of the best management practices (BMPs) that were identified in the City's 2006 SWPPP. The Plan also identifies specific projects and activities that are not specified in the City's NPDES Program SWPPP.

The first step in meeting the Phase II requirements in 2003 included a self assessment process that the City completed to prepare their Notice of Intent (NOI or permit application) for coverage under the NPDES MS4 Phase II Permit. In this process, the City considered the receiving waters within the City, the City's existing storm water management plan and a range of BMPs that could be followed to achieve the goals of this Plan and the MS4 requirements. The self assessment resulted in an understanding of the City's current storm water programs and future priorities.

Relative to the TMDL impaired waters program mentioned above, and based on the draft 2008 303(d) List of impaired waters, the City currently does not have any impaired waters within its boundaries. However, a portion of the City drains to Kohlman Lake, Beaver Lake and Beaver Creek Lake, all of which are impaired for nutrients/phosphorus. A portion of the City also drains to Battle Creek which is impaired for chlorides. The City will likely be impacted by TMDL studies and implementation plans in the future for each of these waters.

Throughout the process of selection and development of Best Management Practices (BMPs), the City considered the significant sources of pollution, the potentially polluting activities being conducted in the watershed and the sensitivity of the receiving waters. The City has also considered the physical and organizational characteristics of the watersheds within the City. The ultimate goal of the City's Phase II SWPPP is to control or reduce the discharge of pollutants in storm water runoff.

C. Plan Overview

One of the first steps taken to develop this Plan was to gather and compile the best available information and data from a number of sources. Sources of these data include the City's *1989 Surface Water Management Plan*, the Watershed District plans, MPCA NPDES Program and other relevant data were then reviewed and evaluated as part if the update process. Following this

introductory section, the Plan presents a summary of the information reviewed and evaluated. The subsequent sections provide a brief background and history and describe the existing physical environment (Section II); identify specific goals and policies (Section III); present specific information regarding key water bodies within the City (Section IV) and establish an implementation plan to guide future projects and management activities for the protection and future enhancement of the City's water and wetland resources (Section V).

Using the nine goals summarized in Table 1, the Plan is intended to guide surface water and water resource management activities over at least the next ten years. Though long term in focus, the Plan has numerous future decision points related to recommended capital improvements and ongoing inspection, maintenance and monitoring activities. Where applicable, staff and financial resources of the City, WDs and adjacent communities are called on to maximize the effectiveness of the results. The Plan was developed recognizing the need for proper land utilization and growth and, at the same time, emphasizing the need to prioritize management actions and decisions based on the assigned category of a receiving water body (i.e., lake or wetland).

Table 1. Oakdale Storm Water Management Plan Goals

Goal Number	Goal
1	Water Quality
2	Water Quantity (Flooding)
3	Wetlands
4	Erosion Control
5	Groundwater
6	Recreation, Habitat and Shoreline Management
7	Public Participation, Information and Education
8	Maintenance and Inspection
9	Regulatory Responsibility

The Implementation Plan is made of nine action-implementation Plans created for each of the nine Plan goals. The overall Plan includes a mixture of capital improvement projects, studies, ongoing maintenance, inspection, monitoring and other management activities recommended over approximately the next 10-15 years. The implementation plan is based on goal and policy-driven action-implementation plans. The process of developing the action and implementation plans is based on four steps:

- Development of goal statements consistent with Minnesota Rules Chapter 8410, the WMOs and Metropolitan Council;
- Identification of issues or problems related to achieving the goals;
- Identification of solutions corresponding to each of the issues; and
- Development of specific action steps, including identification of resources, measurement and anticipated schedules.

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Second Generation

Surface Water Management Plan

II. BACKGROUND, HISTORY AND PHYSICAL ENVIRONMENT

The City is now almost fully developed and will rely on infill and redevelopment to meet the changing needs of residents. Overall, the low-density residential development pattern will remain with some areas transitioning to higher density residential uses, employment centers, and shopping areas. The largest areas of undeveloped land in the City are located in the far northern portion between CSAH 35/50th Street and Highway 36 and in the east central portion, bordering 40th Street to the north and south, just east of I-694.

A. Soils and Geology

The surficial geology is typified by layers of sand, gravel, silt, and clay overlying the bedrock. The Minnesota Geological Survey can provide maps detailing the bedrock hydrogeology of Minnesota, addressing rock formations and aquifers.

The soils of Oakdale can be classified into two broad groups. The north and central parts of the City are part of the Twin Cities Formation, typified by loamy, rolling terrain. These soils are part of the Eastern St. Croix Moraine and are a complex mix of grayish and reddish brown till. It is a mixture of sands, silts, pebbles, cobble, and boulders, but contains predominantly silt and sand. In the northwestern and central parts of the City soils are loamy, well drained, light colored soils with about 10 percent of the soils having a loamy sand surface. Some small peat bogs are also included. Significant soil series include Kingsley, Hayden, Nessel and Freeon.

The southwest part of the City is part of the Mississippi Valley Outwash Region. These soils are typical of river valleys and their associated terraces and outwash plains. The gently rolling terrain is made up of loamy and sandy materials as well as scattered deposits of peat. Significant soil series include Onamia and Kingsley.

Infiltration capacities of soils can affect the amount of direct runoff resulting from a rainfall event. Generally, the higher the infiltration rate is for a given soil, the lower the runoff potential. Conversely, soils with low infiltration rates produce relatively high runoff volumes and higher peak discharge rates. The most recent focus of storm water management techniques has been on

volume reduction practices which use infiltration or filtration to treat storm water runoff and to reduce the volume of runoff that must be treated. Infiltration and volume reduction efforts are intended to help storm water managers and site designers better mimic natural hydrologic processes and ultimately reduce the impacts of development on surface water resources.

While there is great interest and focus on the benefits of these infiltration practices, there have also been concerns for the practices to be located and designed properly, installed properly and maintained long-term to achieve the desired result. To help understand the general location of the soils and their infiltration capacity in Oakdale, information has been included in Figure 3 to help take a first look at a potential site. More detailed soils investigation will be necessary to more accurately define what potential a given site has for infiltration practices.

Four general hydrologic groups for soils based on texture and slope have been established by the Natural Resource Conservation Service (NRCS). The groups as shown in Figure 3 are:

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

Soil characteristics are essential for completing hydrologic analyses and are also important when developing erosion control plans. Special attention to erosion control measures and establishment of interim cover during construction must be considered in areas of steep slopes, in areas with highly erodible soils and in areas with prolonged land disturbance. The erosion control handbook published by the Board of Water and Soils Resources (BWSR) includes recommended practices and the Ramsey Soil and Water Conservation District has published a "Soil Erosion and Sediment Control Handbook" (1989) that outline recommended Best Management Practices (BMPs) that should be used for erosion protection.

B. Precipitation

Climate within the Minneapolis-St. Paul metropolitan area is described as a humid continental climate with moderate precipitation, wide daily temperature variations, warm humid summers and cold winters. The total average annual precipitation is almost 29 inches. The average annual snowfall is approximately 50 inches, equivalent to roughly 5 inches of water. Rainfall data for a variety of return frequencies and storm duration for the Minneapolis-St. Paul metropolitan area is shown in Table 2.

Several rainfall parameters are considered in using the NRCS hydrologic design methodology. Storm duration, rainfall depths, time distribution (how the total rainfall depth is distributed over the duration of the rainfall event), and recurrence interval (how probable it is that the rainfall event will recur in a given year) are important factors.

Table 2. Rainfall in Minneapolis-St. Paul Metropolitan Area (inches)

Return Frequency	24-Hour	12-Hour	6-Hour	3-Hour	2-Hour	1-Hour	30-Minute	15-Minute
1-Year	**2.3**	2.0	1.7	1.5	1.4	1.2	0.9	0.6
2-Year	**2.8**	2.4	2.1	1.7	1.7	1.4	1.1	0.7
5-Year	**3.6**	3.1	2.7	2.3	2.2	1.8	1.4	1.0
10-Year	**4.2**	3.7	3.1	2.6	2.5	2.1	1.7	1.3
25-Year	**4.6**	4.2	3.5	3.0	2.8	2.3	1.9	1.4
50-Year	**5.3**	4.6	4.0	3.4	3.1	2.7	2.1	1.5
100-Year	**5.9**	5.0	4.4	3.8	3.5	2.9	2.4	1.7

The 24-hour, NRCS Type II rainfall distribution with average soil moisture conditions (AMC-2) will be used for overall subwatershed planning within the City of Oakdale. The first generation 1989 Plan used a Type I storm distribution in development of the City-wide hydrologic model. At that time the Minnesota Hydrology Guide recommended a Type I distribution as the standard for all land use areas. The Guide has since been revised and now recommends a Type II distribution for hydrologic analyses of urban areas. See Appendix A for more detail on Type I, II and C storm distributions. Of the two following storm events, the Flood Evaluation Storm (FES) for a selected water body will be the storm that results in the highest elevation reached in the water body:

- NRCS 100-year, 24-hour, Type II rainfall distribution with wet soil moisture conditions (AMC-3) which is heavy rainfall, or light rainfall and low temperatures have occurred within the last five days.
- NRCS 100-year, 10-day runoff, Type "C" distribution (National Engineering Handbook, Section 4).

The South Washington Watershed District, Watershed Management Plan states that the District prefers Bulletin 71, Midwest Climate Center (Huff and Angle, 1992), as the most robust reference for hydrologic analysis. Based on this publication, a 100-year, 24-hour, 6.3-inch event is the standard for determining high water elevations in this region. As mentioned in Goal 2, Water Quantity, the City will evaluate the use of the 6.3-inch depth as it finalizes updates to its official controls in 2009.

The return period is related to the probability of a given event being equaled or exceeded. The probability that the "100-year event" will be exceeded in a given year is 1 percent. Conventional wisdom holds that if a 100-year event occurs in one year, then it cannot occur for another 100 years. This belief is false because it implies that rainfall occurs deterministically rather than randomly. Because rainfall occurs randomly, there is a finite possibility that the 100-year event could occur in two consecutive years or more frequently than one occurrence in any given year. More information on the NRCS design method or rainfall events is available at http://www.nrcs.usda.gov.

C. Land Use

The City of Oakdale is nearly 90% developed as of 2007. The predominant land uses include single-family and multi-family residential, industrial and office space and a wealth of parks and open space. The City and its residents place the highest value on preserving the natural environment and ensuring that new development fits the character of existing neighborhoods. The proposed land use plan shown in Figure 4 identifies the intended future land uses throughout the City. This plan takes into consideration the City's existing land use pattern, projected growth and land use policies. For more information on land use within the City of Oakdale refer to the City's Comprehensive Plan.

Future land use projections help to identify areas that may be available for water resource enhancements and also to help prioritize improvements. Significant changes in land use can increase runoff rates and volumes due to the additional impervious surface. As areas develop or redevelop at a higher density, storm water runoff generally increases. Roofs, driveway, parking lots, and other impervious surfaces increase the volume of runoff and decrease the volume retained in the soil by infiltration. A key challenge of this Plan will be to establish and implement reasonable and effective standards that meet stated water quantity and quality goals when development or redevelopment results in an increase in impervious surface.

The City of Oakdale has created numerous park areas throughout the City. In addition, many outlots or natural areas are incorporated into developments. While many of these outlots are marginal lands for development, most contain wetlands or are used for storm water detention. These areas also provide important wildlife habitat as well as aesthetic benefits for the City.

D. Public Utilities

Public utilities within the City include sanitary sewer, water supply system and storm sewer. The City's municipal sanitary sewer is a conveyance system only; the City does not own or operate any sewage treatment facilities. The municipal system collects sewage from individual properties within the City limits and routes it to the regional sewage interceptor system that delivers sewage to regional treatment facilities.

Few properties in the City use private individual sewage treatment systems (ISTS). The City relies on the ISTS Inspection and Certification Program of Washington County and has a contract with the County for these efforts. The program and is consistent with recently revised Minnesota Pollution Control Agency Rule 7080 which includes ISTS inspection and maintenance requirements.

The City has no access to suitable surface water sources for water supply and relies solely on groundwater. The Prairie du Chien-Jordan aquifer, located approximately 500 feet below the ground surface, serves as the City's municipal water source. The City appropriates water from this aquifer under a permit from the Minnesota Department of Natural Resources (DNR) and has four elevated storage tanks.

A significant portion of the City's drainage system is storm sewer. Construction of new storm sewer and improvement of existing storm sewer throughout the City is controlled by new development and street maintenance or reconstruction activities. The storm water conveyance system is discussed in more detail in Section V of this Plan. As part of the City's ongoing public works management program, the City's storm sewer system database has been regularly updated and corrected. These updates result in both GIS-based and AutoCAD versions of the storm sewer system. These files have served as one of the key tools for complying with the inspection, maintenance and reporting requirements for the National Pollutant Discharge Elimination System (NPDES) Phase II storm water permit program discussed in Goal 9 of this Plan.

E. Water-Based Recreation Areas

As mentioned previously, the City has several lakes, wetlands and waterways that provide aesthetic, environmental and recreational value to the community. Based on the Department of Natural Resources Protected Waters and Wetlands Inventory, there are 57 protected waters located fully or partially with the City. These water bodies, as shown in Figure 5, are identified as protected waters (i.e., lakes or wetlands). Several City Parks are located on or near these protected waters. Tanners Lake Park provides boat ramps, fishing access and swimming beaches, along with trails and picnic areas. Oakdale Nature Preserve offers an observation deck, trails, and a Discovery Center. Table 3 summarizes the water-based recreational facilities at these parks.

Table 3. Summary of Water-Based Recreation Facilities at Protected Waters

Water Body	Park or Area	Boat Ramp	Fishing Access	Swimming Beach	Trails or Picnic Areas
Silver Lake	Joy Park	●	●	●	●
Tanners Lake	Tanner's Lake Park	●	●	●	●
Mud (Acorn) Lake	Oakdale Nature Center and Preserve				●

F. Unique Features and Scenic Areas

The Minnesota DNR maintains a database of unique and sensitive plant and animal species. Given the lakes, wetlands and open space in the City and surrounding area, it is no surprise that Oakdale is home to a variety of wildlife including a number of rare species and natural communities. These species add to the City's biological wealth and diversity.

G. Pollutant Sources

Information on pollutant sources is available from the MPCA (651.296.6300). This detailed information has not been included here as it is subject to frequent change and may be obtained by calling the MPCA or by visiting the MPCA's website (www.pca.state.mn.us) which has information on various pollutant sources and related and related regulatory programs. The MPCA will identify leaking underground storage tank (LUST) sites, and maintain a list of registered above and underground storage tanks (ASTs and USTs) within the City. The MPCA also has information on permitted wastewater discharges and hazardous waste sites.

O a k d a l e • M i n n e s o t a

Second Generation

Surface Water Management Plan

III. GOALS AND POLICIES

Minnesota Rules, Part 8410.0170, subpart 5 (italics below), relating to Surface Water Management, requires local governments to establish goals and policies for the effective management of water resources. The nine goals established in this Plan support the City's Purpose Statement described in the Introduction by translating each goal into specific policies and action-implementation plans.

> *M.R. 8410.0170, Subpart 5. Establishment of policies and goals (Local Plans). Each local (SWMP) plan must state specific goals and corresponding policies related to the purpose of these plans, be consistent with the policies and goals of the organization plans within the city or township, and address the relation of the local plan to the regional, state, and federal goals and programs outlined in Part 8410.0070.*

A ***goal*** is a desired end toward which surface water management efforts are directed. This section identifies goals for water resources planning and management functions throughout the City. The goals of this plan were established in accordance with the purposes of the water management programs required by Sections 103B.201 to 103B.251 and in conformance with the goals of the WMOs having jurisdiction in Oakdale including the Ramsey-Washington-Metro WD (RWMWD), Valley Brach WD (VBWD) and South Washington WD (SWWD). Table 4 summarizes the City's nine goals and corresponding goal statements. Each goal has several corresponding ***policies*** that form the governing principals that will be followed to achieve the goals. Each of the nine goals and the corresponding policies is presented in more detail in the following pages.

