SURFACE WATER MANAGEMENT PLAN

Final Report

City of New Prague

March 2008

Project Number: 641-02115-0

Bonestroo

2335 Highway 36 W
St. Paul, MN 55113

Tel 651-636-4600
Fax 651-636-1311

www.bonestroo.com

March 4, 2008

Renee Christianson
City Planner
City of New Prague
118 Central Avenue North
New Prague, MN 56071

Re: New Prague Surface Water Management Plan
City of New Prague
Bonestroo File No.: 641-02115-0

Dear Renee,

We are pleased to transmit New Prague's Surface Water Management Plan. At this point the City can begin implementing the stormwater management program outlined within the Plan. Significant changes in this Plan over the previous include a runoff volume management strategy and increased emphasis on water quality. The changes are consistent with those seen in other Scott County communities and reflect a statewide emphasis on controlling both runoff rate and runoff volume. Though New Prague's new management standards put it at the forefront of progressive surface water management by Cities in Minnesota, the management system is nonetheless intended to be flexible to allow for more dense development within the downtown area and other areas where soils may not be conducive to infiltration.

Sincerely,

BONESTROO

Bob Barth
Associate

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Executive Summary

This Report provides the City of New Prague with a Comprehensive Surface Water Management Plan (SWMP) that will serve as a guide to managing the surface water system throughout the City.

This Report is organized as follows:

- **Section 2 – Physical Environment** describes the physical environment including watersheds and drainage patterns, dominant land uses, and significant waterbodies within the City.
- **Section 3 – Regulatory Context** lists federal, state, and local agencies with some jurisdiction over surface waters and how this jurisdiction relates to New Prague's own surface water management efforts.
- **Section 4 – Assessment** describes water quantity and water quality assessments conducted by New Prague and others and how these affect New Prague's surface water management program.
- **Section 5 – Goals and Policies** lists the City's goals and policies regarding surface water management.
- **Section 6 – Technical Background** describes the affect rural drainage has on municipal systems both now and in the future, provides detail on the proposed stormwater management system, and provides the theoretical basis for stormwater analysis and design.
- **Section 7 – Implementation Plan** covers regulatory responsibilities, redevelopment guidelines, prospective NPDES Phase II stormwater permit impacts, educational programs, operation and maintenance, the capital improvement program, and financing considerations. Section 7 also provides a developer's guide that describes the type of submittal the City expects and the design criteria that should be applied to development and redevelopment sites.

The three major subwatersheds within the study area are:

- Phillip Creek
- Raven Stream
- Sand Creek

The Phillip Creek Subwatershed reaches beyond the study area's southern limit well into Lanesburg Township. The majority of drainage from New Prague's existing storm sewer system enters Phillip Creek. The tributary storm sewer reaches as far east as Lexington Avenue North. In the undeveloped study area this subwatershed includes areas immediately south and west of the current City limits.

The Raven Stream Watershed, overall, is much larger than that for Phillip Creek. As it relates to the SWMP and its study area, the Raven Stream Subwatershed is actually smaller than that for Phillip Creek. The Raven Stream Subwatershed consists of areas north of Trunk Highway 19 and west of Trunk Highway 21.

The Sand Creek subwatershed includes the eastern portions of the City and future development areas between the existing City limits and the eastern extent of the study area. The majority of areas within the existing City limit that drain to Sand Creek do so through a tributary. Historically the tributary began as a ditch south of Trunk Highway 13/19 in what is now the Prague Estates development. This portion of the tributary has been eliminated by development. North of the highway the tributary runs approximately a meandered mile to its confluence with Sand Creek proper. The confluence lies immediately east of the current City limits. Much of the area outside the City limits that drains to the Creek is agricultural, though a significant band of woodland parallels the Creek along its path through the study area.

Changes from undeveloped land uses within these three subwatersheds, like agricultural and natural, to more heavily developed land uses like low, medium, and high density residential and commercial have a pronounced affect on hydrology. The increased impervious surface associated with the urban land uses leads to higher runoff peak flows and increased runoff volume. One of the challenges the New Prague SWMP addresses is how to mitigate the impact of this urbanization on these streams.

The intent of the ponding system described in this Report is to reduce the post development peak discharge to the City's streams to a rate more in line with natural conditions. This will be done by utilizing both wetland and constructed storage and volume control areas. This type of strategy protects the City's streams from erosion and flooding. Volume control is aimed at reducing the post development runoff depth. By reducing the post development runoff depth through infiltration in other means, to something more akin to the depths seen off the natural landscape stream and wetland protection is augmented. Additionally, infiltration helps maintain stream base flows. Infiltration design and potential limitations to its use are specific to each development, its particular soils, and its specific hydrologic conditions.

Many local, state and federal agencies regulate some aspect of stormwater management and this regulation has an affect on how New Prague develops and implements its surface water management system. Section 3 of the SWMP provides an overview of these agencies and their various roles. Of particular importance to New Prague is the Scott WMO. The Scott WMO was formed upon the dissolution of four "non-implementing" WMOs:

- Sand Creek
- Shakopee Basin
- Southwest Scott
- Credit River

New Prague falls within the Sand Creek watershed and thus the Scott County portion of the City is within the recently created Scott WMO.

The Scott WMO has prepared its Comprehensive Water Resource Management Plan. The plan intent is to "help direct the future of Scott County water resources." Section 4 of the Scott County Report outlines goals and policies in eight major subject areas. Section 4 presents 8 goals, reasons behind the goals, and policies for implementing and objectives behind the goals.

Readers are encouraged to visit the Scott County website at www.co.scott.mn.us to obtain more up-to-date and detailed information and to review a copy of the plan. Scott WMO has also adopted rules that put into regulatory form many of the goals and policies contained in the WMO plan. These rules are also available on the Scott County website.

As a rural growth center, New Prague has no adjacent municipalities with whom to coordinate surface water management planning efforts. Since New Prague does not lie within the Metropolitan area, as defined by statute, it is not required to meet Metropolitan Council requirements for local surface water management plans. What is left is to meet the standards and requirements of the Scott WMO Plan. More specifically, the City must show that its standards and requirements lead to equivalent protection of the surface water resources within the City's municipal boundaries. It is not necessary for the City to establish that its controls are equivalent, only that they lead to the same outcome.

Given this need for equivalent protection Section 3 describes the protections provided by the various Scott WMO rules and how the City establishes equal protection, either through this Plan, through existing ordinance, or through proposed ordinance.

The preparation of the New Prague SWMP included a full review of the current surface water system in New Prague. The physical system was mapped to establish watershed sub-basins and runoff paths. Sub-basin boundaries were delineated using USGS ten-foot and City of New Prague two-foot contour information. New Prague's record drawings were referenced to verify the storm sewer system layout. This information was used to create a hydrologic model of the entire City and its future growth area for use in future watershed planning. The modeled sub-basins, system layout, and modeled ponds are shown on Map 1 attached to this plan and in the Appendices.

Runoff curve numbers for each basin were estimated using the Soil Survey, land uses shown in the City's Comprehensive Plan and land cover identified in aerial photographs. Areas and curve numbers for each sub-basin are listed in the Appendices. Section 6 provides additional detail on hydrologic modeling assumptions.

The hydrologic provides a useful tool that allows the City to better address specific drainage and water quality concerns such as:

- Streambank erosion
- Lack of pipe capacity in the older portions of the City
- Neighborhood flooding and flood concerns
- Controlling urban drainage into agricultural areas
- Preserving agricultural drainage through urban development
- Prospective Total Maximum Daily Load (TMDL) implementation

An important goal of New Prague's SWMP is to plan for the orderly management of stormwater as development occurs in the City. Historically, "orderly management" has meant getting runoff off the landscape as quickly as possible while protecting the built environment from flooding. This plan considers "orderly management" as something that incorporates the previous definition and expands upon it by including no adverse impacts to the City's and the region's surface water resources due to development.

The current SWMP differs from the 1998 SWMP in that it focuses on future development as shown on the 2004 Future Land Use Plan. The 1998 plan emphasized existing development. By focusing on future development, the goals and policies of the current plan – as well as the guidelines that promote them – ensure that future development augments rather than diminishes the natural and built environments in New Prague and surrounding areas.

To provide develop that augments rather than diminishes water resources, the SWMP develops City goals and policies in the following areas:

- Water Quantity and Flooding
- Water Quality
- Hazardous Materials
- Education and Outreach
- Wetland Protection

The Implementation Plan section of the New Prague SWMP describes those activities, programs, and requirements that the City will implement to improve its surface water management program and preserve and enhance its surface water resources. Capital outlay for the surface water system (pipes, channels, and ponds) shown in Map 1 will be large. For this reason a financing mechanism, called an area charge, is developed in this Section. Based on the Capital Improvement Plan and the developable acreage within the growth area, an area charge is developed and application of this charge is discussed.

The Implementation Plan continues with a wetland management section where restrictions on the use of wetlands for stormwater are based on their susceptibility to stormwater impacts. This Implementation Plan also includes a developer's guide. The developer's guide outlines submittal requirements, design standards, and acceptable stormwater control measures. The final component of the Implementation Plan revolves around operational and programmatic elements including:

- Operation and Maintenance
- Education
- Ordinance Implementation
- Amendments Procedures
- Annual Report to Council

1. Introduction

This Report provides the City of New Prague with a Comprehensive Surface Water Management Plan (SWMP) that will serve as a guide to managing the surface water system throughout the City.

Founded in 1856 by Anton Phillip, the City of New Prague lies in both Le Sueur and Scott Counties, about 25 minutes south of the Twin Cities Metropolitan Area, as shown in Figure 1. New Prague is a growing community that surpassed 5,000 residents in 2003. As the City continues to grow, the importance of adequate stormwater management controls also grows. The intent of the New Prague SWMP is to detail what these controls are and make the connection between these controls and the overall City goal of preserving and enhancing its natural resources and protecting its residents from flooding.

The most notable water resource features of New Prague and its environs are the three creeks that pass near the City: Raven Stream, Phillip Creek, and Sand Creek. All three creeks generally flow north out of New Prague toward the Minnesota River. North of the current City limits, near the sewage treatment plant, lies a large Minnesota Department of Natural Resources (DNR) protected wetland: #104W. Smaller wetlands are found within the City and, more commonly, in the agricultural areas adjacent to the City. Many wetland areas have been drained for agricultural production. While these drained wetlands have potential as sites for stormwater storage or, in limited cases, wetland restoration, many are not currently wetlands and thus may not be subject to the protections offered wetlands in state and federal law.

1.1 PURPOSE AND SCOPE

Based on the guidance provided by the New Prague City Council and staff, this Report addresses the City's current surface water management needs and provides a framework for successful implementation of a comprehensive stormwater management program.

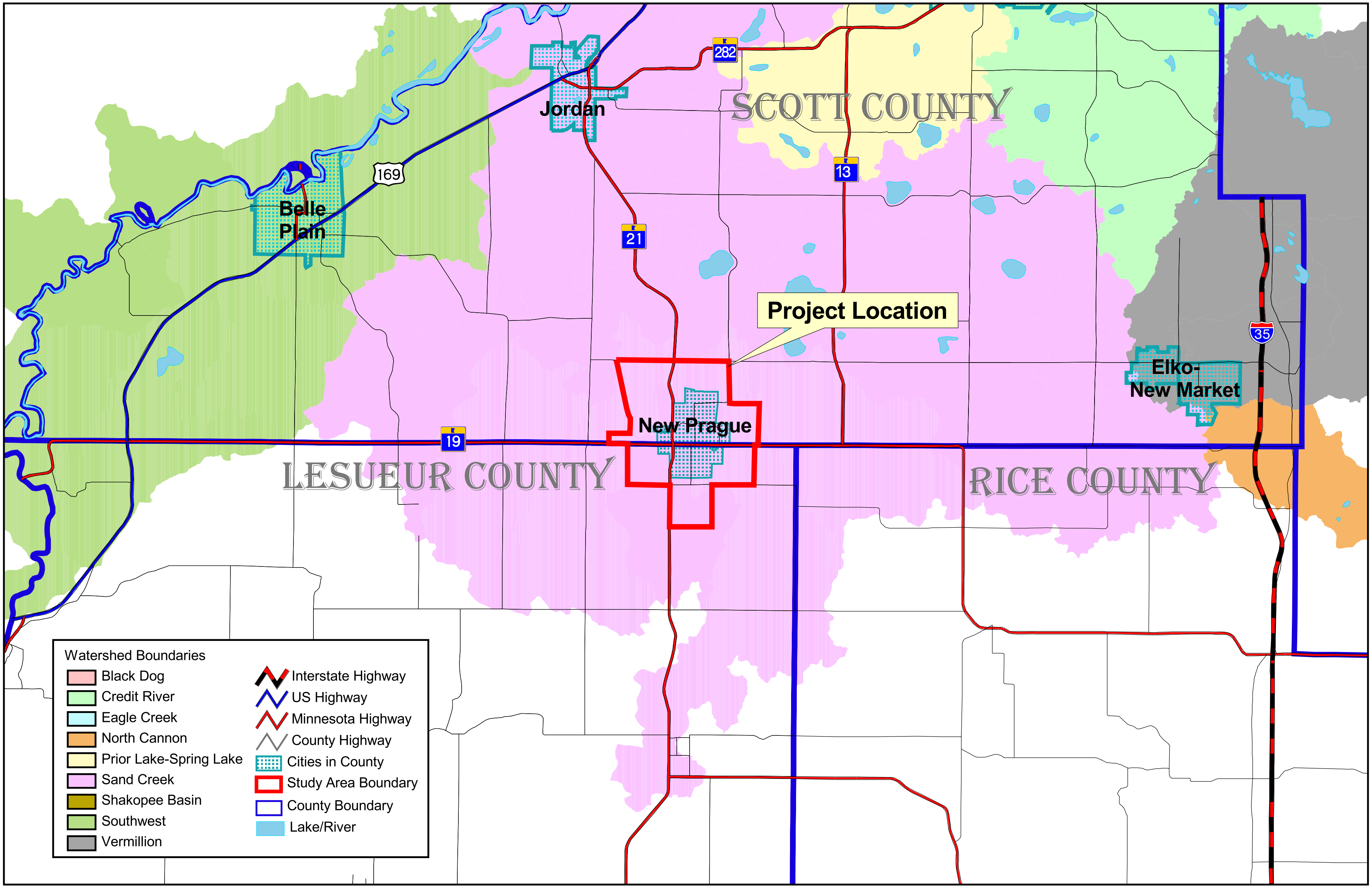
New Prague presents something of a contrast. In older parts of town, city staff must meet the challenges of maintaining what is certainly one of the older storm drainage systems in the state. In other areas, new development is adding new infrastructure to the stormwater system and thus increasing the City's maintenance responsibilities. The SWMP is primarily aimed at this new development and the goals, policies, guidelines, controls, and preliminary system design reflect that emphasis.

1.2 ORGANIZATION

This Report is organized as follows:

- **Section 2 – Physical Environment** describes the physical environment including watersheds and drainage patterns, dominant land uses, and significant waterbodies within the City.
- **Section 3 – Regulatory Context** lists federal, state, and local agencies with some jurisdiction over surface waters and how this jurisdiction relates to New Prague's own surface water management efforts.
- **Section 4 – Assessment** describes water quantity and water quality assessments conducted by New Prague and others and how these affect New Prague's surface water management program.
- **Section 5 – Goals, Policies and Guidelines** lists the City's goals and policies regarding surface water management.

- **Section 6 – System Analysis and Design** describes the affect rural drainage has on municipal systems both now and in the future, provides detail on the proposed stormwater management system, and provides the theoretical basis for stormwater analysis and design.
- **Section 7 – Implementation Plan** covers regulatory responsibilities, redevelopment guidelines, prospective NPDES Phase II stormwater permit impacts, educational programs, operation and maintenance, the capital improvement program, and financing considerations. Section 7 also provides a developer's guide that describes the type of submittal the City expects and the design criteria that should be applied to development and redevelopment sites.



Bonestroo Rosene Anderlik & Associates
Engineers & Architects

April 30, 2007

City of New Prague

Location Map

Surface Water Management Plan

Figure 1

Miles
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2. Physical Environment

2.1 TOPOGRAPHY AND SUBWATERSHEDS

The topography of New Prague is relatively flat. While this lack of relief makes the land more developable, it also tends to produce sprawling wetland areas that reduce developable acreage. The area's flatness also makes developing a stormwater system more difficult.

New Prague's steepest areas lie to the northwest, south, and southeast. In the northwest high ground drops to Raven Stream, in the south another ridgeline drops to the Le Sueur County ditch that becomes Phillip Creek, while in the southeast similar ridgelines drop to Sand Creek. These steeper slopes within the study area average approximately five percent and are not considered particularly steep such that steep slope protection would be required.

As mentioned, the direct stormwater impacts of New Prague's topography are the difficulty in getting land to drain for residential and commercial development. Additionally, high water table requires sump pumps in virtually all residential construction. Even with sometimes marginal drainage, the area has historically been well suited to agriculture.

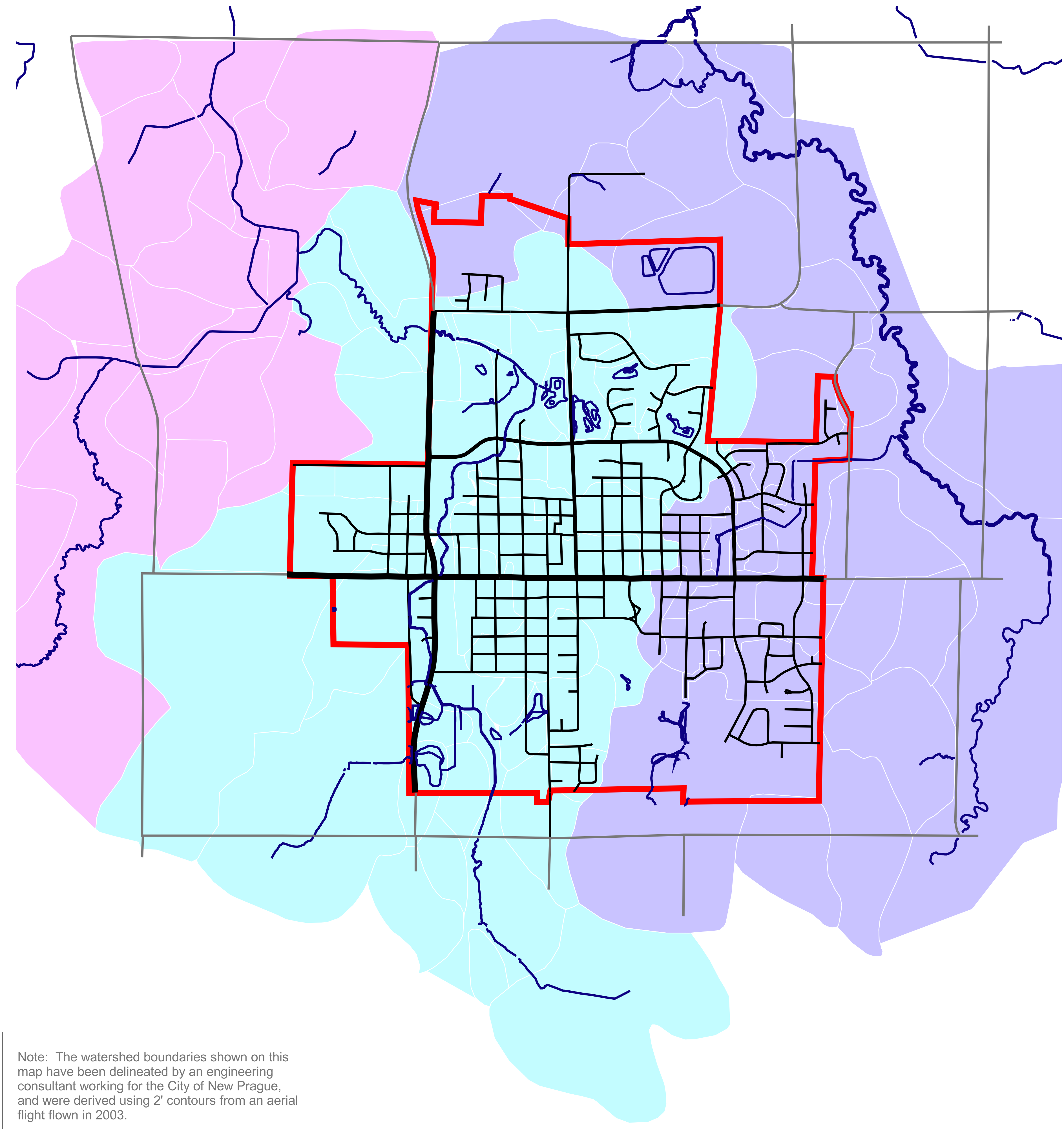
Map 4-3 shows the three major subwatersheds within the study area:

- Phillip Creek
- Raven Stream
- Sand Creek

Referring to Map 1 at the back of the Report, Phillip Creek runs on the west side of the current City limits generally parallel to Trunk Highway 21. Sand Creek lies at the eastern fringe of the study area. The Raven Stream subwatershed occurs in the northwest quadrant of the study area. Phillip Creek is tributary to Raven Stream. A more detailed description of each subwatershed follows. Though three separate subwatersheds are defined, it should be noted that these three actually constitute parts of the larger Sand Creek Watershed as recognized by county and state agencies.

City of New Prague Watershed Areas

Phillip Creek
Raven Stream
Sand Creek



Note: The watershed boundaries shown on this map have been delineated by an engineering consultant working for the City of New Prague, and were derived using 2' contours from an aerial flight flown in 2003.

Map 4-3

Sand Creek Subwatershed

The Sand Creek subwatershed includes the eastern portions of the City and future development areas between the existing City limits and the eastern extent of the study area. The majority of areas within the existing City limit that drain to Sand Creek do so through a tributary. Historically the tributary began as a ditch south of Trunk Highway 13/19 in what is now the Prague Estates development. This portion of the tributary has been eliminated by development. North of the highway the tributary runs approximately a meandered mile to its confluence with Sand Creek proper. The confluence lies immediately east of the current City limits. Much of the area outside the City limits that drains to the Creek is agricultural, though a significant band of woodland parallels the Creek along its path through the study area.

Phillip Creek Subwatershed

The Phillip Creek Subwatershed reaches beyond the study area's southern limit well into Lanesburg Township. The majority of drainage from New Prague's existing storm sewer system enters Phillip Creek. The tributary storm sewer reaches as far east as Lexington Avenue North. In the undeveloped study area this subwatershed includes areas immediately south and west of the current City limits.

Raven Stream Subwatershed

The Raven Stream Watershed, overall, is much larger than that for Phillip Creek. As it relates to the SWMP and its study area, the Raven Stream Subwatershed is actually smaller than that for Phillip Creek. The Raven Stream Subwatershed consists of areas north of Trunk Highway 19 and west of Trunk Highway 21.

2.2 SOILS

Predominant soils within the study area include Lester, Le Sueur, and Cordova. Generally these soils form an association known as the Lester-Le Sueur-Cordova Association. The description of this association from the general county soil map is:

"Nearly level to moderately steep, well drained to poorly drained, loamy soils on uplands."

Lester soils are found in gently sloping to moderately steep areas typical of the knolls and slopes seen in the New Prague area. Le Sueur soils are found in nearly level to gently sloping areas typical of the low rises and knolls found in parts of the study area. These soils are also found in the lower portions of side slopes toward the transition to more lowland soils. The Cordova soils are found in nearly level areas, on broad flats, and in slight depressions.

In lowland areas adjacent and within wetlands or drained wetlands peat and muck type soils area found. These are fairly common throughout the area even in areas that might be under active agricultural production.

