Report

West Side Stormwater Management Plan

Village of

Prairie du Sac, WI

February 2010

Report for

Village of Prairie du Sac, WI

West Side Stormwater Management Plan

Prepared by:

STRAND ASSOCIATES, INC.®
910 West Wingra Drive
Madison, WI 53715
www.strand.com

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SECTION 1
INTRODUCTION

1.01 BACKGROUND

Planning for future development is important for the community, land owners, and developers. A primary component of planning has to do with how land is intended to be used in the future and typically includes the development of undeveloped land. Another component that must be addressed is how increased volumes of stormwater runoff and higher peak discharges from developed conditions are going to be managed. Stormwater drainage facilities are an essential part of orderly and economical development.

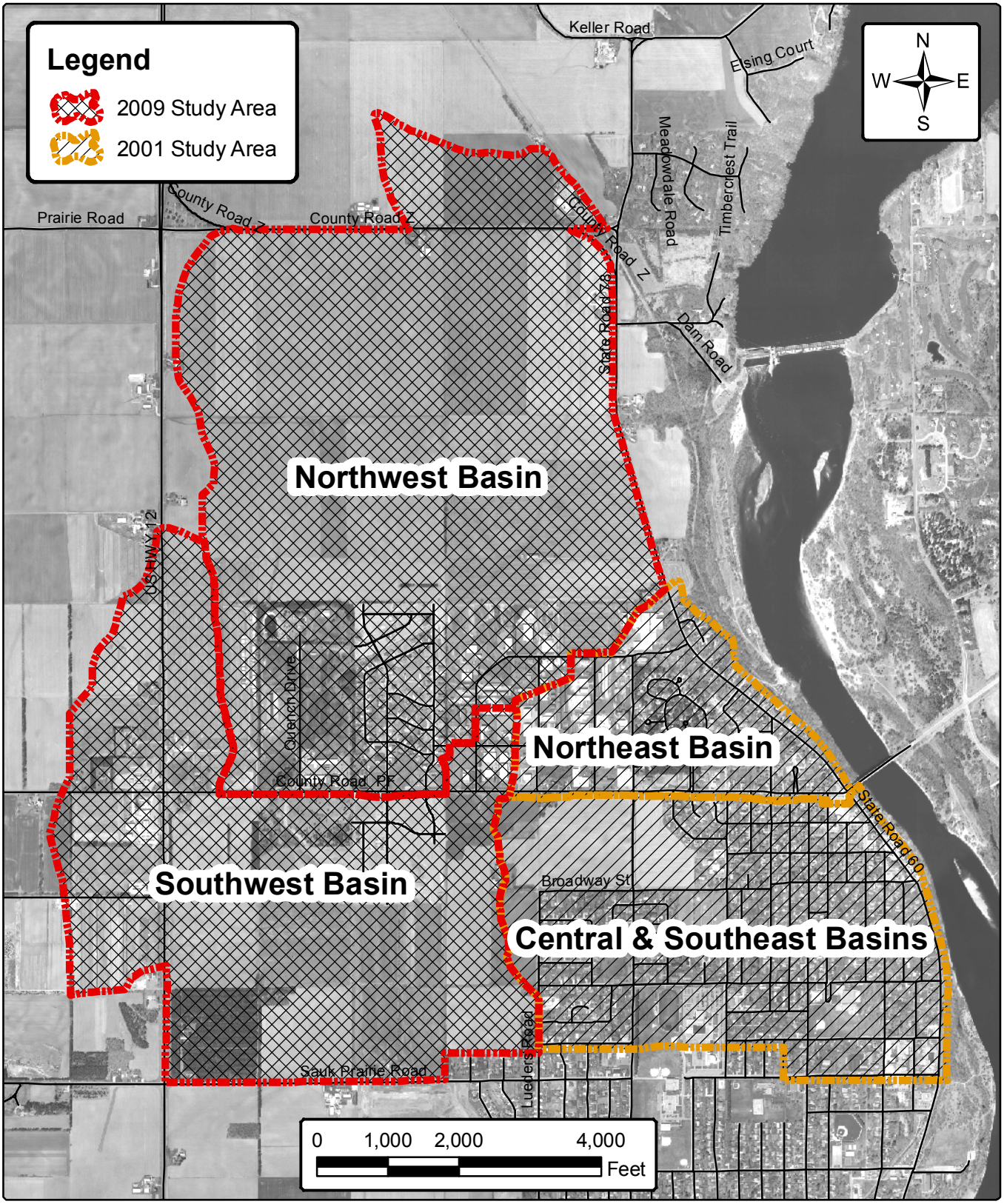
As part of the Stormwater Management Study completed by Strand Associates, Inc.® in 2001, the Northeast, Southeast, and Central drainage basins in the Village of Prairie du Sac were evaluated. The majority of these three basins were developed at the time the 2001 study was completed. The remaining two basins, the Northwest (NW) and Southwest (SW), were not included in the 2001 study (Figure 1.01-1). Current development within the NW and SW Basins include the Highland Park subdivision, portions of the Fieldstone and Westwynde subdivisions, and portions of the Industrial Park. Future expansion of the Fieldstone and Westwynde subdivisions and the Mueller property have been designed but not yet constructed. Because of the relatively flat topography within these basins, development is exceptionally challenging. The purpose of this study is to identify sustainable measures that allow for future land development within the NW and SW Basins to occur.

When planning for future development, it is vital to consider how stormwater quality and quantity will be managed to accommodate new development. It is also important to evaluate potential impacts to downstream receiving lands. As development has occurred within the NW and SW Basins, stormwater management facilities have typically been constructed on a “site-by-site” basis.

An alternative approach to site-by-site stormwater management would be to construct regionalized facilities at critical locations within the watershed that serve to reduce peak flows, provide water quality treatment, and safely convey floodwaters. These facilities can be in the form of wet detention basins, sediment and infiltration basins, or engineered channels.

If regional stormwater facilities are not pursued, it may be prudent to establish a maximum cubic foot per second (cfs) per acre release rate to limit the discharge of runoff to that of existing conditions or to capacities of existing receiving stormwater conveyance facilities. With a maximum stormwater release rate, the developer would be required to implement stormwater management techniques on a site-by-site basis in order to comply with the set limitation.

There are five sections in this report. Section 1 provides introductory and general information regarding the study. Section 2 provides a description of the planning area, including watershed characteristics and existing stormwater facilities. Section 3 summarizes results of the engineering analyses of watershed hydrology, hydraulics, and total suspended (TSS) loadings. Section 4 discusses potential implementation of regional stormwater management facility alternatives. Section 5 summarizes overall conclusions and recommendations.



S:\MAD\1300--1399\1381\019\Data\GIS\Figures\For Report\Figure 1.01-1 StudyLimitsMap.mxd

STORMWATER MANAGEMENT STUDY LIMITS

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRIARIE DU SAC
SAUK COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 1.01-1
1381.019

1.02 STORMWATER MANAGEMENT ISSUES

Based on discussions with Village staff, we believe the following are the most critical stormwater management issues facing the NW and SW Basins of the Village:

A. Comprehensive Mapping

The Village needs comprehensive mapping of existing stormwater management facilities and drainage basins. This mapping should include topographic data, drainage basin divides, primary drainageways and channels, culvert crossings, storm sewer systems and outfalls, and locations of existing stormwater detention/infiltration basins. This report provides such mapping for the NW and SW Basins.

B. Stormwater Impacts from Future Development

Because much of the NW and SW Basins currently consists of undeveloped lands, it is understood that sound stormwater planning will be necessary to accommodate future development. Because soils in the watershed are predominantly sandy in nature, undeveloped lands generally drain efficiently via infiltration and produce lesser amounts of stormwater runoff. However, as land development within the watershed continues to occur, introduction of additional impervious surface (roadways, parking lots, and rooftops) will have a more significant impact to increases in stormwater runoff volumes and flows when compared to land development where clayey or loamy soils are present. Additionally, the primary conveyance feature in the watershed is an open drainageway that has little slope and no defined stable bed and bank. This fact makes development of lands adjacent to the existing drainageway difficult and challenging. Implementation of a more defined open drainageway will be necessary to facilitate future development in the watershed, particularly between Broadway Street and Sauk Prairie Road and also northwest of the Highland Park subdivision.

1.03 SCOPE OF STUDY

This study was completed to identify, locate, and quantify stormwater management features to address impacts of land development in the NW and SW Basins. This study is also intended to supplement the Stormwater Management Study for the central and eastern portions of the Village that was completed in 2001.

Components of the study include the following:

A. Navigability Determination Request

A navigability determination from the Wisconsin Department of Natural Resources (WDNR) was requested for the open drainageway from the north end of 20th Street to Sauk Prairie Road. A site visit was completed on April 27, 2009, by WDNR Water Management Specialist Jeff Schure. Based on this determination, there are no navigable waterways present between 20th Street and Sauk Prairie Road. Documentation of this navigability request is included in Appendix A.