Plan ***standards*** (or storm water Development Guidelines) are an extension of the goals and policies that provide detailed guidance on storm water management practices. They provide specific, detailed guidance regarding water quantity and quality management practices. Plan standards are included in Appendix C of this Plan.

Action-Implementation Plans have been developed for each of the nine goals. The Action Plans identify real or potential problems related to achieving the stated goals and recommended

approaches and/or solutions for addressing the problems. For each of the water bodies and goals, a related ***Plan*** has been established.

The Action-Implementation Plans may include specific activity steps, reference to the applicable NPDES Permit Best Management Practice (BMP), available resources, and the means of measuring the completion of the activity step and a target date for completion. The combination of these implementation plans will formulate the overall strategy for implementing the City's second generation Surface Water Management Plan. Many of the action-implementation activities correspond directly to actions committed to in the City's NPDES Permit submittal known as the Storm Water Pollution Prevention Program (SWPPP).

Table 4. Plan Goals and Goal Statements

Goal Number	Goal	Goal Statement
1	Water Quality	Maintain or improve water quality to meet established standards consistent with the intended use and classification.
2	Water Quantity	Control flooding and protect property while minimizing public expenditures necessary to control volumes and rates of runoff
3	Wetlands	Preserve and improve wetlands acreage, functions and values and achieve no net loss of wetlands in conformance with the Minnesota Wetland Conservation Act and associated rules
4	Erosion Control	Minimize soil erosion and sedimentation
5	Groundwater	Protect the quality and quantity of groundwater resources and promote groundwater recharge
6	Recreation, Habitat and Shoreline Management	Recreation, habitat and shoreline management. Protect and enhance fisheries and wildlife habitat, surface water recreation and shorelands
7	Public Participation, Information and Education	Public participation, information and education. Provide information and educational resources to improve knowledge and promote an active public role in management of water resources
8	Maintenance and Inspection	Preserve function and performance of public infrastructure through continued implementation of a maintenance and inspection program
9	Regulatory Responsibility	Maintain primary responsibility for managing water resources at the local level but continue coordination and cooperation with other agencies and organizations

A. Goal 1. Water Quality

Water quality is often directly related to the level of available nutrients in a water body. While nutrients comprise only one category of substances that can affect water quality, nutrients, principally phosphorous, must be controlled to achieve the water quality goals of this Plan. Phosphorous is most often the limiting factor for plant growth and increases in available phosphorous allow plant species to dominate the lakeshore, open water, or marsh. There are several key activities that can be followed to minimize the delivery of phosphorus into the City's priority water bodies. The City has developed the water quality policies listed in Table 5 to support the water quality goals of this Plan.

Table 5. Water Quality Policies

Goal Statement:	**Maintain or improve water quality to meet established standards consistent with the intended use and classification.**
Policy No.	**Goal 1: Water Quality - Policies**
1.1	Water bodies within the City will be classified by their use, function and water quality in accordance with the classification defined in Section IV of this plan.
1.2	Water bodies will be managed to meet RWMWD, SWWD, and VBWD plans and standards to maintain and/or improve water quality. High, medium and low priority water bodies will be managed for water quality, habitat, diversity and aesthetics. Stormwater ponds will be managed according to their function (nutrient or sediment removal).
1.3	Water quality monitoring of water bodies shall be completed in accordance and in cooperation with watershed and regulatory requirements and, if applicable, Metropolitan Council's water quality monitoring program. The City will support the watershed monitoring programs.
1.4	For new or reconstructed storm water discharge points or outfalls, pretreatment of storm water is required prior to its discharge to wetlands and priority water bodies. For existing discharge points or outfalls, the City will endeavor to eliminate all direct storm sewer discharges into high to low priority water bodies.
1.5	The City will encourage the improvement and/or expansion of existing detention areas rather than creation of new areas where feasible. Improvement may include modifications to increase the infiltration capacity of the treatment systems in suitable locations and soils.
1.6	Water quality infrastructure construction or improvement projects should provide for long-term access and maintenance.
1.7	The City shall continue their ISTS Inspection and Certification Program in conjunction with the Washington County program consistent with Minnesota Rules 7080 and Metropolitan Council policies. As required by the ISTS Program, properties currently served by individual sewage treatment systems should connect to the municipal sanitary sewer system.
1.8	The City will participate in and support the future TMDL program studies and implementation plans as part of the ongoing NPDES MS4 Permit program. The City recognizes that meeting the standards established in this plan will provide the basis for future TMDL implementation needs. In some cases, additional efforts may be needed to meet future load allocation limits established in approved TMDLs.
1.9	The City will encourage and enforce volume reduction standards throughout the City and where site conditions are feasible. The City will strive to reduce or minimize impervious surface coverage where practical or feasible.

Housekeeping practices such as removing leaves from streets and storm drains and limiting the use of phosphorus fertilizers are examples of simple ways individuals (residents) and the City can make improvements in water quality. According to the Minneapolis Chain of Lakes Clean Water Partnership, many people do not realize that organic materials, like leaves and grass clippings, fertilizer, pesticides and pet waste can disrupt the sometimes fragile ecosystem of a lake. Once in the lakes, these organic materials decay, releasing phosphorus. The excess phosphorus increases algae growth, inhibiting the growth of other aquatic plants. When algae die and decay, they exert a biological oxygen demand on the lake, depleting available oxygen for fish and other aquatic species. Limiting nutrients is the key to maintaining and improving water quality in City water bodies.

1. Water Quality Assessment

One method the City may use to approach future water quality management decisions is to consider three key factors:

- The priority (or category) of the receiving water as determined by the City and watershed organization;
- The degree of anticipated land use change in terms of impervious surface cover; and
- The existing treatment capacity available (excess or deficit).

This and/or other prioritization methods can be used along with the actions the City has already committed to as part of the MS4 NPDES SWPPP (submitted to the MPCA in 2006) to guide future water quality-related projects and decisions.

While there are no impaired waters directly within Oakdale, a portion of the City contributes runoff to the following impaired waters, listed with the respective impairment:

- Battle Creek (chloride impairment)
- Battle Creek Lake (nutrient/phosphorus impairment)
- Beaver Lake (nutrient/phosphorus impairment)
- Kohlman Lake (nutrient/phosphorus impairment)

The City intends to continue working with the watershed organizations that are leading the TMDL study and implementation program development for these impairments.

2. NPDES Phase II SWPPP

The overriding goal of the NPDES Phase II storm water permit program in urban areas is to protect and improve water quality. The regulatory program in Minnesota covers three aspects of storm water runoff: Industrial Sites, Municipal Separate Storm Sewer Systems (MS4), and construction sites. The City's MS4 SWPPP for the years 2006 to 2011 has been established and is presented in more detail in Appendix G. SWPPP activities have been incorporated into relevant sections and implementation plans within this SWMP.

3. Implementation Plan

Table 6 outlines activity steps that are intended to guide the City in achieving the water quality goals of this Plan. Table 6 also shows the corresponding BMP Identification number as listed in the MS4 SWPPP, a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 6. Water Quality Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. Implement NPDES Permit Program to Prohibit Non-Storm Water Discharges into surface waters.	3b-1	• City Staff • Technical Assistance	• Determine if existing Ordinances need revisions. • Complete process. • Implementation.	2007 2009 Ongoing
2. Post-Construction Runoff Control Ordinance	5b-1	• City Staff • Surface Water Management Plan – Goals and Policies • SWWD, RWMWD, VBWD Standards	• Complete update and revisions needed to meet NPDES requirements and City goals and policies	2009
3. Explore opportunities to implement BMPs to improve water quality in priority water bodies	NA	• Streets Projects • Area developers • Watershed Districts	• BMPs installed or implemented	Annual
4. Encourage development to include alternative storm water practices and promote infiltration and volume reduction	NA	• Watershed Districts • Suitable soils • Grant funds • Developers	• Review development plans and make recommendations • Implement practices on City projects	Annual
5. Complete a study of potential infiltration and volume reduction areas to support future street recon projects	NA	• Street Recon Plan • Watershed standards • Wellhead Protection Plan • Grant funds	• Completed study • Mapping and prioritization of potential infiltration areas • Implemented individual and regional BMPs in most suitable areas	2009 Ongoing
6. Track List of Impaired Waters by MPCA	NA	• MPCA Final 303(d) List	• Number of water bodies on impairment list	Ongoing
7. Track Nondegradation Rule development by MPCA	NA	• Guidance from MPCA on Select 30 • City staff • Technical assistance	• Implement nondegradation approach for impaired waters • Possible changes to City standards	2010-2011

B. Goal 2. Water Quantity

Traditional storm water management deals with just one component of the hydrologic cycle; surface runoff. Large amounts of energy are directed towards alleviating significant negative impacts of surface runoff and flooding on the cultural, water, and natural resources. The primary management strategy is shifting from detention in both existing natural (i.e., wetlands) and constructed basins, towards a combination of traditional approaches and runoff volume reduction techniques. Emphasizing the reduction of runoff volumes by infiltration or small volume storage will help mimic predevelopment hydrology for smaller and more frequent rainfall events. This trend provides opportunities to help remedy the negative impact, of storm runoff on lake water quality and reduce the volume of runoff that may otherwise contribute to flooding.

The approach to volume control typically does not replace traditional storm water management needs, but instead provides alternatives to reduce the extent of a conventional system, enhance overall performance and, in some cases, reduce maintenance needs for these systems. The discussion of volume control practices could just as easily be presented in the water quality goal section of this Plan. However, one of the key features of volume control is the emphasis on reduction of runoff created at the source by reducing the impervious area or directly connected impervious areas. In addition, BMPs that provide on-site runoff control via infiltration, bioretention or small volume storage to mimic predevelopment hydrology for more frequent rainfall events reduce the overall runoff volume from a given area.

This approach to water quantity management relates directly to water quality, wetland management, erosion control, and land development strategies. By doing a better job at managing the quantity of runoff at or very close to the source, the other goals of this Plan are more easily and efficiently achieved. In Oakdale, where infill and redevelopment will be a large part of the development activity in the future, volume control practices and approaches may be a feasible option where land is not available for a conventional storm water pond. However, the City also understands that, if not done properly, infiltration practices can create a greater maintenance burden and cost compared to conventional practices.

As discussed previously, one local example of a shift in the type of storm water management practices that are encouraged or required is in the recent adoption of volume reduction and infiltration requirements by watershed organizations. While the basis for these new standards will help achieve the overall goals for water quality, the changes have created new challenges for developers and the City to shift their approaches to development and street reconstruction projects. This can be especially challenging in areas where the site conditions are not suitable for infiltration practices. The City's development standards in this plan include provisions for designs of infiltration systems and requirements for the construction process to help these practices get installed properly. The Plan appendix also includes an example maintenance agreement that can be used to assign the long-term expectations for operation and maintenance of a given storm water practice.

With increased value placed on wetlands, the number and extent of wetlands that can be used for detention will continue to decline. The approach to water quantity management relates directly to water quality, wetland management, erosion control, and land development strategies. By doing

a better job at managing the quantity of runoff, the other goals of this Plan are more easily and efficiently achieved.

In Oakdale the issue of flooding has two primary priorities: eliminating or reducing the extent and duration of flooding in existing development and reducing the risk of flooding at proposed developments. The policies presented in Table 7 outline the City's approach towards meeting the water quantity goal.

Table 7. Water Quantity Policies

Goal Statement: **Control flooding and protect property while minimizing public expenditures necessary to control volumes and rates of runoff.**	
Policy No.	**Goal 2: Water Quantity (Flooding) - Policies**
2.1	The level of protection adjacent to floodways, streams and channels and around all wetlands, ponds, detention basins and lakes shall be based on the critical-duration 100-year flood, consistent with the standards of this plan.
2.2	Non-trunk storm water systems should be planned to provide discharge capacity for the critical-duration runoff event that is not less than a 10-year frequency event, consistent with the standards of this plan.
2.3	Proposed development, redevelopment and infrastructure projects shall not overburden the existing downstream storm water drainage system. It is the responsibility of the design engineer to evaluate a project's impact on the downstream system and consider the entire upstream tributary area.
2.4	Easements over floodplains, detention areas, wetlands, ditches and all other parts of the storm water system should be obtained as areas develop or redevelop.
2.5	Infiltration practices shall be promoted within the limitations imposed by construction practices, soil conditions, groundwater supply and recharge, safety, snow removal, maintenance and other issues.
2.6	Where possible, regional pond areas, as opposed to individual on-site ponds, should be used to reduce flooding, to control discharge rates and to provide necessary storage volumes as indicated in this plan.
2.7	All developments must, to the extent determined by the City, provide land, funding or a combination of both to develop on-site or regional storm water management facilities (ponds, storm water storage, infiltration or filtration BMPs, etc.) to achieve the rates and volumes indicated in this plan. Standards of the RWMWD, SWWD, and VBWD will also apply to each development.

1. Hydrologic Modeling Update

One of the larger efforts undertaken as a part of this SWMP update was to update the City-wide hydrologic model to improve on the accuracy of results and produce a model that was in a software format that was widely used and current with design engineers in the area. Early in the project staff determined that converting the previous TR-20 model to a HydroCAD model was the best approach. The second step in updating the model was to update the input parameters using the most recent and best available data on GIS (Geographic Information Systems). A digital terrain model (DTM), consisting of two-foot contours and GIS was used to establish watershed boundaries and identify detention/storage areas.

The DTM based drainage area delineation process divided the City into relatively small drainage areas and also took into account the most recent storm sewer GIS files. The process did not consider alterations to the drainage that may have occurred since the DTM was created. These issues were resolved by reviewing as-builts of the storm sewer system and field reconnaissance, as needed. These watershed boundaries developed by the DTM were then compared to the boundaries generated for the 1989 SWMP and the boundaries from the watershed district plans.

Once the final watershed boundaries were established, this file was merged with the hydrologic soil group and future land use files. Curve numbers were also generated using GIS. A weighted curve number was then calculated for each watershed. The updated curve numbers were compared to the original numbers to ensure they were logical and were revised as reasonable. Figure 7 (foldout map) illustrates the drainage network that forms the basis for the City-wide hydrologic model. For the watersheds that were not altered significantly from the 1989 boundaries, the original time of concentration was used. For altered or new subwatersheds a new time of concentration was determined.

The goal of this effort was to better predict and understand the urban hydrology within the City such that potential future flooding issues resulting from development or redevelopment could be addressed. In any hydrologic modeling effort, the basic analytical problems that must be solved to complete these objectives are the prediction of storm water and/or snow melt peak runoff rates, runoff volumes and flood hydrographs within the drainage system. Ultimately, a peak elevation is determined for water bodies in each major drainage system under several storm scenarios of Flood Evaluation Storms (FES).

This update employs Natural Resources Conservation Service (NRCS) methods to analyze the City's hydrologic system. Two storm (or runoff) events were modeled to determine the event that produces the highest peak water surface elevations for a given water body:

- 100-year, 24-hour, Type II distribution with antecedent moisture conditions 2 (AMC-2);
- 100-year, 10-day runoff, "C" distribution (NEH-4).

The peak elevations determined from the hydrologic modeling are be used to set the recommended minimum building elevations (MBE). The results of the hydrologic modeling update are presented in tabular format in Appendix D. The City intends that the MBE presented in Appendix D be used to evaluate development and redevelopment projects, but recognizes that in some cases more detailed modeling may be available for selected areas of the City. In these cases the City will consider the modeling results on an individual basis if results are significantly different than those presented in Appendix D. The MBE is based first on 2-feet above the 100-year design storm peak elevation. If any of the other modeled storms exceed this elevation, the MBE is set at that level to provide additional protection. Where no modeled high water level of Base Flood Elevation has been established, the MBE is set at 3-feet above the highest know water level or the elevation determined by a technical evaluation.