The Hydrologic Soil Group (HSG) defines a soils propensity to generate runoff for a given rainfall event. Four HSG groups area identified: A, B, C, and D. HSG A soils have the lowest potential to generate runoff and are typically sandy or gravelly soils. HSG D soils have the highest potential to generate runoff and typically consist of muck, peaty muck, and tight clay soils. The associations found within the New Prague SWMP study area fall into HSG B, indicating a moderate potential to generate runoff. Two exceptions to this are noted. Cordova soils can range from HSG C to D while the peat and muck soils fall under HSG D. These designations indicate that within Cordova soil areas and within the peat and muck soils found throughout the study area, there is limited potential to infiltrate water through ponds.

Development proposals should be reviewed for underlying soil type. Where Cordova soils, peat or muck are noted a modification to existing and post-development curve numbers should be made to reflect the HSG C/D designation. Otherwise, it is the method of the SWMP to base the hydrologic modeling on the HSG B designation. Given the soils found in the area and the fact that the soils with higher infiltration capacities are found almost exclusively in upland areas, the City should place infiltration areas near the point of runoff generation and not in the large, low areas that will be used for storage and rate control.

2.3 LAND USE

The City of New Prague adopted a Land Use Plan under the auspices of its 2004 Comprehensive Plan. Continued rapid growth (compared to historic growth rates) rendered the 2000 Land Use Plan obsolete and necessitated the rather quick update in 2004. Generally, the SWMP study area conforms to the growth boundary shown on the City's Future Land Use Plan (Map 5-2 from the Comprehensive Plan). In some cases the study area extends out farther than the comprehensive plan boundary so that drainage patterns and their impact on development can be fully understood and quantified. The general assumption is that areas not covered by the 2004 Future Land Use Plan should be a mixture of Low Density Residential (R-LD) and Medium Density Residential (R-MD), with R-LD predominating.

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

City of New Prague Future Land Use Plan

- Existing Road Corridors
- Future Road Corridors
- Roads outside.shp
- Water/Drainage Ways
- City Limits
- Comprehensive Plan Boundary (2030)

Existing Zoning Classifications Within Current City Limits:

- RL70
- RL84
- RL90
- RH
- RM
- B1
- B2
- B3
- I1
- Park

Future Land Use Designations Outside City Limits & Within Future Growth Area:

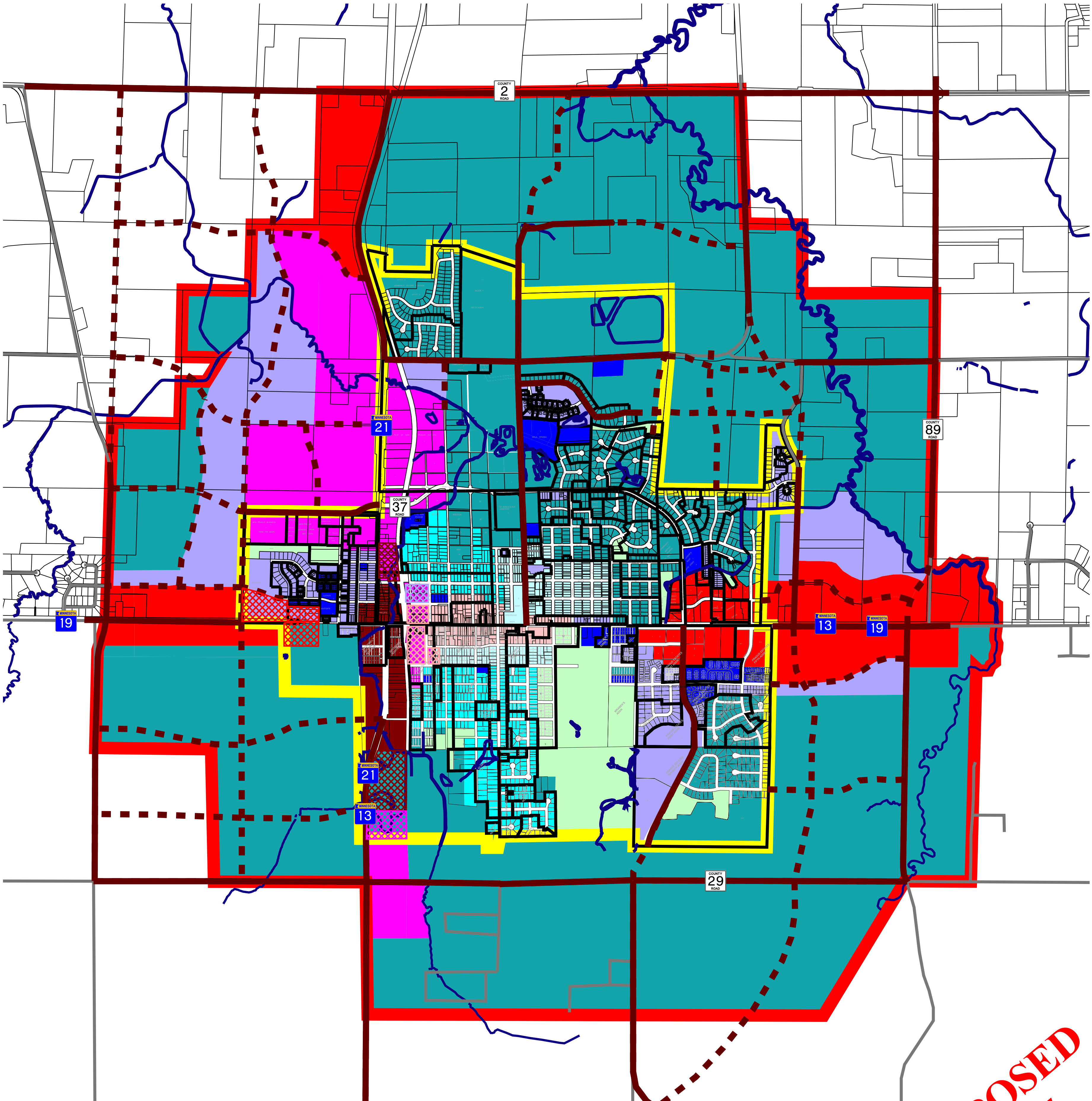
- RL - Low Density Residential
- RM - Medium Density Residential
- B2 - Community Commercial
- I1 - Light Industrial

Re-guided/Redevelopment Areas Within Current City Limits:

- RL - Low Density Residential
- RM - Medium Density Residential
- B3 - Highway Commercial
- B2 - Community Commercial
- B1 - Central Business District
- I1 - Light Industrial District

LAND USE OPTION #7 NOTES:

EXISTING CITY LIMITS - 2015 ACRES
TOTAL GROWTH AREA - 3,723 ACRES
RESIDENTIAL (LOW) - 2,802 ACRES
RESIDENTIAL (MEDIUM) - 294 ACRES
COMMERCIAL - 352 ACRES
INDUSTRIAL - 275 ACRES



Note: The future land uses and roadway corridors shown on this map have been prepared for discussion purposes only. This map is intended to be a draft map and should not be used for Planning purposes, as it has not been adopted by the New Prague City Council.

PROPOSED 2/3/05

Map 5-2

TABLE 2.1

LAND USE BASED PEAK AND VOLUME COMPARISONS

Land Use	2-year (2.8") SCS Type II, 24-hour Rainfall		100-year (6.0") SCS Type II, 24-hour Rainfall	
	Runoff Peak	Runoff Volume	Runoff Peak	Runoff Volume
	cfs/ac	inches	cfs/ac	Inches
Natural	0.03	0.2	0.4	1.8
Agricultural (row crop in May and June)	0.3	0.8	1.3	3.4
Low Density Residential (35% impervious)	0.5	0.8	2.3	3.4
Commercial (85% impervious)	1.9	2.0	4.8	5.2

Table 2.1 is illustrative only and is not to be construed as New Prague's official rate control policy.

This Report describes new official controls that require volume control and rate control. These are described in more detail later but can be summarized as follows:

- **Volume control requirement:** At development scale there shall be no increase in existing runoff volume.
- **Rate control requirement:** At the development scale there shall be no increase in existing runoff rate for the 2-, 10- and 100-year rainfall events.
- **Rate control goal:** At the regional level the City will endeavor to reduce peak discharge rates to natural conditions as generally described in Table 2.1 above. The City will accomplish this by restoring storage to the landscape while maintaining desirable functions and values within its wetlands.

At a regional level, the rate control goal is more ambitious than the requirement applied at the development scale. The regional ponding system described in the Report Appendices and Map 1 reflects the regional rate control goal. Consequently, the Map and Appendices do not constitute rate control policy.

Natural wetlands and landscape depressions form this regional system. Since many natural wetlands are currently drained, the City believes that it can increase landscape storage through wetland restoration. Clearly, any use of wetlands for stormwater storage must be considered in light of the functions and values desired within that wetland. Furthermore, this wetland storage does not serve in lieu of constructed storage within developments to accomplish the development scale volume control and rate control requirements.

By reducing the post development runoff depth through infiltration or other means, stream and wetland protection is augmented. Additionally, infiltration helps maintain stream base flows. Infiltration design and potential limitations to its use are specific to each development, its particular soils, and its specific hydrologic conditions.

A change in land use from agricultural and natural to urban is the primary factor driving the need for the New Prague Surface Water Management Plan. The goal of the Plan is to mitigate the impacts caused by urbanization.

2.4 KEY WATER RESOURCES

A description of key water resources within the study area follows. Key water resources include the three streams identified earlier as well as the large DNR wetland (104W) north of the wastewater treatment plant.

SAND CREEK

Sand Creek is a DNR protected watercourse though its tributary is not. The tributary is a ditch that begins immediately north of Trunk Highway 19 in Greenway Park. This ditch runs north through the Park before turning west under County Road 37. The ditch enters Sand Creek approximately 1,000 feet east of the current City limits. The protected portion of Sand Creek begins at Le Sueur County Road 29. From New Prague, Sand Creek flows north and west toward the Minnesota River. Its confluence with the Minnesota River occurs north of Jordan. Sand Creek joins Raven Stream upstream of the Minnesota River, just south of Helena. Further downstream of its meeting with Raven Stream and Sand Creek joins Porter Creek.

From Porter Creek to the Minnesota River, approximately 13.2 creek miles, Sand Creek is listed as impaired under the Minnesota Pollution Control Agency's (MPCA) impaired waters list. The listing of impaired waters is one of the MPCA's duties in its administration of Section 303d of the federal Clean Water Act. According to the MPCA, the impairment is to aquatic life due to turbidity. The turbidity is most likely caused by high stream velocities that erode stream banks as well as sediment runoff from agricultural drainage.

The USGS maintains a flow measuring station on Sand Creek at Trunk Highway 19. At that location Sand Creek's tributary area totals approximately 62.2 square miles. The USGS has measured historic peak discharges since 1960. In 1960 the USGS recorded a 1,100 cubic feet per second (cfs) discharge at this station – the highest flow ever recorded. The lowest annual peak discharge occurred in 1963 at 54 cfs. These flows are the annual highs. In dry times, the Creek flow can dwindle to nothing. Most commonly, instances of annual peak discharge highs occur in the spring though there are some instances when the annual peak discharge resulted from a summertime rainfall event. Typically, when any significant snowpack is present, snowmelt will generate the highest peak flows. The majority of annual peak discharge highs fall within the range of 200 to 400 cfs – including those recorded in the period 2000 to 2003.

In addition to the USGS station, the MPCA maintained a monitoring station on Sand Creek from 2000 through 2001. This station was located at 270th Street. The MPCA placed their station to collect water quality for their stream status evaluation.

Recent FEMA flood studies have set base flood elevations for Sand Creek. The Sand Creek tributary was also part of this study and base flood elevations have been calculated for the tributary. Scott County and FEMA are currently restudying Sand Creek. Base flood elevations for Sand Creek have been established for all of Scott County and will appear on new floodplain mapping panels scheduled to be produced in 2008.

PHILLIP CREEK

Phillip Creek begins as a Le Sueur County ditch 2½ miles south of Le Sueur County Road 29. North of County Road 29, it becomes Phillip Creek, a DNR protected water course. This protection extends north to the Creek's confluence with Raven Stream. Phillip Creek itself runs only 2½ miles before it joins Raven Stream. Over most its length the Creek runs adjacent to Trunk Highway 21. Before the Creek leaves the City limits it takes a wide arc to the east and then west, meeting up with Raven Stream approximately ½ mile west of the City limits.

MPCA data indicates that there are two current NPDES industrial permittees discharging to Phillip Creek. These are B and F Distributing Inc. of New Prague and the City of New Prague wastewater treatment plant. The MPCA maintains monitoring sites along the Creek to ensure permit compliance.

FEMA flood studies have developed base flood elevations for Phillip Creek from Le Sueur County Road 29 to Trunk Highway 21 (FIRM Map #27079C0087 D; Panels 87 and 89; July 21, 1999). For development proposals adjacent to the Creek these are a necessary reference. Base flood elevations range from 986 (MSL) at County Road 29 to 959 (MSL) at Trunk Highway 21. Floodplain encroachment onto developed property is most notable in the vicinity of the Middle School and along 1st and 2nd Avenues NW near their intersections with 6th Street NW.

RAVEN STREAM

The Raven Stream detailed in this Report is actually the East Branch of Raven Stream. The main branch of Raven Stream originates in Belle Plaine Township, Scott County, approximately 8 miles northwest of New Prague. Another branch of Raven Stream, the west Branch, originates in Derrynane Township, Le Sueur County, approximately 6 miles southwest of New Prague. The main and west branches join the east branch approximately one mile north of the study area boundary. For ease of reference Raven Stream, in the context of this Report, refers to the East Branch within the SWMP study area.

Raven Stream begins as a public ditch near Lake Pepin in Lanesburg Township. From Le Sueur County Road 29 north it is a DNR protected watercourse. From 1960 to 1985, the USGS maintained a flow measuring station on Raven Stream where it crosses under 260th Street. According to USGS data the tributary area at this point is approximately 22.1 square miles. Similar to Sand Creek, the USGS has collected historic annual peak flows at this station since 1960. And, again similar to Sand Creek, the highest of these annual peak flows occurred in 1960 when a flood peak of 929 cfs was measured.

The Raven Stream drainage area at the station is 1/3 that of Sand Creek at its station yet the 1960 annual peak flow is similar. Overall, the historical record indicates a higher discharge per acre in the Raven Stream subwatershed than in the Sand Creek subwatershed (upstream of TH 19). Typically a higher per acre discharge results from topographic differences or from differences in the agricultural practices (i.e., presence of ditching, draining of wetlands). The majority of Raven Stream's annual peak discharges occur during the spring though a handful has occurred in the summer and fall.

FEMA has prepared some floodplain mapping of Raven Stream though no base flood elevations have been developed (FIRM Map #27079C0088 D, Panel 88; FIRM Map #27079C0089D, Panel 89; both dated July 21, 1999).

Figure 4 at the end of Section 3 describes regulatory jurisdiction over watercourses. This protection applies to all three streams north of where they cross Le Sueur County Road 29. The DNR protection of these streams means that any work affecting their course, current, or cross section requires a DNR permit.

OTHER NATURAL AND WATER RESOURCES

The Public Waters Inventory (PWI) identifies the large wetland north of the wastewater treatment plant. In rural areas, wetlands larger than 10 acres are designated as DNR protected. In urban or developed areas, including the New Prague City limits, this threshold falls to 2.5 acres. For this reason two additional DNR protected wetlands exist in the City which do not have PWI numbering. These are the wetlands immediately south of the Middle School on either side of Columbus Avenue North.

3. Regulatory Context

3.1 PURPOSE OF SECTION

This section of the SWMP presents a synopsis of the current federal, state, and county agency regulation concerning surface water. The City is committed to the preservation and enhancement of its surface water resources through full compliance with local, state, and federal regulations.

3.2 FEDERAL, STATE, AND LOCAL AGENCY REQUIREMENTS

3.2.1 CITY OF NEW PRAGUE

The New Prague Public Works Department manages the City's infrastructure and parks. Public Works, Planning, and the City Engineer are responsible for the planning, administration, design, and inspection of infrastructure improvements. City staff coordinates with watershed districts and other outside agencies in water resource management and conservation. City staff is also responsible for local administration of the Wetland Conservation Act. New Prague's Public Works department provides monitoring and maintenance of storm sewers and ponding areas.

The New Prague Planning Department manages comprehensive planning and administers the zoning code within the City.

3.2.2 COUNTY JURISDICTION

The City of New Prague falls under the jurisdiction of the Scott Watershed Management Organization (WMO) within the Scott County portions of the City. The Scott WMO was formed upon the dissolution of four "non-implementing" WMOs:

- Sand Creek
- Shakopee Basin
- Southwest Scott
- Credit River

New Prague falls within the Sand Creek watershed and thus the Scott County portion of the City is within the recently created Scott WMO.

The Scott WMO has prepared its Comprehensive Water Resource Management Plan. The Plan intent is to "help direct the future of Scott County water resources." Section 4 the Scott WMO Report outlines goals and policies in eight major subject areas. Section 4 presents 8 goals, reasons behind the goals, and policies for implementing and objectives behind the goals.

Readers are encouraged to visit the Scott County website at www.co.scott.mn.us to obtain more up-to-date and detailed information and to review a copy of the Plan. Scott WMO has also adopted rules that put into regulatory form many of the goals and policies contained in the WMO plan. These rules are also available on the Scott County website.

3.2.3 MINNESOTA DEPARTMENT OF NATURAL RESOURCES

Originally created in 1931 as the Department of Conservation, the DNR has regulatory authority over the natural resources of the state. DNR divisions specialize in waters, forestry, fish and wildlife, parks and recreation, land and minerals, and related services. The Division of Waters administers programs in lake management, shoreland management, dam safety, floodplain management, wild and scenic rivers, the public waters inventory (PWI), and permitting of development activity within public waters.

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

If an area meets the jurisdictional criteria but is not on the state's inventory, it is not regulated. If it does not meet the statutory criteria but is listed on the inventory, it still is subject to MNDNR regulation. There is no mechanism presently for adding or deleting wetlands. The inventory was begun in the late 1970s and all state inventories were completed during the early 1980s.

The MNDNR rules specify that permits may not be issued for any project except those that provide for public health, safety, and welfare. Any private development projects are effectively excluded from permit consideration by this requirement.

3.2.4 MINNESOTA POLLUTION CONTROL AGENCY

The MPCA is the state's lead environmental protection agency. Created by the State Legislature in 1967, the MPCA is responsible for monitoring environmental quality and enforcing environmental regulations to protect the land, air, and water. The MPCA regulates Stillwater's management of wastewater, stormwater, and solid waste. The MPCA is the permitting authority in Minnesota for the National Pollutant Discharge Elimination System (NPDES), the federal program administered by the Environmental Protection Agency to address polluted stormwater runoff. The MPCA has not included the City of New Prague on the list of cities that must obtain NPDES permit coverage in 2007. Cities that are required to have NPDES permit coverage must develop a stormwater pollution prevention program (SWPPP) to address six minimum control measures:

1. Public education
2. Construction site runoff control
3. Public involvement
4. Post-construction runoff control
5. Illicit discharge detection and elimination
6. Pollution prevention in municipal operations

The MPCA is also required to publish a list of impaired waters: lakes and streams in the state that are not meeting federal water quality standards. For each water body on the list, the MPCA is required to conduct a study to determine the allowable Total Maximum Daily Load (TMDL) for each pollutant that exceeds the standards. The 2006 MPCA list of impaired waters identifies 2,250 TMDL Reports needed for 1,297 lakes, rivers, and streams in the state. None of these impaired waters within New Prague, though downstream of

New Prague Sand Creek and the Minnesota River are both listed. Once the MPCA or some other agency prepares TMDL studies and implementation plans for Sand Creek and the Minnesota River, New Prague will be required to incorporate each of the TMDL studies into this surface water management plan.

3.2.5 Board of Water and Soil Resources

The Minnesota Board of Water and Soil Resources (BWSR) works through local government agencies to implement Minnesota's water and soil conservation policies. The BWSR is the administrative agency for soil and water conservation districts, watershed districts, watershed management organizations, and county water managers. The BWSR is responsible for implementation of the Metropolitan Surface Water Management Act and the Wetland Conservation Act. Staff members are located in eight field offices throughout the state.

First established in 1937 as the State Soil Conservation Committee, the agency became part of the University of Minnesota in the 1950's, transferred to the Department of Natural Resources in 1971, then transferred to the Department of Agriculture in 1982. In 1987 the State Legislature established the current Board of Water and Soil Resources. The Board consists of 17 members, appointed by the governor to four-year terms. Multiple state and local agencies are represented on the Board.

In 1992, the BWSR adopted rules (8410), establishing the required content for local surface water management plans.

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

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

3.2.6 Minnesota Department of Health

The Minnesota Department of Health (MDH) manages programs to protect the public health, including implementation of the Safe Drinking Water Act. The MDH has regulatory authority for monitoring water supply facilities such as water wells, surface water intakes, water treatment, and water distribution systems. The MDH also is responsible for the development and implementation of the wellhead protection program.

3.2.7 Minnesota Environmental Quality Board

The EQB is comprised of five citizen members and the heads of ten state agencies that play an important role in Minnesota's environment and development. The EQB develops policy, creates long-range plans, and reviews proposed projects that may significantly influence Minnesota's environment.

3.2.8 Minnesota Department of Transportation (MnDOT)

Within the City of New Prague, MnDOT administers two state highways: Trunk Highway 21 and Trunk Highway 19. MnDOT approval is required for any construction activity within state right-of-ways. Additionally, MnDOT drainage review is required for any project that has the potential to affect discharge rates into or through a MnDOT right-of-way.

3.2.9 U.S. Environmental Protection Agency (EPA)

The EPA develops and enforces the regulations that implement environmental laws enacted by Congress; however the MPCA bears responsibility for implementing many of the resulting programs within Minnesota. The NPDES program and the Impaired Waters List are both the result of the Clean Water Act, administered by the EPA.