B. Drainage Basin and Outfall Mapping

Watershed mapping identified major and minor drainage basin divides, outfalls, storm sewers, culverts, ditches, channels, detention basins, and environmental features. Outfalls and culvert structures were located using mapping-grade global positioning system (GPS) techniques. Storm sewers, detention basins, and other conveyance facilities were supplemented by review of existing subdivision plans.

C. Land Use and Water Resources Feature Mapping

Land use mapping provided by the Village was utilized for Source Load and Management Model (SLAMM) and hydrologic modeling. National Wetlands Inventory mapping was used to determine that no wetland locations are present in the NW or SW Basins.

D. Hydrologic Modeling

Hydrologic models were developed using the HydroCAD computer software program to reflect both existing and future conditions within the study watershed. Existing and future 2-, 10-, 25- and 100-year peak discharges and runoff volumes were estimated and are summarized in this report.

E. Water Quality Modeling

A WinSLAMM computer model was developed for the study watershed for baseline conditions (no controls), existing conditions (with current controls), and future conditions. This model will evaluate current pollutant loadings to outfalls and review impacts of alternative best management practices (BMP).

F. Regional BMP Implementation Evaluation

Potential locations and impacts of BMPs, including proposed drainageways and detention basins, were identified. Conceptual designs were developed and modeled for these regional stormwater management facilities. Opinions of probable capital costs and annual operations and maintenance costs for recommended facilities were developed. In addition, a possible cost-sharing model for apportionment and recovery of costs to the stormwater utility were prepared.

1.04 ABBREVIATIONS AND ACRONYMS

ac	acre
BMP	best management practices
cfs	cubic foot per second
CMCP	corrugated metal culvert pipe
CN	runoff curve number
FS	Fieldstone Subdivision
ft	feet
GPS	Global Positioning System
HERCP	horizontal elliptical reinforced concrete pipe

hr	hour
HSG	Hydrologic Soil Group
HP	Highland Park Subdivision
in	inch
NRCS	National Resource Conservation Service
NW	Northwest
RCBC	reinforced concrete box culvert
RCP	reinforced concrete pipe
SLAMM	Source Loading and Management Model
sq ft	sq ft
SW	Southwest
t_c	time of concentration
TIF	Tax Incremental Financing
TRM	targeted runoff management
TRM	turf reinforcement mat
TSS	total suspended solids
UNPS&SW	Urban Nonpoint Source and Stormwater Management
WDNR	Wisconsin Department of Natural Resources
WW	Westwynde Subdivision

SECTION 2
DESCRIPTION OF PLANNING AREA

2.01 WATERSHED DESCRIPTION

A. General

The amount of stormwater discharging from a watershed depends on a number of physical characteristics. Watershed size and topography, land use, soil types and degree of saturation, type of drainage system (i.e., storm sewers, open channels), and amount of watershed storage available all affect stormwater discharge. To quantify stormwater flows and volumes, an inventory of watershed physical characteristics in the Village was completed. This section describes physical land characteristics within the NW and SW Basins which impact stormwater runoff.

2.02 PROJECT SETTING

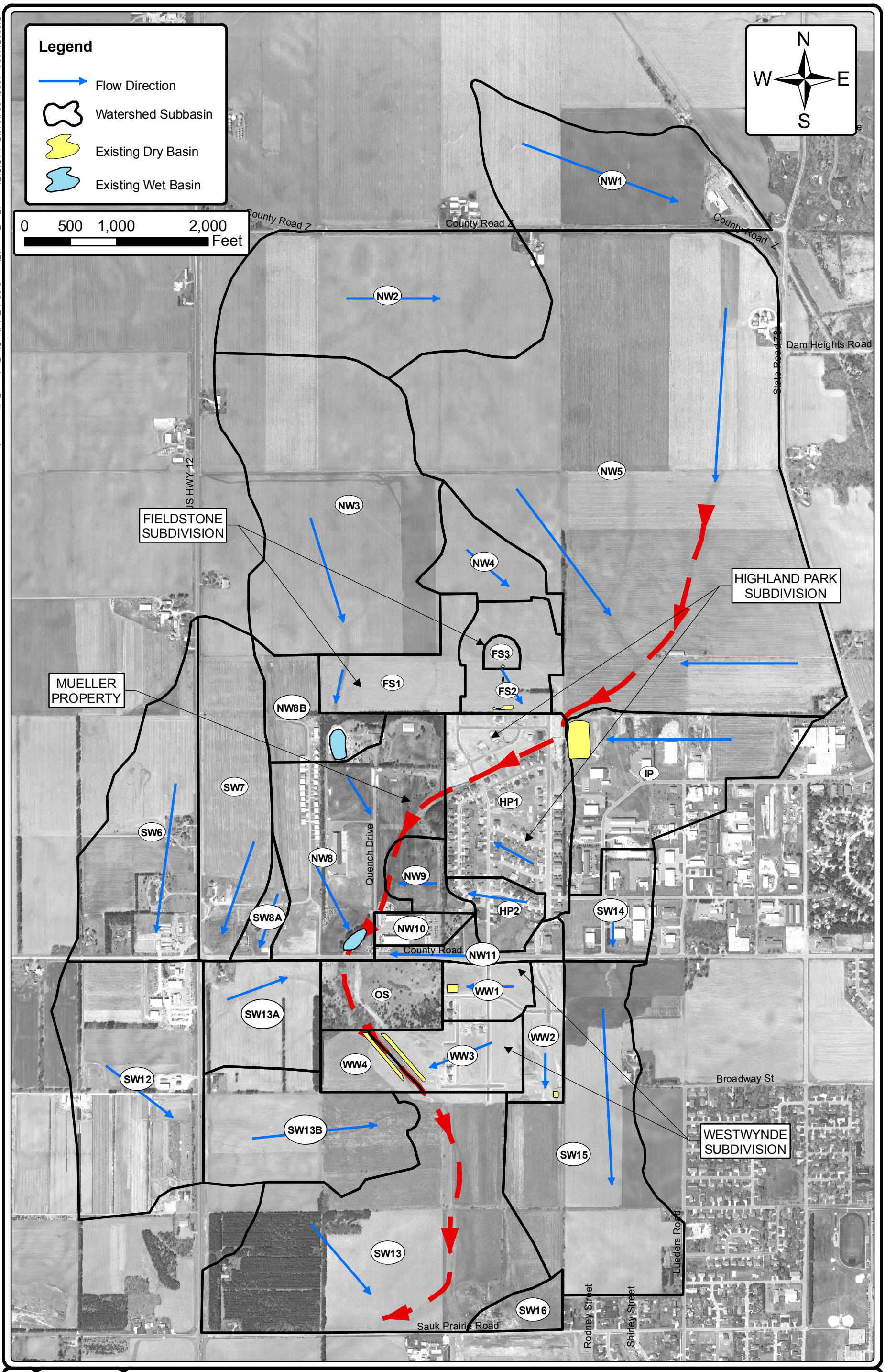
A. Topography and Drainage Patterns

The majority of the NW and SW Basins lie in the Honey Creek watershed. The Honey Creek watershed includes a 220-square-mile area (130,000 acres) that drains a southerly portion of Sauk County. The NW and SW Basins consist of approximately 1,500 acres of primarily undeveloped lands that generally drain in a southwesterly direction. Figure 2.02-1 identifies existing drainage patterns within the study watershed. Primary stormwater conveyance in the watershed is via a natural open drainageway that bisects the drainage basin. The open drainageway generally has gradual slopes between 0.003 and 0.004 ft/ft and does not have a defined bed and bank. Within undeveloped areas, the drainageway generally consists of cultivated farmland.

The open drainageway, which begins approximately 5,000 feet southwest of the intersection of County Road Z and State Route 78 within Subbasin NW5, is directed to the southwest and meanders through the Highland Park subdivision. The drainageway continues to the southwest across the Mueller property through an existing wet detention basin located immediately north of County Highway PF. South of County Highway PF, the drainageway is directed through the Westwynde subdivision. The natural drainageway abruptly ends on the north side of Sauk Prairie Road where it discharges through an existing 2-foot by 7-foot reinforced concrete box culvert beneath Sauk Prairie Road. Sauk Prairie Road serves as the likely future corporate boundary between the Village of Prairie du Sac (to the north) and the Village of Sauk City (to the south). Additional culvert capacity under Sauk Prairie Road is provided via two separate 24-inch-diameter corrugated metal culvert pipes (CMCPs).

Based on visual inspection, there is no defined drainage ditch downstream of Sauk Prairie Road. Based on review of available topographic contour data, drainage is directed to the southwest through cultivated farmland and passes under USH 12 approximately 2,000 feet downstream of Sauk Prairie Road.