In some cases, the MBE reported for this Plan update is different than the elevations reported in the 1989 Plan and that were based on earlier modeling. The data in Appendix D presents both MBE numbers, where previous data were available. The City intends to apply the new elevation

for new structures, but does not consider existing structures built in accordance with the elevations in the previous plan as non compliant.

As mentioned in the South Washington Watershed District's Watershed Management Plan, the publication Bulleting 71, Midwest Climate Center (Huff and Angel, 1992), is the District's preferred reference for hydrologic analysis. Based on this document, a 6.3-inch, 100-year, 24-hour event is the recommended standard for determining high water elevations in this region. The City will evaluate this approach further as the update to official controls is completed.

2. Flood Mapping

The City of Oakdale is within Washington County, and is a participating community in the National Flood Insurance Program and mapping of designated floodplain areas is available through the Federal Emergency Management Agency (FEMA). It is possible that some of the high water levels (HWLs) reported in this Plan may be different than those reported in the (FEMA) maps or subsequent map revisions. In general, the effect base flood elevation in a FEMA map or Flood Insurance Study (FIS) will be the determining factor in regulatory decisions relating to minimum building elevations and setback requirements.

Flood Insurance Rate Maps (FIRMs) are essential for accurate flood insurance rating. Lenders and insurance companies rely on FIRMs to determine which properties require flood insurance and to aid in determining the rate of the insurance. Lenders and insurance companies may require that landowners within flood prone areas designated on the FIRM have flood insurance or the landowner must prove that their property is not a flood hazard.

There are several homes on Tanners Lake that are within the 100-year floodplain. Emergency plans these homes have been established that require the City to take action in the event of flooding.

3. Implementation Plan

Table 8 outlines activity steps that are intended to guide the City in achieving the water quantity goals of this Plan. Table 8 also shows a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 8. Water Quantity Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. Review the function and need for changes to the Mud Lake outlet	NA	• City staff • Valley Branch Plan • HydroCAD Model	• Completed report or technical memo to Valley Branch WD	Completed
2. Evaluate minimum building elevations and peak discharge rates for conformance to plan requirements	NA	• City staff • Hydrologic modeling • Developer submittals	• Completed reviews	Ongoing
3. Complete emergency response plan for flood risk on homes on Tanner Lake	NA	• RWMWD • City staff	• Completed plan • Implementation of plan	2009 Ongoing
4. Coordinate hydrologic model refinement with watershed district models.	NA	• SWWD, RWMWD and VBWD models • Project reviews • Developer models	• Updates completed during project reviews	Ongoing

Item number 1 in the Table identifies a review of the Mud Lake Outlet function. This outlet was evaluated using the updated HydroCAD model for a number of rainfall events and outlet conditions. The model shows that even under extreme conditions of a 12-inch rainfall event, or back-to-back 100-year events, the basin reaches a peak elevation of about 996.3 to 996.9. Under the 100-year design storm, the peak elevation is 994.7. The extreme event peak elevations are still below the emergency overflow elevation of the basin at 998 and, based on the current contour mapping, below the low openings of the adjacent homes.

C. Goal 3. Wetlands

The key to meeting the City's wetland goal is the implementation of the rules and requirements of the Wetland Conservation Act (WCA). The wetland areas in the City shown in Figure 6 are derived from the National Wetland Inventory (NWI) GIS database. RWMWD classification of wetlands is based on a district-wide inventory and assessment. These wetlands are shown in Figure 1.A-7 of the RWMWD Watershed Management Plan (www.rwmwd.org). Field

delineation, assessment of hydrology, identification of all plant species and characterizations of soils were not performed.

Ramsey Washington Metro Watershed District (RWMWD) and Valley Branch Watershed District (VBWD) currently have jurisdiction over wetlands within the City and act as the Local Government Units (LGUs) on behalf of the City to administer the WCA. For wetlands which are in the South Washington Waterhsed District (SWWD), the RWMWD acts as the LGU to manage these wetlands. The watershed organizations each have regulatory buffer requirements all development and redevelopment activities disturbing 1-acre or more. The City will adopt and apply these buffer standards as part of its development review process.

The policies listed in Table 9 will be used as the basis to achieve the City's wetland goals. The policies and strategies will apply to new development and redevelopment projects proposed within the City. Any wetland habitat on property to be developed will be subject to these management policies, as well as the rules and requirements of the Wetland Conservation Act and other City regulations.

Table 9. Wetland Policies

Goal Statement:	**Preserve and improve wetlands acreage, functions and values and achieve no net loss of wetlands in conformance with the Minnesota Wetland Conservation Act and associated rules.**
Policy No.	**Goal 3: Wetlands - Policies**
3.1	Within SWWD, the City shall administer wetland protection and mitigation in accordance with the Minnesota Wetland Conservation Act and associated rules. In the RWMWD and VBWD, the watershed districts are the responsible local government units under the Minnesota Wetland Conservation Act.
3.2	Wetlands shall be protected from impacts in the following order: avoid, minimize, mitigate. Mitigation of unavoidable wetland impacts must be accomplished through restoration (first priority), enhancement (second priority) or wetland creation (third priority).
3.3	Prior to development activities or public projects, a wetland delineation must be completed including a field delineation and report detailing the methodology and findings of the delineation.
3.4	Where feasible, the duration and magnitude of water level fluctuation in wetlands from storm water runoff shall be minimized to prevent adverse habitat changes.
3.5	Natural buffer zones are required around all wetlands City-wide and shall be provided on City-owned ponds where required by the standards established by the watershed organization and as adopted by the City. Buffer areas should not be mowed or fertilized, except that harvesting of vegetation may be performed to reduce nutrient inputs or pest species. Allowances may be made for multiple use detention areas.

1. Implementation Plan

Table 10 outlines activity steps that are intended to guide the City in achieving the wetland goals of this Plan. Table 10 also shows the corresponding BMPs from the NPDES SWPPP, a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 10. Wetland Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. Continue citizen participation programs to encourage stewardship of wetland resources	1-01-R 1-02-R	• City staff • Oakdale Update newsletter • NPDES Phase II program	• Completed wetland public participation activities	Ongoing
2. Prepare materials for public education about the importance of wetland resources and their protection and management.	1-01-R 1-02-R	• City staff • Oakdale Update newsletter • NPDES Phase II program	• Newsletter and/or mailings • Web page postings • Adopt-a-wetland Program	Ongoing
3. Support Watershed District implementation of WCA	NA	• City staff • Technical Assistance • VBWD/RWMWD	• Completed Guidelines	Ongoing

D. Goal 4. Erosion Control

As discussed previously in Goal 1, water quality problems are frequently linked to high phosphorus concentrations. Phosphorus is often transported to surface water through soil erosion but can also be transported to waters in a variety of other mechanisms**.** Nevertheless, erosion control is extremely important in the effort to improve water quality. Soil erosion and sediment deposition also can create pond and drainage way performance and maintenance problems.

Ponds, drainage facilities and water bodies can be impacted by erosion and sediment from a variety of sources including construction sites and winter street sanding operations. The coarse sediment accumulates in water bodies where runoff or flow velocities are relatively low. Usually a sand delta appears at a storm sewer outfall that is a visible indication of the effectiveness of erosion and sediment control measures and road maintenance activities of the past winter.

As sediment builds up over time, it reduces the capacity of drainage systems and the pollutant removal capabilities of ponds by reducing dead storage volume (i.e., the volume below the outlet elevation). Sediment from erosion also reduces infiltration rates in basins or BMPs design for groundwater recharge. Extending the life of facilities involves source control and elimination of material that causes the problem. Regulatory aspects will control a major portion of the sediment at the source and an effective street sweeping will also have a positive impact. The policies listed in Table 11 are intended to help the City achieve the erosion control goal of this Plan.

Table 11. Erosion Control Policies

Goal Statement: **Minimize soil erosion and sedimentation.**	
Policy No.	**Goal 4: Erosion Control - Policies**
4.1	Erosion control plans shall be required for all land disturbance activities one acre or more in accordance with NPDES construction site permit requirements.
4.2	Best management practices (BMPs) shall be used at all construction sites per the Minnesota Pollution Control Agency's "Protecting Water Quality in Urban Areas" (2000) and Minnesota Storm Water Manual (2005).
4.3	Natural vegetation shall be preserved to the greatest practical extent.
4.4	Graded areas shall be protected from runoff to reduce erosion in a manner consistent with the standards of this plan. Streets will be swept at least daily by the project owner where construction activities spill or track sediments onto public streets.
4.5	Stockpiled soil (and or like-materials) shall be protected to prevent erosion.
4.6	Effective energy dissipation devices should be provided at all conveyance system discharge points to prevent bank, channel or shoreline erosion. Design of stream bank stabilization and streambed control measures should consider unique or special site conditions, energy dissipation potential, adverse effects, preservation of natural processes and aesthetics in addition to standard engineering and economic criteria.
4.7	The City will coordinate construction site inspections and enforcement with the watershed district inspection staff. Enforcement actions will be taken where warranted to support protection of water resources.

1. Watershed Programs

RWMWD and VBWD require storm water construction permits for and filling or grading activity that disturbs a land surface area of over one acre or that is within a floodplain or wetland. SWWD also requires permits for land disturbances that result in the augmentation or diversion of storm water to a receiving water body and all subdivisions, plats, or developments. In addition to the aforementioned activities that require storm water construction permits, VBWD also requires permits for projects which create more than 6000 square feet of new impervious area.

2. NPDES Phase II SWPPP

As part of the requirements of the City's NPDES MS4 permit requirements, the City will update its Erosion and Sediment Control ordinance which is currently addressed in the City's Municipal Codes under Chapters 5 and 21 relating to Building Regulations. The City Building inspection works with the Engineering Department to review and enforce erosion control plans. The City will complete the update in 2008. The City also encourages use of the documents reference in Policy 4.2 as sources for developing a project SWPPP or erosion and sediment control plan.

The City addresses sites less than 1-acre through its building permit requirements. Sites less than 1 acre are reviewed by City staff prior to issuing a permit and inspected for issues including, but not limited to, erosion control measures during construction.

3. Implementation Plan

Table 12 outlines activity steps that are intended to guide the City in achieving the erosion goals of this Plan. Table 12 also shows the corresponding BMPs from the NPDES SWPPP, a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 12. Erosion Control Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. Review and update construction erosion and sediment control ordinance sections	4a-1	• City Staff	• Review ordinance language and requirements. • Complete process and Council approval. • Consider sites less than 1-acre	2009 2009
2. Development plan review process	4d-1	• City Staff	• Improved water quality • Compliance of completed developments	Annual Annual
3. Construction site inspection	4f-1	• City Staff • Contractor	• Reduction in the number of sites not incompliance at the time of inspection	Annual

E. Goal 5. Groundwater

The City of Oakdale relies solely on groundwater as its water supply source. The Prairie du Chien-Jordan aquifer, located approximately 500 feet below the ground surface of Oakdale, serves as the City's municipal water source.

Washington County published the *Washington County Ground Water Plan 2003-2013*. The Washington County Plan identifies groundwater contaminated areas and predicts areas that are potentially susceptible to groundwater contamination. The Washington County Plan also contains a comprehensive topographic and geological overview describing groundwater aquifers in the County.

The Minnesota Department of Health has recently completed a Source Water Assessment for Oakdale. All eight City wells have a source water protection area designated. The assessment also shows that the wells are not susceptible because they meet well construction standards and do not present a pathway for contamination to readily enter the water supply. In 2004 the city developed a Wellhead Protection Plan (WHPP) as required by the Minnesota Department of Health. The goal of the WHPP is to protect the public water supply from contaminants. It is a preventative program, keeping harmful contaminants from entering the public water supply system. The City is responsible for formulating and implementing the WHPP in accordance with Minnesota Rules Chapter 4720.

Several areas throughout the City have soils that are very conducive to storm water infiltration practices and groundwater recharge (see Figure 3). In addition, the RWMWD, VBWD and SWWD have requirements for certain projects to infiltrate a portion of the storm water form a rainfall event. The Minnesota department of Health has prepared a guidance document for the evaluation of potential impacts of storm water infiltration on groundwater resources. As the City moves towards implementing the various state and local storm water requirements and addressing the Individual Sewage Treatment Systems (ISTS) located throughout the City, evaluation of the soils and surface water features will be an important task. The City has developed the policies in Table 13 to help guide future groundwater related decisions.

Table 13. Groundwater Policies

Goal Statement: **Protect the quality and quantity of groundwater resources and promote groundwater recharge.**	
Policy No.	**Goal 5: Groundwater – Policies**
5.1	When site conditions are suitable, the City will support infiltration strategies to reduce the runoff volume of storm events.
5.2	Groundwater recharge areas as identified in the City Wellhead Protection Plan shall be protected from adverse development and from potential contamination.
5.3	Washington County is recognized as the lead agency regarding groundwater. The City supports the policies in the Washington County Groundwater Plan. The City will coordinate issues relating to sensitive groundwater areas, wellhead protection areas, water use and contingency plans and other groundwater issues with other LGUs.
5.4	The City will evaluate the need to eliminate or manage unused/abandoned wells as they may be encountered in conjunction with infrastructure improvement projects.
5.5	Develop land use regulations to protect groundwater resources based on completed studies and rankings of groundwater recharge areas.
5.6	The City will continue to implement the Wellhead Protection Plan Part 1, (September 2002) and Part 2 (December 2004).

1. Implementation Plan

Table 14 outlines activity steps that are intended to guide the City in achieving the groundwater goals of this Plan. Table 14 also shows a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 14. Groundwater Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. Collaborate with WDs to monitor the impacts of volume control standards on groundwater. Modify policies and/or approaches as necessary.	NA	• City staff • Watershed Districts • Washington County • Wellhead Protection Plan	• Established Policies	ongoing
2. Evaluate the need for groundwater plans (to address protection and/or monitoring) for businesses that store or use hazardous materials. Permit review process.	NA	• Wellhead Protection Plan • City staff	• Groundwater protection review added to permit review process.	2009

F. Goal 6. Recreation, Habitat and Shoreline Management

The goal of the Minnesota Department of Natural Resources (DNR) Division of Fish and Wildlife is to protect and enhance the fisheries and wildlife resources and the aquatic biological community for their long-term recreational, ecological, aesthetic, and economic benefits to the state. (Anon., 1993). The DNR is the agency with exclusive responsibility for the management of fisheries in waters of the state. Specifically relating to this SWMP, the concept of ecosystem management requires that not just a species of interest be managed in a given water body, but that all plants, animals, and the physical and chemical constituents of the environment be part of the management program. (Anon., 1993).

The City of Oakdale has developed policies to help support the Recreation, Habitat and Shoreline Management goal to help protect and enhance recreational opportunities for City residents, and to improve the quality of shoreland areas for fish and wildlife habitat. These policies are outlined in Table 15.

Table 15. Recreation, Habitat and Shoreline Management Policies

Goal Statement: **Protect and enhance fisheries and wildlife habitat, surface water recreation and shorelands.**	
Policy No.	**Goal 6: Recreation, Habitat and Shoreline Management - Policies**
6.1	To the extent possible, natural areas shall be preserved, especially adjacent to wetland areas, for the benefit of wildlife.
6.2	Buffer zones of natural vegetation shall be provided around publicly-owned and maintained ponds and wetlands to provide habitat where adequate land is available. Private property owners will be encouraged to create and maintain buffer zones along wetlands and shorelines.
6.3	The City shall cooperate with the state and the county to enhance water-based recreation by maintenance of public boat access to City lakes. The City recognizes the need to balance water recreational activities with water quality and habitat issues.
6.4	The City shall generally support efforts of lead agencies (e.g., DNR, Washington County, Watersheds, etc.) to control exotic and invasive species in City lakes and wetlands.
6.5	Alternative landscape designs are encouraged that increase beneficial habitat and recreation uses and promote infiltration.