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

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

3.2.11 Federal Emergency Management Agency (FEMA)

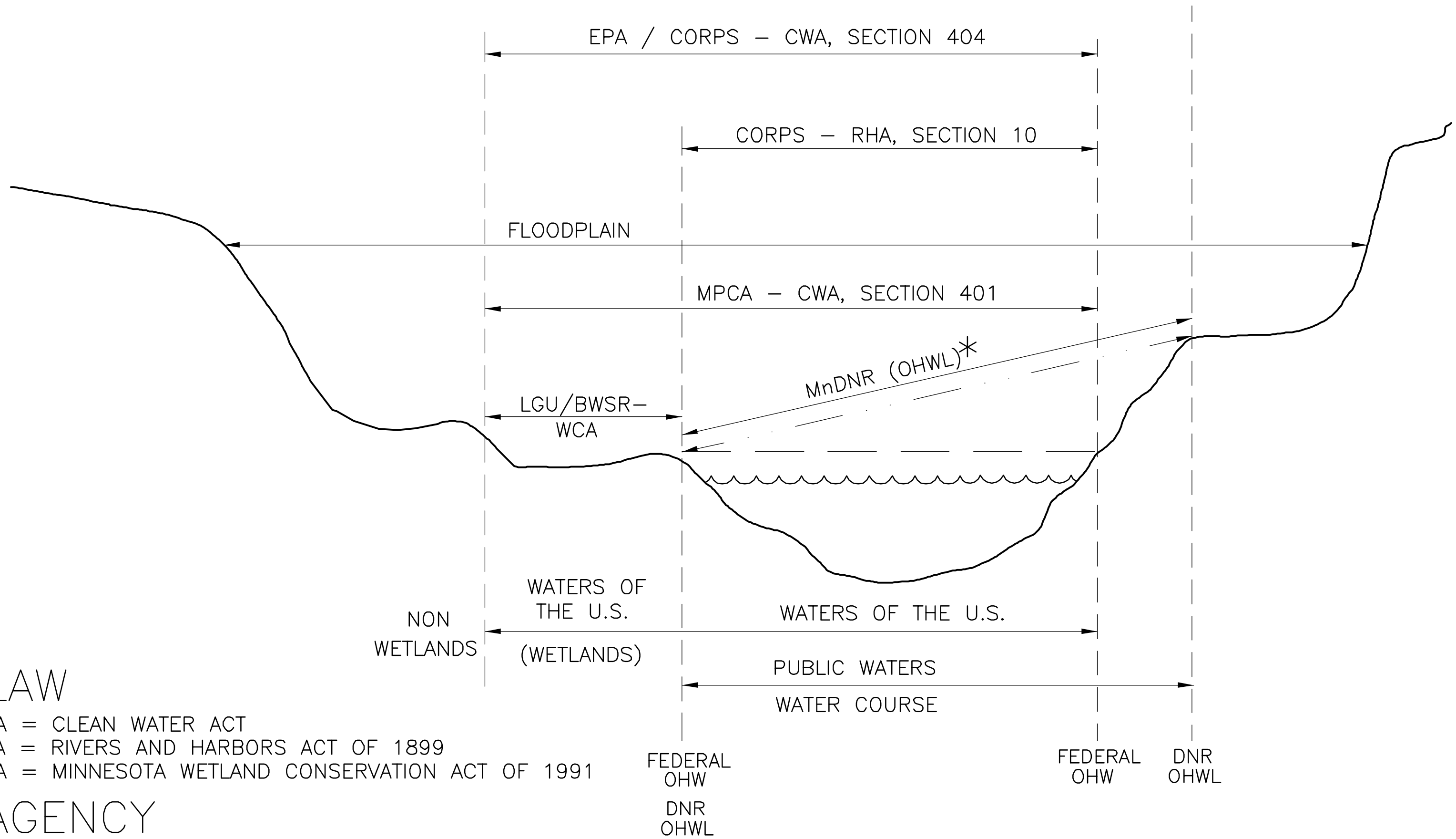
FEMA manages federal disaster mitigation and relief programs, including the National Flood Insurance Program (NFIP). This program includes floodplain management and flood hazard mapping. FEMA has published Flood Insurance Rate Maps (FIRM) for New Prague. Scott County and FEMA are currently restudying Sand Creek. Base flood elevations for Sand Creek have been established for all of Scott County and will appear on new floodplain mapping panels scheduled to be produced in 2008.

3.2.12 tate and Federal Jurisdictional Boundaries

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

For wetlands that fall under the MNDNR jurisdiction, the Ordinary High Water level (OHW) determines the boundary of MNDNR jurisdiction. The OHW is established by the DNR. A summary of agency jurisdiction is presented in Figures 2 and 3.

MINNESOTA STATE AND FEDERAL JURISDICTION OVER "WATERS"



LAW

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

AGENCY

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

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

PUBLIC WATERS: WATER COURSE

Bonestroo Rosene Anderlik & Associates

CITY OF NEW PRAGUE

FIGURE 2

SURFACE WATER MANAGEMENT PLAN

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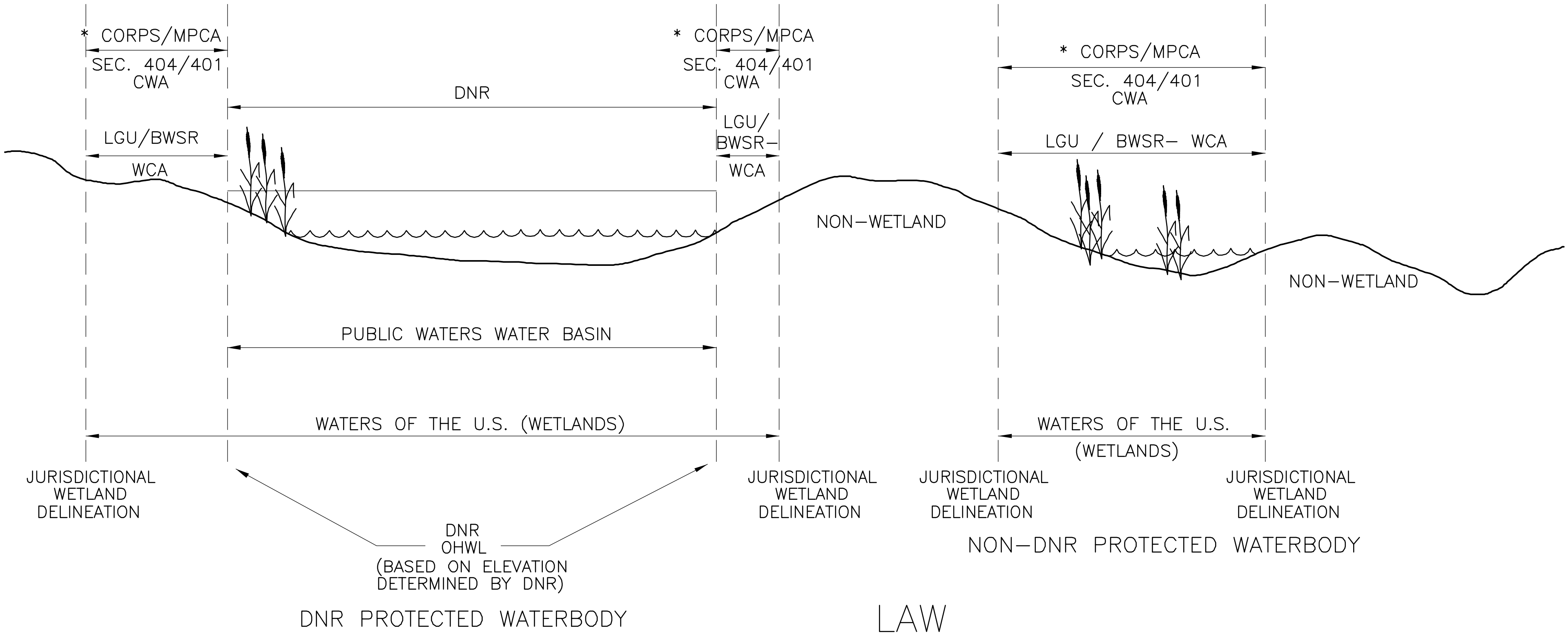
MINNESOTA STATE AND FEDERAL JURISDICTION OVER "WATERS"



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

LAW

CWA = CLEAN WATER ACT
WCA = MINNESOTA WETLAND CONSERVATION ACT

AGENCY

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

PUBLIC WATERS: WATER BASIN

CITY OF NEW PRAGUE

FIGURE 3

SURFACE WATER MANAGEMENT PLAN

Bonestroo Rosene Anderlik & Associates

64102115W03.DWG 4-30-07

3.3 COMPATIBILITY WITH OTHER PLANS

As a rural growth center, New Prague has no adjacent municipalities with whom to coordinate surface water management planning efforts. A portion of New Prague lies within Scott County and within the jurisdiction of the Scott WMO, which has a Water Management Plan. New Prague closely coordinates surface water management planning with the WMO.

Since New Prague does not lie within the Metropolitan area, as defined by statute, it is not required to meet Metropolitan Council requirements for local surface water management plans. What is left is to meet the standards and requirements of the Scott WMO Plan. More specifically, the City must show that its standards and requirements lead to equivalent protection of the surface water resources within the City's municipal boundaries. It is not necessary for the City to establish that its controls are equivalent, only that they lead to the same outcome.

Given this need for equivalent protection the following is a description of the protections provided by the various Scott WMO rules and how the City establishes equal protection, either through this Plan, through existing ordinance, or through proposed ordinance.

RULE B – PROCEDURAL REQUIREMENTS

The City's subdivision ordinance provides a process through which stormwater management issues can be addressed. Subdivision and development within the City of New Prague is a three phase process which begins with submission of a sketch or concept plan and then progresses through preliminary and final plat approvals as the requirements of each stage have been met. The entire process is closely monitored to identify issues and solve any problems as they are realized as a means of reaching the best design and layout in the shortest feasible timeframe.

The City has developed its "Residential Subdivision and Development Guide" to formalize its process and standards.

RULE C – GENERAL STANDARDS

This SWMP and existing ordinance provide equivalent protection to the regulation in Rule C. In regard to "Minimum WMO Bluff Standards," these would only apply to areas adjacent to Sand Creek and only a small portion of the Creek is within the City's growth area. This Plan provides a policy that until such time as the City prepares their own bluff ordinance, the Scott WMO rule will apply. The City has 180 days from the Scott WMO approval of this SWMP to amend its official controls.

RULE D – STORMWATER MANAGEMENT

The goals and policies outline the City's stormwater management approach. It is not necessary for the City to establish controls identical to those of Scott WMO. Rather, it is more important that the City's approach lead to outcomes equivalent to those sought by the WMO.

RULE E – EROSION AND SEDIMENT CONTROL

Scott WMO Rule E, Erosion and Sediment Control, essentially states that erosion and sediment control measures shall be consistent with Best Management Practices and meet the requirements of the NPDES General Construction Permit. Section VII of the City's Zoning Ordinance provides the following:

709 Drainage Standards
No land shall be developed and no use shall be permitted that results in water runoff causing flooding or erosion on adjacent properties. Such runoff shall be properly channeled into a storm drain, watercourse, ponding area, or other suitable facility.

Additionally, the goals and policies reference two BMP design manuals that are used as guides for BMP design. Finally, NPDES General Stormwater Permit for Construction Activity is a state permit issued by the MPCA. It is not necessary for the City to reiterate requirements that are already in place through a state permit program, though the goals and policies do state that the requirements of the construction permit are incorporated as the City's standard for erosion and sediment control.

RULE F – FLOODPLAIN ALTERATION

The City has a floodplain ordinance (Number 148) and is a participant in the National Flood Insurance Program.

RULE G – WETLANDS

The City administers the Wetland Conservation Act and formalizes, through this SWMP, a function and values approach to wetland management. The City will be updating its subdivision ordinance in 2008. At that time the City will consider differing buffer requirements based on function and values assessments. The City's 1998 Comprehensive Storm Water Management Plan, updated in April of 2002, provides for a 40-foot buffer around all wetland basins. The Scott WMO buffer regulations call for a variable buffer depending on the wetland type, as shown in Table 3.1.

TABLE 3.1

SCOTT WMO BUFFER WIDTHS

Buffer Requirement	Wetland Ranking			
	Exceptional	High	Medium	Low
Average Buffer Width	65 feet	50 feet	35 feet	25 feet
Minimum Buffer Width	25 feet	25 feet	25 feet	25 feet

It is the City's intent to adopt the Scott WMO buffer requirements as the City's requirement. The wetland ranking is established through a functional assessment using the Minnesota Routine Assessment Methodology. As stated in the City's policies on wetlands, this sort of assessment is required as part of the submittal for any development or land disturbing project that falls under the purview of the City's subdivision review process. The current buffer setback is 50 feet and this will be maintained. The City will obtain buffer and wetland areas through outlot dedication or easement.

RULE H – BRIDGE AND CULVERT CROSSINGS

Though not a stated policy, all watercourse crossings of significance within the City limits are publicly owned. No such crossing would be removed or replaced without the detailed analysis described in the Scott WMO's Rule H.

Rule I – Drainage Alterations

The City Zoning Code specifically states:

709 Drainage Standards

No land shall be developed and no use shall be permitted that results in water runoff causing flooding or erosion on adjacent properties. Such runoff shall be properly channeled into a storm drain, watercourse, ponding area, or other suitable facility.

Similar to Scott WMO's Rule I the City code states that surface water may be drained only in a manner which does not unreasonably burden upstream or downstream land.

Section 724 of the Zoning Code Regulates Land Alterations

724 Land Alterations

1. The approval of the City Engineer and City Council and a permit shall be required in all cases where excavation, grading, and filling of any land would result in a substantial alteration of existing ground contour or would change existing drainage or would cause flooding or erosion or would deprive an adjoining property owner of lateral support and would remove or destroy the present ground cover resulting in less beneficial cover for present and proposed development. Substantial alteration shall be defined as the extraction, grading or filling of land involving movement of earth and materials in excess of 25 cubic yards.
2. Applications for a permit shall contain the following additional information:
   a. Legal description of land to be altered.
   b. Nature of proposed alteration and future use of the property.
   c. Starting date and approximate completion date of the operation.
   d. The names of all owners of the land to be altered.
   e. The names and addresses of all owners and occupants of the adjoining land that may be affected by said land alterations.
   f. A construction plan showing existing and proposed elevations.
3. The City Council may require with a Land Alteration Permit, adequate proof of bonding in the form of a performance bond, sufficient in value to cover the expense of the completion of the development plan or to bring such portion of the completed project to a safe grade and elevation so as to be healthful and safe to the general public and to provide safe and adequate drainage to the site.
4. If, during the land alteration work it becomes necessary for the person altering the land to create a condition of grade or drainage not in the interest of health or safety, it shall become that person's duty to correct immediately the dangerous situation created, as well as fence or screen the area from the public upon order of the Building Inspector.
5. The person responsible for the proposed land alteration shall agree to replace cover that has been removed by seeding or sodding, such cover to be replaced within thirty (30) days after completion of grading. Where construction of homes or buildings is being done over an extended period of time, the City may require replacement of ground cover on a portion of the area before the entire project is completed.

Drainage alterations of any significance would be covered under this section of City Code. It should be noted that the 30 day requirement for reestablishing cover is not consistent with the NPDES construction permit. The goals and policies explicitly state that the construction permit is the City's minimum standard.

Consequently, the ordinance provision above is no longer applicable. Suitable reference to the construction site permit will be provided in the City's 2008 update to the subdivision ordinance.

Rule J – Groundwater

The City Zoning Code prohibits public nuisances one of which is:

"The effluence from any cesspool, septic tank, drainfield or human sewage disposal system discharging upon the surface of the ground, or dumping the contents thereof at any place except as authorized."

Section 401 of City Code prohibits individual sewage treatment systems.

The City of New Prague has completed a Phase 1 Wellhead Protection Plan and has begun work on Phase 2.

Rule K – Security

The City's subdivision ordinance and zoning ordinance both allow for the collection of security to assure compliance with project plans.

Rule L – Variances

Section 506 of the Zoning Code outlines variance criteria and process, and provides equivalent protection to the Scott WMO's Rule L.

Rule M – Appeals

Equivalent protection is provided.

Rule N – Enforcement

To the extent that equivalent protection of surface water resources is provided by New Prague's City code, then the code provides for the following penalties:

(A) Any person, firm, or corporation who violates any provision of this code for which another penalty is not specifically provided shall, upon conviction, be guilty of a misdemeanor. The penalty which may be imposed for any crime which is a misdemeanor under this code, including Minnesota Statutes specifically adopted by reference, shall be a sentence of not more than 90 days or a fine of not more than $1,000, or both.

(B) Any person, firm, or corporation who violates any provision of this code, including Minnesota Statutes specifically adopted by reference, which is designated to be a petty misdemeanor shall, upon conviction, be guilty of a petty misdemeanor. The penalty which may be imposed for any petty offense which is a petty misdemeanor shall be a sentence of a fine of not more than $300.

(C) In either the case of a misdemeanor or a petty misdemeanor, the costs of prosecution may be added. A separate offense shall be deemed committed upon each day during which a violation occurs or continues.

(D) The failure of any officer or employee of the City to perform any official duty imposed by this Code shall not subject the officer or employee to the penalty imposed for a violation.

3.4 WATER RESOURCE RELATED AGREEMENTS

The City has no formal water resources related agreements though an informal agreement exists with Scott County regarding construction of a regional retention and sedimentation basin along the north branch of Philipp's Creek. This project was considered part of the Scott County Road 37 realignment and a County obligation with the City of New Prague contributing funds to increase the project's capacity.

3.5 AGENCY CONTACTS

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

City of New Prague

City Planner
City of New Prague
118 Central Avenue North
New Prague, MN 56071
(952) 758-4401

Scott Watershed Management Organization

WMO Administrator
200 4th Avenue West
Shakopee, MN 55379
(952) 496-8054

Scott County Soil and Water Conservation District

District Manager
Scott County Soil and Water Conservation District
7151 West 190th Street
Jordan, MN 55352
(952) 492-5425

Le Sueur County Soil and Water Conservation District

District Manager
Le Sueur County Soil and Water Conservation District
181 West Minnesota Street
Le Center, MN 56057
(507) 357-4879

Minnesota Department of Natural Resources – Le Sueur County

Area Hydologist
Minnesota Department of Natural Resources
1810 30th Street NW
Faribault, MN 55021
(507) 333-2051

Minnesota Department of Natural Resources – Scott County

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

Board of Water and Soil Resources – Le Sueur County

Board of Water and Soil Resources
261 Highway 15 South
New Ulm, MN 56073
(507) 359-6074

Board of Water and Soil Resources – Scott County

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

Minnesota Pollution Control Agency – Scott County

Pollution Control Specialist
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155
(651) 296-7036

Minnesota Pollution Control Agency – Le Sueur County

Pollution Control Specialist
Minnesota Pollution Control Agency
18 Woodlake Drive SE
Rochester, MN 55904
(507) 281-7763

4. Assessment

4.1 WATER QUANTITY ASSESSMENTS

4.1.1 HYDROLOGIC MODEL

The preparation of this Plan included a full review of the current surface water system in New Prague. The physical system was mapped to establish watershed sub-basins and runoff paths. Sub-basin boundaries were delineated using USGS ten-foot and City of New Prague two-foot contour information. New Prague's record drawings were referenced to verify the storm sewer system layout. This information was used to create a hydrologic model of the entire City and its future growth area, for use in future watershed planning. The modeled sub-basins, system layout, and modeled ponds are shown on Map 1 attached to this Plan and in the Appendices.

Runoff curve numbers for each basin were estimated using the Soil Survey, land uses shown in the City's Comprehensive Plan and land cover identified in aerial photographs. Areas and curve numbers for each sub-basin are listed in the Appendices. Section 6 provides additional detail on hydrologic modeling assumptions.

The level of detail provided in the model is consistent with planning level estimates of runoff volumes and rates. The model establishes a framework that can be used as a starting point for more refined analyses within individual sub-basins.

4.1.2 PHILLIP SQUARE

The Housing and Redevelopment Authority Senior Housing (Phillip Square) site and adjacent areas next to Phillips Creek have a relatively long history of flooding. An initial flood analysis was performed and summarized in a 2002 Philipp Square Storm Sewer Feasibility Study (February 2002), completed prior to construction of the Phillip Square site. This Report addressed protection of the building from floodwaters rising from the truck parking area west of the site. Three storm sewer improvements of increasing scope and cost were recommended in order to mitigate potential flooding and minimize the floodwater elevation in the truck parking area. The first of these recommendations (Option A) was constructed and consisted of replacing the 42-inch storm sewer pipe, located northwest of the Phillip Square site and draining west under the railroad to Phillips Creek, with a 54-inch RCP pipe.

Subsequent to the construction of option A and the Phillip Square site itself, the site began to experience frequent flooding. A review of the site plan and as-built elevations in 2003 indicated that the building was built on a location that has historically seen a significant amount of overland flow from the east. Recent projects have rerouted some storm sewer flow away from the pipes that run adjacent to the site, though the 2003 calculations indicated a significant amount of runoff would still move through the streets toward the site for storms as small as the 2-year event.

Flood relief at Phillip Square consists of long-term and short-term strategies as discussed below.

LONG-TERM STRATEGIES

To substantially mitigate flooding potential at Phillips Square, major storm sewer system upgrades are required. The necessary upgrades are described below on a conceptual level and maps are attached showing each. Each of these strategies could be a phased improvement implemented in the order indicated.

1. Complete replacement and upsizing of storm sewer trunks and laterals north and south of the HRA site as detailed in Option C of the 2002 Feasibility Report.
2. Additional inlet capacity should be added to the storm sewer system upstream of the HRA site wherever feasible.
3. Replacement and upsizing of the storm sewer main running northwest from Central Avenue North to First Avenue Northwest.

SHORT-TERM STRATEGIES

Possible short-term strategies to reduce the occurrence of flooding at Phillips Square are listed below.

1. Frequent inspection and maintenance of the catch basins located northeast of the Phillip Square site at First Avenue Northwest and at the intersection of First Avenue Northwest and Second Street Northwest.
2. Installation of high capacity vane grates for the catch basins located northeast of the site at First Avenue Northwest and at the intersection of First Avenue Northwest and Second Street Northwest.
3. Rerouting catch basin overflow from First Avenue Northwest to the north of the HRA site.

4.1.3 STREAMBANK EROSION

New Prague is characterized by its three streams: Raven Stream, Phillip Creek, and Sand Creek. Past agricultural practices and recent urban development have increased bank erosion within these streams. It is widely held that discharge rates for the 1-year to 2-year recurrence rainfall determines the shape and cross section of a stream. As this 1 to 2-year discharge increases, the stream begins to reshape itself in response.

Changes to the agricultural landscape and development of the City have increased flows in Raven Stream, Phillip Creek, and Sand Creek. Agriculture in the areas tributary to the streams is now predominantly row crop. Years ago more pasture, wood lot, and perennial and cool season crops occurred. This change has increase runoff volume and runoff peak. Likewise, development in the City has increased runoff volume and runoff peak to these streams.

The Scott WMO, through its fluvial geomorphology study of Sand Creek will develop a better understanding on how this process works on Sand Creek. In the interim, the City of New Prague has developed rate control and volume management policies (see Section 5) to hold the line on increases in discharge rate and volume.

Resolution: Resolution of this issue is the rate and volume control policies of this plan

When applied to development these policies have the net effect of maintaining current runoff volumes and runoff peaks. In fact, by restoring wetlands and using some flood storage in them the City may be able to reduce large storm flood peaks over current conditions.

The policies anticipate that the City of New Prague will quite soon be regulated by the NPDES permit and that once this happens, non-degradation requirements will be applied.

4.1.4 OLDER SYSTEM CAPACITY

In the older parts of the City stormwater drainage is accomplished by storm sewer pipe and overland flow routes only – no significant storage areas exist. Many of these pipes have capacity for less than the 1-year event. For this reason a significant amount of runoff flows through the City's streets when large rainfalls occur. As the City continues to reconstruct streets in these older areas, it will have limited ability to improve storm drainage capacity. At best worn out storm sewer is replaced with new storm sewer of the same capacity and in some cases storm sewer has been rerouted to avoid bottlenecks. Beyond this the City does not envision any comprehensive program to improve drainage within the older parts of the community.

4.1.5 RURAL DRAINAGE

When development occurs in agricultural areas they typically discharge to agricultural lands or receive discharge from agricultural lands. Historically, the mixing of urban and rural drainage has led to disputes – particularly during grading operations.

Resolution: Policy 1.8 – Rural Drainage, intends to address this issue to some extent.

Where new development introduces urban drainage into agricultural areas (not including county ditches, DNR waterways, or DNR wetlands) the City requires that the developer acquire easements for stormwater conveyance or storage from the agricultural landowner.

Where agricultural drainage discharges into new urban developments, the City requires that the new development accommodate this drainage in fundamentally the same manner as it was accommodated prior to development.

4.2 WATER QUALITY ASSESSMENTS

4.2.1 CLEAN WATER ACT ASSESSMENTS

The Minnesota River between Sand Creek and Carver Creek (Assessment Unit ID # 07020012-532) and Sand Creek from Porter Creek to the Minnesota River (Assessment Unit ID # 07020012-513) are listed in the state impaired waters list. Known as the 303(d) list from the applicable section of the federal Clean Water Act, these waters are ones that do not currently meet their designated use due to the impact of a particular pollutant or stressor. This listing will potentially affect management of drainage that directly discharges to these streams, including that of New Prague.