Approximately 140 acres of the SW Basin (Subbasins SW14, WW2, and SW15) include industrial and undeveloped lands that drain in a southeasterly direction via overland flow. The existing agricultural areas have relatively flat slopes of approximately 0.01 ft/ft. These lands ultimately drain to the southeast corner of the Wiess Property, where drainage is directed to a small rear-yard depression located between Lueders Road and Shirley Street, north of Sauk Prairie Road. Drainage from this depression is directed to the south to an existing 18-inch apron end wall located on the north side of Sauk Prairie Road approximately 1,500 feet west of Lueders Road. This 18-inch apron end wall ultimately ties into the Village of Sauk City's storm sewer system.



S:\MAD\1300--1399\1381\019\Data\GIS\Figures\For Report\Figure 2.02-1 ExistingSiteDrainagePatterns.mxd

EXISTING DRAINAGE PATTERNS

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

STRAND ASSOCIATES, INC. ENGINEERS

FIGURE 2.02-1
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In summary from the 2001 Stormwater Management Plan, the Northeast, Central, and Southeast Basins are primarily urbanized lands consisting of approximately 440 acres outfalling to the Wisconsin River and 170 acres outfalling to a detention basin in Walter Doll Park.

B. Land Use and Development Plan

Land use also affects the amount of stormwater runoff that will be produced by a rain event. Urbanization and development reduce the ability of the ground to absorb stormwater, typically causing peak discharges and runoff volumes to increase. The time from the beginning of the storm event to the occurrence of the peak runoff may be significantly shortened.

Existing Village land use is shown on Figure 2-02.2 and summarized in Tables 2.02-1 and 2.02-2. As indicated, present land use is primarily agricultural in both the NW and SW Basins. Residential land use includes the development of the Highland Park (Subbasins HP1, HP2) subdivision and portions of the Fieldstone (Subbasin FS2) and Westwynde (Subbasins WW1, WW2, WW3) subdivisions. The Sauk-Prairie Airport, defined as transportation land use, occupies lands located immediately east of USH 12 and north County Road PF. Industrial areas are primarily concentrated within Subbasins IP (Industrial Park), SW14, and on the Mueller property (Subbasins NW9 and NW10).

Land Use	Area (ac)	
	Existing	Future
Agriculture	845	7
Commercial	5	178
Industrial	52	271
Institutional	10	10
Open Space/Water	14	21
Residential	104	543
Transportation (Airport)	38	38
Total	**1,068**	**1,068**

Table 2.02-1 Prairie du Sac Land Use Summary–Northwest Basin

Land Use	Area (ac)	
	Existing	Future
Agriculture	528	62
Commercial	35	92
Industrial	15	54
Institutional	1	1
Open Space/Water	-	47
Residential	49	371
Transportation (Airport)	57	57
Total	**684**	**684**

Table 2.02-2 Prairie du Sac Land Use Summary–Southwest Basin

Future Village land use is shown on Figure 2-02.3 and summarized in Tables 2.02-1 and 2.02-2. Future land uses for the purposes of this report were based on the Sauk Prairie Comprehensive Plan of January 2006. Future residential development is expected to occur in areas south of County Road PF, including the expansion of the Westwynde subdivision (Subbasin WW4). Additional expansion of the industrial park and office/research land uses to the north of the existing industrial park area are also expected.

It must be noted that the Village's comprehensive plan for 20-year growth shows the future land use in Subbasins NW1, NW2, NW3, NW4, NW5 and SW6 to be agriculture. For planning purposes and sizing of regional stormwater facilities, the above-mentioned subbasins have been assumed to be residential, industrial, commercial, or a combination thereof. Future development in the NW and SW Basins will directly affect the sizing of future stormwater facilities and impact already developed areas.

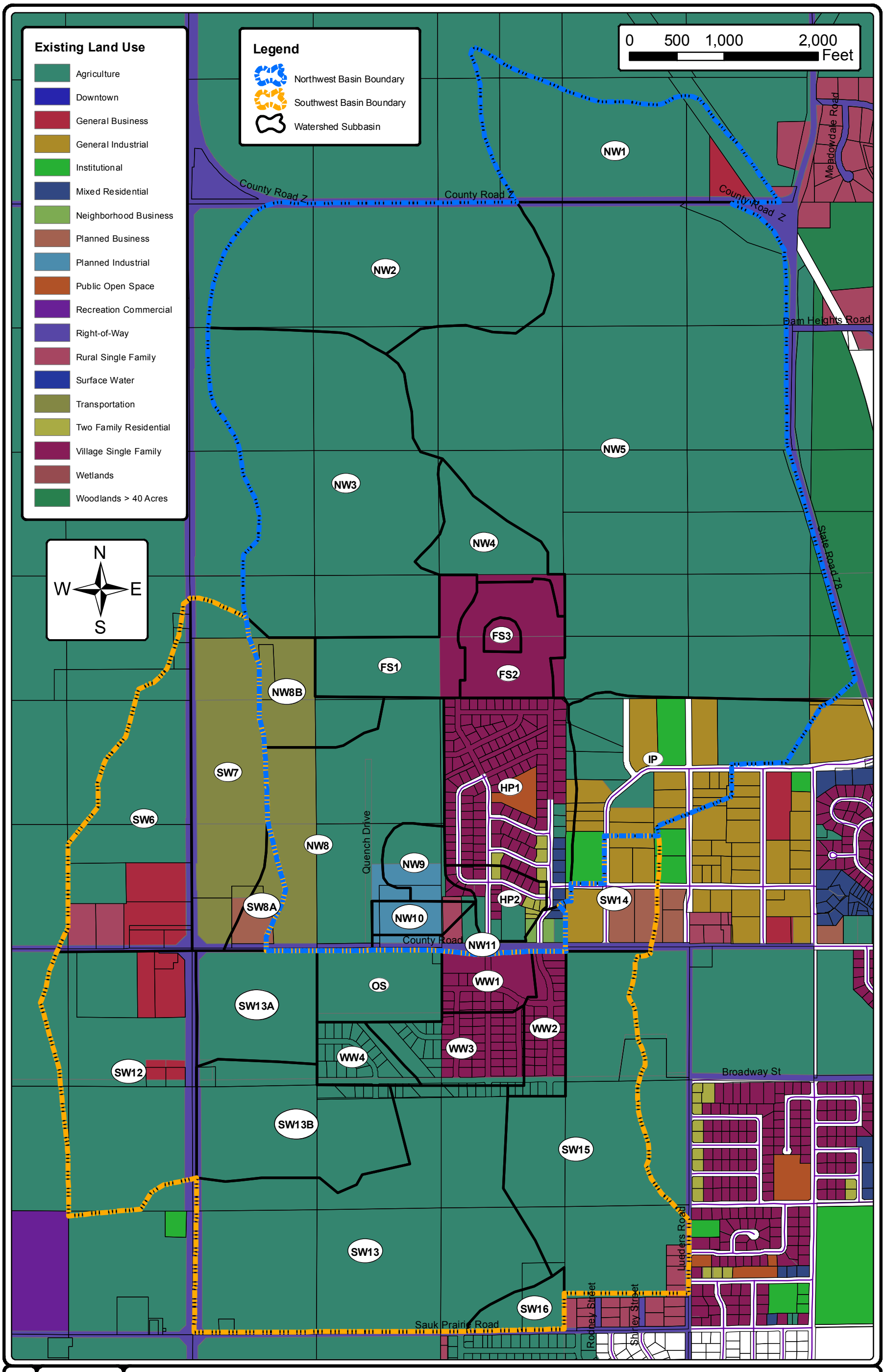

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FIGURE 2.02-2
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EXISTING LAND USE