1. Water Bodies

Oakdale water bodies are classified according to the use, function and water quality characteristics in accordance with an updated classification system discussed in Section IV of this Plan. Figure 5 illustrates DNR protected waters in Oakdale. The basis functions of each category of water body are described in Section IV.

2. Implementation Plan

Table 16 outlines activity steps that are intended to guide the City in achieving the recreation, shoreline and habitat goals of this Plan. Table 16 also shows the corresponding BMPs from the NPDES SWPPP, a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 16. Recreation, Habitat and Shoreline Management Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. Publish information relating to DNR programs for shoreland and habitat management and enhancement	NA	• Oakdale Update • DNR • Washington County	• Improved shoreland and habitat areas	Ongoing
2. Evaluate opportunities to improve recreation opportunities related to development and redevelopment projects	NA	• City staff • Developers • DNR guidance	• Completed projects with recreational features (e.g., wildlife habitat, aesthetics, access to waters)	Ongoing

G. Goal 7. Public Participation, Information and Education

Public participation and involvement is a strategy that recognizes people want to be involved in decisions that affect any facet of their life. The process of involving the public creates and implements opportunities for the public to participate in the processes that lead to decision-making and result in more ownership in the outcome. The City has developed the public information and participation policies listed in Table 17 to help achieve the goals of this Plan. Public education and participation activities are also requirements of the National Pollutant Discharge Elimination System (NPDES) Permit for which the City is required to comply with. Goal 9 and Appendix G of this Plan provide more detail on the City's NPDES program activities relating public participation and involvement.

Table 17. Public Participation, Information and Education Policies

Goal Statement:	**Provide information and educational resources to improve knowledge and promote an active public role in management of water resources.**
Policy No.	**Goal 7: Public Participation, Information and Education - Policies**
7.1	The City will provide opportunities for public involvement (e.g., neighborhood meetings, public hearings, mailed notices, etc.) for significant water resource decisions or projects.
7.2	The City will coordinate and consult with appropriate city commissions and committees on surface water management issues.
7.3	The City shall actively develop and implement a community education program related to water resources. This program will use a variety of media including use of notices, mailings, local cable television, newsletters, articles in Oakdale Update, web sites, workshops and/or presentations to inform and educate the public.
7.4	The City will cooperate with other agencies and encourage establishment of model interpretative sites for public education.

1. WD Programs

Ramsey Washington Metro Watershed District (RWMWD) formed a Watershed Advisory Committee in January of 2007 to improve public involvement in the WD's programs. RWMWD's Public Involvement and Education Program strategy consists of seven features: focus, multiple aspects, technical aspects, relevance, empowerment, learner-to-mentor progression, and institutional support. In addition, RWMWD and Oakdale are two of the multiple sponsors of the annual WaterFest educational event.

South Washington and Valley Branch Watershed Districts are both members of a partnership called the East-Metro Water Resources Education Program aimed at developing a comprehensive education and outreach program. Components of the current program include: a general education campaign, the Blue Thumb Program, Storm Water U, the MS4 toolkit, NEMO workshops, and annual SWPPP public meetings.

2. City Programs

The City has a website where information regarding the City's Environmental Management Commission, their mission statements and past agendas and meeting minutes are available. As part of the NPDES Phase II Storm water Permit the City has also created an electronic version of the SWPPP accessible through the City's website. As part of the NPDES program, the City is required to implement a public education and outreach program, along with a public participation and involvement program and to incorporate public information into each of the six minimum control measures of the permit.

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

The City will continue to distribute information on pertinent water and wetland management issues via the city newsletter and will promote opportunities for residents to participate in water resources management activities. The City will also make an ongoing effort on both a City-wide and watershed level toward educating the public by distributing information to its residents on responsible practices they should employ to protect water resources within the community. The program will educate residents on things such as the benefits of using phosphorus-free fertilizer and the proper use of a wide range of lawn chemicals.

3. Implementation Plan

Table 18 outlines activity steps that are intended to guide the City in achieving the public participation, information and education goals of this Plan. Table 18 also shows the corresponding BMPs from the NPDES SWPPP, a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 18. Public Participation, Information, and Education Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. Continue Storm Water Education Program established in NPDES SWPPP	1c-11	• City Staff • Washington County • Watershed Districts	• Oakdale Update • City website • Cable access television • Local paper • Public Meetings • Volunteer programs	Annual

H. Goal 8. Maintenance and Inspection

Inspections help to spot potential problems before they become major problems. Routine maintenance reduces the long-term costs related to drainage system maintenance, while helping to achieve water quantity and quality goals. The application of development standards ensures consistency in the work produced and the documentation of the constructed systems. Appropriate land use controls can be used to maximize the preservation of the natural drainage systems and to control increases in runoff rate, volume and pollutant loading. Inspections and long-term maintenance of these systems is the critical final step to ensure the planned long-term benefits.

There are four basic steps to developing an effective storm drainage maintenance program.

- Evaluating problems, needs, and opportunities;
- Defining goals and objectives of inspection and maintenance activities;
- Establishing policies, programs and priorities; and
- Developing criteria and standards for evaluating performance and

One of the often forgotten aspects of storm water facility maintenance is private ponds. Pond maintenance agreements with private pond owners can ensure that ponds are kept in good operating condition and that routine maintenance occurs. An example storm water practice maintenance agreement is provided in Appendix C. The example agreement can easily be modified to address other BMPs (e.g., infiltration basins, bioretention areas, grit chambers, etc. Recommended maintenance activities and schedules for a wide range of BMPs can be found on the Stormwater Managers Research Center website at http://www.stormwatercenter.net as well as many other on-line sources. Documentation or review comments and changes and acquisition of proper ponding easements are also important considerations during the development review process.

Each of the four essential elements listed above is covered by this SWMP. However, to be effective, three needs must be addressed: the need for good management, the need for good data; and the need for sound financing. Many well-conceived maintenance plans are never fully implemented because of the lack of funding. A sound and continuous source of revenue is vital to an effective maintenance program. The City has a source of revenue in the Surface Water Management Fund and has developed the policies in Table 19 to help ensure that the inspection and maintenance goals of this Plan are met.

Table 19. Maintenance and Inspection Policies

Goal Statement:	**Preserve function and performance of public infrastructure through continued implementation of a maintenance and inspection program.**
Policy No.	**Goal 8: Maintenance and Inspection - Policies**
8.1	The City will continue to implement a maintenance and inspection program for water resource facilities (e.g., ponds, storm sewer systems, outfalls to waters, etc.). The City's maintenance and inspection program shall meet the requirements of the NPDES Phase II MS4 Storm Water Program.
8.2	The City will require maintenance of privately constructed water quality treatment ponds through formal development or maintenance agreements (see Appendix C for example agreement).
8.3	The City shall require adequate maintenance-related access for public and private water resource management facilities.
8.4	Pond and detention facility clean out activities will comply with the requirements of the Minnesota Wetland Conservation Act, the Minnesota Department of the Natural Resources, the Minnesota Pollution Control Agency and the standards of this plan.
8.5	The City will continue its operation and maintenance activities that preserve the drainage system function and water quality, including street sweeping, pond and grit chamber maintenance and appropriate application of salt/sand that balances public safety and environmental protection.

1. Storm Water Management Program

The City 1989 SWMP was developed primarily to prevent flooding and improve water quality. While maintenance and inspection goals and policies were not specifically stated, the 1989 Plan included Quality Standards that included the following practices:

- ***Litter control***. Semi-annual wetland inspections and collection. Seasonal public education efforts.
- ***Chemical application to reduce aquatic vegetation***. Discourage this practice to the greatest extent possible.
- ***Controlled burns***. Controlled burns may be used under specific conditions to temporarily improve flow conditions within the drainage system. Permits from the local burn official and the MN DNR may be required.
- ***Vegetation harvesting***. In areas specially developed and maintained to control and reduce nutrients, vegetation should be harvested in the late summer of each year. Storm water should then be diverted from the treatment area until vegetation can be reestablished.

2. NPDES Phase II SWPPP

The City is currently following these other activities typically associated with a storm system maintenance and inspection program. The City's NPDES MS4 SWPPP also includes several BMPs that the City will follow to meet the goals of this Plan and the requirements of the NPDES Permit. The key components of the City's inspection and maintenance program include:

- A structural BMP and outfall inspection program;

- Follow-up maintenance activities including removal of accumulated sediments;
- Creation of storm sewer system maintenance database; and
- A prioritized street sanding and sweeping program.

Each of these activities is discussed in more detail in the SWPPP BMP sheets provide on the City's webpage through a link in Appendix G.

3. Implementation Plan

Table 20 outlines activity steps that are intended to guide the City in achieving the maintenance and inspection goals of this Plan. Table 20 also shows the corresponding BMPs from the NPDES SWPPP, a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 20. Maintenance and Inspection Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. City staff training and inspection program	6a-1	• City Staff • WDs	• Conduct training sessions • Maintenance staff meetings	Annual Annual
2. Structural BMP and outfall inspection program	6b-3	• City Staff	• Inspect system outfall and ponds • Inspect other pollution control devices	Annual Annual
3. Storm water system maintenance program	6b-2	• City Staff	• Inspect and maintain system	Annual
4. Development of database for tracking and reporting storm water program activities	6b-6	• City Staff	• Implement database • Update database and review enhancement options	2009 Annual
5. Sweep streets at least twice per year and more frequently as priorities warrant and resources allow.	6a-2	• City staff	• Completed sweeping program	Annual

I. Goal 9. Regulatory Responsibility

According to the City of Oakdale's 1989 Surface Water Management Plan, the City assumed the role of permitting all land alteration activities and enforcing the standards and policies set forth by that Plan. Watershed Districts also reviewed and commented on any proposed land alteration within their jurisdiction. Since then, the RWMD has taken the lead role for permitting projects within their jurisdiction, while the City has maintained the permitting authority in the areas covered by the VBWD and SWWD. The watershed organizations have maintained authority over wetlands within their jurisdiction.

The City's intent is to maintain water-related permitting for all sites within the VBWD and SWWD. The City will defer permitting authority to RWMWD within that portion of Oakdale,

and maintain a parallel water-related permitting process for developments within the RWMWD, focusing on sites of less than 1 acre.

Local Permitting Authority in Oakdale

Project Criteria	Watershed District		
	RWMWD	VBWD	SWWD
Stormwater Management Sites 1 acre or more	RWMWD	City	City
Stormwater Management Sites less than 1 acre	City	City	City
Wetland Conservation Act	RWMWD	VBWD	RWMWD

* This table is not intended to be all inclusive of permits that may apply to a given project. Other federal, state and local permits may apply.

The Minnesota Department of Natural Resources has authority over issues relating to water and wetlands designated as State Protected Wetlands and Waters. As of early 2009, the U.S. Army Corps of Engineers has regulatory authority relating to all non-isolated wetlands.

Washington County and the Minnesota Department of Health have regulatory authority over groundwater issues within the City. Erosion control falls under several jurisdictions including the City, watersheds and the MPCA. The MPCA has regulatory authority over individual septic systems.

As with any regulatory program, funding and financing issues are a critical consideration. As such this section contains a summary of funding programs that related specifically to water resources and surface water management activities. Consistent with the intent of related regulatory agencies, the City has developed the policies in Table 21 to help ensure that the regulatory responsibility goals of this Plan are met.

Table 21. Regulatory Responsibility Policies

Goal Statement:	**Maintain responsibility for managing water resources and continue to coordinate and cooperate with the watersheds and other regulatory agencies and organizations.**
Policy No.	**Goal 9: Regulatory Responsibility - Policies**
9.1	This plan and all subsequent amendments shall be consistent with all other regulatory agencies.
9.2	The programs and standards of this plan shall be implemented as required by regulatory responsibilities and, as needed, at the direction of the City Council.
9.3	The City will develop and implement ordinances and programs to remain consistent and compliant with local, regional and national programs related to storm water management.
9.4	The Minnesota Department of Natural Resources and the U.S. Army Corps of Engineers have regulatory authority relating to waters and wetlands identified by their respective inventories.
9.5	The local government units for implementation of the wetland conservation act in Oakdale are the Ramsey-Washington-Metro Watershed District and the Valley Branch Watershed District. The City will support the programs established by the watershed organizations.

1. NPDES Phase II SWPPP

The NPDES Phase II Permit Program (http://www.pca.state.mn.us/water/stormwater/index.html) is a federal regulatory program that requires owners of Municipally Separate Storm Sewer Systems (MS4s) to prepare and implement a Storm Water Pollution Prevention Program (SWPPP) and apply for the permit with the administrative agency. The Minnesota Pollution Control Agency administers the Phase II MS4 program in the state and the City submitted their most recent permit application in May 2006, to comply with the submittal deadline. This SWMP incorporates the best management practices (BMPs) that were identified in the City's SWPPP along with several specific projects that were not specified as part of the Phase II program.

One step in meeting the Phase II requirements included a self assessment process that the City completed to prepare their Notice of Intent (NOI or permit application) for coverage under the NPDES MS4 Phase II Permit. In this process, the City considered the receiving waters within the City, the City's existing storm water management plan and a range of BMPs that could be followed to achieve the goals of this Plan and the MS4 requirements. The self assessment resulted in an understanding of the City's current storm water programs and future priorities.

The City currently has erosion control, water quality and water quantity design measures in place under their Municipal Codes. The City requires a Grading Permit, Erosion Control Plans and security deposits from all developers within the Community. The City also inspects all projects being constructed within the City limits. BMPs that form the City's SWPPP are summarized and described in more detail in Appendix G. Information and references to permit requirements are provided in the individual BMP summary sheets. The City is required to review, and if needed, create or revise ordinances addressing illicit discharge detection and elimination, construction site storm water runoff control, and post-construction storm water management in new development and redevelopment.

2. Funding/Financial Considerations

Paying for water management projects and administrative activities has become more complex in recent years. In the past, special assessments against benefited properties financed most of the necessary improvements. However, the financial options have broadened considerably. The question is, which method(s) best suit the needs of the City. The major categories of funding sources are: Ad Valorem Taxes; Special Assessments; Development Charges [Building Permits, Land Development Fees and Land Exaction]; and Grants. The City currently has a storm water utility (Surface Water Management Fund) in place. The following paragraphs summarize some of the financing methods available to fund storm water management activities and projects.

Ad Valorem Tax. General taxation is the most common revenue source used to finance government services including minor maintenance measures for drainage and water quality facilities. Using property tax has the effect of spreading the cost over the entire tax base of a community. A special tax district can also be used to raise revenue. The special tax district is similar to the administrative structure under general taxation except that all or part of the community may be placed in the tax district. The principle is to better correlate improvement costs to benefited or contributing properties.

Stormwater Utility Fee. The City instituted a storm water utility fee in January 2003 to provide a dedicated funding source and to meet federally required storm water standards. This fee is charged to existing properties based on estimates of the surface water runoff they generate. The purpose of all derived funds is to finance three primary categories:

- To meet federal and state mandated requirements to address water quality issues with storm water runoff (estimated annual costs $100,000);
- To conduct proper maintenance and repair of catch basins and the storm water collection systems (estimated annual costs $100,000); and
- To maintain and clean over 200 sediment basins and storm water treatment ponds (estimated annual costs $100,000).

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

Development Charges. Fees charged to new development that generates runoff can be charged to finance infrastructure needed to serve the development.