If monitoring and assessment indicate that a water body is impaired by one or more pollutants, it is placed on the list. At some point a strategy would be developed that would lead to attainment of the applicable water quality standard. The process of developing this strategy is commonly known as the Total Maximum Daily Load (TMDL) process and involves the following phases:

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

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

Information on the MPCA program can be obtained at the following web address: http://www.pca.state.mn.us/water/tmdl/index.html.

The following is an excerpt from the MPCA website describing the program and its need.

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

The Minnesota River's affected use for the assessment unit immediately downstream of Sand Creek is aquatic consumption, though aquatic recreation and aquatic life are affected elsewhere on the river. The pollutants or stressors that have been identified as causing the Minnesota River's multiple impairments are the following:

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

Sand Creek's affected use is aquatic life and the pollutant or stressor is turbidity due to sediment runoff or stream bank erosion.

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

It remains to be seen how the TMDL issues will be resolved for the Minnesota River and Sand Creek. It is likely that once TMDL plans are in place, this SWMP will have to be amended to incorporate the requirements of the TMDLs. TMDL requirements could also become part of the MS4 permit, if the NPDES permit coverage is eventually extended to New Prague.

4.3 SCOTT WMO ASSESSMENT OF ISSUES

Section 3 of the Scott WMO Comprehensive Water Resource Plan goes into detail on current water resource issues within the WMO's jurisdiction. For the most part, the WMO identifies issues that arise when land converts from agricultural uses to urban development, though the WMO Plan includes discussion of the impact of agriculture on water resources, as well. This section of the WMO Plan serves as a good general reference on the issues New Prague's water resources management strategies must address.

5. Goals and Policies

5.1 PURPOSE

The primary goal of New Prague's Surface Water Management Plan (SWMP) is to plan for the orderly management of stormwater as development occurs in the City. Historically, "orderly management" has meant getting runoff off the landscape as quickly as possible while protecting the built environment from flooding. This plan considers "orderly management" as something that incorporates the previous definition and expands upon it by including no adverse impacts to the City's and the region's surface water resources due to development.

The plan provides clear guidance on how New Prague intends to manage surface water in terms of both quantity and quality. Since the City first prepared its 1998 Comprehensive Stormwater Management Plan, development pressures have increased and the City's goals in regard to managing stormwater have evolved. This partly reflects a change in the municipal attitude toward stormwater management since the City now has more experience with development and the potential surface water problems associated with development. The evolution of the City's goals also reflects the evolution of the society at large in regard to stormwater management priorities.

The current plan differs from the 1998 plan in another fundamental aspect. It focuses on future development as shown on the 2004 Future Land Use Plan. The 1998 plan emphasized existing development. By focusing on future development, the goals and policies of the current plan – as well as the guidelines that promote them – ensure that future development augments rather than diminishes the natural and built environments in New Prague and surrounding areas.

In summary, the SWMP provides the blueprint for New Prague's response to the important surface water management issues that face the City.

5.2 BACKGROUND

The City's 2004 Comprehensive Plan guides future growth and development within the City. The natural resource objectives from that plan are:

1. Promote conservation of key natural resources and open space areas.
2. Establish a balance between the protection of natural resources and future development.
3. Promote environmental stewardship including reducing, recovering, and recycling waste materials.

The Comprehensive Plan identifies 14 policies to further the goals above. In general, each of these policies has some surface water management aspect. Though the goals and policies listed in New Prague's SWMP are more specific to surface water management, all of them are complementary to the objectives and policies identified in the Comprehensive Plan.

The Implementation Section of this Report identifies specific ordinance recommendations so that the goals and policies identified in this Section can be made real.

5.3 CITY OF NEW PRAGUE SWMP GOALS AND POLICIES

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

GOAL 1: Water Quantity and Flooding

Control the rate of stormwater runoff from development to reduce downstream flooding and erosion. Protect property adjacent to lakes, wetlands, streams, and stormwater ponds by stipulating vertical separation from 100-year high water levels to low ground at building elevations.

Policy 1.1 – Flood Analysis Design Storms and Critical Conditions

The City of New Prague requires a 10-year recurrence storm sewer design in all developments. The design flood events are the 100-year, 24-hour Type II rainfall event and/or 100-year, 10-day snowmelt event. Design of flood storage, design of pond outlet and overland conveyance capacities, determination of freeboard and other important flood control parameters are based upon the flood event that produces the highest water level.

Policy 1.2 – Peak Flow Rate Limits (Rate Control)

Peak flow rates after development shall not exceed existing peak flow rates for the 2-year, 10-year, and 100-year recurrence interval precipitation events. Rate control is evaluated at the point of discharge to any federal or state protected water body, wetland, or stream. Existing conditions is defined by the predominant land use over the past 10 years.

Policy 1.3 – Freeboard Requirements I

All new structures will be a minimum 2 feet above the peak water surface elevation for the critical flood event and at least 1 foot above the as-built emergency overflow elevation from any area where surface water is impounded during a flood event. The low structure elevation is defined as the lowest ground elevation adjacent to the structure.

Policy 1.4 – Freeboard Requirements II

When a structure is located less than 50 feet horizontal from 100-year calculated high water level then the structure's low floor elevation must be two feet above the 100-year high water level.

Policy 1.5 – Freeboard Requirements III

Under no circumstances should the low floor elevation be below the planned normal water level of a stormwater basin or other naturally occurring water body.

Policy 1.6 – Floodplain

Land development within official floodplain will be regulated to ensure that floodplain capacity and flood elevations are not adversely impacted by development and that new structures are protected from damage.

DEFINITIONS:

Land-locked basin: A stormwater storage area that does not discharge for up to the 100-year design event.

Partially land-locked basin. A stormwater storage area that discharges only for events larger than the 2-year design event. The 2-year design event is a 24-hour rainfall using a type II distribution.

Policy 1.7 – Freeboard Requirements for Land-Locked Areas

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

Policy 1.8

Land-locked basins will remain land-locked under post-development conditions.

Policy 1.9

Partially land-locked basins will remain partially land-locked under post development conditions.

Policy 1.10 – Regional vs. On-site Detention Basins

Regional detention basins are used to manage peak flow rates whenever possible. On-site detention basins are utilized when regional basins are not in place or are not feasible. The City encourages the use of regional versus on-site basins for rate control and flood protection. Where flood and rate control basins are not feasible or desired (because of a preference for a regional approach, for instance) area charges to acquire and construct regional facilities will be collected.

Policy 1.11 – Rural Drainage

Where new development introduces urban drainage into agricultural areas (not including county ditches, DNR waterways, or DNR wetlands) the City requires that the developer acquire easements for stormwater conveyance or storage from the agricultural landowner.

Where agricultural drainage discharges into new urban developments, the City requires that the new development accommodate this drainage in fundamentally the same manner as it was accommodated prior to development.

Policy 1.12 – Applicability

The water quantity and flooding policies above apply to and development or redevelopment that disturbs more than 1 acre.

GOAL 2: Water Quality

To promote the reduction of phosphorus and total suspended solids loading as well as other pollutants to water bodies by regulation, municipal management activities, and public education.

Policy 2.1 – Stormwater Treatment

The City requires stormwater treatment for new development and redevelopment. Water quality treatment facilities are designed to provide wet volume equivalent to the site runoff from a 2.5-inch rainfall. In some cases a site's water quality treatment will be provided by BMPs other than ponds. In such instances the wet volume sizing criteria is not applicable and the requirement becomes at least 60% removal of total phosphorus and 90% removal of total suspended solids on an average annual basis. Accepted technical methodologies, such as the PondNET model for phosphorus and the P-8 model for TSS, and/or scientifically valid field studies are used to evaluate the effectiveness of these practices.

Policy 2.2 – Interim Volume Management

All new development and redevelopment shall not increase runoff volume discharged from the site on an average annual basis. To meet this policy, it shall be sufficient to establish that the volumetric discharge for the 1.5-year event is maintained at existing conditions. Concentrated infiltration is precluded in locations where the hazardous materials are handled or in any commercial and industrial land use within a well-head protection area. Concentrated infiltration is not recommended when seasonal high water table is within 3 feet of the ground surface. Diffuse infiltration and volume management techniques such as reduced imperviousness, impervious disconnection, runoff water recycling etc., are not constrained in by water table elevation or by location in a well-head protection area.

Policy 2.3 – Volume Management Policy Revision

Scott County WMO is conducting a fluvial geomorphology study of Sand Creek to diagnose the causes of channel instability. The City of New Prague will revisit and potentially revise, Policy 2.2 according to the results of that study.

Policy 2.4 – Limitations to Volume Management

Volume control standards do not apply to development or redevelopment within the City's B1 – Central Business District as shown in the 2005 Comprehensive Plan's Future Land Use Plan (Map 2).

Policy 2.5 – Volume Management Preferred Methods

The preferred method of obtaining volume control is through reduction in impervious surface, preservation of natural areas, filtration swales, and shallow infiltration areas placed close to the point of runoff generation.

Policy 2.6 – Infiltration Adjacent to Ponds

Infiltration at ponds shall be in the form of an infiltration bench outside the wet volume of the pond. This infiltration bench and all infiltration areas shall be sized to infiltrate the required volume in 72 hours based on the following infiltration rates:

Type A soils:	0.30 inches/hour
Type B soils:	0.15 inches/hour
Type C soils:	0.07 inches/hour

Policy 2.7 – Scott County WMO Credits

Project proposers are free to use the following Scott County WMO credits toward reducing the area dedicated to infiltration:

Natural Area Conservation Credit
Rooftop Disconnection Credit
Non-rooftop Disconnection Credit
Buffer (disconnection) Credit

Policy 2.8 – Water Quality Cash Dedication

Where water quality facilities are not feasible or not desired (because of a preference for a regional approach, for instance) the developer will be responsible for the applicable area charges to cover the cost of regional facilities. Whether on-site mitigation, a cash dedication in lieu of on-site mitigation, or a combination of the two is required will be at the discretion of the City.

DEFINITION:

BMP: Short for Best Management Practice or one of many methods used to treat stormwater runoff including ponding, street sweeping, filtration, and infiltration.

Policy 2.9 – BMP Design

The MPCA's Protecting Water Quality in Urban Areas or its Minnesota Stormwater Manual serve as design guidance for the City of New Prague. Specific pond design criteria area highlighted in Section 7 under design and analysis standards.

Policy 2.10 – Bluff Protection

Until such time as the City passes its own bluff ordinance, Scott County WMO Rule C shall serve as the City's Bluff standards.

Policy 2.11 – Street Sweeping

The City sweeps all urban street sections at least once each year.

Policy 2.12 – Erosion and Sediment Control

The City's incorporates the requirements of the NPDES General Stormwater Permit for Construction Activity as its minimum standard for temporary and permanent erosion and sediment control, with the following exceptions:

1. Temporary sedimentation ponds area required when 5 or more acres are disturbed.
2. Temporary seeding is required at the beginning of a project if, under existing conditions, an area is already disturbed and will not be graded immediately.

Policy 2.13 – Applicability

The water quality policies above apply to any development or redevelopment that disturbs more than 1 acre.

GOAL 3: Hazardous Materials

Prevent hazardous material from entering the stormwater system.

Policy 3.1 – Illegal Dumping in Storm Sewer System

The City will modify its ordinances to prohibit the dumping of foreign material into the stormwater system, including oil, gasoline, antifreeze, paint, solvents, herbicides/pesticides, grass clippings/leaves, pet wastes, and other ecologically harmful chemicals.

Policy 3.2 – Spill Response Capability

The City has a spill response capability in place. The response program focuses on containing, neutralizing, and properly disposing of spilled material. This will be extended to include preventing the discharge of spilled toxic or hazardous materials into the stormwater system. The Fire Department and the Public Works Department have a readily available supply of response materials including containment booms and absorbent pads.

GOAL 4: Education and Outreach

To involve the general public, City staff, and the business community in water quality management efforts.

Policy 4.1 – Public Education

The City will assist development and implementation of public education programs in cooperation with the Counties and the County Soil and Water Conservation Districts of which the City is a part.

Policy 4.2 – City Staff Involvement

The City is committed to educating its own staff on aspects of stormwater management that are important to their jobs.

Policy 4.3 – City Setting an Example Regarding Housekeeping Practices On City-Owned Land

The City follows Best Management Practices in managing and maintaining City-owned land. These practices include soil fertility testing for maintained areas and following fertilizer application recommendations based on those test results, fall (not spring) application of fertilizers containing phosphorus (if needed), preservation of natural unmaintained buffers between watercourses and turf areas, and preventing discharge of grass clippings from mowing operations onto paved areas.

Policy 4.4 – City Cooperation in Providing Information on State Fertilizer Regulations

The state bans application of lawn fertilizers containing phosphate with some exceptions, such as where a recent soil test has shown the lawn soil is deficient in phosphorus. The City will continue to promote awareness of this law among its residents and business owners.

GOAL 5: Wetland Protection

Identify and protect wetland resources in order to maintain or improve their function and value.

Policy 5.1 – No Net Loss of Wetlands

As Local Government Unit for the implementation of the Wetland Conservation Act of 1991 the City is committed to a "no net loss" of wetlands within its jurisdiction.

Policy 5.2 – City Wetland Inventory

The City will work toward developing and maintaining an inventory of wetlands within high priority areas, such as parks and natural areas, by 2010. Wetlands will be classified by type and function as well as susceptibility to stormwater impacts.

Policy 5.3 – Wetland Conservation Act Administration

The City will act as the Local Government Unit (LGU) for administration of the Wetland Conservation Act of 1991 and all subsequent amendments in all portions of the City.

Policy 5.4 – Function and Values Assessments

Proposers of land disturbing activity on sites that fall under the City's subdivision ordinance shall submit a function and values assessment of wetlands on the site. The function and values shall be in the latest version of the Minnesota Routine Assessment Methodology.

Policy 5.5 – Mitigation

Unavoidable wetland impacts shall be mitigated for by wetland with the same or better function and values within the Sand Creek Watershed.

Policy 5.6 – Wetland Buffer

The City shall adopt the Scott County WMO wetland buffer standards detailed in Table 3.1. Until such time as the City revises its ordinance, the City may be required to enforce a minimum buffer of 40 feet. Wetland and buffer areas will be obtained through dedication of outlot or easement to the City.

6. Technical Background

6.1 MAP 1 AND APPENDICES

Map 1 shows the major drainage divides, storage areas, channels, and other water resources that have been incorporated into the New Prague Surface Water Management Plan (SWMP). The purpose of Map 1, the Technical Appendices, and the stormwater model they summarize is to identify and quantify the infrastructure needed to allow continued development in New Prague while avoiding the negative impacts, such as flooding and water resource degradation, often associated with development.

6.2 WATER QUANTITY

Water quantity relates to those measures intended to reduce the potential for flooding, particularly flooding that could result from development within currently rural areas. A system that functions for water quantity purposes prevents flooding; prevents the erosion of ravines, rivers and streams; and protects wetlands from the adverse impacts associated with increased stormwater runoff.

6.2.1 RUNOFF AND LAND USE

Stormwater runoff is defined as that portion of precipitation which flows over the ground surface during, and for a short time after, a rainfall. The quantity of runoff is dependent on the intensity of the storm, the amount of antecedent rainfall, the length of the storm, the type of surface upon which the rain falls, and the slope of the ground surface. The intensity of a storm is described by the amount of rainfall that occurs over a given time interval. Storms are typically characterized by their return frequency. A return frequency designates the average time span during which a single storm of a specific magnitude is expected to recur. Thus, the degree of protection afforded by storm sewer facilities is determined by selecting a return frequency for analysis.

For the New Prague SWMP the following return frequencies were used:

- 10-year Rational Method for storm sewer design.
- 100-year, 24-hour (Type II Distribution) event for overland drainage and pond storage design.

A 100-year, 24-hour frequency event (6.0 inches in 24 hours for south and central in southern Scott County and northern Le Sueur County) has a 1% chance of occurring or being exceeded in any given year. This design rainfall return period is commonly used for flood control throughout Minnesota.

As development occurs in New Prague, actual storm sewer design should be a 10-year minimum recurrence interval. The design recurrences imply that no street, parking lot, or backyard ponding would occur for the design event.

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

The excess runoff caused by storms greater than that used for design will be accommodated by transient street ponding and overland drainage routes. Providing areas for this transient flooding and routes for overland drainage reduce flood damage potential. Chapter 5 details requirements for preserving overland drainage routes.

A number of methods have been developed to determine the expected maximum rate of runoff from a known area for a specific design storm, given land use and soil moisture conditions. The preliminary trunk storm sewer design presented in the SWMP and shown on Map 1 is based on the Rational Method and the pond design on the HydroCAD computer program, described in detail later in this Chapter.

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

A minimum time of concentration of 15 minutes was selected for the design of the trunk storm sewer system. Shorter times may be utilized in lateral system design. As the stormwater runoff enters the system, the flow time in the storm sewer is then added to the time of concentration, resulting in a longer time of concentration and thus lower average rainfall intensity as the flow moves downstream from the initial design point.

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

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

These factors are taken into account when selecting a runoff Coefficient (C) in the Rational Method or a runoff Curve Number (CN) for use in HydroCAD.

In the Rational Method, the runoff coefficient for urban areas varies from 0.2 for parks to 0.95 for asphalt and concrete surfaces, while in HydroCAD the CN varies from 58 for parks to 98 for asphalt and concrete surfaces. CN values depend on the type of soil, cover type, and hydrologic condition. Under fully developed conditions, the values of CN will rise with increases in impervious area caused by street surfacing, building construction, and grading.

Table 6.1 provides CN values and runoff coefficients used in the SWMP modeling. To ensure consistency with the SWMP future analyses, whether they be for development proposals or other City projects, should use the values contained within Table 6.1. For other types of land use not identified in the Table, SCS Technical Release 55 (TR-55) Curve Numbers should be used.

As noted in Section 2, the predominant Hydrologic Soil Group (HSG) within the study area is HSG B. A couple exceptions to this are noted in that Section. Consequently, the Table 6.1 CN values reflect HSG B. The CN values also reflect Antecedent Moisture Condition II (AMC II), which is a typical assumption in hydrologic analyses. AMC II simply implies that average soil moisture conditions apply prior to simulation of the rainfall event.

TABLE 6.1

RUNOFF COEFFICIENTS

Land Use Type	Average Runoff Coefficient C for Rational Method			CN Value
	5 year	10 year	100 year	
Park/Open Space	0.16	0.25	0.30	60
Low Density Residential (30% impervious)	0.33	0.45	0.50	72
Medium Density Residential (65% impervious)	0.59	0.63	0.72	85
High Density Residential (72% impervious)	0.66	0.70	0.77	88
Commercial/Industrial (85% impervious)	0.76	0.79	0.85	92
Ponds	1	1	1	99

6.2.2 COMPUTER MODELING

The computer modeling of stormwater quantities for pond design and trunk pipes was carried out using the computer software HydroCAD. HydroCAD stormwater runoff hydrographs are calculated in accordance with SCS TR-20 methodology. Hydrograph routing through channels and detention basins is performed using the Storage-Indication method. SCS 24-hour Type I, IA, II, and III storm distributions are allowed in the model. All analyses performed for the SWMP utilized Type II storm distributions.

6.2.3 STORM SEWER AND CHANNELS

In the New Prague SWMP, a combination of storm sewer and channels has been used to transport simulated stormwater runoff. Channels used for conveyance should not be former agricultural ditches unless they are graded to reduce side slope steepness and flow depth. If naturalizing agricultural ditches for conveyance is not an option, then buried storm sewer will be used.

Proper design of a storm sewer system requires that all sewer lines be provided with access through manholes for maintenance and repair operations. Generally, spacing of manholes should be no greater than 400 feet for sewer lines 15 inches or less in diameter and 500 feet for sewer lines 18 inches to 30 inches in diameter. Intervals on larger diameter lines can be increased since the pipes are sufficiently large for a person to physically enter the storm sewer pipe itself for maintenance operations. Regardless of sewer size, manholes should normally be provided at all junction points and at points of abrupt alignment or grade changes.

Although lateral systems are designed for 5-year or 10-year storm events, their performance must be analyzed for storms exceeding the design storm. Lateral and trunk pipes will surcharge when their design criteria is exceeded. During surcharging, the pipes operate as closed conduits and become pressurized with different pressure heads throughout the system. Low areas that are commonly provided with catch basins become small detention ponds that relieve pressure in the storm sewer. This pressure release manifests itself as water bubbling out of catch basins. For this reason, it is extremely important to ensure that these low areas have an acceptable overland drainage route with proper transfer capacity.

At a minimum, ponding on streets must meet all of the requirements of the 100-year design criteria. For safety reasons, the maximum depth should not exceed two feet at the deepest point and the lowest exposed building elevation should be at least one foot above the elevation to which water could rise before overflowing through adjacent overland routes. It should be noted that the criteria above apply to residential streets. For Municipal State Aid routes, state trunk highways, and county roads different criteria are applied to determine the allowable amount of transient street ponding.

All storm sewer facilities, especially those conveying large quantities of water at high velocities, should be designed with efficient hydraulic characteristics. Manholes and other structures at points of transition should be designed and constructed to provide gradual changes in alignment and grade. Pond outlet control structures should be designed to allow water movement without abrupt changes in flow path. This prevents turbulence and resultant erosion damage and minimizes debris build-up around outlets.

Catch basins and inlets should be liberally provided at all low points where stormwater collects and at points where overland flow is to be intercepted. Inlet structures are of special importance, since it is a poor investment to have an expensive storm sewer line flowing partially full while property is being flooded due to inadequate inlet capacity. Inlets should be placed and located to eliminate overland flow in excess of 500 feet on minor streets, or a combination of minor streets and swales, and 300 feet on collector streets and arterials.

Additionally, inlets should be located such that 3 cfs is the maximum flow at the inlet for the 5-year or 10-year rational design storm. Where steeper street grades are encountered catch basin "blow by" can occur. On steeper streets the assumed inlet capacity should be reduced according to grate manufacturer's guidelines. Intake grates and opening should be self-cleaning and designed to minimize capacity reduction when clogged with twigs, leaves, and other debris. Vaned grates serve best for self cleaning.

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

- Inlet and outlet pipes of stormwater ponds should be extended to or slightly below the normal water level.
- Outfalls with velocities of less than 4 fps that project flows downstream into the channel in a direction 30 degrees or less from the normal channel axis generally do not require energy dissipators or stilling basins, but do require rip rap protection.
- Where an energy dissipator is used, it should be sized to provide an average outlet velocity of less than 6 fps, unless rip rap is also used. In the latter case, the average outlet velocity should not exceed 8 fps.
- Where outlet velocities exceed 8 fps, the design should be based on the unique site conditions present. Submergence of the outlet or installation of a stilling basin approved by the City is required when excessive outlet velocities are experienced.
- In the case of discharge to channels, rip rap should be provided on all outlets to an adequate depth below the channel grade and to a height above the outfall or channel bottom. Rip rap should be placed over a suitably graded filter material and filter fabric to ensure that soil particles do not migrate through the rip rap and reduce its stability. Rip rap should be placed to a thickness at least 2.5 times the mean rock diameter so as to ensure that it will not be undermined or rendered ineffective by displacement. If rip rap is used as protection for overland drainage routes, grouting may be recommended.

- Overland drainage routes where velocities exceed 8 fps should be reviewed by the City Engineer and approved only when suitable stabilization measures are proposed.