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

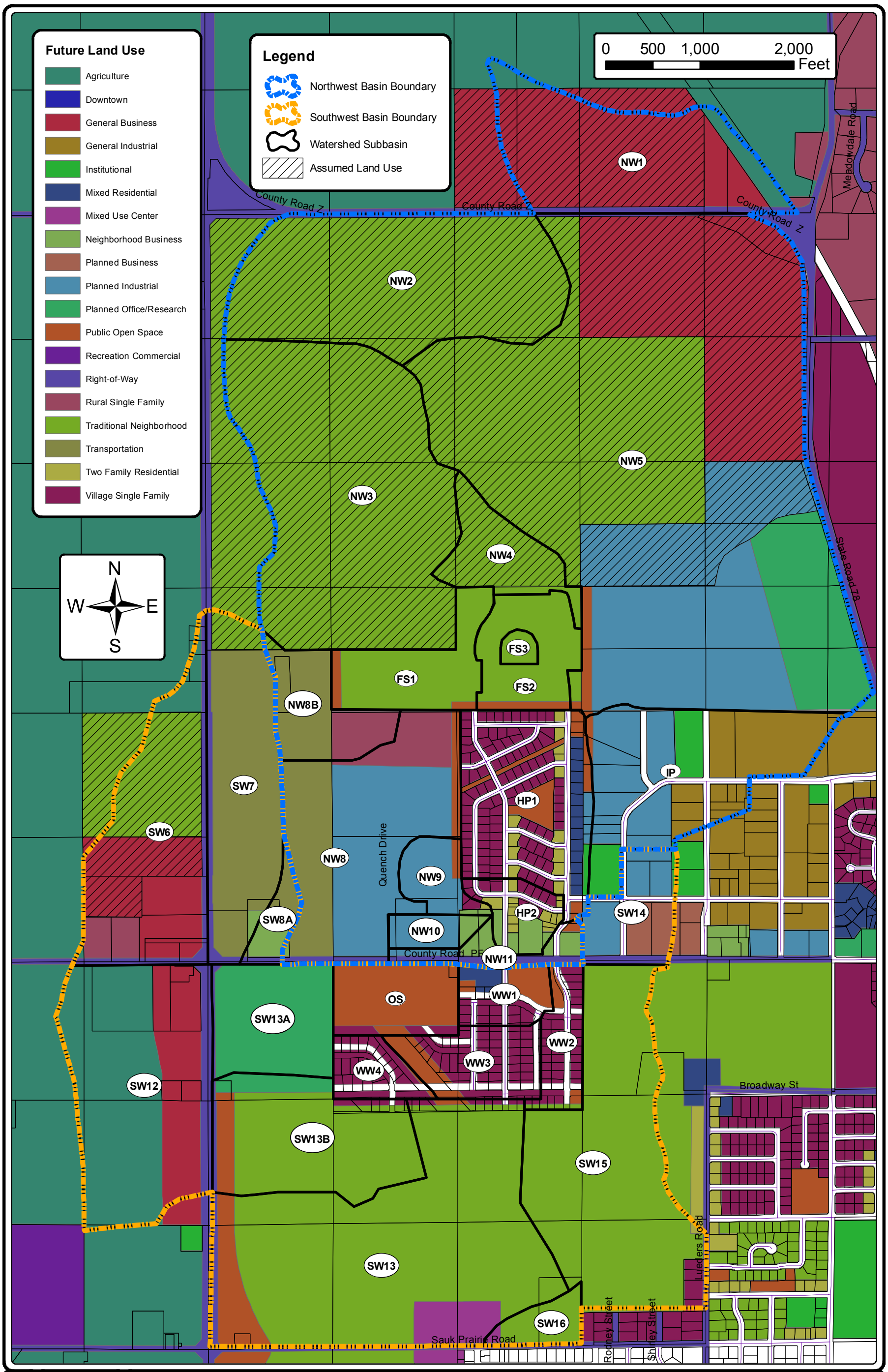

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FIGURE 2.02-3
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FUTURE LAND USE

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

C. Soils

The amount of stormwater runoff produced by a storm event is impacted by the types of soil underlying the watershed. Soils having a high percentage of sand and gravel will absorb a higher percentage of stormwater runoff than will soils having a high clay content.

This means that sandy soil generally produces less runoff than clayey soil. The Natural Resource Conservation Service (NRCS) classifies soil types in categories known as Hydrologic Soil Groups (HSG). Group A soils consist of sandy soils having high infiltration rates and low runoff potential. Group B soils have moderately fine to moderately coarse textures and moderate runoff potential. Group C soils are typically sandy clay loam soils having moderately fine to fine textures and low infiltration capacity. Examples of Group D soils have a very low infiltration capacity and have high runoff potential.

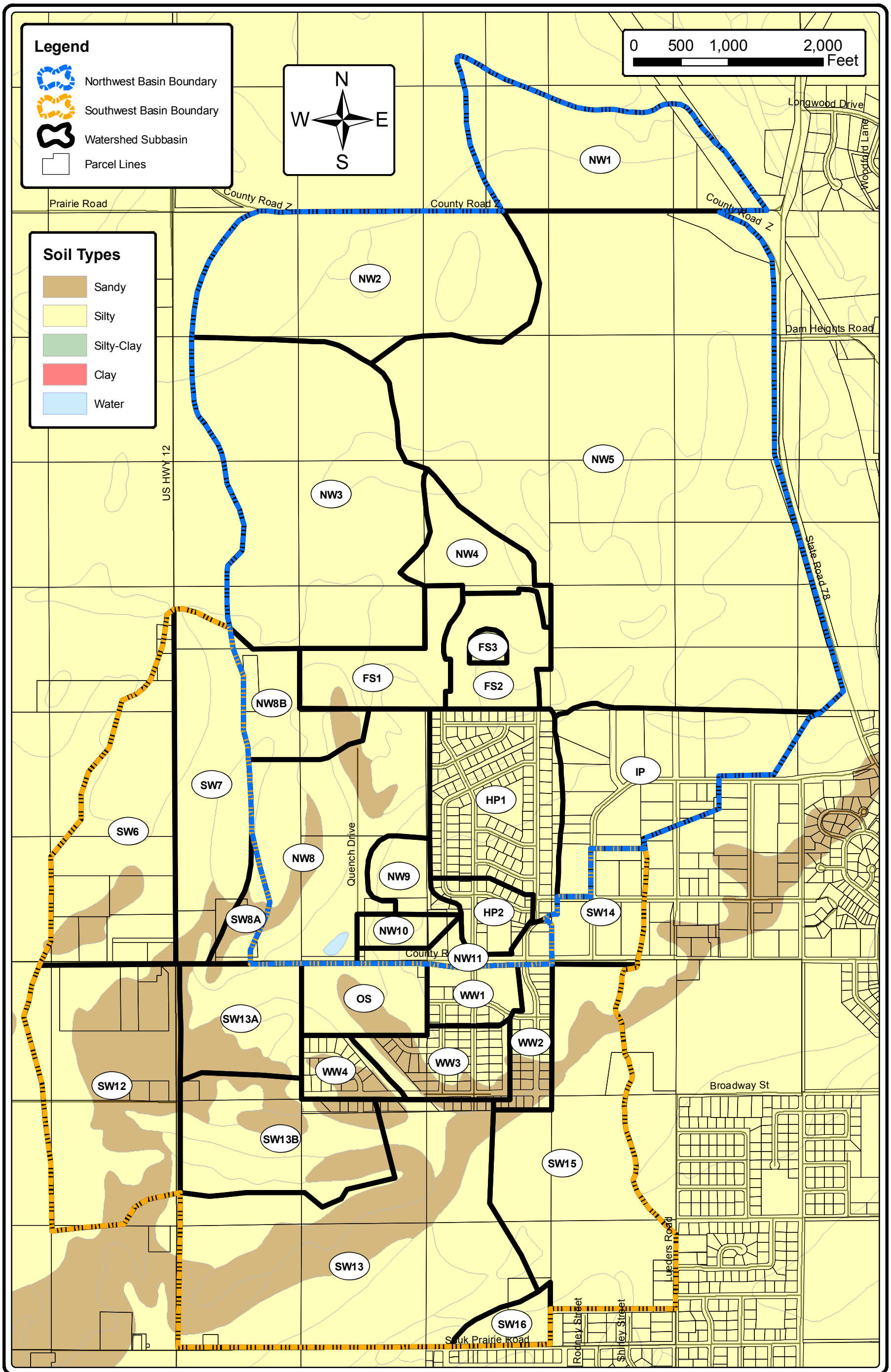
Soil types in the Village are identified in Figures 2.02-4 and 2.02-5. Soils in the NW Basin are primarily silty and more specifically classified as HSG B soils. The SW Basin has a combination of sandy (HSG A) and silty (HSG B) soils. Infiltration rates for Group A soils range from 0.30 to 0.45 inches per hour. Group B soils have infiltration rates ranging between 0.15 and 0.30 inches per hour.

D. Wetlands and Navigable Streams

There are no regulatory wetland areas in the NW or SW Basins according to the review of National Wetland Inventory mapping. A copy of the wetland mapping from the National Wetland Inventory for the Prairie du Sac area can be found in Appendix A. A navigability determination was requested from the WDNR for the drainageway between the north end of 20th Street and Sauk Prairie Road. A portion of the drainageway south of County Highway PF appears to be an intermittent stream according to the WDNR Water Surface Viewer map. However, based on correspondence with Jeff Schure, Water Management Specialist with the WDNR, there are no navigable waterways between the north end of 20th Street to Sauk Prairie Road and no Chapter 30 permit issues in relation to this drainage area. A copy of the e-mail correspondence and WDNR Water Surface Viewer map can be found in Appendix A.

E. Rainfall Depths and Critical Duration Analysis

Rainfall depths for the 2-, 10-, 25-, and 100-year storm frequencies at various storm durations are summarized in Table 2.02-3. Rainfall depths used for the hydrologic analysis were taken from Bulletin 71, *Rainfall Frequency Atlas of the Midwest,* Floyd A. Huff and James R. Angel, 1992. Appropriate Huff rainfall time distributions taken from Circular 173, *Time Distribution of Heavy Rainstorms in Illinois,* Floyd A. Huff, 1990, were applied for the analysis. A critical duration analysis was completed for different regions within the study area to determine which storm duration resulted in the highest runoff discharge. Factors such as land surface topography, soils, and land use can impact the critical duration.