Grants. State grants are available for surface water management and non-point source pollution. However, it is generally not a good financial practice to rely on grants for a service program. This source of revenue is not dependable and requires constant speculation as to its availability. Grants are useful but should only be used to supplement a planned local revenue source. Recent trends in Minnesota have been towards more funding available through the Clean Water Legacy Act program that offers assistance through several state agencies for a range of water quality

improvement projects. Although not a complete list of available grant programs, the following list summarizes several current and common grant programs of three state agencies:

Minnesota Pollution Control Agency

- Clean Water Partnership Program (CWPP) provides matching grants to local units of government to protect and improve lakes, streams, and groundwater that are affected by nonpoint source pollution.

- Lake Assessment Program (LAP) is a cooperative study of a lake involving MPCA staff and local citizens, such as a lake association or municipality. LAP studies characterize a lake's condition and provide basic information about the interaction of the lake and its watershed.

- As of 2007, Clean Water Legacy Nonpoint Source Restoration and Protection Grant and Loan Program provides funds for: 1) restoration projects of impaired waters identified in completed TMDL Implementation Plans; and 2) protection projects of waters identified in local water management plans or on the 303(d) Impaired Waters list.

Minnesota Department of Natural Resources

- Shoreland Habitat Restoration (SHR) Program helps to expand the diversity and abundance of native aquatic and shoreland plants; improve and protect the quality of shoreline habitat; enhance and protect water quality; raise awareness of the value of native shoreline and aquatic vegetation.

- Environmental and Conservation Partnerships (ECP) Grant Program supports: 1) enhancement of fish, wildlife, and native plant habitats; 2) research of fish and wildlife directly related to specific habitat improvement projects; and 3) environmental projects and related education activities.

- Fishing pier grants support improvements in fishing opportunities, especially to meet the needs of children, the elderly, and people with disabilities and Fishing in the Neighborhood (FiN) Program provides great fishing opportunities for residents and visitors in the Minneapolis-St. Paul metropolitan area. This urban fishing program has been working since 2001 to expand Twin Cities fishing opportunities.

Board of Water and Soil Resources

- Local Water Resources Protection and Management Program provides financial and technical assistance for restoration and protection projects related to lake protection and management.

Watershed Authorities

The Ramsey-Washington Metro Watershed District (RWMWD) BMP Cost Share Program offers financial assistance to efforts that protect and improve water and natural resources within our watershed (please see Find Your Watershed on homepage for information on watershed boundaries). BMP Cost Share assistance may be used by public or private landowners implementing programs and projects that support one or more of the following:

- Promote actions that prevent flooding or lessens the effect of drought;
- Improve water quality or increases the capacity of the watershed to store water;
- Preserve, protect, and restore native plant and wildlife communities, especially lakes, rivers and wetlands;
- Protect and preserves groundwater quality and quantity;
- Treat the natural environment as intrinsically valuable in land use decisions.

The RWMWD has allocated $250,000 for the BMP Cost Share program and projects for 2007. The RWMWD will provide applications year round until funds are depleted for the year. The minimum grant amount available is $100.00. The maximum grant amount is residential: $2,000.00, commercial and government: $30,000.00. Funds are a reimbursement of 50% match for materials and labor. The funds must be used within one year of receiving grant approval. The following individuals and organizations are eligible for the grant funds:

- All residents of the RWMWD
- Not-for-profit and religious organizations
- Governmental agencies
- Businesses and corporations located within the RWMWD
- Public and private schools located within the RWMWD

The SWWD has established a water quality BMP cost share program for residential, neighborhood, and commercial/municipal projects. Details of the program can be found on the SWWD website www.swwdmn.org.

The VBWD has a BMP Cost share program for individuals and communities. The program details can be found on their website at http://www.vbwd.org/GrantForms.htm.

3. Implementation Plan

Table 22 outlines activity steps that are intended to guide the City in achieving the regulatory responsibility goals of this Plan. Table 22 also shows the corresponding BMPs from the NPDES SWPPP, a list of possible resources available, the measurement system and a project target date for each of the planned activities.

Table 22. Regulatory Responsibility Implementation Plan

Activity Steps	BMP Unique ID No.	Resources	Measurement	Target Date
1. Coordinate projects as needed with Watershed Districts	NA	• City Staff • VBWD • RWMWD • SWWD	• Completed projects • Water quality or quantity issue resolved	Annual
2. NPDES SWPPP	All	• City Staff • Existing permit SWPPP • MPCA Forms and guidance	• Implement program and complete Annual Report for MS4 • Adjust SWPPP as needed	Annual Ongoing
3. Explore Grant Program opportunities to help fund water resources projects and initiatives.	NA	• City Staff • WDs	• Completed grant applications and projects	Ongoing

O a k d a l e • M i n n e s o t a

Second Generation

Surface Water Management Plan

IV. WATER BODIES

A. Overview

Oakdale water bodies are classified according to the use, function and water quality characteristics in accordance with the VBWD classification system shown in Table 23. Water bodies in Oakdale are classified as High Priority, Medium Priority, Low Priority, or Stormwater Pond. Table 24 also shows the management and leadership role for water bodies in the City.

This section of the Plan is intended to describe the key water bodies within Oakdale according to their relative priority or category. Each category of water bodies is presented in the following subsections. Water bodies in each category are presented along a summary of the information collected and analyzed for each water body to date, an assessment of any problems and recommended implementation priorities.

Table 23. Water Body Classification and Management Lead for Oakdale Lakes and Water Bodies

Water Body Name	DNR ID #	Water Body Classification	Management Lead
Silver Lake	62-0001	HIGH	VBWD
Mud (Acorn) Lake	82-0102	MEDIUM	VBWD
Armstrong Lake	82-0116	LOW	SWWD
Tanners Lake	82-0115	HIGH	RWMWD

Relative to the TMDL impaired waters program mentioned above, and based on the draft 2008 303(d) List of impaired waters, the City currently does not have any impaired waters within its boundaries. However, a portion of the City drains to Kohlman Lake, Beaver Lake and Beaver Creek Lake, all of which are impaired for nutrients/phosphorus. A portion of the City also drains to Battle Creek which is impaired for chlorides. The City will likely be impacted by TMDL

studies and implementation plans in the future for each of these waters. The City may also be impacted by the Lake Pepin or future Mississippi River TMDL implementation plans as they are developed and finalized. Requirements of future TMDLs will be incorporated into the City's NPDES MS4 Permit program.

B. High Priority Water Bodies

High Priority water bodies are typically used for swimming and other direct contact recreational activities. These water bodies have the highest/best water quality and are usually the most popular water bodies with the public or drain directly to an Outstanding Resource Value Water body or special water (i.e. trout stream). High priority water bodies are discussed individually in the following pages and include:

- Silver Lake
- Tanners Lake

1. Silver Lake (DNR ID No. 62-0001P)

Silver Lake is located in North St. Paul, Maplewood, and Oakdale and has a surface area of approximately 76 acres. The maximum depth of Silver Lake is about 18 feet with an average depth of 7.4 feet. Ramsey County in addition to a swimming beach and fishing pier located along the south shore at a park owned by the city of North St. Paul.

The 100-year flood elevation of Silver Lake is maintained at 991 by a V-notch weir outlet at an overflow elevation of 988.5 located on the east side of the lake at Century Avenue (T.H. 120). Maintenance of the outlet is assumed by Ramsey County Public Works. The overflow is routed under Century Avenue to a DNR protected wetland #82-0375W in Oakdale.

Water level data has been collected on Silver since 1925 by the Minnesota DNR, Ramsey County and volunteers. Ramsey County and VBWD have collected water quality data on the lake for many years. As described in the VBWD Watershed Management Plan (Barr, 2005) Secchi disk readings and chlorophyll *a* concentrations would classify Silver Lake as mesotrophic while total phosphorus concentrations indicate that Silver Lake is classified as a eutrophic lake. Since 1973, the average Secchi disk readings have gone down at a rate of 0.072 m/year.

Numerous studies have been completed on the management of Silver Lake, including:

- *Silver Lake Water Management Plan*. Part of the VBWD WMP prepared for VBWD by Barr Engineering, November, 2005 and September, 1995.
- *Draft Report, Tri-Lakes (Lakes DeMontreville, Olson and Jane), Long, Echo, Mud (Acorn) and Silver Lakes Watershed and Lake Management Plan, Volume I: Lake and Watershed Conditions, Water Quality Analysis, Improvement Options and Recommendations*. Prepared for VBWD by Barr Engineering, August, 2000

Some of the recommendations for water quality improvements to Silver Lake from these studies have already been completed. However, the water quality of Silver Lake continues to be a concern due to the fact that it is used for many recreational activities including fishing, boating

and swimming. According to the VBWD Watershed Management Plan (2005) the Secchi disc transparency trend has significantly improved since 1973. Additionally, the chlorophyll *a* and total phosphorus concentrations have improved, indicating improved water quality. Implementing management practices suggested in the Tri-Lakes Watershed and Lake Management Plan (2000) would likely lead to better water quality and meeting VBWD water quality goals more consistently. VBWD plans to work with Ramsey County, North St. Paul and Maplewood to evaluate and implement management practices for Silver Lake.

The VBWD has set water quality goals for the different types of lake in the District. Silver Lake has an "Excellent" ranking. The goal of an excellent ranking is for the summer average total phosphorus concentrations to be equal to or less than 40 ug/L, and the VBWD would prefer the total phosphorus concentration in Silver Lake to be equal to or less than 30 ug/L. According to the VBWD Plan, the total phosphorus concentration in Silver Lake has exceeded 40 ug/L four times and 30 ug/L ten times between 1990 – 2004. The City of Maplewood adopts the VBWD's water quality goals for Silver Lake. The City of Oakdale adopts these goals, which are shown in Table 24.

Table 24. Summary of Water Quality Goals for Silver Lake

Water Quality Parameter	VBWD Water Quality Goal	Mean - Based on 1997-2006 STORET Data
Total Phosphorus	40 ug/L	36 ppb
Chlorophyll *a*	NA	6.9 ppb
Secchi Disc	3.6 m (Excellent)	8.9 ft

Note: 1 ug/L = 1 ppb

Before 1985 Silver Lake experienced winter fish kills, this prevented establishment of a gamefish population. Ramsey County has managed a winter aeration system since 1985 that has enabled a gamefish population to develop. This population aids in management of the bottom-feeding fish which can contribute to degrading water quality. Ramsey County continues to operate the winter aeration system, and the gamefish population in Silver Lake continues to flourish. As a result of this change in fish population the water quality in Silver Lake continues to improve.

2. Tanners Lake (DNR ID No. 82-0115P)

Tanners Lake is located in the southwestern portion of the City of Oakdale, located almost entirely within Oakdale and Landfall. Tanners Lake discharges to the south into Battle Creek Lake in Woodbury. Tanners Lake has a surface area of approximately 70 acres, has a maximum depth of approximately 46 feet and an average depth of 20 feet. Tanners Lake is used for many recreational activities, including fishing, boating and swimming. Boat access is provided in Tanners Lake Park on the south side of the lake which is operated and maintained by the city of Oakdale.

Tanners Lake collects runoff from its immediate drainage area. The Lake discharges into Battle Creek Lake through an outlet structure under I-94. The outlet structure at the south end of Tanners Lake was replaced by RWMWD in 1992 to prevent flooding anticipated by the collapse of the previous deteriorating outlet pipe. No further modifications to the Tanners Lake outlet have occurred to date.

Water level data has been collected on Tanners Lake since 1966 by the Minnesota DNR. The OHW level is 963.3 feet above MSL. The RWMWD has collected water quality data on the lake since 1983. Based on available water quality data, Tanners Lake is a eutrophic lake. There has been improvement of clarity for Tanners Lake based on Secchi disc readings during the period of record.

Numerous studies have been completed on the management of Tanners Lake, including:

- *Grant Application to Conduct a Phase I Diagnostic/Feasibility Study of Water Quality Problems and Restorative Measures for Tanners Lake (Washington County, Minnesota).* Prepared for RWMWD by Barr Engineering, April 1987.
- *Phase I Diagnostic/Feasibility Study of Water Quality Problems and Restorative Measures for Tanners Lake*. Prepared for RWMWD by Barr Engineering, May 1989.
- *Tanners Lake Outlet Hydrologic Study*. Prepared for RWMWD by Barr Engineering, September, 1993.
- *Clean Water Partnership Project Implementation Grant Application to Conduct a Phase II Lake Improvement/Protection Study of Tanners Lake (Washington County, Minnesota) (Draft)*. Prepared for RWMWD by Barr Engineering, October 1993.
- *Diagnostic/Feasibility Study of Water Quality Problems and Restorative Measures for Tanners Lake*. Prepared for RWMWD by Barr Engineering, October 1993.
- *Management Alternatives Report on the Diagnostic Feasibility Study of Tanners Lake (Summary)*. Prepared for RWMWD by Barr Engineering, August 1993.
- *Tanners Lake CIP Performance Evaluation*. Prepared for RWMWD by Barr Engineering, August 2003.

The RWMWD has implemented several capital improvement projects in the Tanners Lake subwatershed that has resulted in a significant reduction in phosphorus loading to the lake. Tanners Lake was once on the impaired waters list for excessive nutrients, but has been removed for that impairment. The RWMWD constructed an alum treatment facility upstream of Tanners Lake. This facility treats the majority of stormwater runoff before it enters Tanners Lake. Tanners Lake is still listed as impaired for mercury.

Since 1987, RWMWD implementation of capital improvement projects for water quality improvements in the watershed resulted in a 48% phosphorus load reduction to Tanners Lake in a typical hydrological year according to the *Tanners Lake CIP Performance Evaluation* report (Barr, 2003). RWMWD plans to continue operation and maintenance of the Tanners Lake alum treatment facility which has been in operation since 1998. The City will review development and redevelopment plans and look for opportunities to incorporate conventional and alternative

BMPs on a site specific basis. The City does not anticipate implementing large-scale BMP projects in the Tanners Lake drainage areas at this time.

The RWMWD lists water quality goals for Tanners Lake in its Watershed Management Plan. The City of Oakdale adopts these goals, which are shown in Table 25.

Table 25. Summary of Water Quality Goals for Tanners Lake

Water Quality Parameter	2006 RWMWD Water Quality Goal	Mean - Based on 1997-2006 STORET Data
Total Phosphorus	30 ug/L	36 ppb
Chlorophyll *a*	10 ug/L	9.1 ppb
Secchi Disc	5.25 ft	8.5 ft

Note: 1 ug/L = 1 ppb

There are several homes on Tanners Lake that are within the 100-year floodplain. Emergency plans these homes have been established that require the City to take action in the event of flooding.

C. Medium Priority Water Bodies

Medium Priority water bodies are typically used for indirect contact recreational activities such as boating and fishing that involve incidental contact with lake water. Category II water bodies have poorer water quality than Category I water bodies but are still popular with the public. Category II water bodies are discussed individually in the following pages and include:

- Mud (Acorn) Lake

1. Mud (Acorn) Lake (DNR ID No. 82-0102W)

Mud (Acorn) Lake is located in north central Oakdale. Mud Lake has a surface area of approximately 44 acres, a maximum depth of about 10 feet, and an average depth of 2.4 feet. Mud Lake is surrounded by Oakdale Nature Preserve which offers a nature center, trails, and picnic areas. Public use is primarily for aesthetics and educational activities at the Nature Center.

The VBWD has not set a numeric goal for Mud Lake and not enough sample data has been collected to establish a statistical mean. The City will continue to approach development and redevelopment in the contributing watershed according to City and VBWD standards to maintain the current quality of the resource. A summary of the recent water quality data (ranges) presented in the VBWD Watershed Management Plan are shown in Table 26.