Open channels and swales are recommended where flows and small grade differences prohibit the economical construction of an underground conduit and in areas where open channel type drainage will enhance the aesthetic qualities of a development. Whenever possible, a minimum slope of 2% should be maintained in unlined open channels and overland drainage routes. Slopes less than 2% and greater than 1% are difficult to construct and maintain and may require an underdrain system. Slopes less than 1% are not allowed. Side slopes on swales and channels should be no steeper than 4:1 (horizontal to vertical) with gentler slopes being desirable. Where space permits, slopes should be cut back to match existing grade so that abrupt changes in grade are avoided.

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

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

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

6.2.4 PONDS

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

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

Cost and regulatory considerations aside, well designed ponds:

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

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

Most of the ponding areas proposed in this Plan collect water from large regional drainage areas. This is in line with the City's goal to have a regional rate control or flood control system. In many cases Map 1 shows these ponds within wetland areas. The implication is not that the ponding would occur by converting the wetland to a stormwater pond but rather that a certain amount of storage is needed in this general location and some portion could occur within the wetland but some large portion would also occur in a stormwater pond constructed in an upland area.

To provide proper protection for adjacent property, the design storm for ponding areas is the maximum flood from a Type II, 24-hour, 100-year rainfall event (6.0 inches of rain in 24 hours). Lateral storm sewer piping is designed according to the demands of a 5-year or 10-year rational design. To provide an additional safety factor, the lowest ground elevation adjacent to a structure in new development should be at least two feet above the 100-year High Water Level. Both the low opening elevation (i.e., walkout threshold or sill of lookout window) and the low ground at building should be specified in grading plans and certified by builders when they submit their certificates of lot survey prior to building.

Section 5, Goals and Policies, defines variations on freeboard requirements based upon proximity to a water body and whether the water body is land-locked.

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

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

6.3 WATER QUALITY

Establishing the highest water quality goals that are both reasonable and sustainable is one of the objectives of the New Prague Surface Water Management Plan. The only effective way to maintain high quality water bodies is to prevent sediment, nutrients, and other materials from entering the storm drainage system. Complete interception of stormwater for treatment at the point of discharge is not currently feasible, though the City encourages the implementation of techniques such as rainwater gardens, infiltration areas, and filtration swales etc., that capture a portion of runoff at the point of generation.

Application of these small-scale techniques should be on a site specific basis. In general the City emphasizes water quality treatment at the neighborhood level and not at the regional level.

The City's other underlying goal governing its water quality standards and strategy is to develop in a manner such that no adverse impact to surface water resources occurs. The City assumes that it will someday be required to hold a permit from the Minnesota Pollution Control Agency (MPCA) that allows its current and future stormwater discharges and that the MPCA will use this permit to require Nondegradation analysis and mitigation of the City. What this means is that any increase in loading for:

1. Runoff volume
2. Phosphorus
3. Total Suspended Solids

to surface water resources must be quantified and, to the maximum extent practical, mitigated. In essence, the runoff volume, runoff rate, and water quality treatment controls outlined in this Plan mean that the City will not have to come back to retrofit treatment to developments created between now and the time the City becomes regulated under the state permit.

6.3.1 Pollutant Control

The three main sources for degradation of water quality are:

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

Identification of the source and implementation of reasonable control measures can minimize the degradation of New Prague's wetlands and streams due to the pollutants found in stormwater.

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

The importance of erosion control measures during construction cannot be overemphasized. The Best Management Practices (BMPs) recommended in the Minnesota Pollution Control Agency's (MPCA) Protecting Water Quality in Urban Areas or State of Minnesota Stormwater Manual should be followed for all development.

The Minnesota general National Pollutant Discharge Elimination System (NPDES) Stormwater Permit for Construction Activity, revised in 2003, now requires a permit for construction activities that disturb one or more acres.

When disturbing 10 or more acres, the NPDES construction permit requires developers to provide temporary settling ponds to treat the runoff from their grading sites. These ponds are intended to prevent the introduction of sediment and its associated pollution into the storm sewer system and are required to function, in their various forms, until grading has ceased and adequate cover has been established. New Prague's goals and policies state that the NPDES General Stormwater Permit for Construction Activity contains requirements for erosion control that form the City's minimum standards, but that temporary sedimentation ponds are required at a 5-acre disturbance threshold. Additionally, temporary seeding is required at the beginning of a project if, under existing conditions, an area is already disturbed and will not be graded immediately.

When the outlet for a siltation basin, either permanent or temporary, is located below the normal water surface, the basin can also serve to confine floating solids that may otherwise enter a downstream pond or lake. This practice is typically referred to as skimming. If a hazardous material such as fuel oil were to spill, a skimmer structure would retain it within the basin and thus isolate it for easy access and prompt cleanup. Skimmer structures should be used for all constructed ponds upstream of wetlands, lakes, rivers, and streams. For constructed ponds that discharge into other constructed ponds, skimmer structures are not as important.

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

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

It bears repetition that a solids removal structure must be regularly maintained if it is to remain effective. Since maintenance is the controlling factor in the long term performance of sediment control measures, pond forebays are recommended over sump manholes. Pond forebays are small portions of larger ponds separated from the larger pond by submerged berms. Forebays trap coarse sediment in a relatively compact area making it easier for maintenance crews to remove.

Sump manholes, if numerous, often go without maintenance. An individual pond requires more maintenance time than a sump, but system maintenance time goes down when ponds are the preferred method of sediment removal as long as pond slopes and benching allow access by maintenance equipment (see Chapter 5 for pond grading requirements). For this reason sump manholes should be limited to storm sewer lines discharging directly to wetlands, lakes, rivers, streams, ravines, and constructed channels and should be avoided upstream of constructed ponds. In all cases, the location, type, and number of sediment control structures must be established at the time of final design of that portion of the storm sewer system.

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

Occasionally, with small plats (of 5 acres of less), water quality ponding cannot be constructed to the extent required by the SWMP without severely hampering the site development or destroying other habitat such as upland grasslands and forests. In such cases, it is within the City's discretion to reduce the required water quality ponding. Very often the decision to reduce ponding requirements will depend on the quality of the receiving water body.

6.3.2 Water Quality Modeling

To adequately address the needs of the City, PondNet water quality management model is recommended. PondNet is an empirical model developed from data collected by the Environmental Protection Agency (EPA) Nationwide Urban Runoff Program (NURP). The model predicts the phosphorus removal efficiency of a large number of hydrologically connected ponds. Phosphorus is the primary nutrient modeled because it has been found to be the nutrient most likely to promote the growth of algae in lakes and deep water wetlands. A limitation of the PondNet model is its inability to predict phosphorus concentrations in large, deep water bodies, which is not an issue in New Prague. Benefits of the PondNet model include:

1. It is entirely adequate for calculating phosphorus loadings from agricultural land.
2. Its algorithms are transparent.
3. It can be suitably modified to calculate TSS loadings and removal.

For the reasons above, PondNet when combined with in-lake modeling software, becomes an excellent tool for nondegradation analyses.

Values for average runoff phosphorus concentrations, average annual summer runoff coefficients and the resulting phosphorus export coefficients were determined for use in the model. The values are shown in Table 6.2 and are obtained through a review of published literature values.

Pollutant loads are the product of runoff volume and pollutant concentration. Runoff volume is a result of precipitation and runoff coefficients. Both runoff coefficients and pollutant concentrations in runoff vary greatly with land use type.

The over-riding consideration in developing input parameters reflective of all land uses was to generate unit load estimates within accepted literature value ranges for Minnesota and the upper Midwest. For agricultural row crop and low density residential, it is also important to reflect the general view among knowledgeable water quality professionals that raw TP export rates for agricultural row crops with conservation practices are slightly/moderately lower than raw export rates for residential.

The two land use classifications that have the greatest influence on PondNet modeling are row crop agriculture and low density residential areas, since these are the predominant land uses in the predevelopment and post-development conditions. These areas experience the most change throughout the non-degradation timeframe. Table 6.2 presents runoff coefficients and pollutant concentrations for these two land uses, as well as provides the values designated for the remaining land uses.

TABLE 6.2

PONDNET MODELING PARAMETERS

Land Use	TP Runoff Concentration (ppb)	Runoff Coefficient (fraction)	Unit P Loading (lbs/ac/yr)	TSS Runoff Concentration (ppm)	Unit TSS Loading (lbs/ac/yr)
Row Crop[1]	540	0.14	0.57	163	170
Continuous Hay	350	0.12	0.31	163	146
Pasture	350	0.12	0.31	163	146
Rural Residential	350	0.12	0.31	216	194
Low Density[2] Residential	450	0.21	0.71	140	220
Medium Density Residential	450	0.35	1.18	140	366
High Density Residential	350	0.61	1.60	140	639
Commercial/ Industrial	350	0.68	1.78	90	458
Forest/Woodland	200	0.08	0.12	216	129
Park	250	0.14	0.26	216	226
Golf Course	550	0.12	0.49	216	194
Other (ROW)	438	0.24	0.79		

[1] Dominant non-urban land use. Values assume no significant tile drainage
[2] Dominant urban land use. Low density residential assumed to reflect average of 3 units/acre, 30% impervious coverage.

The values themselves were derived using a combination of detailed site specific study results from the upper Midwest, generally accepted literature values from credible sources, knowledge of local conditions, and professional judgment.

The export coefficients reflect a large increase in nutrient loading as land use changes from open space and agricultural to urban. The main reason for this increase is the large increase in runoff rate and volume, caused by the amount of impervious area, which washes off the pollutant buildup from those surfaces.

Computer models that predict concentrations and removal efficiencies for heavy metals are currently available. These models predict removal efficiency in terms of inflow particle distribution and the pond's ability to remove suspended solids. Based on a number of studies recently performed by various agencies, it can be assumed that wet detention ponds which remove 60 percent of phosphorus also remove high percentages of heavy metals. Table 6.3 shows the benefits of wet detention ponds as estimated by the DNR in Wisconsin.

TABLE 6.3

ADDITIONAL BENEFITS OF WET DETENTION PONDS (WHERE PHOSPHORUS REMOVAL = 60%)

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

Based on these findings, it can be assumed that water quality ponds which reduce phosphorus loadings by 60% under standard runoff concentrations will also reduce heavy metal concentrations by 70% and sediments by 90%. For this reason it is sufficient to model for phosphorus and from those results infer removals of other pollutants according to the percentages in Table 6.3.

Actual modeling of water quality basins and their treatment capacities can be cumbersome for developers and their engineers. For this reason, New Prague's sizing requirement is based on the runoff from a 2.5-inch rainfall event (see Policy 2.1). In some cases a site's BMPs will not rely solely on water quality ponding and might include a more diverse set of volume management BMPs. In such cases, the simplistic 2.5-inch rainfall sizing criteria is not adequate and the standard becomes an overall treatment efficiency of 60%.

6.4 ATER QUANTITY AND QUALITY IMPACTS TO WETLANDS

Wetlands provide a significant amount of flood storage, and the SWMP proposes using this flood storage to reduce systemwide flows. The use of wetlands for flood storage must be balanced against the damage that may occur due to increased inundation and due to the quality of the water discharged to the wetland.

Historically, most of the wetlands in the City have been affected by agriculture or urbanization. In urbanizing areas, wetland degradation can be an ongoing process. However, some degraded wetlands can be improved by stabilizing water levels and reducing sediment loads.

Water quality plays a significant role in the overall quality of a wetland. When the quality of the incoming stormwater declines, the wetland's plant community may become less diverse, retaining only those species that are tolerant of high nutrient and sediment loads. Once a wetland's plant community is changed, the wetland's character and ecosystem will change, often to a less valuable system in terms of diversity, wildlife habitat, and aesthetic qualities. Section 7.4 provides additional detail on the role wetlands serve in New Prague's surface water management system.

6.5 LOCAL VS. REGIONAL WATER QUALITY

The ponds shown in Map 1 are flood control basins and not considered areas for water quality treatment. Water quality treatment is not considered a regional element but rather something to be installed with individual developments. Regional water quality treatment is considered less effective than local treatment and some analyses suggest that regional water quality basins can become pollutant sources rather than sumps. Additionally, by dispersing water quality to the local level, a wider range of techniques can be used such as:

- Filtration swales
- Infiltration swales
- Infiltration basins
- Structural units like swirl separators
- Sand filters
- Reducing impervious surface

7. Implementation Plan

7.1 GENERAL

The Implementation Plan section of the New Prague SWMP describes those activities, programs, and requirements that the City will implement to improve its surface water management program and preserve and enhance its surface water resources. Capital outlay for the surface water system (pipes, channels, and ponds) shown in Map 1 will be large. For this reason a financing mechanism, called an area charge, is developed in this section. Based on the Capital Improvement Plan and the developable acreage within the growth area, an area charge is developed and application of this charge is discussed.

The Implementation Plan continues with a wetland management section where restrictions on the use of wetlands for stormwater are based on their susceptibility to stormwater impacts. This Implementation Plan also includes a developer's guide. This is essentially the guide provided in the 1998 Comprehensive Stormwater Management Plan (RLK Kuusisto LTD), with minor revisions and updates. The developer's guide outlines submittal requirements, design standards, and acceptable stormwater control measures. The final component of the Implementation Plan revolves around operational and programmatic elements including:

- Operation and Maintenance
- Education
- Ordinance Implementation
- Amendments Procedures
- Annual Report to Council

7.2 COST ANALYSIS AND CAPITAL IMPROVEMENT PLAN

7.2.1 COST ESTIMATION METHODS

To minimize excavation, ponds have generally been proposed for existing low areas. Where natural topography does not lend itself to ponds either excavation or berming is proposed to create the requisite pond areas.

Ponds serve to reduce peak flows. In that capacity they are desirable in and of themselves. Ponds also have an added benefit of reducing downstream pipe sizes and thus trunk pipe costs. Since ponds themselves involve cost it is desirable to reach a balance point between ponds and larger pipes so that the least expensive system is proposed. Generally, when pipes larger than 48-inches are prevalent, overall system costs might be reduced by additional ponding areas.

Trunk pipes are generally located in existing drainage ways so that excessive pipe depth can be avoided. The trunk pipes proposed for the growth area (Map 1 and Appendix B) do not involve pipes deeper than 20 feet. This keeps pipe costs down and is the specific reason why it is best to install trunk pipes in existing drainage ways. Appendix B provides detail on the proposed pipe and channel reaches while Appendix D provides cost estimates for building these reaches. Appendix D also includes construction costs for ponds, which follow from the pond data provided in Appendix C.

Pipe costs are based upon:

- Pipe Construction
- Easement Acquisition
- Indirect Costs

Pipe and Channel Construction

The Appendix D pipe costs are based upon a pipe cost matrix that relates pipe cost to diameter and pipe depth. This matrix is based on an analysis of bid tabulations and discussions with large utility contractors. The matrix is updated annually based on the ENR index and more recent bid tabulations as they become available. The per linear foot pipe costs given in Appendix D include pipe material costs, installation, manholes, and bedding, as well as restoration and are thus comprehensive in terms of the various costs associated with installing pipe. In many cases, existing channels are used in lieu of trunk pipe. The costs associated with channels are for the excavation and shaping that is usually necessary to make channels function properly.

Easement Acquisition

For each pipe reach, a cost is included for permanent and temporary easement. Permanent easement is assumed to cost $25,000 per acre. Appendix D includes no costs for temporary easement. Temporary easement is usually not necessary since construction of the proposed facilities occurs on development sites. As pipe depths increase the permanent easement width around the pipe also increases. This is reflected in the cost estimates. For the purposes of estimating costs, it is assumed that 75% of future trunk pipe will fall in dedicated easement or right-of-way, so easement costs are applied to only 25% of trunk footage.

Indirect Costs

A 35% factor for indirect costs is included in the cost estimate presented in Appendix D – applicable to pipe, channel and pond construction. Indirect costs include engineering, administration, contingencies, and fiscal costs. For easement acquisition a 10% indirect cost has been applied. This accounts for the appraisal and administrative costs associated with easement acquisition.

Pond costs involve the following:

- Pond Construction (excavation and berming)
- Easement Acquisition

Pond Construction

The primary element of pond construction is excavation. To some extent berming will also be necessary to create the ponds shown in Maps 1. Pond construction costs vary considerably depending on whether excavation is necessary. At one extreme are ponds that obtain their requisite flood storage solely by excavation. At the other extreme are ponds that are existing depressions with the required storage provided or ponds that can be created by berming. To account for the variability in pond construction costs, three different pond construction costs are used. Each of the three is based on a unit cost per acre of pond at High Water Level (HWL). The three costs and the rationale behind their use are as follows:

1. Minimal excavation or berming: $4,500/acre of pond at HWL
2. Combination of excavation and berming: $9,000/acre of pond at HWL
3. Full excavation of flood storage volume: $13,000/acre of pond at HWL

The minimal excavation or berming criteria covers most of the large wetlands used for flood storage. Some of these areas can be quite large and the costs of developing storage does not increase linearly with their size. For this reason, storage costs for ponds and wetlands developed through berming and minimal excavation are capped at $20,000. It should be noted that the regulatory controls identified in this LSWMP place limitations on the use of wetlands for flood storage.

Appendix D details the costs of pond construction. The construction cost is for providing flood storage only and does not include costs associated with providing water quality treatment. As stated previously, water quality treatment is considered a development cost and not a trunk cost. To the extent they are not wetlands, the ponds identified in Map 1 could also serve water quality purposes, but this cost would be strictly a developer cost with no reimbursement or participation by the City.

Pond Easement Acquisition

For each pond, a cost is included for permanent easement. Permanent easement is calculated at 50% the fee title value of upland areas (50% x $25,000/acre = $12,500/acre). 50% fee title, instead of 100%, is used to account for the fact that many of these low areas are otherwise undevelopable since many are jurisdictional wetlands or would be used for the required water quality ponding.

7.2.2 SYSTEM COSTS AND CAPITAL IMPROVEMENT PLAN

Appendix D summarizes the proposed system costs by element, by major watershed, and for the system as a whole. Appendix D serves as the City's stormwater CIP for future development and for calculating area charges.

The proposed system, as shown in Map 1, has an estimated cost of approximately $11 million. This cost includes indirect costs of 35% on trunk and pond construction.

7.3 FINANCING AND COST RECOVERY

7.3.1 AREA CHARGES AND COST RECOVERY CALCULATIONS

The gross acreage within the growth area is 4,185 acres. The system cost per gross acre is thus:

$11,204,380/(4,185 acres) = $2,677/acre

Table 7.1 summarizes acreage, system costs, and area costs for the growth area.

TABLE 7.1

COSTS AND PER ACRE CHARGE

		System Costs			
	Area (ac)	Regional Pond ($)	Trunk Pipe and Channel ($)	Total ($)	Area Cost ($/Acre
Growth Area	4,185	8,471,993	2,732,387	11,204,380	2,677

Generally, it is cumbersome to apply separate area charges for different areas within a City, so a uniform area charge is recommended that covers all new development regardless of its location. This is the method reflected in Table 7.1 where aggregate costs are applied uniformly throughout the growth area.

Typically area charges are not collected from land used for the following:

- Major roadway right-of-way
- Parks, including greenway corridors
- Storm ponds at HWL footprint
- Wetlands

These sorts of exemptions typically reduce gross area by about 30%. Applying this to the New Prague example:

$11,204,380/(4,185 acres x 70%) = $3,825/acre

An area charge rate should depend upon the land use of the proposed development and application of the area charge should depend upon what facilities developers construct at their own expense versus those facilities for which the City must bear the cost.

Highly impervious development requires larger – and thus more costly – trunk pipes, channels, and ponds. For this reason commercial, industrial, and higher density residential developments should pay higher area charges than low density residential development.

To resolve the $3,825 per acre charge into an actual area charge based upon land use depends upon the proportion of a specific land use within the growth area. New Prague's 2005 Comprehensive Plan determines these land uses for the growth area. Based on the Comprehensive Plan the following land use percentages were assumed: 60% low density residential, 30% medium density residential, 5% high density residential, 5% commercial. The calculation of area charges then proceeds according to the following formulas:

$$A_n \times C_n = \text{System Cost}$$
$$\text{System Cost} = 60\% \times A_n \times C_{ldr} + 30\% \times A_n \times C_{mdr} + 5\% \times A_n \times C_{hdr} + 5\% \times A_n \times C_c$$

Where

A_n = Net Acreage = 70% Gross Acreage = 2,930 acres
C_n = Per Acre Charge = $3,825
C_{ldr} = Low density residential area charge
C_{mdr} = Medium density residential area charge
C_{hdr} = High density residential area charge
C_c = Commercial area charge

Additionally, based on standard runoff curves for large rainfall events – the sorts of events that determine the design of the stormwater system – we can equate the land use based area charges as follows:

C_{mdr} = $1.6 \times C_{ldr}$
C_{hdr} = $1.9 \times C_{ldr}$
C_c = $1.9 \times C_{ldr}$

Putting all this together, Table 7.2 provides area charges based on land use. These are the base area charges for application to future development.

TABLE 7.2

LAND USE BASED AREA CHARGE RATES

Land Use	Factor	Area Charge
Low Density Residential (1 to 6 units per acre)	1.0	$3,012
Medium Density Residential (6 to 12 units per acre)	1.6	$4,818
High Density Residential (12 or more units per acre)	1.9	$5,723
Office Commercial, Community Commercial, Highway Commercial, Industrial, and Industrial Park	1.9	$5,723

To a large extent, the 10-year rainfall determines the size of trunk pipe. The 100-year rainfall determines the size of regional ponds and channels. The factor for uses other than low density residential is the average of the two runoff coefficient ratios (10-year and 100-year) as shown in the following example:

Commercial
SCS Curve Number = 92
10-year runoff coefficient = C_{10} = 0.79
100-year runoff coefficient = C_{100} = 0.85

Low Density Residential
SCS Curve Number = 72
10-year runoff coefficient = C_{10} = 0.38
100-year runoff coefficient = C_{100} = 0.50

Factor = Commercial/Low Density Residential = ((0.85/0.50) + (0.79/0.38))/2 = 1.9

As shown in Table 7.3 the base area charge consists of two components: regional pond and trunk pipe/channel.

TABLE 7.3

STORMWATER AREA CHARGE COMPONENTS – LOW DENSITY RESIDENTIAL EXAMPLE

	Regional Pond	Trunk Pipe and Channel	Total
System Costs ($)	8,471,993	2,732,387	11,204,380
% of Total	76%	24%	100%
Area Charge ($/ac)	2,289	723	3,012

In many instances developers will contribute some portion of the regional system. If, for instance a developer dedicates regional ponding then full credit of $2,289/acre will be given for the regional ponding portion of the area charge, leaving an area charge of $723/acre. For land uses with a factor greater than 1.0 this credit will be larger.

In some cases a development will be using a regional pond dedicated within a downstream development. Under this scenario the full $3,012/acre area charge should be applied. In other cases, portions of the regional system are dedicated and the area charge could be reduced with partial credits that reflect this dedication.

7.3.2 AREA CHARGE SUMMARY

Sections 7.2 and 7.3 develop an area charge for the City of New Prague that can be applied to future development within the City. The area charge has been constructed methodically as follows:

1. Pond and trunk costs for near term development have been estimated for the focus areas. A stormwater CIP has been created and is contained in Appendix C.
2. The gross acreage of the growth has been calculated.
3. The gross acreage has been reduced by 30% to account for typical exemptions from area charges.
4. The base area charge has been modified into a land use based area charge.
5. Examples of how to apply credits have been given.

7.3.3 STORMWATER UTILITY

Section 52 of the New Prague City Code establishes a stormwater utility for the City as allowed under Minnesota Statutes 444.075. The basis for determining the stormwater utility charge is the Residential Equivalency Factor or REF, which is defined as the ratio of the average volume of runoff generated by one acre of a given land use to the average volume of runoff generated by one acre of typical single family residential land during a one-year rainfall event. The utility fee for a parcel is determined by multiplying the REF for the parcel by the acreage of the parcel and then multiplying this product by the charge per REF. Table 7.4 provides a summary of the number of REFs applied to various property types.