S:\MAD\1300--1399\1381\019\Data\GIS\Figures\For Report\Figure 2.02-4 SoilsMap.mxd

FIGURE 2.02-4
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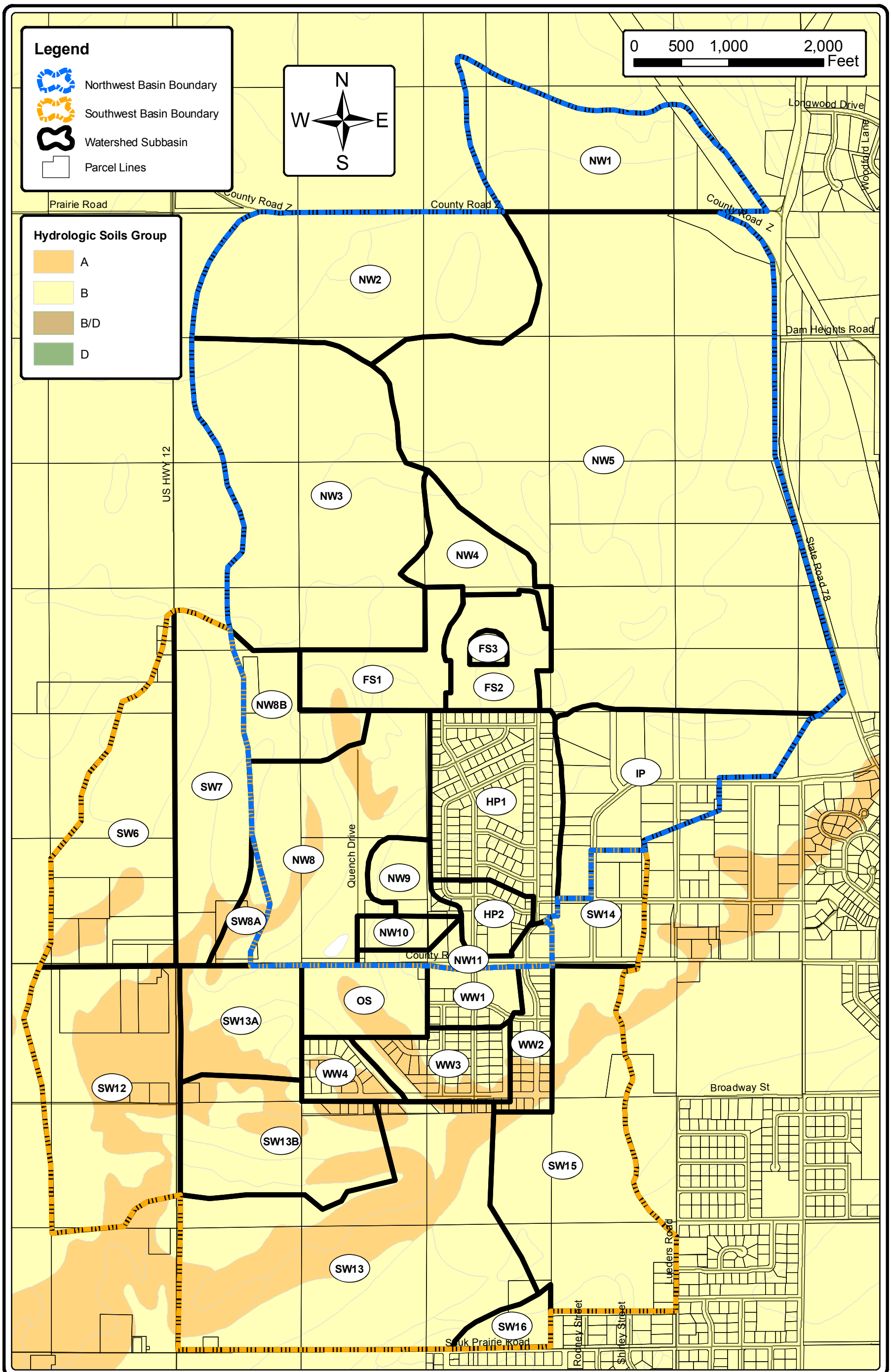
SOIL TYPES

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN



S:\MAD\1300--1399\1381\019\Data\GIS\Figures\For Report\Figure 2.02-5 SoilsHSGMap.mxd

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FIGURE 2.02-5
1381.019

HYDROLOGIC SOIL GROUPS

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

Frequency (yr)	Storm Duration (hr)						
	1-hr	2-hr	3-hr	6-hr	12-hr	18-hr	24-hr
2	1.33	1.64	1.80	2.12	2.45	2.65	2.82
10	2.03	2.50	2.76	3.23	3.75	4.05	4.31
25	2.49	3.07	3.39	3.97	4.60	4.97	5.29
50	2.90	3.58	3.95	4.63	5.37	5.80	6.17
100	3.36	4.15	4.58	5.36	6.22	6.72	7.15

* Reference: Huff, Floyd A and Angel, James R., Rainfall Frequency Atlas of the Midwest, Midwestern Climate Center, Bulletin 70, 1992.

Table 2.02-3 Design Storm Rainfall Depths (Inches)

2.03 CULVERTS AND OTHER CONVEYANCE FACILITIES

A. Existing Culverts, and Other Conveyance Facilities

There are numerous existing cross culverts in the NW and SW Basins that convey runoff from one subbasin to another. These culverts range in size between 12 inches and 48 inches in diameter and are typically located beneath existing roadways. Table 2.03-1 summarizes physical characteristics and estimated capacities of the existing culverts within the NW and SW Basins. Overtopping capacities and frequencies were calculated using the CulvertMaster software by inputting approximate roadway/berm overtopping elevations and culvert tailwater characteristics.

The natural drainageway originating in the northeast corner of the Village and extending to the southwest corner is conveyed through two separate 3.5-foot by 10-foot reinforced concrete box culverts crossings (20th and 21st Street) within an engineered greenway in the Highland Park subdivision. The culverts through Highland Park also convey any excess runoff that does not infiltrate within the existing Industrial Park dry basin. Moving downstream, the drainageway is directed to the southwest through the Mueller property and passes through a cross culvert under Quench Drive. Drainage is then directed to a wet detention basin located at the northwest corner of County Road PF and Quench Drive. Twin 48-inch corrugated metal culverts serve as the outlet for the wet detention basin. The drainageway then meanders through an engineered swale constructed as part of the Westwynde subdivision. There are two dry basins bordering each side of the swale. Any excess stormwater that does not infiltrate within these two dry basins overflows to the adjacent drainage swale. As the Westwynde subdivision completes its development, a box culvert will need to be installed along the constructed greenway once Broadway Street is extended to the west.

In addition to the Industrial Park dry basin and the wet detention basin located at the County Road PF and Quench Drive intersection, the Fieldstone and Westwynde subdivisions include several smaller stormwater detention facilities. These detention facilities collect and store runoff within the subdivisions before ultimately discharging to the natural drainageway.

TABLE 2.03-1

EXISTING CULVERT CHARACTERISTICS AND CAPACITIES

Label	Location	Tributary Area (ac)	Size (in)	Material	Length (ft)	Invert Elevations Inlet (ft)	Invert Elevations Outlet (ft)	Crest Elevation (ft)	Overtopping Conditions Capacity (cfs)	Overtopping Conditions Existing Storm Event Capacity	Overtopping Conditions Future Storm Event Capacity
1	NW1 - NW5	73	27	RCP	76	826.1	826.5	832.3	30.1	< 10 yr	< 2 yr
2	FS2 - NW4	22	27x42	HERCP	620	818.4	809.9	824.0	62.3	-	-
3	FS2 - NW5	27	15	RCP	466	810.4	805.8	809.0	8.7	< 25 yr	< 25 yr
4	FS2 - NW5	0.5	19 x 30	HERCP	137	806.3	805.8	809.0	9.7	-	-
5	FS2 - NW5	0.5	19 x 30	HERCP	137	806.3	805.8	809.0	9.7	-	-
6	IP - HP1	34	27	RCP	54	805.5	805.4	808.7	38.2	< 100 yr	< 10 yr
7	IP - HP1	34	27	RCP	54	805.5	805.4	808.7			
8	HP1	579	42x120	RCBC	96	803.0	802.6	808.0	263.2	< 25 yr	> 100 yr
9	HP1	638	42x120	RCBC	64	798.4	798.1	803.8	327.9	< 25 yr	> 100 yr
10	SW6 - SW12	71	18	CMCP	36	815.9	815.5	818.4	9.5	< 10 yr	< 2 yr
11	SW6 - SW7	2	24	RCP	123	815.2	814.1	820.7	30.1	-	-
12	SW7 - SW13A	60	27	RCP	106	811.4	809.4	818.1	31.8	> 100 yr	> 100 yr
13	SW8A - SW13A	8	24	CMCP	43	803.2	802.6	806.9	18.7	> 100 yr	> 100 yr
14	NW8 - OS	481	48	CMCP	55	787.8	787.0	794.1	205.0	< 10 yr	> 100 yr
15	NW8 - OS	481	48	CMCP	55	787.9	787.2	794.1			
16	NW11 - NW8	11	12	CMCP	61	795.8	794.5	797.2	3.1	< 10 yr	< 2 yr
17	NW11	2	15	CMCP	53	813.5	813.4	815.4	4.2	-	-
18	NW11	2	15	CMCP	53	813.4	813.2	815.4	4.6	-	-
19	NW11	2	12	CMCP	57	816.6	816.2	818.3	2.7	-	-
20	SW14	6	15	CMCP	71	817.6	816.6	821.2	7.0	-	-
21	SW14 - SW15	22	30	CMCP	63	815.7	815.1	822.4	42.7	> 100 yr	> 100 yr
22	SW12 - SW13A	8	27	RCP	85	806.0	805.6	812.6	33.4	-	-
23	SW12 - SW13	153	48	RCP	86	799.6	797.7	810.1	174.1	> 100 yr	> 100 yr
24	SW13	6	24	CMCP	56	794.5	794.4	799.2	20.8	-	-
25*	SW13	1,499	24	CMCP	32	764.9	764.3	768.2	23.7	< 10 yr	< 10 yr
26*	SW13	1,499	24	CMCP	32	764.7	764.2	768.0	24.0	< 10 yr	< 10 yr
27*	SW13	1,499	24x84	RCBC	22	765.2	765.3	768.0	92.2	< 10 yr	< 10 yr
28	S OF SW15	2	12	CMCP	28	767.8	767.8	769.5	2.6	-	-
29	S OF SW15	2	18	CMCP	40	766.7	766.1	769.7	9.4	-	-
30	S OF SW15	138	18	RCP	38	766.1	765.8	769.6	13.9	< 10 yr	< 10 yr