Table 26. Summary of Water Quality Goals for Mud Lake

Water Quality Parameter	2006 VBWD Water Quality Goal	Range from VBWD
Total Phosphorus	NA ug/L	49 to 280 ppb
Chlorophyll *a*	NA ug/L	19 to 175 ppb
Secchi Disc	NA ft	0.5 to 4.6 ft

Note: 1 ug/L = 1 ppb

Surface water from Mud Lake flows through a 12-inch diameter pipe outlet, then into Long Lake in Pine Springs and Mahtomedi. The MCES along with their Citizen Monitoring Program have collected water quality data since 2006. The VBWD monitored total phosphorus, chlorophyll *a*, and Secchi disc depth in 1995, 2000, and 2003. In general the Secchi disc depths indicate that Mud Lake is a eutrophic lake. Sufficient data is not available on total phosphorus, chlorophyll *a*, or Secchi disc depths to conduct a trend analysis.

D. Low Priority Water Bodies

Low Priority water bodies serve important functions for wildlife habitat and aesthetic enjoyment and may also provide opportunities for warm-water fishing provided winterkill does not occur. These water bodies have poorer water quality than high and medium priority water bodies and typically are not viewed as swimmable. Low priority water bodies are discussed individually in the following pages and include:

- Armstrong Lake

1. Armstrong Lake (DNR ID No. 82-0116W)

Armstrong Lake is located in the southeastern portion of the City within the cities of Oakdale and Lake Elmo. The lake is divided into north and south basins by County Road 10. Armstrong Lake has a surface area of approximately 39 acres, and is a relatively shallow basin with a maximum depth of 3 feet and 5 feet in the north and south basins, respectively. Private property surrounds the southern basin of Armstrong Lake. Because there is not a public access the lake is not frequently used for recreational activities, however, non-motorized boating is possible. Armstrong Lake has a two 24-inch RCP pipes that serve as the outlet. A culvert under County Road 10 connects the north and south basins.

Water level data has been collected on Armstrong Lake since 1999 by the Minnesota DNR. The MCES along with their Citizen Monitoring Program have collected water quality data since 1998. There is no significant increasing or decreasing trend in Secchi disc depth. In general the Secchi disc depth, total phosphorus concentrations, and chlorophyll *a* concentrations indicate that Armstrong Lake is a eutrophic lake. The SWWD Watershed Management Plan suggests setting lake-specific maximum allowable nutrient loads for development and redevelopment to prevent transition to hyereutrophic conditions.

The SWWD has not yet established a numerical goal for Armstrong Lake, but has identified the setting of goals as an action item in their Watershed Plan (Policy WQ-1). The City will continue to approach development and redevelopment in the contributing watershed according to City and SWWD standards to achieve the goals established by the SWWD. A summary of the recent water quality data (ranges) presented in the SWWD Watershed Management Plan are shown in Table 27.

Table 27. Summary of Water Quality Goals for Armstrong Lake

Water Quality Parameter	2006 SWWD Water Quality Goal	2007 Summer Average (from SWWD)
Total Phosphorus	NA ug/L	0.099 mg/L
Chlorophyll *a*	NA ug/L	25 ug/L
Secchi Disc	NA ft	2.75 ft

Note: 1 ug/L = 1 ppb

E. Stormwater Ponds

Stormwater ponds are intended to reduce downstream loading of phosphorus and other nutrients that contribute to water pollution. Stormwater ponds are typically designed to have total phosphorus (TP) removal efficiencies of at least 50 to 60 percent and a total suspended sediment (TSS) removal of 80 to 90 percent on an annual basis. The primary management activity that the City will complete as part of this Plan will be to continue to implement the inspection and maintenance program for ponds and storm sewer system inlets/outlets as described in the NPDES SWPPP.

F. Wetlands

The City coordinates management of the wetlands in the City through the Ramsey-Washing-Metro Watershed District and Valley Branch Watershed District. Figure 6a illustrates the extent of wetlands areas in the City based on the National Wetlands Inventory and Figure 6b shows the wetlands identified by RWMWD in their inventory and assessment of wetlands. This map does not illustrate all wetland areas within the City. Using Figure 6 as a starting point and guide, projects are required to have a delineation of all wetlands on a project site completed and, if any exist and will be impacted, obtain permits from the regulatory agencies having jurisdiction over the wetland.

The VBWD began a wetland inventory and assessment project in 2007 and intends to complete the work in 2009. The VBWD will share this work with the cities within it's jurisdiction and will classify all wetlands to allow a more direct application of the applicable wetland management standards.

O a k d a l e • M i n n e s o t a

Second Generation

Surface Water Management Plan

V. IMPLEMENTATION PLAN

A. Overview

The Implementation Plan is the final section of the Plan and one which is intended to provide guidance in carrying out the Plan goals and objectives. The implementation section summarizes capital improvement projects, studies and ongoing maintenance, inspection, monitoring and other management activities recommended for at least the years 2006 through 2011 related to the City's NPDES SWPPP as well as activities that are intended to continue on a much longer-term basis. Estimated costs of recommended actions are not provided recognizing that planning level estimates often set unrealistic expectations of the actual costs of projects and/or activities. Procedures for amending the Plan are presented.

The implementation plan is based on goal and policy-driven action-implementation plans. The process of developing the action and implementation plans is based on four steps:

- Development of goal statements consistent with Minnesota Rules Chapter 8410, the WMOs and Metropolitan Council;
- Identification of issues or problems related to achieving the goals;
- Identification of solutions corresponding to each of the issues; and
- Development of specific action steps, including identification of resources, measurement and anticipated schedules.

Based on the action-implementation plans from each of the nine goals, a process for accomplishing the goals and policies of this SWMP is established.

B. Implementation Priorities and Costs

The implementation plan as described in the implementation Tables for each Plan goal includes identification and prioritization of capital improvements, administration, maintenance and inspections, permitting, plan amendments, financing alternatives, public involvement and

monitoring programs. Prioritization of improvements was based on a review of recommended and required actions for the nine individual goal action-implementation plans

The City's water bodies, wetlands and open spaces are exceptional resources for City residents. They offer a range of recreational opportunities and are generally in very good shape from a water quality perspective. The City's challenge in the years ahead will be to successfully implement this SWMP and the requirements of the NPDES Phase II program to maintain, and where feasible, improve these existing resources. Water Quantity, or flooding, issues are another key area for the City to focus efforts on in the coming years. While no significant issues exist, there are several areas throughout the City where localized flooding can be addressed by infrastructure improvements associated with street reconstruction and/or development projects.

The City's implementation priorities are listed in 28 with references to the plan section and a planning level cost estimate where costs are not already included in the City's overall storm water management program budget. The City's highest priorities are to continue to manage their program in compliance with the NPDES MS4 permit program requirements and to take a more focused approach to meeting the recently adopted volume control requirements for much of the City.

Table 28. Implementation Priorities

Activity Steps	Plan Section(s)	Estimated Cost	Target Date
1. Implement NPDES Permit Program.	• Table 6 – Water Quality	• NA	Annually
2. Update Post-Construction Runoff Control Ordinance and Erosion and Sediment Control Ordinance	• Table 6 – Water Quality • Table 12 – Erosion Control	• $5,000	2009
3. Complete a study of potential infiltration and volume reduction areas to support future street recon projects	• Table 6 – Water Quality • Table 14 - Groundwater	• $15,000	2009 - 2010
4. Track List of Impaired Waters by MPCA	• Table 6 – Water Quality	• NA	Annually
5. Development of database for tracking and reporting storm water program activities	• Table 20 – Maintenance and Inspection	• $4,000 • $2,500	2009 Annually
6. Explore Grant Program opportunities to help fund water resources projects and initiatives.	• Table 22 – Regulatory Responsibility	• $2,000	Annually (Ongoing)

The financial goal for this Plan is to fit within the existing funding sources to pay for water resources management activities. Except for the items listed below, planning-level estimates of capital expenditures have not been made. The primary funding source for Plan activities is the City's Surface Water Management Fund. The Fund is anticipated to be supplemented by special assessments, grant and other available funding on a project specific basis. In consideration of recent municipal budget situations, a renewed focus will be placed on securing grants, enlisting regional watershed funding and investigating other innovative financing mechanisms.

Except for the activities that are taken from the City NPDES SWPPP, the Implementation Plan is not a hard and fast commitment to complete each and every activity in the time frame suggested. Rather, it is a suggested course of action that will accomplish the major goal of this plan, to accommodate in-fill development and redevelopment in the community while protecting and improving Oakdale's water resources. The Implementation Plan will be reviewed on an annual basis as part of the City's annual report to Council. At that time, proposed improvements and new activities are to be considered, City budgets adjusted if needed, and additional improvement projects or management activities added to, or removed from, the program.

C. Amendments to the Plan

1. Amendment Procedures

The Surface Water Management Plan is intended to extend approximately through the year 2018. The NPDES SWPPP activities will be reviewed and evaluated annually in a public meeting and the permit program itself will be updated in 2011. For the plan to remain dynamic, an avenue must be available to implement new information, ideas, methods, standards, management practices, and any other changes which may affect the intent and/or results of the Plan. Amendment proposals can be requested any time by any person or persons either residing or having business within the City.

2. Request for Amendments

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

3. Staff Review

Following a request for Plan amendments, staff will make a decision as to the validity of the request. Three options exist:

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

4. Council Consideration

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

5. Public Hearing and Council Approval

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, Council could approve of the amendments.

6. WDs Approval

All proposed amendments must be reviewed and approved by the appropriate WDs prior to final adoption of the amendments.

7. Council Adoption

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

D. Annual Report to Council

An annual report will be completed by City staff summarizing water resource management activities that have been completed over each calendar year. To the extent practicable, and to avoid duplication of efforts, the annual report will be coordinated with preparation of the Phase II NPDES program annual report that must be submitted to MPCA by March 10th of each year. The NPDES annual report includes a public notice, meeting and comment process prior to finalizing the annual report. The City will use this annual reporting process to evaluate the storm water program overall. Recommended changes to the Plan will not necessarily require individual amendments, but instead may be considered when the plan is brought up to date.

The Plan will remain in effect through approximately 2018 and should then be reviewed for consistency with current water resources management methods. Staff's intent is to revisit the goals, policies, tools and progress of the Plan on a three to five year basis. Water quality trends will be reviewed, the effectiveness of regulatory programs will be evaluated, and the success of public improvement projects will be assessed. Based on these subsequent reviews, the SWMP will be updated to produce a truly dynamic plan. In addition, NPDES permits issued by MPCA are effective for a maximum term of five years. Therefore, the City will also be revising their SWPPP on a five year basis (2006, 2011, etc.) as part of the NPDES program requirements.

APPENDIX A – ACRONYMS, GLOSSARY

Acronyms

BMP	Best Management Practices
BWSR	Minnesota Board of Water and Soil Resources
DNR	Department of Natural Resources
EPA	United States Environmental Protection Agency
EQB	Minnesota Environmental Quality Board
EQC	Environmental Quality Committee
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
SWCD	Soil and Water Conservation District
IMP	Integrated Management Practice
LID	Low Impact Development
MCES	Metropolitan Council Environmental Services
MPCA	Minnesota Pollution Control Agency
MS4	Municipal Separate Storm Sewer System
MUSA	Metropolitan Urban Services Area
NPDES	National Pollutant Discharge Elimination System
NURP	Nationwide Urban Runoff Program
SWMP	Surface Water Management Plan
SWPPP	Storm Water Pollution Prevention Program (or Plan)
TP	Total Phosphorus
TSS	Total Suspended Solids
WD	Watershed District
WMO	Water Management Organization

Glossary

100-Year Flood: The flood having a one-percent (1%) chance of being equaled or exceeded in any given year. A 100-year flood is synonymous with Base Flood, Regional or 1% Chance Flood.

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

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

Buffer: The use of land, topography, difference in elevation, space, fences, or landscape planting to screen or partially screen a use or property from the vision of another use or property, and thus reduce undesirable influences such as: sight, noise, dust, and other external effects.

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

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

Design Storm: A rainfall event of specified size and return frequency that is used to calculate the runoff volume and peak discharge rate to a BMP.

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

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

Drawdown: The gradual reduction in water level in a pond BMP due to the combined effect of infiltration and evaporation.

Draining: The removal of surface water or ground water from land.

Drop Structure: Placement of logs with a weir notch across a stream channel. Water flowing through the weir creates a plunge pool downstream of the structure and creates fish habitat.

Easement: A grant of one or more property rights by a property owner for use by the public, a corporation, or another person or entity. Ecologically Harmful Exotic Species: Non-native aquatic plants or wild animals that can naturalize, have high propagation potential, are highly competitive for limiting factors, and cause displacement of, or otherwise threaten, native plants or native animals in their natural communities.

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

Erosion: The wearing away of land surface by the action of natural elements.

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

Existing Development: A property or parcel of land that has previously been subject to development, and that is not undeveloped property.

Extended Detention: A storm water design feature that provides for the gradual release of a volume of water (0.25 - 1.0 inches per impervious acre) over a 12 to 48 interval times to increase settling of urban pollutants, and protect channel from frequent flooding.

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

Extended Detention Wetland: A storm water wetland design alternative in which the total treatment volume is equally split between a shallow marsh and temporary detention of runoff above the marsh. After a storm, the normal pool of the shallow marsh may rise by up to two feet. The extra runoff is stored for up to 24 hours to allow pollutants to settle at, before being released downstream.

Flood: A temporary rise in stream flow or stage that results in inundation of the areas adjacent to the channel or water body.

Flood Frequency: The average frequency, statistically determined, for which it is expected that a specific flood stage or discharge may be equaled or exceeded.

Flood Fringe: That portion of the 100-year floodplain outside of the floodway.

Flood Obstruction: Any dam, well, wharf, embankment, levee, dike, pile, abutment, projection, excavation, channel rectification, culvert, building, wire, fence, stockpile, refuse, fill, structure or matter in, along, across or projecting into any channel, watercourse or regulatory flood hazard area which may impede, retard or change the direction of the flow of water, either in itself or by catching or collecting debris carried by such water, or that is placed where the flow of water, either in itself or by catching or collecting debris carried by such water, or that is placed where the flow of water might carry the same downstream to the damage of life or property.

Floodplain: Floodplains are lowland areas adjoining lakes, wetlands, and rivers that are susceptible to inundation of water during a flood. For regulatory purposes, the floodplain is the area covered by the 100-year flood and it is usually divided into districts called the floodway and flood fringe. Areas where floodway and flood fringe have not been determined are called approximate study areas or general floodplain.

Flood Proofing: A combination of structural provisions, changes or adjustments to properties and structures subject to flooding primarily for the reduction or elimination of flood damages to properties, water and sanitary facilities, structures and contents of buildings in a flood hazard area in accordance with the Minnesota State Building Code.

Floodway: The floodway is the channel of a river or other watercourse and the adjacent land areas which must remain open in order to discharge the 100-year flood.

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

Freeboard: A factor of safety usually expressed in feet above a certain flood level. Freeboard compensates for the many unknown factors (e.g., waves, ice, debris, etc.) that may increase flood levels beyond the calculated level.

General Floodplain Area: The general floodplain area is determined using the best available data, in lieu of performing a detailed engineering study. These data may be from soils mapping, experienced high water profiles, aerial photographs of previous floods, or other appropriate sources. There are no associated published 100-year flood elevations with general floodplain delineations, unlike detailed study areas. General floodplain area is synonymous with approximate study area and unnumbered A-Zone.

Impervious Surface: The portion of the buildable parcel which has a covering which does not permit water to percolate into the natural soil.

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

Infiltration Trench: A conventional infiltration trench is a shallow, excavated trench that has been backfilled with stone to create an underground reservoir. Storm water runoff diverted into the trench gradually exfiltrates from the bottom of the trench into the subsoil and eventually into the water table. An enhanced infiltration trench has an extensive pretreatment system to remove

sediment and oil. It requires an on-site geotechnical investigation to determine appropriate design and location.