TABLE 7.4

REF FOR SELECT PROPERTY TYPES

Classification	Land Use	REF
1	Cemeteries, golf courses	0.25
2	Parks with parking facilities	0.75
3	Single family and duplex residential	1.00
4	Public and private schools	1.25
5	Multiple family residential, churches & government buildings	2.50
6	Commercial, industrial, warehouse	5.00

As allowed by the ordinance, the City Council may adopt and/or adjust a properties stormwater drainage fee based upon hydrologic data supplied by the property owner, which demonstrates a hydrologic response substantially different from the standards.

Total Stormwater Utility revenue for 2005 was $200,000.

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

The current charges provide approximately $200,000 per year in revenue of which only a fraction has been used for pond maintenance. As the City's maintenance responsibilities grow the stormwater utility funding also needs to grow to keep pace.

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

The NPDES permit and SWPPP commit the City to certain activities, including capital projects, for the purpose of improving the quality of the City's stormwater discharge. The U.S. EPA has estimated that the financial commitments that City's will make may total $10 per household per year. Others place this figure at $20. Since many of the activities identified by the City's future SWPPP may already be funded (like street sweeping and pond maintenance) the $20 figure is probably too high. For the purposes of planning increases in SWU collection the $10 per year figure should be used. Table 7.5 summarizes the additional stormwater utility charges identified above.

TABLE 7.5

FUTURE STORMWATER UTILITY FUNDING

Item	Annual Charge to Single Residential Unit	Quarterly Charge to Single Residential Unit
Current Commitments		
Future Pond Maintenance	$25.00	$6.25
NPDES Permit and SWPPP	$2.00	$0.50
NPDES Permit Compliance	$10.00	$2.50
Total	**$37.00**	**$9.25**

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

A $37.00+/REF would be close to one of the highest rates among Metro Area cities – similar to what is currently charged in a couple like Burnsville and Savage. It should be noted though that the unfunded mandates from the federal level through the Minnesota Pollution Control Agency are driving the need for this funding.

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

7.4 WETLAND MANAGEMENT

The City of New Prague has no ordinance that controls activities in and around wetlands. The City does have a buffer requirement of 40 feet and a buffer setback of 50 feet but these requirements originate with the 2001 update of the 1998 Comprehensive Stormwater Management Plan. Implementation of a wetland management and protection ordinance is one of the three ordinance implementation items recommended by this Plan.

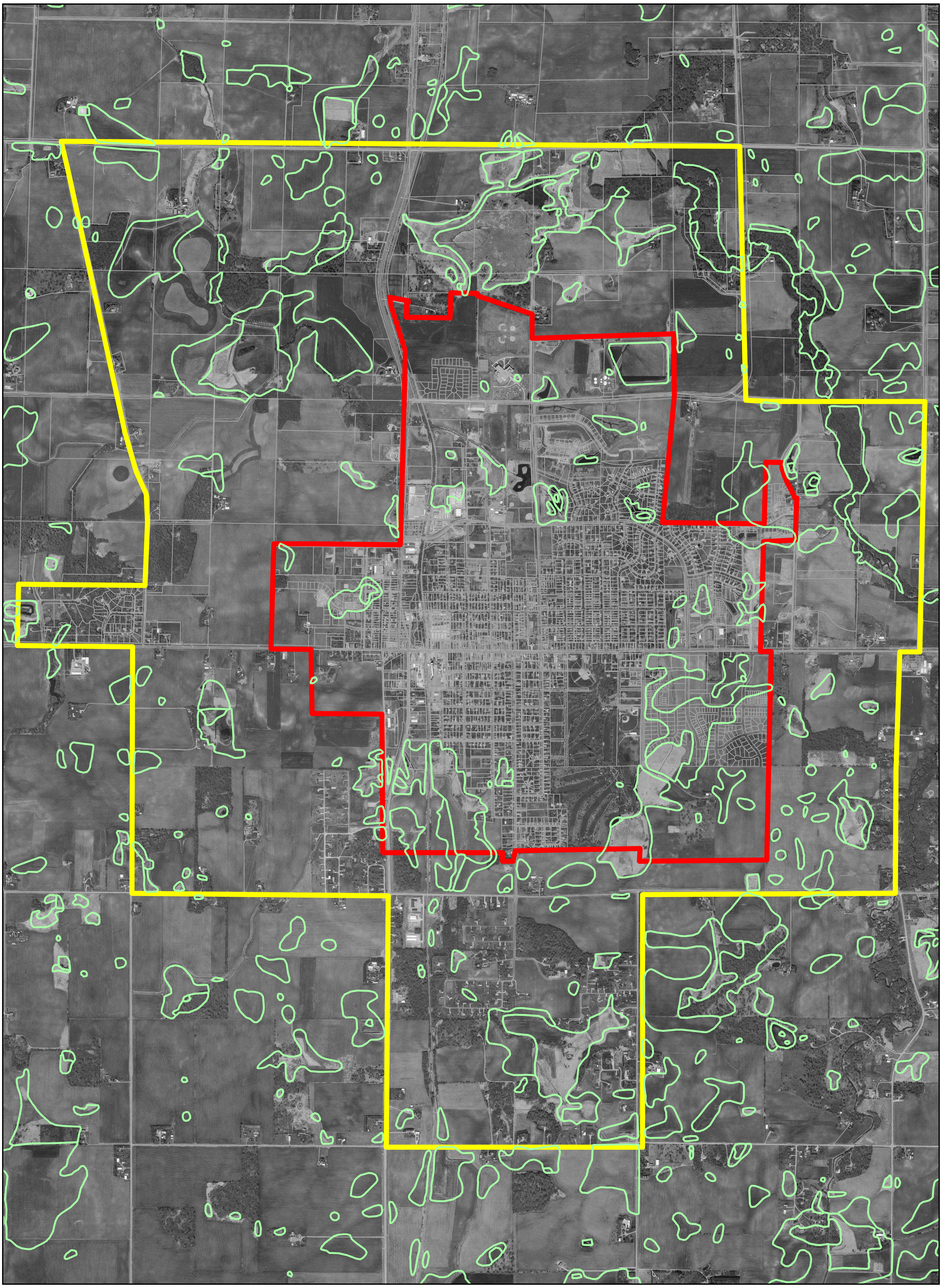
Figure 4 shows National Wetlands Inventory wetlands within New Prague and its surrounding area.

Wetland protection strategies depend upon the wetland type. The City does not have a wetland inventory to determine wetland type for the many wetlands shown on Figure 4. Consequently, the LSWMP requires that projects with wetland impacts include preparation of a function and values assessment using the latest version of MnRAM software and that this assessment be submitted to the City Engineer for review. This function and value assessment, once accepted by the City Engineer, becomes the basis for applying the protection standards outline in Tables 7.6 and 7.7.

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

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

The stormwater susceptibility ranking system used in this Report was determined by correlating the National Wetland Inventory (NWI) with the wetland plant community types as described in *Wetland Plants and Plant Communities of Minnesota and Wisconsin* (Eggers and Reed 1997). NWI classifies wetlands based on the *Classification of Wetlands and Deep Water Habitats of the United States* (Cowardin et al. 1979). In this system, wetlands in Minnesota are classified based on hydrology regime and vegetation types. Then from the Eggers and Reed publication, Table 1 was used to associate the NWI system with the plant community type. For example: PEMC is equivalent to shallow marsh. The *Guidance for Evaluating Urban Stormwater and Snowmelt Runoff Impacts to Wetlands* (State of Minnesota Stormwater Advisory Group, 1997) classifies wetlands based on the Eggers and Reed wetland plant communities. This guide was used in the determination of wetland sensitivity to stormwater.



City of New Prague

National Wetlands Inventory

Surface Water Management Plan

Figure 4

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

April 30, 2007

Study Area Boundary
City Boundary
National Wetland Inventory
Parcel Basemap

Feet
2000 0 2000

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This document divides wetlands into rankings that include: highly susceptible, moderately susceptible, and slightly susceptible. The wetlands that fall into these ranking classifications are detailed in Table 7.6 below.

TABLE 7.6

RELATIVE SUSCEPTIBILITY OF WETLANDS TO STORMWATER IMPACTS

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

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

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

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

NOTES:
There will always be exceptions to the general categories listed above.
Use best professional judgment. Pristine wetlands are those that show little disturbance from human activity.
Source: (MPCA, 1997)

Water quality plays a significant role in the overall quality of a wetland. When the quality of the incoming water declines, the wetland's plant community may change with species diversity diminishing – ultimately leaving only those species that are tolerant of high nutrient and sediment loads. Once a wetland's plant community is changed, the wetland's character and ecosystem will change, often to a less valuable system in terms of biodiversity, habitat for wildlife, and aesthetic enjoyment.

Table 7.7 summarizes the 1997 Stormwater Advisory Group's pretreatment recommendations. BMPs can be used to accomplish the pretreatment requirements given in Table 7.7.

TABLE 7.7

STORMWATER PROTECTION STANDARDS

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

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

It should be understood that the treatment levels in Table 7.7 are minimum treatment levels and that New Prague's official controls, as outlined in Section 5, provide a higher level of treatment than shown in Table 7.7.

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

This Plan addresses stormwater quantity impacts to wetlands by providing protection strategies to maintain the existing integrity of the wetland through special protection strategies for highly, moderately, and slightly susceptible rankings as described in Table 7.8.

TABLE 7.8

WETLAND QUANTITY STANDARDS

Hydroperiod Standard	Highly Susceptible	Moderately Susceptible	Slightly Susceptible
Storm bounce	Existing	Existing plus 0.5 feet	Existing plus 1 foot
Discharge Rate	Existing	Existing	Existing or less
Inundation period for 1 & 2 year precipitation event	Existing	Existing plus 1 day	Existing plus 2 days
Inundation period for 10 year precipitation event or greater	Existing	Existing plus 7 days	Existing plus 14 days
Run-out control elevation (free flowing)	No change	No change	0 to 1 feet above existing run out
Run-out control elevation (landlocked)	Above delineated wetland	Above delineated wetland	Above delineated wetland
Source: (MPCA, 1997)			

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

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

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

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

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

Water Quality Protection: (Depends on vegetation, slope, density and type of adjacent land use and quality of receiving water)	25 feet or more
Protection from human encroachment:	50 - 150 feet or more
Bird Habitat preservation:	50 feet or more
Protection of threatened, rare or endangered species:	100 feet or more

The City has a standard buffer of 40 feet for all wetlands. In cases of "high" and "exceptional" ranked wetlands the City is proposing to use the Scott County WMO buffer widths of 50 and 65 feet, respectively.

7.5 DEVELOPMENT AND REDEVELOPMENT GUIDELINES

7.5.1 GRADING AND EXCAVATION PERMITS

By issuing grading permits after City review of grading projects the City of New Prague can ensure that its water quality, rate control, and erosion control goals are being met. The grading/excavation permit process kicks in when a threshold of disturbance is exceeded. A typical threshold might be ½ acre of disturbance or 1,000 cubic yards of excavation and/or fill. It is important that the threshold be set high enough so that typical landscaping activities do not require a grading permit. Where disturbance exceeds 1 acre a grading and erosion control plan will be submitted with the grading permit. City ordinance should specify the threshold for disturbance after which a grading permit is needed.

To obtain a grading permit a developer typically pays a fee based on the area of disturbance. Cities set up fee schedules that outline the costs associated with obtaining a permit for projects of varying disturbance. In the process of obtaining the permit the developer or developer's representative is usually required to provide insurance and present a letter of credit to the City. This requirement may be waived depending on the size of the grading project.

7.5.1.1 PROCESS DESCRIPTION

The City of New Prague has a three phase subdivision and development process that includes concept plan submittal, preliminary and final plat submittals. The following grading review process is fit to this existing process.

STEP 1) Provide applicant with grading permit application packet, a typical packet may include:

1. Grading Permit Procedure
2. Grading Permit Application Form
3. Grading Bond Form
4. MPCA Permit Application Reminder Sheet

5. Grading Permit Plan Requirements
6. Erosion and Sediment Control Plan Requirements
7. Erosion and Sediment Control Standard Details
8. Lot Grading Standard Details
9. Standard NURP Pond Layout
10. Temporary Sedimentation Pond Guidelines
11. Park Grading Requirements
12. City Grading Ordinance and Specifications
13. Grading Bond Release Form

STEP 2) Applicant submits preliminary grading plan with preliminary plat submittal and receives City comments.

STEP 3) Applicant submits completed Grading Permit Application and four (4) sets of Grading, Erosion Control and Detail plans to the City with the final plat submittal.

STEP 4) Applicant acquires other approvals as necessary from:

1. Minnesota Department of Natural Resources
2. Minnesota Pollution Control Agency (NPDES Program and/or other)
3. U.S. Army Corp of Engineers
4. County
5. Other Governing Agencies if necessary

STEP 5) City engineering and planning staff review the grading application and proposed mass grading plan (note that such a plan is not a requirement for disturbances below the threshold set by City ordinance):

1. Staff provides Applicant with review comments for the Grading Plan and the amounts required for fees and security.
2. Applicant makes any required revisions/changes to the Grading Plan and Erosion Control Plan per Staff recommendations.
3. Applicant provides two (2) copies of the revised Grading Plan to the City Engineering Department for final review.
4. If no further modifications are required and the revised Grading Plan meets all City Requirements, a total of four (4) copies of the Final Grading Plan will need to be provided to the City Engineering Department for distribution.
5. Applicant provides copies of all required approvals (Step 3) to the City Engineering Department.

STEP 6) Applicant contacts the City to schedule a grading pre-construction meeting.

STEP 7) Applicant provides grading performance bond or equivalent cash security to City and the grading review fees are paid.
STEP 8) Pre-construction meeting is held onsite.

STEP 9) City issues Grading Permit, along with any special conditions.

STEP 10) Grading is permitted to start. The City will perform periodic inspections of the grading progress.

NOTE: After City approval of the final grading plan, any proposed revision(s) to said plan will require City approval. Any modifications to the plan not approved by the City will not be accepted and grading activities may be halted until such time revised grading plans are received, reviewed, and approved by the City.

STEP 11) Grading is completed and the seeding contractor contacts the City prior to application of seed and mulch. A City inspector must be present at the time of application to verify seed mix and application rates of seed and mulch.

STEP 12) Applicant provides two (2) copies of the Record (as-built) Grading Plans and a disk copy of the Record Grading Plans (if available) to City Engineering Staff (See grading plan requirements for as-built guidelines).

STEP 13) City inspects site as it relates to the submitted Record Grading Plan. Plans are stamped and distributed.

STEP 14) **Prior to the issuance of building permits**, Steps 10, 11, and 12 must be completed and all necessary erosion control devices must be in place and functioning. The City will inspect the site to determine its suitability for building activities. If the public utilities have not been installed at this point, it may be necessary to withhold building permits for various lots to allow the contractor adequate space to perform this work.

STEP 15) To release the financial security, the bonded party submits the completed grading bond release form to the Engineering Department.

STEP 16) City performs a final mass grading inspection of the site and issues a punch list (if necessary).

STEP 17) All punch list items are completed and approved.

STEP 18) City releases Grading Performance Bond.

It is the Applicant's responsibility to contact Gopher State One-Call for all utility locations.

7.5.1.2 Submittal Requirements

All grading, erosion control, and site restoration work should be done in accordance with the most recent additions of the MnDOT Standard Specifications for Highway Construction and the Minnesota Pollution Control Agency's Protecting Water Quality in Urban Areas and its State of Minnesota Stormwater Manual. Minimum requirements for erosion and sediment control requirements are those of the NDPES General Stormwater Permit for Construction Activity.

Issuance of grading permits require a submittal of the supporting data outlined in the City of New Prague Grading Permit Plan Requirements and the City of New Prague Grading Permit Conditions for Erosion and Sediment Control as follows:

CITY OF NEW PRAGUE

GRADING PERMIT PLAN REQUIREMENTS

A complete grading plan submitted to the City shall consist of two components. 1) the Grading and Erosion Control Plan, and 2) the Standard Detail Sheet. The grading and erosion control plan shall be drawn to scale and shall be of sufficient clarity to indicate the nature and extent of the work proposed and show in detail that they will conform to the provisions of this code and all relevant laws, ordinances, rules and regulations. The Standard Detail Sheet shall give clarity to all of the engineering applications pertaining to grading, erosion control, and drainage system.

Grading and Erosion Control Plan

Each sheet of the grading plans shall give the location of the work and the name and address of the owner and the person by whom they were prepared. They shall be certified and signed by a registered Professional Engineer of the State of Minnesota.

The grading plans, as a minimum, shall include the following information:

1. Grading plans shall be prepared in accordance with Section 7-6 (d) of the New Prague Grading Ordinance.
2. Name, address, and telephone and fax numbers of engineering firm and developer.
3. General vicinity of the proposed site.
4. North arrow (up or to the left).
5. Scale of 1 inch = 50 feet for overall grading and erosion control plans. Scale of 1 inch = 20 feet for grading related to ponds, infiltration areas, altered wetlands, wetland mitigation, and stream banks.
6. Area of the proposed site in acres or square feet.
7. Identify all park and wetland mitigation areas. The seeding specifications for these areas should be on the grading plan.
8. Property limits and accurate contours of existing ground and details of terrain and area drainage for the entire parcel and two hundred (200) feet around the parcel.
9. As a minimum, wetlands, ponds, lakes, streams, and a 200-foot strip around the perimeter of the proposed grading area need to be field surveyed for horizontal and vertical control including topographical features such as buildings, trees, fences, etc.
10. Details on existing wetlands, lakes, streams etc.
    A. Normal Water elevation (NWL) and 100-year design storm High Water Level (HWL)
    B. Ordinary High Water Level, if available, for wetlands within the site
    C. Whether streams are DNR protected
    D. Wetland delineations for wetlands on the site
    E. Any FEMA floodplain of floodway within the site
11. Maximum contour interval of 2 feet. All contours to be labeled.
12. Drawings showing existing and proposed drainage boundaries.
13. Hydrologic and hydraulic calculations for the 2-year, 10-year, and 100-year 24-hour (type II distribution) rainfall event.
14. Indicate site and lot drainage with direction arrows.

15. Show percent grade and elevation for all streets, major drainage swales, and parking areas.
16. Very detailed information will be required for pond and wetland areas disturbed by grading activities. The necessary information is as follows: 1 inch= 20 feet scale plan, 1 foot contour intervals, show maintenance/access and aquatic benches, show normal water level and 100 year design storm High Water Level for all ponds, wetlands and lakes. Where drainage features, ponds, etc., extend beyond the property line, show entire drainage feature and topography extending 200 feet on all sides of feature.
17. Show all existing utilities, both public and private.
18. Information on individual lots including:
    A. Type of structure (i.e. walkout or rambler)
    B. Lowest ground elevation adjacent to building
    C. Proposed lot corner spot elevations
    D. Proposed mid-point side lot spot elevations
    E. Proposed spot elevations at any high points or drainage breaks
    F. Proposed spot elevations where drainage swales intersect lot lines
    G. Proposed spot elevations where drainage and utility easements intersect with lot lines
19. Park pathways need to be graded so as to be in conference with Americans with Disabilities Act specifications.
20. Details of topsoil removal, stockpile, and re-spreading must be noted on the plans.
21. Details of all proposed surface and subsurface drainage devices, ponds, ditches, storm sewers, swales, walls, cribbing, dams and other protective devices to be constructed with, or as a part of, the proposed work.
22. Emergency overflows along with the high point elevation and direction of overflow shall be provided and clearly marked on the grading plan for all interior lot drainage structures and all ponding areas.
23. Minimum elevation differences shall be as follows:
    A. 100-year High Water Level of ponds to lowest ground at building elevation = +2 feet.
    B. Emergency overflow high point elevation to lowest adjacent building opening = +1 foot.
24. Location of any buildings, structures or walls on the property where the work is to be performed.
25. Specifications shall contain information covering construction and material requirements.
26. Provide a listing and show on the grading plan all significant trees. The certified tree inventory shall include:
    A. The species, diameter, conditions and location of all deciduous trees measuring 8” in diameter or greater.
    B. The species, diameter, conditions, and location of all coniferous trees measuring 6” in diameter or greater.
    C. A forested area of at least one acre of unplatted land which has trees over 8” in diameter on at least 25% of the total area.
27. Identify types and areas where erosion and sediment control measures are to be installed.
28. Do not place the standard detail plates on the Grading and Erosion Control Plan sheet(s).
29. Any other information required by the City.

Standard Detail Sheet

1. This sheet must contain all standard details that are specific to the project being proposed.

CITY OF NEW PRAGUE

GRADING PERMIT CONDITIONS FOR EROSION AND SEDIMENT CONTROL

Developer:

Subdivision:

Date:

1. Erosion and Sediment Control. On construction sites where grading disturbs more than one (1) acre, the developer/contractor shall meet the following conditions:
   A. All erosion control facilities shall be installed prior to any site grading operations. The City's Engineer must be notified upon completion of the installation of the required erosion control facilities and prior to any grading operation being commenced. If damaged or removed during construction, all erosion control facilities shall be restored and in place at the end of each day.
   B. Any additional erosion control facilities deemed necessary by the City, either before, during or after the grading activities, shall be installed at the request of the City.
   C. No deviations shall be made from the elevations shown on the approved grading plan, without prior approval from the City.
   D. Upon completion of the grading work, the developer shall certify that all grading was performed in accordance with the approved grading permit.
   E. Prior to the issuance of building permits, all necessary erosion control devices must be in place and functioning. The City will inspect the site to determine its suitability for building activities. If the public utilities have not been installed at this point, it may be necessary to withhold building permits for various lots to allow the contractor adequate space to perform his work.
   F. For sites greater than 1.0 acre, as required by NPDES permit requirements, an erosion control inspection log must be kept by the permit applicant. Inspection must be made once every seven days and within 24 hours after every rain event. The inspection records must be made available to the City within 24 hours of request.
   G. All debris created in the process of clearing and grading the site shall be removed from the site. This includes trees, shrubs, and debris from existing buildings, including footings. Under no circumstances shall this type of material be buried on the site.
   H. All top soil shall be stripped and salvaged for re-spreading on the site prior to seeding and mulching. No top soil shall be removed from the site. The topsoil stripping, stockpiling and re-spreading shall be done in accordance to, and noted on, the approved grading plan.
   I. All grading and operations shall be conducted in a manner to minimize the potential for site erosion. Erosion control measures shall be installed to prevent sediment from running off into adjacent properties. Any damage to adjacent properties must be correct and restored when permission is granted from the property owner(s).
   J. Specific measures to control erosion based on grade and length of the slopes on the site shall be provided as follows:
      a. Silt fences along the toe of slopes that have a grade of less than three percent and are less than 400 feet long from top to toe shall be supported by sturdy metal or wooden posts at intervals of four feet or less.
      b. Flow lengths up-slope from each silt fence shall not exceed 400 feet for slopes that have a grade of less than 3 percent and are more than 400 feet long from top to toe.

c. Silt fences along the toe of slopes that have a grade of 3 to 6 percent and are less than 200 feet from top to toe shall be supported by sturdy metal or wooden posts at intervals of 4 feet or less.
d. Flow lengths up-slope from each silt fences shall not exceed 200 feet for slopes that have a grade of 3 to 6 percent and are more than 200 feet long from top to toe.
e. Diversion channels or dikes and pipes shall be provided to intercept all drainage at the top of slopes that have a grade of more than 10 percent and are less than 100 feet long from top to toe. Silt fencing along the toe of said slopes shall be supported by sturdy metal or wooden posts at intervals of 4 feet or less.
f. Diversion channels or dikes and pipes shall be provided to intercept all drainage at the top of slopes that have grades of more than 10 percent and are more than 100 feet long from top to toe. Also, diversion channels or dikes, terraces, and pipes shall be provided across said slopes if needed to ensure that the maximum flow length does not exceed 100 feet. Silt fencing along the toe of said slopes shall be reinforced and supported by sturdy metal or wooden posts at intervals of 4 feet or less. Dams, dikes and diversions shall be stabilized within 21 days of construction.
g. Reinforced silt fence will be required around all wetlands.
h. There shall be a 5-foot buffer area between the silt fence and any wetland limits.
i. The locations of silt fences will be reviewed as grading occurs and adjustments made as directed by the City.