* Note - Culverts 25, 26, & 27 Operate in Series
HERCP - horizontal elliptical reinforced concrete pipe
RCBC - reinforced concrete box culvert

B. Proposed Culverts

According to the 2004 Westwynde subdivision plans produced by Caulkins Engineering, LLC, twin 8-foot by 4-foot and one 6-foot by 4-foot box culverts are to be installed under Broadway Street once the subdivision is extended to the west. Based on calculations in CulvertMaster, these proposed culverts would have a capacity of approximately 1,250 cubic feet per second (cfs), which is sufficient capacity for both existing and future conditions.

The 2-foot by 7-foot box culvert extending beneath Sauk Prairie Road appears to have silt deposited in the culvert. Survey data also indicates that the culvert has a negative slope. The capacity of this culvert is calculated to be approximately 124 cfs. Additionally, the two existing 24-inch diameter corrugated metal culverts under Sauk Prairie Road each have a capacity of 28 cfs. The total capacity of the three culverts is therefore approximately 180 cfs, which is equivalent to an approximate 5-year storm event.

SECTION 3
ENGINEERING ANALYSIS

3.01 HYDROLOGIC MODELING

A. Methodology

A hydrologic model was developed for the NW and SW Basins within the Village. A hydrologic model is a computer-generated simulation of the precipitation runoff process. Hydrographs, which show flow variations over a length of time, are generated for a given storm event and duration. The primary purposes of hydrologic modeling are to:

1. Quantify Runoff Peak Discharges and Volumes

   Provide a means of quantifying existing and potential future condition peak discharges and stormwater runoff volumes. This data is used by engineers to size stormwater conveyance and detention facilities.

2. Compare Volume and Discharge

   Provide a tool for comparing existing versus potential future stormwater runoff volumes and peak discharges. This enables estimation of where and how much future land use changes within a watershed may impact stormwater peak discharges and runoff volumes. By incorporating stormwater management facilities or land use practices, impacts resulting from future development on stormwater runoff amounts can be evaluated.

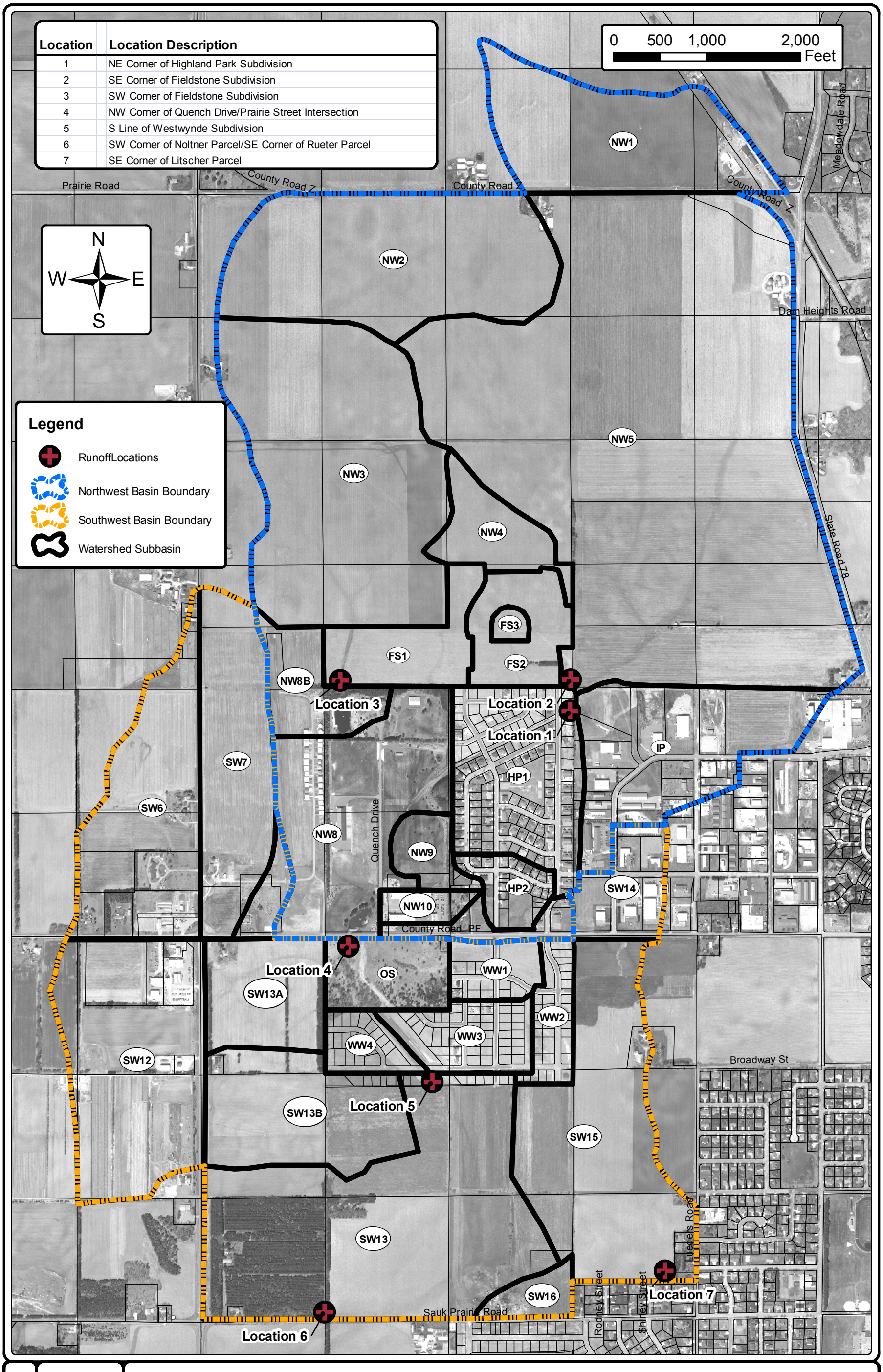
For this project, hydrologic models were developed using the HydroCAD computer program for existing and future development conditions. HydroCAD is a hydrograph routing model where the program is designed to handle flows that vary over time. Primary input parameters include the drainage area, runoff curve number (CN), and time of concentration (t_c). The CN considers land use, soil types, and saturation conditions and dictates the volume of stormwater runoff for a given rainfall depth. The t_c is the time it takes for stormwater to travel from the most hydrologically remote point in the watershed to the outfall location. For this project, flow rates for the 2-, 10-, 25-, and 100-year storm events were estimated by the model.

The hydrologic models estimated flow rates for the 1-, 2-, 3-, 6-, 12-, 18-, and 24-hour storm durations for existing conditions. These flow rates were used to complete a critical duration analysis for seven locations within the NW and SW Basins (See Figure 3.01-1). The critical duration is the storm duration which produces the largest peak runoff discharge. Table 3.01-1 summarizes the critical duration determined for each location.