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

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

Lowest Floor: The lowest floor of a structure, including basement. See also minimum building elevation.

Low Impact Development (LID): An approach to storm water management intended to protect water resources, reduce storm sewer infrastructure costs and provide a more attractive storm water management system. LID practices include infiltration systems, bioretention areas, rain barrels, green roofs, porous pavements and a long list of additional innovative storm water treatment practices.

Minimum Building Elevation (MBE): The minimum building elevation is defined as the lowest slab elevation of a home or building, including basements and crawl spaces. See also lowest floor.

New Development: Development of a property or portion thereof that is currently undeveloped property.

NURP: Nationwide Urban Runoff Program, a study by the U.S. Environmental Protection Agency. A key component of this program was to assess the effectiveness of urban runoff detention/retention basins (e.g., ponds) in removing pollutants from storm water runoff.

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

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

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

Permanent Pool: A 3- to 10-foot deep pool in a storm water pond system that provides removal of urban pollutants through settling and biological uptake. (Also referred to as a wet pond).

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

Public Waters: Those waters of the state identified as public waters or wetlands under Minnesota Statutes, Section 103G.005.

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

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

Regional Flood: A flood which is representative of large floods known to have occurred generally in Minnesota and reasonably characteristics of what can be expected to occur on an average frequency in the magnitude of the 100-year recurrence interval. Regional flood is synonymous with the term _base flood" used in the Flood Insurance Study.

Regulatory Flood Protection Elevation (RFPE): The elevation established by local ordinance to which all new floodplain development must be protected against flood damage. At a minimum, this is an elevation no lower than the 100-year flood elevation plus any increase in flood levels resulting from the designation of floodway areas.

Regulatory Flood Protection Elevation: A point not less than one-foot (1') above the water surface profile associated with the 100-year flood as determined by the use of the 100-year flood profile and surrounding technical data in the Flood Insurance Study plus any increase in flood heights attributable to encroachments on the floodplain. It is the elevation to which uses regulated by City ordinance are required to be elevated or flood proofed.

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

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

Runoff (Storm Water): The overland and near surface flow from storm water and snowmelt.

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

Runoff Pretreatment: Techniques to capture or trap coarse sediments before they enter a BMP to preserve storage volumes or prevent clogging within the BMP. Examples include forebays and

micropools for pond BMPs, and plunge pools, grass filter strips and filter fabric for infiltration BMPs.

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

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

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

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

Storm Water Treatment: Detention, retention, filtering or infiltration of a given volume of storm water to remove urban pollutants and/or reduce flooding.

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

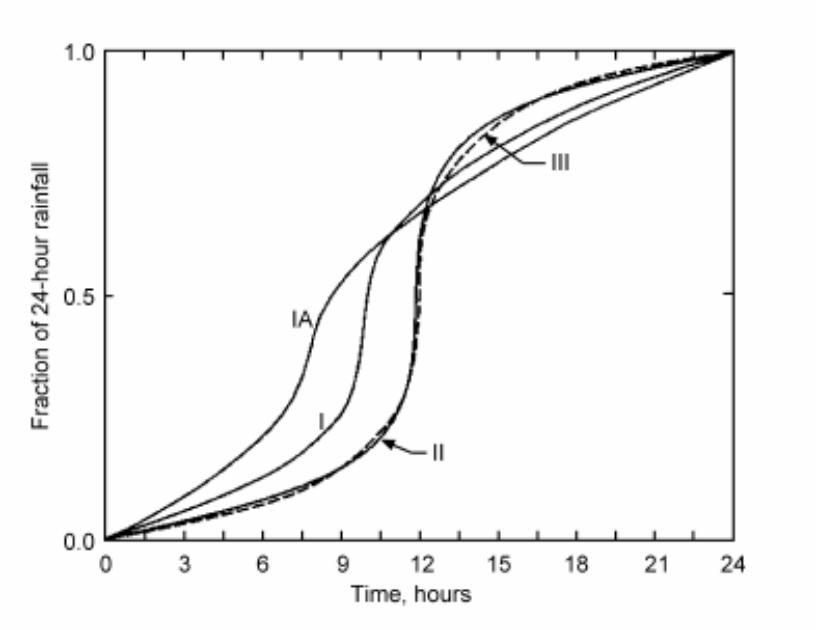
Structure: Anything which is built, constructed or erected; an edifice or building of any kind; or any piece of work artificially built up and/or composed of parts joined together in some definite manner whether temporary or permanent in character. Among other things, structures including but not limited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

Ten-Day Runoff with Type "C" Distribution (100-Year/10-day runoff): A modeled runoff event that represents snowmelt conditions over a 10-day period for a return period snow depth of 100 years. The runoff event is simulated for a curve number (CN) of 100 which represents frozen soil conditions or where all surfaces are considered impervious. For some drainage basins the ten-day runoff event is the critical event for identifying the high water level of the basin or water body. The Type C distribution is similar in concept to the Type I and II distributions, and for this event, establishes the time distribution of runoff volume over the ten-day period.

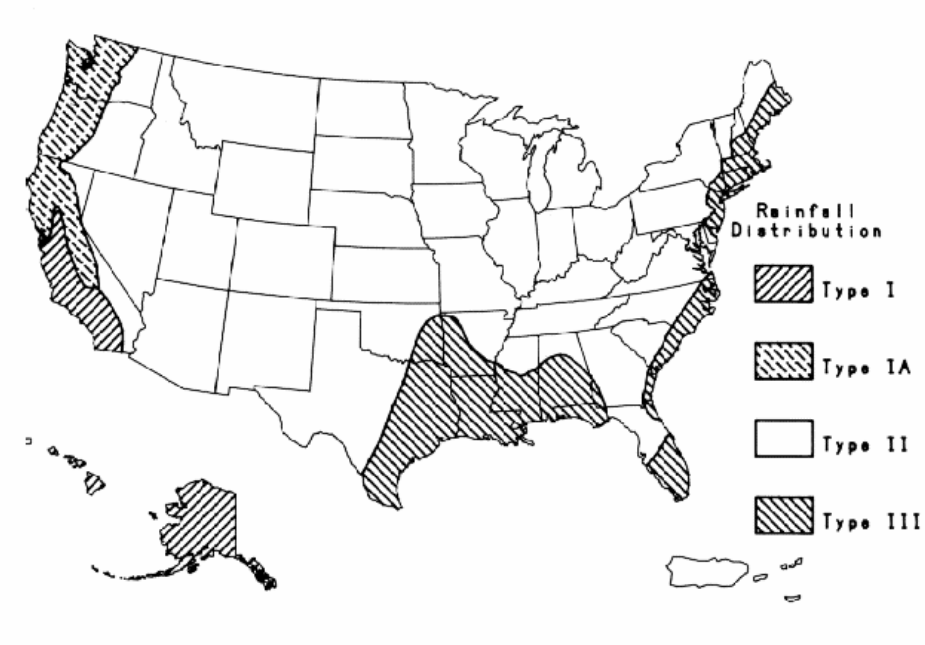
Treatment Volume (Vt): The volume of storm water runoff that is treated within a BMP or IMP storm water wetland. Typically expressed in terms of inches of runoff per impervious acre. In the Washington metropolitan area, the recommended Vt for sizing a storm water wetland is 1.25 inches per impervious acre.

Type I, IA, II and III Storm Distributions - NRCS: These storm types represent the time distribution of a 24-hour rainfall event for areas throughout the United States. The total storm depth is distributed according to the diagram in subpart A. Type II storms are more "flashy" (i.e., convective/thunderstorms) than a Type I or IA storm. Subpart B illustrates that all of Minnesota is within the Type II rainfall distribution area.

A. SCS 24-hour rainfall distributions (SCS, 1986):



B. Approximate geographic boundaries for SCS rainfall distributions (SCS, 1986):



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

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

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

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

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

Wetlands: Areas inundated or saturated by surface or ground water at a frequency and duration to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for saturated soil conditions. In short, wetlands are areas inundated or saturated for long enough periods of time to result in the development of hydric soils and dominance by hydrophytic (water tolerant) vegetation.

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

Wet Pond: A conventional wet pond has a permanent pool of water for treating incoming storm water runoff (see detail cross section in Appendix C).

APPENDIX B - WATER MANAGEMENT AGENCY/ORGANIZATION CONTACTS

Water Management Agency/Organization Contacts

Numerous agencies and organizations in Minnesota have varying authorities and/or interest in surface water management activities relative to the City of Oakdale's Plan. A summary of these agencies and organizations is listed below with a link to their respective website at the time this Plan was created. More detailed information is available on each web page including contacts and key responsibilities relative to surface water management.

Agency/Organization	Website Link
MN Pollution Control Agency	http://www.pca.state.mn.us
MN Department of Natural Resources	http://www.dnr.state.mn.us
Board of Water and Soil Resources	http://www.bwsr.state.mn.us
City of Oakdale	http://www.ci.oakdale.mn.us
Ramsey Washington Metro WD	http://www.rwmwd.org
South Washington WD	http://www.swwdmn.org
Valley Branch WD	http://www.vbwd.org
Washington County	http://www.co.washington.mn.us
US Army Corps of Engineers	http://www.usace.army.mil
Natural Resources Conservation Service	http://www.nrcs.usda.gov

APPENDIX C – DEVELOPMENT STANDARDS

These development standards are intended to be used by developers and/or project proposers in design and layout of their site plans and storm water management features. These standards do not replace or supersede City ordinances, watershed district regulations, state and federal rules or permits required for the project.

All plans shall be reviewed by the City Engineer and all applicable permits must be obtained prior to commencing construction. For all newly constructed storm water facilities (ponds, retention areas, infiltration basins, storm sewer, etc.) or existing facilities that are modified, as-built plans shall be prepared by the developer. As-built plans shall be signed and certified by a licensed professional engineer in the State of Minnesota and record drawings shall be provided to the City.

A maintenance agreement may also be required by the City and/or watershed district to establish the long-term responsibilities for monitoring and maintaining the practices installed. An example agreement for ponds is provided at the end of this appendix. The agreement may be modified to address a wide range of BMPs (infiltration systems, retention areas, grit chambers, etc.) with the addition of maintenance activities and schedules specific to the selected BMP. Recommended maintenance activities may be found at number of sources including the Stormwater Manager's Research Center website http://www.stormwatercenter.net.

DESIGN REQUIREMENTS

I. General Criteria

A. Any grading or filling activity that disturbs one or more acres of land shall meet the standards and design requirements of this Plan.

B. Projects in the Valley Branch Watershed District that meet one or more of the following are also required to obtain a permit from the District:

1. Any subdivision, plat or development project;
2. Any projects that creates a new impervious surface of 6,000 square feet or more;
3. Any project that results in a discharge of municipal or industrial storm water to a surface water drainage system;
4. All projects within the floodplain of the VBWD;
5. Any project that impacts a wetland; and
6. Any project that proposes lake augmentation.

C. Projects in the South Washington Watershed District that proposes augmentation or diversion of surface water to a receiving water are also required to obtain a permit from the District.

D. Any work within a wetland, surface water or FEMA designated floodplain shall obtain permits from the City, watershed district, DNR and Corps of Engineers, if applicable to the specific project, prior to commencing and construction, grading, clearing or filling activity.

II. Water Quality Treatment and Volume Control Requirements

A. For projects in the **Ramsey-Washington-Metro Watershed District**, the project shall provide infiltration or filtration BMPs sufficient to satisfy the requirements of the District's Volume Control Worksheet. The worksheet requires volume reduction practices on-site that treat the runoff from a 1-inch rainfall over the impervious areas of the project. For projects that meet the volume control requirements of the RWMWD, the water quality treatment requirements in Item C are considered to be met.

B. For projects in the **South Washington Watershed District**, the water quality standard is to provide 1-inch of volume control for the site impervious area. In some cases, and based on the total phosphorus export limit for the downstream water body, a more restrictive treatment level may be required. Table 6.4 in the SWWD WMP specifies the maximum allowable P-load per acre on an annual basis.

C. For projects in the **Valley Branch Watershed District**, the water quality treatment shall meet the requirements in VBWD Rule 2, including completion of the Volume Control Worksheet.

D. For projects or portions of projects not subject to item A or B, water quality treatment shall be provided that achieve 90% removal of TSS and 60% removal of TP on an annual basis using a standard NURP particle size distribution in the analysis. A permanent pool dead storage volume of at least the runoff from a 2.5 rainfall over the area tributary to the pond shall be provided. The runoff volume shall be determined by evaluating separate subcatchment areas for the pervious and impervious surfaces under assumed fully developed watershed conditions.

III. Rate Control Requirements

A. No increase in peak discharge may result from a proposed project for the 2-year storm, the 10-year storm and the 100-year storm event and the 100-year, 10-day runoff/snow melt. Variances *may* be allowed if computations can be provided which demonstrate no adverse downstream effects will result from the proposed system. If the methodology is inconsistent with City standards, and the results are significantly different from the City's, then the City results shall control. Cumulative storm depths for the required events are:

1. 2-Year = 2.8 inches
2. 10-Year = 4.2 inches
3. 100-Year = 5.9 inches (6.3 inches in SWWD)

B. For projects located in the South Washington Watershed District, and in addition to the rate control standards above, peak storm water discharge rates and shall be consistent with the values shown in the District's Plan. Flows from Oakdale into adjacent cities are limited to the following:

1. To Lake Elmo (at CR 13 between 10^{th} and 4^{th}) 135 cfs
2. To Lake Elmo (at CR 13 and 4^{th}) 220 cfs
3. To Woodbury (at I-94 from Lake Elmo and Oakdale) 35 cfs

C. No project shall result in an increase in the discharge rates leaving the city into an adjacent city.

IV. Floodplain Management and Storage

A. Flood storage volume must be maintained such that any loss of storage in a FEMA-designated floodplain has no significant net downstream effect.

B. For projects within the Ramsey-Washington-Metro Watershed District, no placement of fill is allowed within the 100-year floodplain unless compensatory storage is provided. Compensatory storage must be provided on the development site or immediately adjacent to the site and within the affected floodplain.

C. For projects within the Valley Branch Watershed District, the cumulative affect of all filling must not raise the 100-year flood level of lakes, ponds and wetlands more than 0.1 foot or more than 0.5 feet on streams.

D. Available storage volume of landlocked areas shall be established by estimating the water surface elevation resulting from a 100-year/10 day runoff (7.2 inches) with CN=100. For landlocked areas, available freeboard and infiltration capacity of in-place soils should be analyzed (if analyzed for unfrozen soil conditions). When freeboard is unavailable, an annual water balance should be used, considering the 100-year annual runoff and average annual losses from evaporation, transpiration and infiltration.

E. The minimum building elevation for buildings adjacent to surface water features shall be the highest of the elevations determined for the following:

1. Two (2) feet above the 100-year/24-hour event or the effective Base Flood Elevation (BFE);
2. Two (2) feet above the 100-year/10 day runoff (snowmelt) event;
3. Four (4) feet above the normal water elevation.

F. Where an effective BFE has not been established the elevation to which the lowest floor, including basement, must be placed or flood-proofed shall be:

1. For Lakes: at least 3 feet above the highest known water level.
2. For Rivers or Streams: at least 3 feet above the flood of record, if data are available. If data are not available, by placing the lowest floor at least 3 feet above the flood elevation determined by a technical evaluation.

G. The building or structure shall be a horizontal distance of at least 15 feet from the nearest location of the Base Flood Elevation.

H. Where the emergency overflow (EOF) elevation is above the high water level determined in Item E.1 or E.2 above, and the EOF is plus one (1) foot is below the minimum building elevation, then the minimum building elevation shall equal the EOF elevation plus one (1) foot.