K. All temporary sedimentation ponds shall be constructed as the first priority of site grading. (See water quality guidelines.)
L. Flows from diversion channels or pipes shall be routed to sedimentation basins or appropriate energy dissipaters to prevent transport of sediment to outflow or lateral conveyors and to prevent erosion and sedimentation when runoff flows into the conveyors.
M. Site-access roads 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 roads. Site-access roads/driveways shall be surfaced with crushed rock where they adjoin existing paved roadways.
N. Soils tracked from the site by motor vehicles or equipment shall be cleaned daily from paved roadway surfaces throughout the duration of construction.
O. All erosion control measures shall be used and maintained for the duration of site construction. If construction operations or natural events damage or interfere with these erosion controls measures, they shall be restored to serve there intended function at the end of each day or when field conditions allow access.
P. All construction areas disturbed during construction shall be restored according to the requirements of the NPDES construction site permit. Restoration of disturbed areas should be as follows:
    a. If the graded area is anticipated to be developed within 6 months, provide a temporary vegetative cover consisting of Minnesota Department of Transportation seed Mixture 900 at the rate of 80 pounds per acre. If the graded area will not be developed for a period greater than six months, provide a permanent vegetative cover consisting of Minnesota Department of Transportation seed Mixture 500, at the rate of 100 pounds per acre. Seeded areas shall be either mulched and disc-anchored or covered by fibrous blankets to protect seeds and limit erosion.
    b. Temporary or permanent mulch shall be disc-anchored and applied at a uniform rate of not less than two tons per acres and not less than 80% coverage.
    c. Financial security shall be retained until turf has germinated and survived a 60 day growing period.

d. Wetland mitigation area will be restored in accordance with the approved wetland replacement plan.
e. Park areas shall be restored to park specifications.
f. All areas that will not be mowed or maintained as part of the ultimate design will be permanently restored using seed mixture 800 at a rate of 100 pounds per acre.
g. Wetland restoration areas will be restored using seed mixture 250 at a rate of 100 pounds per acre.

Q. Whenever other erosion and sedimentation control practices are inadequate, temporary on-site sediment basins that conform to the criteria for on-site detention basins shall be provided.
R. All storm sewer inlets shall be protected from construction site erosion either by the use of inserts or through installation of silt fence and filter rock around the perimeter of the silt fence.
S. Grading activities proposed to begin after October 15 will require an approved phasing schedule. The area of land that the City will allow to be disturbed at this time of year will be severely limited. The City will also require additional erosion control devices, dormant seed, and higher rates of application of both seed and mulch.
T. Filter blanket and riprap shall be installed on the downstream sides of all storm sewer outlets. All riprap shall be designed and installed with a filter material meeting the Minnesota Department of Transportation specifications for riprap and filter material.
U. Erosion control facilities shall be installed and maintained around the perimeter of all lakes, ponds and wetlands within or adjacent to the area to be graded until the area tributary to the lake, pond or wetland is restored.
V. To minimize erosion, all slopes greater than 3:1 shall be covered with material approved by the City's Engineering Department, such as fibrous blanket or staked sod.
W. All sedimentation occurring in storm sewers, ditches, lakes, ponds and wetlands shall be removed prior to completion of grading activities. Permanent stormwater ponds shall be graded to an elevation 1 foot below design and certified through the as-built grading submittal to be at design elevation when all site restoration is complete.
X. Erosion control items and devices should be removed only as directed by the City.

7.5.2 Design Standards for Stormwater Management

The design standards below relate specifically to stormwater management. The City's subdivision ordinance contains additional design standards for other aspects of the development process.

Developers and their engineers should familiarize themselves with the analysis methods outlined in Section 6.2. Section 6.2 also provides the technical basis for the specific design standards that follow. See Section 6.2 for additional design standard information regarding:

- Rational design requirements
- Design storm and modeling method
- Table 6.1 and runoff coefficients to use for analysis
- Definition of trunk
- Requirements and restrictions for transient street ponding
- Velocity control
- Channel and swale grade control
- Freeboard from ponds and builder certification
- NPDES permit

- Best Management Practices guide
- Use of skimmers
- Use of sump manholes
- Limitations to water quality ponding by development size
- Water quality design requirements including options for modeling
- Assessment of and minimum control measures upstream of wetlands

The term High Water Level (HWL), as used below, refers to the maximum water level generated by a Type II, 24-hour, 100-year rainfall event.

The design standards originate from and complement the goal and policy statements of Section 5. Grading and stormwater management design standards are as follows:

1. Maximum allowed pond slopes are 1:3, though 1:4 slopes are preferred. Pond slopes steeper than 1:4 shall have erosion control blanket installed immediately after finish grading. In residential areas slopes no steeper than 1:4 shall be allowed.
2. All constructed ponds and wetland mitigation areas shall have an aquatic or safety bench around their entire perimeter. The aquatic bench is defined as follows:
   A. Cross slope no steeper than 1:10
   B. Minimum width 10 feet
   C. Located from pond NWL to one foot below pond NWL
3. All constructed ponds and wetland mitigation areas shall have a maintenance access bench around sufficient perimeter to provide access to all inlets and outlets. At a minimum the maintenance bench should extend around 50% of the perimeter.
4. Elevation separations of buildings with respect to ponds, lakes, streams, and stormwater features shall be designed as follows:
   A. The lowest ground elevation adjacent to homes and buildings must be a minimum of two feet above the calculated 100-year HWL or one foot above the EOF, whichever criteria leads to the higher elevation.
   B. Landlocked lakes and wetlands require a five foot separation between basin HWL and lowest ground elevation adjacent to building.
   C. Drainage easements for ponds, lakes, wetlands, streams etc. shall encompass an area to one foot (vertical) above the calculated 100-year HWL.
5. Wet volume for water quality ponds shall be designed to a volume equivalent to the runoff from a 2.5" rainfall over the tributary area.
6. Maximum pond depth is 6 feet.
7. All ponds shall be graded to one-foot below design bottom elevation. This "hold down" allows sediment storage until such time as site restoration is complete.
8. The top berm elevation of ponds shall be a minimum of 1.5 feet above the 100-year pond HWL.
9. Grading shall not block or raise emergency overflows from adjoining properties unless some provision has been made for the runoff that may be blocked behind such an embankment.
10. All ponds should be shaped to have a length to width ratio of approximately 3:1.
11. All pond outlets that discharge to wetlands shall have outlet skimming where the preferred technique is a submerged pipe. In no case shall this submerged pipe be smaller than 24 inches in diameter.

12. Pond maintenance access shall be through a permanent easement from the street to the pond. In no case shall the longitudinal slope of this access exceed a 1V:6H slope.
13. Existing conditions is defined as the predominant land cover over the preceding ten years.
14. For water quality analyses, the calculation of runoff depth should be based on separate calculations for pervious and impervious areas and not on an average runoff coefficient for the land use.
15. Infiltration trenches or other forced infiltration features shall not be located near potential sources of contaminants or within the Drinking Water Management Supply Area as defined in the City's Phase 1 Wellhead Protection Plan.
16. Infiltration benches shall be no more than 0.5 feet to 1.0 feet below the outlet elevation and should be flat or gently sloped no steeper than 10H:1V.
17. The 100-year bounce over an infiltration area shall be no more than 3.0 feet.

7.6 OPERATION AND MAINTENANCE

7.6.1 ACTIVITIES

A stormwater system is a major investment for the City of New Prague – both in terms of initial capital cost and in terms of ongoing maintenance costs. The Capital Improvement Program outlines the costs for new trunk system construction which will be funded by area charges. System maintenance is funded by the City's stormwater utility.

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

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

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

As the City obtains more infrastructure and ponds, the management of these might be facilitated by creation of a GIS database for all stormwater system infrastructure. Via this database the City could reference, via interactive mapping, maintenance records, videotapes, and maintenance costs for portions of their system.

7.6.2 STORMWATER BASINS

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

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

Basin Outlets

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

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

Basin Inlets

Inspection and maintenance of basin inlets address the following:

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

Side Slopes

Inspection and maintenance of basin side slopes address the following:

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

Illicit Dumping and Discharges

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

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

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

Sediment Buildup

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

- Basins are inspected to determine if sediment buildup is causing significant loss of storage capacity from design levels. Excessive sediment buildup significantly reduces the stormwater treatment efficiency of water quality ponds.
- Sediment removal is performed where excessive sediment buildup has occurred. As a general guideline, ponds require dredging every 15 to 20 years.

Table 7.9 provides a typical maintenance schedule for wet ponds.

TABLE 7.9

WET POND MAINTENANCE SCHEDULE

Activity	Schedule
Inspect regional pond outlets for clogging.	After significant rainfalls
Inspect for damage. Note signs of hydrocarbon build up. Monitor for sediment accumulation in the facility and forebay. Examine to ensure that inlet and outlet devices are free of debris and operational.	Annual inspection
Repair undercut or eroded areas.	As needed
Mow slopes	Twice annually
Remove sediments from forebay	5 to 7 year cycle
Remove sediment accumulated in main pool	20 to 30 year cycle
NOTE: Adapted from Watershed Management Institute. 1997. Operation, Maintenance, and Management of Stormwater Management Systems.	

7.6.3 SUMP MANHOLES AND SUMP CATCH BASINS

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

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

7.6.4 Storm Sewer Inlet Structures

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

7.6.5 Open Channels

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

Eroded channels can contribute to water quality problems in downstream waterbodies as the soil is continually swept away. If not maintained, the erosion of open channels would accelerate and the repair would become increasingly more costly.

7.6.6 Piping System

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

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

7.6.7 De-Icing Practices

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

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

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

1. De-icing material is stored in waterproof sheds. Where this is not possible, stockpiles are covered with polyethylene and placed on impervious surfaces.
2. Road de-icing stockpiles are not located near municipal well areas or in other sensitive groundwater areas.

3. Runoff from stockpiles is not allowed to flow directly into streams or wetlands where environmental damage can occur.

New Prague has established a detailed "snow and ice removal policy" to address winter maintenance needs. Street conditions are assessed for each individual event and ice control material application is adjusted accordingly. Equipment is maintained in good working order to place ice control material on roadways and is properly calibrated to prevent excessive application. The City maintains a covered sand/salt storage facility.

7.6.8 STREET SWEEPING

Street sweeping is an integral part of the City's effective surface water management system. It greatly reduces the volume of sediments that have to be cleaned out of sump structures and downstream waterbodies.

New Prague does not allow residents to rake leaves into the street for pick up, but does provide a compost site where residents can bring their leaves. This greatly reduces the incidence of inlet blockages and protects the water quality of downstream waterbodies.

The objective of both programs is to minimize impacts from leaf litter, sand, salt and other debris on the surface waters of the City.

7.6.9 DETECTION OF ILLICIT CONNECTIONS

As presented in the goals section New Prague will modify its ordinance to prohibit the dumping of hazardous material into the stormwater system. As staffing allows the City will also inspect storm sewer outfalls during dry periods to determine if any illicit sanitary sewer connections are evident.

7.7 EDUCATION

7.7.1 GENERAL

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

7.7.2 CITY STAFF

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

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

- Planning and delivering education programs.
- Working out cooperative arrangements with regulatory and non-regulatory organizations to achieve SWMP objectives.
- Assisting the City Council in the application of the SWMP policies.

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

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

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

7.7.3 City Residents

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

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

- Catch basin stenciling/door hanger distribution. The objective of this activity is to provide recognition of direct connection between the City storm drainage system and the community's streams and wetlands. The door hangers further explain this connection and why it is important to keep vegetation material, fertilizer, pet litter, and chemicals off hard surfaces and out of the storm drainage system.
- Lawn soil testing. This activity involves the collection and analysis of soil samples from lawns throughout the City to determine whether additional phosphorus in fertilizer is needed for good turf growth. The results would be helpful in determining to what degree low and no-phosphorus fertilizer use should be promoted in the City.
- No-phosphorus fertilizer sales. If soil test results generated in the Twin Cities are any indication, it is likely that a significant percentage of lawn soils tested will indicate no additional phosphorus is necessary for good turf growth. The City may work with lawn and garden retailers to encourage the supply of zero-phosphorus fertilizers. In addition, there will be a need to continue to educate the residents on the statewide fertilizer legislation passed by the 2002 Legislature that will go into effect in 2004.

- Stream and wetland information kiosks. Those who enjoy and use a resource are likely to be highly receptive to information on the condition of the resource and what is needed to protect it. Through the construction of lake and river information kiosks in strategic places, important water quality and other information would be presented at the "point of use/enjoyment." Watershed characteristics, (size, boundary) along with suggestions for residents to reduce their pollutant contributions, could be combined with information about the lake and river itself (e.g., fishing, boating, and other recreational opportunities).
- Brochures. There are numerous excellent brochures available that could easily be customized for the City of New Prague. Distribution could be accomplished through direct mailings, as a fold-in to the City newsletter, a door-to-door distribution by volunteers, etc.

7.7.4 DEVELOPMENT COMMUNITY

The SWMP is designed to provide the official policy direction that City staff and the City Council desire to guide stormwater mitigation for new and redevelopment projects.

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

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

After adoption of the New Prague SWMP by the City Council, the City could hold informational meetings on the SWMP with the City's developers. The meeting would be to outline the impact of the SWMP on development.

7.8 ORDINANCE IMPLEMENTATION

The City will proceed with reviewing the comprehensiveness of existing ordinance toward meeting its surface water management goals. Once this review process is complete, the City may begin drafting and enacting ordinance to cover the following areas:

- Erosion and Sediment Control
- Wetland Management
- Pond Maintenance
- Stormwater Management

The City will also consider whether a shoreland ordinance and bluff ordinance are necessary. The City has limited shoreland and bluff areas and may decide that the requirements of Scott WMO suffice. The City has 180 days from Scott WMO approval of this Plan to amend its official controls.

7.9 IMPLEMENTATION SUMMARY

The following Table 7.10 summarizes the City of New Prague's implementation efforts over the life of this SWMP. This implementation plan will be updated on an annual basis as part of the Annual Report to council.

TABLE 7.10

IMPLEMENTATION SUMMARY

Item	Cost/Funding Source	Timeframe
Ponds and BMP Maintenance		
• Annual pond dredging	$10,000/SWU	Annually
• Inspect regional pond outlets for clogging or damage	NA	After significant rainfalls
• Monitor sediment accumulation in ponds	NA	At least once annually for each pond
• Clear brush		As needed
Storm Sewer System		
• Stormsewer upgrades with street projects	$200,000/SWU	Annually
• Cleaning of sump manholes and catch basins		As needed
• Repair of catch basins and manholes		As needed
• Storm sewer inspection		As problems arise or periodically for chronic problem areas
Programs, Official Controls, Education and Public Relations		
• Review and update ordinance	$8,000/SWU	By March 2008
• Meetings with developers to explain new official controls	NA	Complete
• Implementation plan for Sand Creek (partnering with Scott WMO)	Unknown	Upon completion of Sand Creek study
• Stormwater educational postings and/or brochures	2,000/SWU,AC	Created upon completion of ordinance revisions
• Update Implementation Summary	500/GF	September, 2008
• Encourage Low Impact Development techniques and stormwater sustainability	NA	Through development review process
• Implement the standards of this Plan for development and City projects	SWU & AC	Upon approval of the plan and ongoing from that point
• Erosion and sediment control enforcement	BF	In place and ongoing
• Detailed hydrologic and hydraulic review will occur for all developments	DE	In place and ongoing
Capital Improvements		
• CR 37 regional detention basin (partnering with Scott WMO or Scott County Public Works)	Unknown	Unknown
• Phillip Square storm improvements	Unknown cost/ private funding possible future	Over several phases
SWU = Storm Water Utility; AC = Area Charges; DE = Developer Escrow; GF = General Fund; BF = Bldg. Fees; NA = No funding source needed or identified		

The stormwater utility is the primary funding source for the implementation items listed above though general fund and grants might be used for certain items like the CR 37 regional detention basin.

7.10 AMENDMENT PROCEDURES

The growth area boundary shown in Map 1 circumscribes an area of 6,290 acres. The existing City limits encompass approximately 2,015 acres, so the growth area itself makes up the approximately 4,185 acres difference. In this area several thousand residential units and over 20,000 people could be accommodated. Given this, the New Prague SWMP should serve the City well into the future. Most likely, the SWMP will need to be amended. Events that might trigger an amendment include a redefinition of the growth area or changes in regulation or goals that render portions of the SWMP obsolete.

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

Request for Amendment

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

Staff review of Amendment

A decision is made as to the validity of the request. Three options exist: 1) reject the amendment, 2) accept the amendment as a minor issue, with minor issues collectively added to the plan at a later date, or 3) accept the amendment as a major issue, with major issues requiring an immediate amendment. In acting on an amendment request, City staff shall recommend to City Council whether or not a public hearing is warranted.

Council Consideration

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

Public Hearing and Council

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

Watershed Approval of Amendment

As with this Surface Water Management Plan, amendments to the Plan must, pursuant to Minnesota Statute 103B.235, be submitted to Scott WMO for review and approval.

Council Adoption

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

7.11 ANNUAL REPORT TO COUNCIL

A brief Annual Report will be made by City staff summarizing development changes, capital improvements, and other water management-related issues that have occurred over the past year. The review will also include an update on available funding sources for water resource issues. Grant programs are especially important to review since they may change annually. These changes do not necessarily require individual amendments. The Report can, however, be considered when the plan is brought up to date. The Annual Report should be completed by December 31st each year to allow implementation items to be considered in the normal budget process.

The City should periodically review the SWMP for consistency with current water resource management methods. Occasionally, annual reports and past amendments will need to be added to the document. Depending on the significance of changes, a new printing of the SWMP may be appropriate. At a minimum, the Implementation Plan should be updated annually.

Appendices

APPENDIX A – DRAINAGE AREAS

APPENDIX A
DRAINAGE AREAS

PHILLIPS CREEK DISTRICT									
Sub-District	Total Drainage Area	LAND USE							
		Commercial Industrial	High Density Residential	Medium Density Residential	Low Density Residential	Park/ Open Space	Public Non-profit	Rural beyond growth boundary	Low/Med Density Res. Mix
	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)
PC-1	200					20			180
PC-2	74					14.8			59.2
PC-3	71							71	
PC-4	96	40				19.2			36.8
PC-5	69					13.8			55.2
PC-6	283					40.6		80	162.4
PC-7	60					12			48
PC-8	160							160	
PC-9	70					14			56
PC-10	64	64							
PC-11	125					25			100
PC-11.1	9	9							
PC-12	415					83			332
PC-13	100					20			80
PC-14	61					12.2			48.8
PC-15	26					5.2			20.8
PC-16	61					12.2			48.8
PC-17	746					72.6		383	290.4
PC-18	88					17.6			70.4
PC-19	39					7.8			31.2
PC-20	56					11.2			44.8
PC-21	61				61				
PC-22	12				12				
PC-23	30.5		8.7	6	12.8	3			
PC-24	53		4.9	4.8	43.3				
PC-25	23			6.3	16.7				
PC-26	32						32		
PC-27	31						31		
PC-28	4						4		
PC-29	76					15.2			60.8
PC-30	12.8				6.4	6.4			0
PC-31	23.1				23.1				
PC-32	63.3					15.8			47.5
PC-33	19.6					4.9			14.7
PC-34	35.6					8.9			26.7
PC-35	15.7				15.7				
PC-36	17.1	17.1							
PC-37	15.7	15.7							
PC-38	12.1	2		10.1					
PC-39	0.7	0.7							
PC-40	9.3						9.3		
PC-41	24.6					6.2			18.4
PC-42	28.1					7			21.1
PC-43	46.3					11.6			34.7
PC-44	18.1					4.5			13.6
PC-45	20.6					5.2			15.4
PC-46	154.1					23.6	59.7		70.8

APPENDIX A
DRAINAGE AREAS

SAND CREEK DISTRICT									
Sub-District	Total Drainage Area	LAND USE							
		Commercial Industrial	High Density Residential	Medium Density Residential	Low Density Residential	Park/ Open Space	Public Non-profit	Rural beyond growth boundary	Low/Med Density Res. Mix
	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)
SC-1	106				76		30		
SC-2	84					16.8			67.2
SC-3	84					16.8			67.2
SC-4	82					16.4			65.6
SC-5	29					5.8			23.2
SC-6	130					8		90	32
SC-7	107	43.6				12.7			50.7
SC-8	119					23.8			95.2
SC-9	113					11.7		54.4	46.9
SC-10	70					5.5		42.5	22
SC-11	273			9.7	94.3	65		104	
SC-12	74			11.5	59.5	3			
SC-13	40			27.5	12.5				
SC-14	15		15						
SC-15	19		10	9					
SC-16	8		8						
SC-17	53	20				6.6			26.4
SC-18	53	20				6		3	24
DNR #104W	310					120			190
SC-19	66					7			59
SC-20	28.1					7			21.1

Note: Park/Open Space assumed at 10% of total for undeveloped area

APPENDIX A
DRAINAGE AREAS

RAVEN STREAM									
Sub-District	Total Drainage Area	LAND USE							
		Commercial Industrial	High Density Residential	Medium Density Residential	Low Density Residential	Park/ Open Space	Public Non-profit	Rural beyond growth boundary	Low/Med Density Res. Mix
	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)
RS-13	81			31	50				
RS-15	20			20					
RS-16	23	1		22					
RS-17	66	40		17	9				
RS-18	34	8		21	5				
RS-19	46				46				
RS-20	8				8				
RS-21	18				18				
RS-22	60	6		7	47				