Map Location Number	Location Description	Critical Duration (hr)
1	NE Corner of Highland Park Subdivision	2
2	SE Corner of Fieldstone Subdivision	2
3	SW Corner of Fieldstone Subdivision	18
4	NW Corner of Quench Drive/Prairie Street Intersection	18
5	S Line of Westwynde Subdivision	18
6	SW Corner of Noltner Parcel/SE Corner of Rueter Parcel	18
7	SE Corner of Litscher Parcel	2

Table 3.01-1 Critical Duration Summary

S:\MAD\1300--1399\1381\019\Data\GIS\Figures\For Report\Figure 3.01-1 RunoffLocationIdentification.mxd



RUNOFF MEASUREMENT LOCATIONS

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

STRAND ASSOCIATES, INC. ENGINEERS

FIGURE 3.01-1
1381.019

B. Results

Peak discharges for the 2-, 10-, 25-, and 100-year return interval storm events were estimated for the NW and SW Subbasins using the HydroCAD computer program. The hydrologic parameters input into the HydroCAD model are summarized in Tables 3.01-2 and 3.01-3. Results of the hydrologic analysis are summarized for existing conditions in Table 3.01-4, for future conditions with no controls implemented in Table 3.01-5, and future conditions with controls implemented in Table 3.01-6.

Subbasin	Area (ac)	Predevelopment Conditions		Postdevelopment Conditions	
		Composite CN	Time of Concentration (min)	Composite CN	Time of Concentration (min)
FS1	27.7	78	40	75	20
FS2	25.0	82	5	82	5
FS3	2.9	61	28	61	28
HP1	59.7	76	16	76	16
HP2	13.2	76	18	80	13
IP	68.7	75	60	88	45
NW1	72.6	82	84	92	42
NW2	106.1	58	113	75	56
NW3	148.0	58	190	75	95
NW4	22.4	58	83	75	41
NW5	387.0	80	87	85	44
NW8	80.1	68	74	81	55
NW8B	24.0	64	61	64	61
NW9	12.1	69	42	85	31
NW10	7.6	91	31	95	23
NW11	11.2	74	120	85	90

Table 3.01-2 HydroCAD Input Parameters–Northwest Basin

Subbasin	Area (ac)	Predevelopment Conditions		Postdevelopment Conditions	
		Composite CN	Time of Concentration (min)	Composite CN	Time of Concentration (min)
SW6	72.5	63	104	84	78
SW7	58.6	59	89	59	89
SW8A	7.9	67	76	67	76
SW12	90.0	78	99	81	74
SW13	140.8	49	61	71	31
SW13A	34.6	58	15	84	11
SW13B	58.9	49	40	71	20
SW14	22.3	79	27	87	20
SW15	100.9	57	32	69	16
SW16	9.2	60	32	62	24
OS	23.1	60	39	60	39
WW1	13.8	77	32	77	32
WW2	14.9	74	65	74	65
WW3	23.7	75	12	75	12
WW4	12.6	46	24	71	12

Table 3.01-3 HydroCAD Input Parameters–Southwest Basin

Map Location Number	Location Description	Tributary Area (ac)	Critical Duration (hr)	Existing Peak Discharges (cfs)			
				2-Year	10-Year	25-Year	100-Year
1	NE Corner of Highland Park Subdivision	578.6	2	80	200	306	524
2	SE Corner of Fieldstone Subdivision	50.4	2	0	3	13	27
3	SW Corner of Fieldstone Subdivision	175.7	18	6	21	34	62
4	NW Corner of Quench Drive/Prairie Street Intersection	962.2	18	110	223	232	239
5	S Line of Westwynde Subdivision	1,136.6	18	116	250	277	318
6	SW Corner of Noltner Parcel/SE Corner of Rueter Parcel	1,498.7	18	131	296	347	438
7	SE Corner of Litscher Parcel	138.1	2	6	21	40	88

Table 3.01-4 Existing Peak Runoff Discharges

Map Location Number	Location Description	Tributary Area (ac)	Critical Duration (hr)	Future (No Controls) Peak Discharges (cfs)			
				2-Year	10-Year	25-Year	100-Year
1	Northeast Corner of Highland Park Subdivision	578.6	2	166	369	535	868
2	Southeast Corner of Fieldstone Subdivision	50.4	2	4	11	26	54
3	Soutwest Corner of Fieldstone Subdivision	175.7	18	24	53	74	114
4	Northwest Corner of Quench Drive/Prairie Street Intersection	962.2	18	171	232	238	241
5	South Line of Westwynde Subdivision	1,136.6	18	181	266	296	339
6	Southwest Corner of Noltner Parcel/SE Corner of Rueter Parcel	1,498.7	18	224	359	425	536
7	Southeast Corner of Litscher Parcel	138.1	2	20	64	97	167

Table 3.01-5 Future (No Controls) Peak Runoff Discharges

Map Location Number	Location Description	Tributary Area (ac)	Critical Duration (hr)	Future (With Controls) Peak Discharges (cfs)			
				2-Year	10-Year	25-Year	100-Year
1	Northeast Corner of Highland Park	578.6	2	58	126	166	218
2	Southeast Corner of Fieldstone	50.4	2	4	11	26	54
3	Southwest Corner of Fieldstone	175.7	18	0	1	1	1
4	Northwest Corner of Quench Drive/Prairie Street Intersection	962.2	18	89	128	146	172
5	South Line of Westwynde Subdivision	1,136.6	18	97	162	202	266
6	Southwest Corner of Noltner Parcel/SE Corner of Rueter Parcel	1,498.7	18	118	219	290	417
7	Southeast Corner of Litscher Parcel	138.1	2	6	25	44	85

Table 3.01-6 Future (With Controls) Peak Runoff Discharges

C. Stormwater Facility Descriptions

Various stormwater facilities were input to the HydroCAD model. Several of the facilities are already in place, while others are designed and ready to be built within subdivision developments. A select group has been sized as part of this study for regional stormwater control. Explanations of the various stormwater facilities include:

1. Fieldstone Subdivision

Infrastructure, including roads, storm sewer, park and ponds, for the Fieldstone subdivision (FS) is complete between 20th Street and 21st Street (Subbasins FS2 and FS3). The ponds within these limits of the subdivision are included in the existing, future (no controls), and future models.

The portion of the subdivision west of 21st Street has yet to be constructed (Subbasin FS1). Within the western portion, one sedimentation basin and one infiltration basin are proposed. These sedimentation and infiltration basins are not included in the existing conditions or future (no controls) model, but they are evaluated in the future model.

2. Proposed Regional Basin Northeast of the Highland Park Subdivision

This detention basin was sized as part of this study to accommodate runoff from the northeast portion of the NW Basin (Subbasins NW1 and NW5). The basin was sized to accommodate a 100-year storm given future land use conditions. This control structure was only evaluated in the future model.

3. Industrial Park

A dry detention basin is present in the northwest corner of the Industrial Park (Subbasin IP) to handle water from a portion of the existing Industrial Park area. This pond is included in the existing, future (no controls), and future models. An alternative to combine the existing dry basin with the proposed regional basin northeast of the Highland Park subdivision was also evaluated.

4. Highland Park Subdivision

The north portion of Highland Park subdivision (Subbasin HP1) drains to a constructed greenway passing through the subdivision. The constructed greenway is also used to convey flows from upstream regions to the northeast, portions of the Fieldstone Subdivision, and overflow from the Industrial Park dry basin. Box culvert structures at 20th Street and 21st Street are included in the existing, future (no controls), and future models.

5. Proposed Regional Basin North of Fieldstone Subdivision

This detention basin was sized as part of this study to accommodate runoff from the northwest portion of the NW Basin (Subbasin NW3). The basin was sized to accommodate a 100-year storm given future land use conditions. This control structure was only evaluated in the future model.

6. Mueller Property

The Mueller property contains two wet ponds that are currently constructed, one wet basin located at the northwest corner of the County Highway PF and Quench Drive intersection (Subbasin NW8) and the other located on residential property (Subbasin NW8B). There is also a natural depression located on the west side of Quench Drive that was modeled for storage volume effects. The two ponds located on the Mueller property and natural depression are included in the existing, future (no controls), and future models.

As part of the Mueller Sports Medicine Inc. Warehouse Expansion plan, a sedimentation basin, infiltration basin, and revised site grading are proposed. The revised grading resulted in a change to how a portion of the Highland Park subdivision (Subbasin HP2) was routed. For future conditions, Subbasin HP2 is routed through the proposed sedimentation and infiltration

basins. These sedimentation and infiltration basins are not included in the existing conditions or future (no controls) model, but are evaluated in the future model.

7. Westwynde Subdivision

Although the west portion of the Westwynde subdivision is not constructed, all dry detention basins are complete within the Westwynde subdivision (Subbasins WW1, WW2, WW3, and WW4). Four detention structures are included in the existing, future (no controls), and future models.

8. Proposed Regional Basin South of the Westwynde Subdivision

This detention basin was sized as part of this study to accommodate runoff from the northwest portion of the SW Basin (Subbasins SW6, SW12, and SW13B). The basin was sized to accommodate a 100-year storm given future land use conditions. This control structure was only evaluated in the future model.