V. Erosion and Sediment Control Plans

A. An erosion and sediment control plan shall be created for any land disturbing activity. Erosion and sediment control elements shall be implemented before any grading can begin. A schedule of significant grading work will be required as part of the erosion and sediment control plan. Projects disturbing 1 acre or more must also comply with all required provisions of the most recent MPCA NPDES Construction Storm Water Permit.

B. Site access roads (entrances to construction sites) shall be graded or otherwise protected with silt fences, diversion channels or dikes and pipes to prevent sediment from exiting the site via the access road. Primary site access roads shall be surfaced with crushed rock. The rock entrance shall extend for a distance of 100 feet beginning at existing paved surface. All construction traffic shall utilize the entire length of the rock entrance.

C. Soil tracked from the site by motor vehicles shall be cleaned from paved roadway surfaces daily throughout the duration of construction. Roadway cleaning shall be the responsibility of the party or parties having a building permit with the City.

D. Streambank stabilization and stream bed control structures shall be designed based on the unique site conditions present including soil conditions, flow rate, slope, and flow velocity.

E. Detention basins may be used for temporary sediment retention during the construction phase. The design should include providing permanent storage volume for construction and restoration phase sediment accumulation or the removal of the sediment to restore the required permanent pool volume in the detention area.

F. Detention areas intended to permanently trap sediments shall provide excess dead storage beyond the required water quality volume, to allow for sediment accumulation. Sediment basins shall be capable of removing coarse suspended sediment from storm water for all runoff events and the greatest practical grain size (#40 typically). Sediment storage volume should be estimated by the universal soil loss equation and 0.5 tons per watershed acre per year. Volume below the outlet can be estimated by using the runoff volume resulting from a 2.5” rainfall.

VI. Hydrologic Analysis and Design

A. Storm distributions and storm volumes for hydrologic analysis shall be based upon Hershfield, D.M., 1961, Rainfall Frequency Atlas of the United States for Durations of 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years, Technical Publication No. 40 (TP-40).

B. Design of major facilities (e.g., ponds, detention areas, retention areas) shall be based on the U.S.D.A. NRCS methods, 100-year return period, 24-hour duration, type II distribution with average soil moisture conditions (AMC-2). The analysis of flood levels,

storage volumes and discharge rates for detention basins shall utilize the design storm/freeboard evaluation storm concept.

C. Minor drainage systems (storm sewer) shall be analyzed and designed to protect for the 10-year frequency rainfall, and shall be evaluated for the 100-year frequency rainfall. Full pipe flow analysis shall be used unless special conditions can be demonstrated to consider pressure flow.

D. The Rational Method is the accepted design method for the design of minor systems (storm sewer). The preferred method of design would be a method utilizing a hydrograph approach with factors for land use and soil moisture conditions. NRCS methodology is not acceptable for minor system design unless approved by the City Engineer.

VII. Wetland Requirements

A. Wetland alteration will only be allowed with the approval of and receipt appropriate permits and approvals from the City, the watershed district, the Department of Natural Resources, and the U.S. Army corps of Engineers.

B. Water level fluctuations (peak elevation and duration) for wetlands shall be managed in accordance with the specific watershed organization requirements.

C. Buffer Requirements. The following no-disturbance buffer setbacks apply to projects within the applicable Watershed District:

1. Ramsey-Washington-Metro Watershed District. Wetland mapping is available on www.rwmwd.org.

Wetland Class	Average Buffer Width (feet)	Minimum Buffer Width (feet)
A	75	37.5
B	50	25
C	25	12.5
Storm Pond	10	10

2. South Washington Watershed District. Wetland mapping is available on www.swwdmn.org.

Wetland Class	Wetlands < 1 acre Buffer Width (feet)	Wetlands > 1 acre Buffer Width (feet)
Protect	75	100
Manage I	50	75
Manage II	25	50

3. Valley Branch Watershed District: a minimum of 16.5 foot buffer around a delineated wetland or the Ordinary High Water level, whichever is greater in elevation. The following average buffers and monument requirements also apply.

Wetland Class	Average Buffer Width (feet)	Monument Required at Buffer Edge
A - Preserve	60	Yes
B - Manage 1	40	Yes
B - Manage 2	30	Yes
D - Manage 3	25	No

D. Wetlands which are identified in historic surface water management plans as integral to stormwater conveyance and management under full development may be granted a variance from SWWD standards. All other permits and standards still apply.

VIII. Storm Water Facility Design Criteria

A. All hydrologic data and computations shall be based on NRCS (formerly SCS) methodology. Computer modeling may be completed using HydroCAD, TR20/TR55, SWMM or comparable City-approved modeling software.

B. An emergency overflow spillway shall be identified and designed to convey storm flows from events greater than the 100-year event.

C. Proper allowance shall be made for future access and maintenance.

D. The facility design shall provide adequate live storage to provide protection from the design storm, consistent with minimum building elevation standards in Appendix D of this Plan. Minimum building elevation is defined as the lowest slab elevation for a home or building, including basements and crawl spaces. Overflow conditions may also be considered.

E. Skimming devices are required to remove oils and floatable materials up to a one-year frequency event. The skimmer should be set four inches below the normal surface water elevation and should control the discharge velocity to 0.5 fps.

F. Outlets shall be evaluated for the need to dissipate energy so as to reduce velocities to permissible levels as allowed by the soil and vegetation. Outlet velocities shall be reduced to 4 fps or less. At a minimum, flared end sections should be provided with riprap consistent with Mn/DOT standards. For areas with high flows or where excessive erosion occurs or is anticipated, energy dissipation per Federal Highway Administration standards shall be followed.

G. Riprap shall be provided below the channel grade and above the outfall or channel bottom to insure that riprap will not be undermined by scour or rendered ineffective by displacement. Riprap consisting of natural angular stone suitably graded by weight shall be designed for anticipated velocities. Riprap shall be placed over a suitable filter material or filter fabric to insure that soil particles do not move through the riprap and reduce its stability.

H. For outlets through berms or roadway embankments and all culverts under public traveled streets, anti-seepage collars shall be used. The collars shall be installed so as to increase the creep distance or seepage line along conduit by 15 percent. The locations for the use of collars include:

1. All water and pond structures with a pool depth of two feet and a two-day duration.

2. 250 Acre watershed or more.

3. Design head of 10 feet or more.

I. For wet ponds:

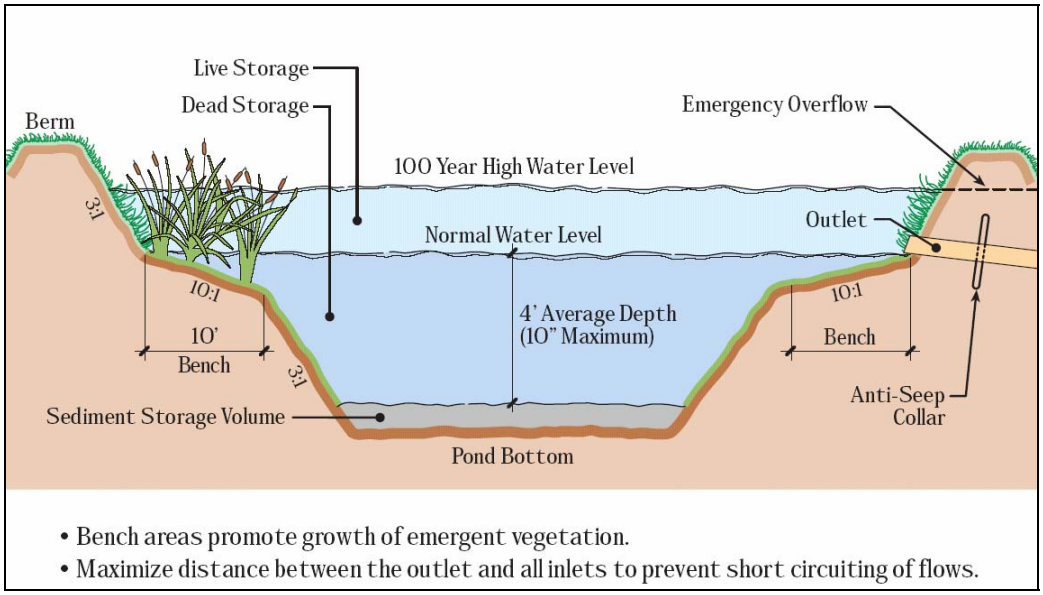
1. Maximum 3:1 (H:V) side slopes (see diagram next page).

2. 10:1 (H:V) safety bench from normal water level (see diagram).

3. A minimum of four feet of standing water (dead storage depth) and a maximum of ten feet shall be provided. (see diagram).

4. Separation between the inlet(s) and outlet shall be maximized to prevent short-circuiting.

5. Inlets shall be placed at or below the normal water level.



J. For infiltration or filtration systems:

1. Infiltration systems are prohibited:

a) Within 50 feet of public or private water supply well (Minn. Rules, Chapter 4725);

b) Where the bottom of the infiltration basin is less than 3 feet to bedrock or the seasonally high water table;

c) Potential storm water hotspots or contaminated soils;

d) Low permeability soils (i.e., Hydrologic Soil Group D soils);

e) Within 10 feet of a property line or building foundation;

f) Within 35 feet of a septic system tank or drain field.

2. Infiltration practices must be designed to draw down to the bottom elevation of the practice within 48 hours. The maximum ponding depth shall be based on the soil infiltration rate determined from site-specific soils investigation data taken from the location of proposed infiltration practices on the site. The soils investigation requirement may be waived for smaller residential property practices where the maximum ponding depth is less than two (2) feet.

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

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

5. The design shall incorporate provisions that will prohibit construction equipment from compacting the soil where infiltration practices are proposed.

K. A vegetative buffer should be established around the perimeter of the pond. Water quality ponds in the RWMWD shall have a minimum buffer of 10 feet.

CITY OF OAKDALE, MN

MAINTENTANCE AGREEMENT (EXAMPLE)

REGARDING STORM WATER MANAGEMENT PRACTICES:

I. THIS AGREEMENT made this _____ day of _____, 200__ by and among the City of Oakdale, Minnesota (hereinafter referred to as the "City") and, _____, a _____ [corporation, individual] (hereinafter referred to as "_____") with reference to the following facts and circumstances:

A. (*)_____ is the fee owner of certain real property situated in the City of _____, legally described as follows:
(Legal)_____,
(*) CAPS _____ (_____)
(hereinafter referred to as the "Subject Property").

B. As a condition of its approval of the development for the Subject Property, the City has required that the parties hereto enter into an agreement, which makes provision for the maintenance of the Storm Water Management Practice located within the boundaries of the Subject Property as the same is described and depicted in those certain construction plans drawn by _____, approved by the City and constructed by _____. The Storm Water Management Practice is located in the platted drainage and utility easement in_____ _____.

C. The parties hereto desire to set forth their agreement with respect to the maintenance of the Storm Water Management Practice and the costs of such maintenance.

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

A. For the purposes of this Agreement, maintenance of the Storm Water Management Practice shall mean the annual inspection and certification by a qualified individual that the pond is functioning in accordance with the approved plans and, if necessary, the periodic dredging of the silt buildup in the Storm Water Management Practice as necessary to maintain function, as established for the Storm Water Management Practice in the construction plans and to maintain the proper operation of the treatment function of the Storm Water Management Practice.

B. (*)_____ shall be solely responsible for the maintenance of the Storm Water Management Practice, and shall bear all costs of such maintenance, until such time as _____ (hereinafter referred to as the "Association") is activated pursuant to Article _____, Section _____, of the Declaration of Covenants for _____,

whereupon the Association shall bear the sole responsibility for such maintenance and shall bear all costs of such maintenance. If (*)_____, or after its incorporation, the Association, does not undertake the necessary maintenance within 30 days of notification by the City, or within 30 days provide the City with a schedule for undertaking the necessary maintenance, the City may undertake such maintenance, and the costs reasonably incurred by the City for performing such maintenance shall be reimbursed to the City within 30 days by the party responsible for such maintenance and, if the responsible party does not timely reimburse the City, then the City may recover its costs by levying a special assessment against all single family house lots in the Subject Property, each lot to bear an equal share.

C. (*)_____, as present owner of the Subject Property, for itself and respective successors and assigns, hereby waives any statutory right which it may have to contest any such assessment by the City of its maintenance costs on the basis of the benefit to portions of the Subject Property.

D. Notwithstanding anything contained in this Agreement to the contrary, in the event the city shall establish a policy for maintenance by the City of Storm Water Management Practices located elsewhere in the City of Oakdale, under which policy the costs of such maintenance are to be paid either out of general City revenues or by collection of utility or service fees or charges, then any owner of any portion of the Subject Property shall be entitled to petition the City for the inclusion of the Storm Water Management Practice under such maintenance program, and the City shall consent to such request and thereupon authorize the termination of this Agreement. The recording of a certified copy of the Resolution of the City Council of the City which sets forth the consent and authorization described in the foregoing sentence shall serve the terminate this Agreement, without further action on the part of any party hereto.

E. The terms and conditions of this Agreement shall be binding upon, and shall insure to the benefit of, the parties hereto and their respective successors and assigns.

III. IN WITNESS WHEREOF, the parties hereto have caused this document to be executed as of the day and year first above written.

_____ _____
Date

Title _____
for the City of Oakdale, Minnesota

_____ _____
[Corporation/individual] Date

THIS INSTRUMENT DRAFTED BY _____

APPENDIX D – HYDROLOGIC SYSTEM DATA SUMMARY TABLES

Hydrologic Summary

This appendix contains the background hydrologic and hydraulic summary data used to develop the city-wide HydroCAD model. These data are provided for reference purposes when using the HydroCAD model or reviewing hydrologic characteristics for modeled drainage areas. The following list outlines the data included:

- **General Data**: This spreadsheet provides the basic hydrologic characteristic data for each drainage area.
- **Tc Calc**: This spreadsheet provides the detailed time-of-concentration calculations used as the basis for model input parameters. Only two subwatershed areas were evaluated in detail to assess the accuracy of the methods used for the remaining subwatersheds.
- **Pond Areas**: This spreadsheet provides the normal water elevation surface area for each ponding area modeled. These data were taken from the GIS contour file.
- **Hydrologic Summary Tables (11 x 17):** The tables in this section summarize the results of the hydrologic modeling for each major subwatershed area. In the tables you will also find base information on the subwatersheds and water bodies in the City; such as, DNR Protected Water/Wetland Designation (if applicable), subwatershed drainage area, curve number and time of concentration. The City Water Body Designation ID corresponds to the subwatershed ID number in the drainage area maps.

The information in the table presents results of the modeling hydrologic. The first two of the following three storm events were modeled to determine the recommended minimum building elevation (MBE):

- Design Storm: 100-year, 24-hour, Type II distribution with normal antecedent moisture conditions (AMC-2).
- 10-day Runoff: 100-year, 10-day runoff, "C" distribution (NEH-4).
- Flood Evaluation Storm: 100-year, 24-hour, Type II distribution with antecedent moisture conditions (AMC-3) – *not modeled*.

The 1989 recommended MBE is listed along with the 2006 elevations. The recommended MBE is the greater of 2-feet plus the high water elevation from the design storm or the high water elevation from either the Design Storm or 10-day Runoff storm. Proposed development should plan to meet the 2006 minimum building elevations, although the City may consider each individual project on a case-by-case basis.

APPENDIX E – FIGURES

APPENDIX F – NPDES PHASE II PROGRAM SUMMARY

City's NPDES Phase II MS4 Permit SWPPP - Link to City of Oakdale Webpage:

http://www.ci.oakdale.mn.us/index.asp?Type=B_BASIC&SEC={CE325B6F-1844-4E1F-916C-A4B0B1457496}

Link to MPCA Main Storm Water Program Webpage:

http://www.pca.state.mn.us/water/stormwater/index.html