APPENDIX B – TRUNK STORM SEWER DATA

APPENDIX B
TRUNK STORM SEWER DATA

Flow From	Flow to	Drainage Area			Design Capacity	Pipe Size	
		Direct	Ponded	Total		Existing	Proposed
		(ac)	(ac)	(ac)	(cfs)	(in)	(in)
PHILLIPS CREEK DISTRICT							
PC-P17	Phillips	746.0	0.0	746.0	45.1		36
PC-P16	Phillips	61.0	0.0	61.0	9.6		18
PC-P15	Phillips	26.0	0.0	26.0	3.3		12
PC-P14	Phillips	61.0	0.0	61.0	8.7		15
PC-P32	Phillips	63.3	0.0	63.3	11.2		18
PC-P34	Phillips	35.6	0.0	35.6	11.2		18
PC-P31	Phillips	23.1	0.0	23.1	3.4		12
PC-P33	Phillips	19.6	0.0	19.6	3.6		12
PC-P30	Phillips	12.8	0.0	12.8	3.4		12
PC-P35	Phillips	15.7	0.0	15.7	3.8		12
PC-P12	PC-P13	415.0	0.0	415.0	17.1		24
PC-P13	Phillips	100.0	415.0	515.0	15.8	66	24
PC-P18	Phillips	88.0	0.0	88.0	22.4		24
PC-P11	PC-P11.1	125.0	0.0	125.0	3.5		12
PC-P11.1	PC-P10	9.0	125.0	134.0	4.6	12	
PC-P10	Phillips	64.0	134.0	198.0	19.0		24
PC-P21	PC-P23	61.0	0.0	61.0	6.1		15
PC-P22	PC-P23	12.0	0.0	12.0	2.4	12	
PC-P23	PC-P24	30.5	73.0	103.5	21.3	30	
PC-P24	PC-P25	53.0	103.5	156.5	15.6	12	
PC-P27	PC-P26	31.0	0.0	31.0	49.0	30	
PC-P26	PC-P25	32.0	31.0	63.0	26.2	12	
PC-P25	PC-P28	23.0	219.5	242.5	28.3	30	
PC-P28	Phillips	4.0	242.5	246.5	28.5	30	
PC-P5	Phillips	69.0	0.0	69.0	9.9		18
PC-P36	Phillips	17.1	0.0	17.1	3.5		12
PC-P37	Phillips	15.7	0.0	15.7	4.6		12
PC-P38	Phillips	12.1	0.0	12.1	4.3		12
PC-P39	Phillips	0.7	0.0	0.7	0.9		12
PC-P40	Phillips	9.3	0.0	9.3	1.3		12
PC-P41	Phillips	24.6	0.0	24.6	9.5		18
PC-P42	Raven	28.1	0.0	28.1	10.4		18
PC-P9	Raven	70.0	0.0	70.0	3.3		12
PC-P8	Raven	160.0	0.0	160.0	21.1		24
PC-P19	Raven	39.0	0.0	39.0	5.4		12
PC-P3	PC-P43	71.0	0.0	71.0	12.2		21
PC-P43	Raven	46.3	0.0	46.3	29.6		30
PC-P7	PC-P29	60.0	0.0	60.0	5.0		15
PC-P29	Raven	76.0	60.0	136.0	10.9		18
PC-P4	Raven	96.0	0.0	96.0	18.4		24
PC-P44	Raven	18.1	0.0	18.1	4.6		12
PC-P45	Raven	20.6	0.0	20.6	5.4		12
PC-P6	Raven	283.0	0.0	283.0	32.1		30
PC-P2	Raven	74.0	0.0	74.0	3.8		12
PC-P20	PC-P1	56.0	0.0	56.0	2.5		12
PC-P1	Raven	200.0	56.0	256.0	21.1		24

APPENDIX B
TRUNK STORM SEWER DATA

Flow From	Flow to	Drainage Area			Design Capacity	Pipe Size	
		Direct	Ponded	Total		Existing	Proposed
		(ac)	(ac)	(ac)	(cfs)	(in)	(in)
SAND CREEK DISTRICT							
SC-P1	DNR #104W	106.0	0.0	106.0	59.1	36	
SC-P2	DNR #104W	84.0	0.0	84.0	11.8		18
SC-P3	DNR #104W	84.0	0.0	84.0	10.6		18
DNR #104W	Sand	310.0	274.0	584.0	2.6		12
SC-P10	SC-P9	70.0	0.0	70.0	2.7		12
SC-P9	SC-P8	113.0	70.0	183.0	8.4		18
SC-P8	Sand	119.0	183.0	302.0	17.7		24
SC-P11	SC-P12	273.0	0.0	273.0	122.6	36	
SC-P12	SC-P13	74.0	273.0	347.0	107.7	48	
SC-P13	SC-P14	40.0	347.0	387.0	113.4	48	
SC-P15	SC-P16	19.0	0.0	19.0	21.9	24	
SC-P14	SC-P16	15.0	406.0	421.0	124.1	48	
SC-P16	Sand Trib.	8.0	421.0	429.0	162.7	60	
SC-P19	Sand Trib.	66.0	0.0	66.0	2.9		12
SC-P17	SC-P7	53.0	0.0	53.0	2.7		12
SC-P18	SC-P7	53.0	0.0	53.0	2.8		12
SC-P7	Sand Trib.	107.0	106.0	213.0	21.0		24
SC-P6	Sand	130.0	0.0	130.0	18.6		24
SC-P5	Sand	29.0	0.0	29.0	3.3		12
SC-P20	Sand	28.1	0.0	28.1	10.0		18

APPENDIX B
TRUNK STORM SEWER DATA

Flow From	Flow to	Drainage Area			Design Capacity	Pipe Size	
		Direct	Ponded	Total		Existing	Proposed
		(ac)	(ac)	(ac)	(cfs)	(in)	(in)
RS-P20	Raven	8.0	0.0	8.0	6.5		12
RS-P21	Raven	18.0	0.0	18.0	6.3		12
RS-P22	RS-13	60.0	0.0	60.0	22.3		21
RS-P13	Raven	81.0	60.0	141.0	45.7		30
RS-P19*	RS-18	46.0	0.0	46.0	2.9		12
RS-P18	RS-17	34.0	46.0	80.0	18.5		24
RS-P17	RS-16	66.0	80.0	146.0	43.6		30
RS-P16	Raven	23.0	146.0	169.0	63.5		36
RS-P15	Raven	20.0	0.0	20.0	4.5		12

* Landlocked under existing conditions

APPENDIX C – POND DATA

APPENDIX C
POND DATA

Pond Number	Drainage Area			NWL	HWL	Area @ NWL	Area @ HWL	Proposed Flood Storage	Proposed 100-Year discharge	100-Year discharge per acre
	Direct	Ponded	Total							
	(ac)	(ac)	(ac)			(ac)	(ac)	(ac-ft)	(cfs)	(cfs/ac)
PHILLIPS CREEK DISTRICT										
PC-P1	200.0	56.0	256.0	940.0	942.9	12.4	16.0	39.8	21.1	0.08
PC-P2	74.0	0.0	74.0	940.0	941.0	16.9	18.0	17.2	3.8	0.05
PC-P3	71.0	0.0	71.0	950.0	953.7	2.5	3.9	12.0	12.2	0.17
PC-P4	96.0	0.0	96.0	960.0	964.0	4.0	5.8	19.4	18.4	0.19
PC-P5	69.0	0.0	69.0	948.0	951.8	2.5	3.9	12.2	9.9	0.14
PC-P6	283.0	0.0	283.0	965.0	969.2	7.0	10.4	35.9	32.1	0.11
PC-P7	60.0	0.0	60.0	982.0	985.9	2.5	3.6	12.0	5.0	0.08
PC-P8	160.0	0.0	160.0	950.0	954.0	4.2	8.6	29.1	21.1	0.13
PC-P9	70.0	0.0	70.0	980.0	982.8	4.7	6.2	16.2	3.3	0.05
PC-P10	64.0	134.0	198.0	970.0	973.1	4.6	6.1	17.1	19.0	0.10
PC-P11	125.0	0.0	125.0	993.0	996.2	8.0	11.8	30.3	3.5	0.03
PC-P11.1	9.0	125.0	134.0	987.0	990.9	0.3	1.2	2.0	4.6	0.03
PC-P12	415.0	0.0	415.0	980.0	983.8	22.0	30.0	98.5	17.1	0.04
PC-P13	100.0	415.0	515.0	970.0	972.4	12.0	15.0	36.5	15.8	0.03
PC-P14	61.0	0.0	61.0	974.0	977.1	2.9	4.1	10.9	8.7	0.14
PC-P15	26.0	0.0	26.0	998.0	1000.6	1.5	1.9	4.7	3.3	0.13
PC-P16	61.0	0.0	61.0	1000.0	1003.9	2.2	3.2	10.5	9.6	0.16
PC-P17	746.0	0.0	746.0	1003.0	1006.2	45.0	61.5	166.1	45.1	0.06
PC-P18	88.0	0.0	88.0	970.0	973.7	1.4	6.0	13.7	22.4	0.25
PC-P19	39.0	0.0	39.0	954.0	957.8	1.4	2.2	7.0	5.4	0.14
PC-P20	56.0	0.0	56.0	958.0	959.1	11.3	13.2	13.3	2.5	0.04
PC-P21	61.0	0.0	61.0	977.3	980.3	3.0	4.8	11.8	6.1	0.10
PC-P22	12.0	0.0	12.0	994.0	995.0	2.0	3.2	2.7	2.4	0.20
PC-P23	30.5	73.0	103.5	970.1	972.4	0.3	3.6	5.7	21.3	0.21
PC-P24	53.0	103.5	156.5	964.9	967.9	0.0	17.6	21.0	15.6	0.10
PC-P25	23.0	219.5	242.5	960.0	966.1	0.0	4.0	12.4	28.3	0.12
PC-P26	32.0	31.0	63.0	966.0	966.8	6.9	12.9	10.0	26.2	0.42
PC-P27	31.0	0.0	31.0	966.0	966.8	0.8	0.9	3.2	49.0	1.58
PC-P28	4.0	242.5	246.5	959.0	961.8	0.3	0.4	1.2	28.5	0.12
PC-P29	76.0	60.0	136.0	945.0	948.3	2.8	5.4	16.0	10.9	0.08
PC-P30	12.8	0.0	12.8	972.0	974.0	0.8	1.1	2.0	3.4	0.27
PC-P31	23.1	0.0	23.1	972.0	974.2	1.5	2.2	4.1	3.4	0.15
PC-P32	63.3	0.0	63.3	974.0	977.8	2.0	3.8	10.6	11.2	0.18
PC-P33	19.6	0.0	19.6	998.0	1000.5	1.0	1.5	3.3	3.6	0.18
PC-P34	35.6	0.0	35.6	974.0	977.7	1.0	1.8	5.2	11.2	0.31
PC-P35	15.7	0.0	15.7	970.0	972.8	0.5	1.2	2.4	3.8	0.24
PC-P36	17.1	0.0	17.1	972.0	975.3	1.0	1.7	4.5	3.5	0.20
PC-P37	15.7	0.0	15.7	968.0	970.9	1.0	1.6	3.9	4.6	0.29
PC-P38	12.1	0.0	12.1	964.0	966.6	0.8	1.3	2.9	4.3	0.36
PC-P39	0.7	0.0	0.7	952.0	952.6	0.1	0.2	0.1	0.9	1.29
PC-P40	9.3	0.0	9.3	954.0	954.7	2.0	2.3	1.7	1.3	0.14
PC-P41	24.6	0.0	24.6	970.0	972.7	1.0	1.6	3.5	9.5	0.39
PC-P42	28.1	0.0	28.1	946.0	949.5	0.8	1.5	4.0	10.4	0.37
PC-P43	46.3	0.0	46.3	944.0	947.2	1.5	2.6	6.6	29.6	0.64
PC-P44	18.1	0.0	18.1	942.0	945.6	0.5	1.0	2.8	4.6	0.25
PC-P45	20.6	0.0	20.6	942.0	945.9	0.5	1.1	3.1	5.4	0.26

APPENDIX C
POND DATA

Pond Number	Drainage Area			NWL	HWL	Area @ NWL	Area @ HWL	Proposed Flood Storage	Proposed 100-Year discharge	100-Year discharge per acre
	Direct	Ponded	Total							
	(ac)	(ac)	(ac)			(ac)	(ac)	(ac-ft)	(cfs)	(cfs/ac)
SAND CREEK DISTRICT										
SC-P1	106.0	0.0	106.0	950.0	955.1	1.9	3.0	12.4	59.1	0.56
SC-P2	84.0	0.0	84.0	955.0	959.0	3.0	4.3	14.8	11.8	0.14
SC-P3	84.0	0.0	84.0	952.0	955.9	3.2	4.6	15.1	10.6	0.13
DNR #104W	310.0	274.0	584.0	948.0	949.1	120.0	249.7	146.9	2.6	0.00
SC-P4	82.0	0.0	82.0	970.0	974.0	3.0	4.4	14.4	11.5	0.14
SC-P5	29.0	0.0	29.0	990.0	993.3	1.2	1.8	5.3	3.3	0.11
SC-P6	130.0	0.0	130.0	975.0	975.7	5.0	7.1	22.6	18.6	0.14
SC-P7	107.0	106.0	213.0	980.0	983.8	5.0	7.1	22.9	21.0	0.10
SC-P8	119.0	183.0	302.0	996.0	1001.7	3.3	15.1	23.7	17.7	0.06
SC-P9	113.0	70.0	183.0	1004.0	1007.0	5.6	15.0	27.0	8.4	0.05
SC-P10	70.0	0.0	70.0	1020.0	1021.7	8.2	12.5	17.7	2.7	0.04
SC-P11	273.0	0.0	273.0	1000.0	1002.3	0.3	16.2	31.2	122.6	0.45
SC-P12	74.0	273.0	347.0	997.0	1001.5	3.0	4.4	16.8	107.7	0.31
SC-P13	40.0	347.0	387.0	992.5	997.9	0.3	1.0	4.2	113.4	0.29
SC-P14	15.0	387.0	402.0	991.0	994.4	0.5	0.6	1.8	124.1	0.31
SC-P15	19.0	0.0	19.0	1000.0	1003.2	0.0	0.5	1.2	21.9	1.15
SC-P16	8.0	421.0	429.0	986.4	992.3	0.0	0.2	0.1	162.7	0.38
SC-P17	53.0	0.0	53.0	1008.0	1010.9	3.8	10.9	13.9	2.7	0.05
SC-P18	53.0	0.0	53.0	1006.0	1009.9	1.8	6.0	13.8	2.8	0.05
SC-P19	66.0	0.0	66.0	980.0	982.7	4.2	5.1	13.6	2.9	0.04
SC-P20	28.1	0.0	28.1	952.0	955.1	1.0	1.7	4.1	10.0	0.4

NOTE:
Proposed wet volume at NWL is based on standard nurp criteria for 2.5-inches of rainfall.

APPENDIX C
POND DATA

Pond Number	Drainage Area			NWL	HWL	Area @ NWL	Area @ HWL	Proposed Flood Storage	Proposed 100-Year discharge	100-Year discharge per acre
	Direct	Ponded	Total							
	(ac)	(ac)	(ac)			(ac)	(ac)	(ac-ft)	(cfs)	(cfs/ac)
RS-P13	81.0	60.0	141.0	944.0	949.0	1.5	3.0	11.6	45.7	0.3
RS-P15	20.0	0.0	20.0	942.0	945.0	0.8	1.3	3.2	4.5	0.2
RS-P16	23.0	146.0	169.0	966.0	971.0	0.3	0.7	2.4	63.5	0.4
RS-P17	66.0	80.0	146.0	976.0	980.7	2.0	3.7	12.7	43.6	0.3
RS-P18	34.0	46.0	80.0	982.0	986.8	0.8	1.3	5.1	18.5	0.2
RS-P19	46.0	0.0	46.0	994.0	996.9	2.8	3.8	9.8	2.9	0.1
RS-P20	8.0	0.0	8.0	944.0	947.5	0.2	0.3	0.8	6.5	0.8
RS-P21	18.0	0.0	18.0	948.0	952.2	0.4	0.7	2.3	6.3	0.4
RS-P22	60.0	0.0	60.0	982.0	987.1	1.0	2.2	8.2	22.3	0.4

APPENDIX D – WATER SEWER SYSTEM COSTS

APPENDIX D
STORM WATER SYSTEM COSTS

Point		Size	Length	Unit Cost	Pond Area at HWL	City Trunk Costs			
						Construction	Easement Acquisition	Cont., Eng., Admin., Fiscal	Total Cost
From	To	(in)	(ft)	($)	(ac)	($)	($)	($)	($)
PHILLIPS CREEK DISTRICT									
PC-P1					16.0	72,000	200,000	95,200	367,200
PC-P2					18.0	81,000	225,000	107,100	413,100
PC-P3					3.9	17,550	48,750	23,205	89,505
PC-P4					5.8	52,200	72,500	43,645	168,345
PC-P5					3.9	50,700	48,750	34,808	134,258
PC-P6					10.4	46,800	130,000	61,880	238,680
PC-P7					3.6	16,200	45,000	21,420	82,620
PC-P8					8.6	38,700	107,500	51,170	197,370
PC-P9					6.2	27,900	77,500	36,890	142,290
PC-P10					6.1	27,450	76,250	36,295	139,995
PC-P11					11.8	106,200	147,500	88,795	342,495
PC-P12					30.0	20,000	375,000	138,250	533,250
PC-P13					15.0	67,500	187,500	89,250	344,250
PC-P14					4.1	18,450	51,250	24,395	94,095
PC-P15					1.9	17,100	23,750	14,298	55,148
PC-P16					3.2	14,400	40,000	19,040	73,440
PC-P17					61.5	20,000	768,750	276,063	1,064,813
PC-P18					6.0	27,000	75,000	35,700	137,700
PC-P19					2.2	9,900	27,500	13,090	50,490
PC-P20					13.2	59,400	165,000	78,540	302,940
PC-P21					4.8	62,400	60,000	42,840	165,240
PC-P29					5.4	48,600	67,500	40,635	156,735
PC-P30					1.1	4,950	13,750	6,545	25,245
PC-P31					2.2	9,900	27,500	13,090	50,490
PC-P32					3.8	17,100	47,500	22,610	87,210
PC-P33					1.5	13,500	18,750	11,288	43,538
PC-P34					1.8	8,100	22,500	10,710	41,310
PC-P35					1.2	5,400	15,000	7,140	27,540
PC-P36					1.7	7,650	21,250	10,115	39,015
PC-P37					1.6	7,200	20,000	9,520	36,720
PC-P38					1.3	11,700	16,250	9,783	37,733
PC-P39					0.2	1,800	2,500	1,505	5,805
PC-P40					2.3	10,350	28,750	13,685	52,785
PC-P41					1.6	14,400	20,000	12,040	46,440
PC-P42					1.5	13,500	18,750	11,288	43,538
PC-P43					2.6	33,800	32,500	23,205	89,505
PC-P44					1.0	9,000	12,500	7,525	29,025
PC-P45					1.1	9,900	13,750	8,278	31,928

APPENDIX D
STORM WATER SYSTEM COSTS

Point		Size	Length	Unit Cost	Pond Area at HWL	City Trunk Costs			
						Construction	Easement Acquisition	Cont., Eng., Admin., Fiscal	Total Cost
From	To	(in)	(ft)	($)	(ac)	($)	($)	($)	($)
PC-P17	Phillips	36	1850	170		314,839	5,309	112,052	432,199
PC-P16	Phillips	18	500	63		31,269	1,435	11,446	44,150
PC-P15	Phillips	12	250	45		11,277	717	4,198	16,193
PC-P14	Phillips	15	120	54		6,520	344	2,403	9,267
PC-P32	Phillips	18	200	63		12,507	574	4,578	17,660
PC-P34	Phillips	18	200	63		12,507	574	4,578	17,660
PC-P31	Phillips	12	200	45		9,022	574	3,358	12,954
PC-P33	Phillips	12	200	45		9,022	574	3,358	12,954
PC-P30	Phillips	12	150	45		6,766	430	2,519	9,716
PC-P35	Phillips	12	200	45		9,022	574	3,358	12,954
PC-P12	PC-P13	24	2150	83		178,539	6,170	64,648	249,356
PC-P13	Phillips	24	100	83		8,304	287	3,007	11,598
PC-P18	Phillips	24	50	83		4,152	143	1,503	5,799
PC-P11	PC-P11.1	12	500	45		22,554	1,435	8,396	32,385
PC-P10	Phillips	24	650	83		53,977	1,865	19,545	75,387
PC-P21	PC-P23	15	1900	54		103,238	5,452	38,041	146,731
PC-P5	Phillips	18	500	63		31,269	1,435	11,446	44,150
PC-P36	Phillips	12	400	45		18,044	1,148	6,717	25,908
PC-P37	Phillips	12	100	45		4,511	287	1,679	6,477
PC-P38	Phillips	12	100	45		4,511	287	1,679	6,477
PC-P39	Phillips	12	100	45		4,511	287	1,679	6,477
PC-P40	Phillips	12	100	45		4,511	287	1,679	6,477
PC-P41	Phillips	18	150	63		9,381	430	3,434	13,245
PC-P42	Raven	18	250	63		15,634	717	5,723	22,075
PC-P9	Raven	12	500	45		22,554	1,435	8,396	32,385
PC-P8	Raven	24	450	83		37,369	1,291	13,531	52,191
PC-P19	Raven	12	150	45		6,766	430	2,519	9,716
PC-P3	PC-P43	21	1250	73		90,987	3,587	33,101	127,674
PC-P43	Raven	30	150	149		22,298	430	7,955	30,684
PC-P7	PC-P29	15	2200	54		119,538	6,313	44,048	169,899
PC-P29	Raven	18	350	63		21,888	1,004	8,012	30,905
PC-P4	Raven	24	400	83		33,216	1,148	12,028	46,392
PC-P44	Raven	12	150	45		6,766	430	2,519	9,716
PC-P45	Raven	12	100	45		4,511	287	1,679	6,477
PC-P6	Raven	30	800	149		118,923	2,296	42,427	163,645
PC-P2	Raven	12	400	45		18,044	1,148	6,717	25,908
PC-P20	PC-P1	12	1050	45		47,364	3,013	17,632	68,009
PC-P1	Raven	24	400	83		33,216	1,148	12,028	46,392
							Phillips Creek District Subtotal		**$8,040,025**

APPENDIX D
STORM WATER SYSTEM COSTS

Point		Size	Length	Unit Cost	Pond Area at HWL	City Trunk Costs			
						Construction	Easement Acquisition	Cont., Eng., Admin., Fiscal	Total Cost
From	To	(in)	(ft)	($)	(ac)	($)	($)	($)	($)
SAND CREEK DISTRICT									
SC-P2					4.3	55,900	53,750	38,378	148,028
SC-P3					4.6	59,800	57,500	41,055	158,355
DNR #104W					249.7	20,000	0	7,000	27,000
SC-P4					4.4	39,600	55,000	33,110	127,710
SC-P5					1.8	16,200	22,500	13,545	52,245
SC-P6					7.1	63,900	88,750	53,428	206,078
SC-P7					7.1	31,950	88,750	42,245	162,945
SC-P8					15.1	67,950	188,750	89,845	346,545
SC-P9					15.0	67,500	187,500	89,250	344,250
SC-P10					12.5	112,500	156,250	94,063	362,813
SC-P17					10.9	49,050	136,250	64,855	250,155
SC-P18					6.0	27,000	75,000	35,700	137,700
SC-P19					5.1	22,950	63,750	30,345	117,045
SC-P20					1.7	15,300	21,250	12,793	49,343
SC-P2	DNR #104W	18	250	63		15,634	717	5,723	22,075
SC-P3	DNR #104W	18	300	63		18,761	861	6,868	26,490
DNR #104W	Sand	12	200	45		9,022	574	3,358	12,954
SC-P10	SC-P9	12	900	45		40,598	2,583	15,113	58,294
SC-P9	SC-P8	18	750	63		46,903	2,152	17,169	66,224
SC-P8	Sand	24	850	83		70,585	2,439	25,558	98,583
SC-W19	Sand Trib.	12	900	45		40,598	2,583	15,113	58,294
SC-P17	SC-P7	12	1950	45		87,962	5,596	32,745	126,303
SC-P18	SC-P7	12	1500	45		67,663	4,304	25,189	97,156
SC-P7	Sand Trib.	24	150	83		12,456	430	4,510	17,397
SC-P6	Sand	24	500	83		41,521	1,435	15,034	57,990
SC-P5	Sand	12	500	45		22,554	1,435	8,396	32,385
SC-P20	Sand	18	200	63		12,507	574	4,578	17,660
								Sand Creek District Subtotal	**$3,164,355**
								STORMWATER SYSTEM TOTAL	**$11,204,380**

Note:
1) Cost estimates for this report are based on 2002 construction costs related to ENR cost index 6578 (November, 2002).
2) Land costs for easements assumed at $25,000/acre.
3) Engineering, Contingencies, Administration, and Fiscal at 35% (applied to construction and land costs).
4) No costs included for ponds that are existing ponds within the City limits