9. Proposed Swale South of the Westwynde Subdivision to Sauk Prairie Road

This swale was sized as part of this study to convey runoff discharging from the south line of the Westwynde subdivision, discharge from the proposed regional pond south of Westwynde, and the runoff from the southwest portion of the SW Basin (Subbasin SW13). The swale was sized to accommodate a 100-year storm given future land use conditions while maintaining a relatively shallow depth. This control structure was only evaluated in the future model.

10. Proposed Regional Basin Southeast of the Westwynde Subdivision

This detention basin was sized as part of this study to accommodate runoff from the east portion of the SW Basin (Subbasins SW14, WW2, and SW15). The basin was sized to accommodate a 100-year storm given future land use conditions. This control structure was only evaluated in the future model.

3.02 SEDIMENT LOADING ANALYSIS

A. General

A sediment loading analysis for the NW and SW Basins was completed using version 9.3.2 of the SLAMM. SLAMM is a computer model approved by the WDNR to address requirements of NR 151 that analyzes nonpoint source pollution abatement. SLAMM has been calibrated using extensive water quality data throughout the United States. As this model is used for regulatory purposes, the results can be compared to other past and ongoing studies. SLAMM is regularly updated to include additional water quality monitoring data to further refine its predictive capabilities.

SLAMM is a planning-level tool that enables municipalities to make decisions regarding BMPs necessary to achieve nonpoint source runoff standards described in NR 151. SLAMM specifically analyzes control practices including street sweeping, wet detention ponds, catch basin and inlet sumps, infiltration devices, porous pavements, and grass swales. SLAMM also predicts relative pollutant contributions from ‘source areas’ including rooftops, parking lots, driveways, streets, sidewalks, and pervious spaces.

B. Methodology

Drainage basins within the NW and SW Basins were analyzed to estimate TSS loading using the SLAMM computer program. Land use data from the Village was intersected with soils data to determine hydrologic parameters for each drainage basin analyzed.

Village land use was divided into the following categories for SLAMM modeling purposes: residential, commercial, institutional, other urban, and industrial. In general, measured land use areas were divided into source areas based on typical percentages identified in the WDNR standard land use files. See Tables 3.02-1, 3.02-2, and 3.02-3 for the percentages utilized in the WDNR standard land use files.

TABLE 3.02-1

SOURCE AREA BY LAND USE

Class	Land Use	Roof (percent)	Driveway (percent)	Sidewalk (percent)	Paved Parking/ Storage (percent)	Unpaved Parking/ Storage (percent)	Playground (percent)	Large Landscaped (percent)	Undeveloped (percent)	Small Landscaped (percent)	Other Pervious (percent)	Isolated Water Body (percent	Directly Connected Impervious (percent)	Partially Connected Impervious (percent)	Street Area (percent)	Total (percent)
Residential	High Density Residential (<1/4 acre lots)	24.2	0.7	6.4	0.4	0	0	0	0.3	41.5	6.3	0	0	0	20.2	100
	Medium Density Residential (1/4 to 1/2 acre lots)	15	7.5	2.2	0.2	0	0	0.2	0.4	57.5	4	0.2	0	0	12.8	100
	Low Density Residential (>1/2 acre lots)	8	4.5	0.7	0.1	0	0	0	4.4	74.8	0.2	0.2	0	0.1	7	100
	Duplex	16.54	5.31	3.96	0	0	0	0	0	60.88	0	0	0	0	13.31	100
	Multifamily	20.7	2.8	4.2	10.8	0.5	0.1	1.4	3	38	3.8	0.1	0	0	14.6	100
	Mobile Home	16.9	12.3	1	13.4	0.6	0	0	4.5	44.7	0	1	2	0	3.6	100
Commercial	Commercial	9.44	0	2.28	26.31	0	0	58.66	0	0	0	0	0	0	3.31	100
	Commercial Downtown	40.73	1.48	8.35	22.61	0	0	0	0	3.56	0.62	0	0	0.08	22.17	99.6
	Shopping Center	21.61	1.81	0.54	60.68	0.34	0	0	2.93	4.53	0.82	0	0.35	0	6.39	100
	Strip Commercial	23.4	2	4.3	40.9	1.4	0	0	0.2	5.8	1.9	0	0	0	20.1	100
Institutional	Institutional	14.41	3	2.2	27.21	0	3.4	5.34	1.83	26.55	2.65	0	0	1.33	12.08	100
	School	15	1.98	2.91	10.65	0	17.33	22.09	0.42	17.43	2.19	0	0	1.35	8.65	100
Industrial	Light Industrial	25.35	2.56	1.28	32.94	6.34	0	3.51	4.34	9.86	2.77	0	0	0.21	10.84	100
	Medium Industrial	23.11	2.8	0.9	34.09	14.61	0	2.81	5.37	4	4.53	0	0	0.23	7.55	100
Other Urban	Cemetery	1.1	7.67	0.06	2.24	0.07	0	86.4	0.48	0.23	0	0.28	0	0.03	1.44	100
	Open Space	0.55	0	0.58	0	0	0	0.59	94.54	0	0	0	0	0	3.74	100
	Park	0.46	1.21	0.49	4.19	0.22	1.8	77.95	0	0.85	0	7.08	0	2.48	3.27	100

WDNR Standard Land Use Files

TABLE 3.02-2

DISTRIBUTION OF IMPERVIOUS SOURCE AREAS BY LAND USE CLASS

Class	Land Use	Pitched Roofs		Flat Roofs		Driveways		Sidewalks		Parking/Storage		Unpaved Parking/Storage		
		Connected (percent)	Unconnected (percent)	Connected (percent)	Unconnected (percent)	Connected (percent)	Unconnected (percent)	Connected (percent)	Unconnected (percent)	Connected (percent)	Unconnected (percent)	Connected (percent)	Unconnected (percent)	Total (percent)
Residential	High Density Residential (<1/4 acre lots)	42.9	33.4	0	0	2.2	0	10.1	10.1	1.3	0	0	0	100
	Medium Density Residential (1/4 to 1/2 acre lots)	18.1	42.2	0	0	22.5	7.6	4.4	4.4	0.8	0	0	0	100
	Low Density Residential (>1/2 acre lots)	14.3	45.9	0	0	24.1	9.8	2.6	2.6	0.8	0	0	0	100
	Duplex	17.4	46.7	0	0	20.6	0	15.3	0	0	0	0	0	100
	Multifamily	36.2	8.2	8.7	0	4.9	2.3	5.4	5.4	27.7	0	1.3	0	100
	Mobile Home	0	0	38.2	0	27.8	0	1.1	1.1	30.3	0	0	1.4	100
Commercial	Commercial	2	0	12.4	10.5	0	0	6	0	69.2	0	0	0	100
	Commercial Downtown	0	0	55.7	0	2	0	11.4	0	30.9	0	0	0	100
	Shopping Center	0	0	25.4	0	2.1	0	0.6	0	71.4	0	0.4	0	100
	Strip Commercial	5.1	0	27.4	0	2.8	0	6	0	56.8	0	0	1.9	100
Institutional	Institutional	18	1.2	11.5	0	6.4	0	4.7	0	58.1	0	0	0	100
	School	0	0	49.1	0	6.5	0	9.5	0	34.9	0	0	0	100
Industrial	Light Industrial	3.8	0	30	3.3	3.7	0	1.9	0	48.1	0	0	9.3	100
	Medium Industrial	2.5	0	22.3	5.9	2.4	1.3	0.6	0.6	45.2	0	0	19.4	100
Other Urban	Cemetery	0	4.9	4.9	0	68.9	0	0.5	0	20.1	0.6	0	0	100
	Open Space	0	0	48.7	0	0	0	51.3	0	0	0	0	0	100
	Park	1.7	3.8	1.5	0	18.4	0	7.5	0	63.8	0	0	3.4	100

WDNR Standard Land Use Files

TABLE 3.02-3

DISTRIBUTION OF PERVIOUS AREAS BY LAND USE CLASS

		Pitched Roofs		Flat Roofs		Driveways		Sidewalks		Parking/Storage		Unpaved Parking/Storage		
		Connected	Unconnected	Connected	Unconnected	Connected	Unconnected	Connected	Unconnected	Connected	Unconnected	Connected	Unconnected	Total
Class	Land Use	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)
Residential	High Density Residential (<1/4 acre lots)	42.9	33.4	0	0	2.2	0	10.1	10.1	1.3	0	0	0	100
	Medium Density Residential (1/4 to 1/2 acre lots)	18.1	42.2	0	0	22.5	7.6	4.4	4.4	0.8	0	0	0	100
	Low Density Residential (>1/2 acre lots)	14.3	45.9	0	0	24.1	9.8	2.6	2.6	0.8	0	0	0	100
	Duplex	17.4	46.7	0	0	20.6	0	15.3	0	0	0	0	0	100
	Multifamily	36.2	8.2	8.7	0	4.9	2.3	5.4	5.4	27.7	0	1.3	0	100
	Mobile Home	0	0	38.2	0	27.8	0	1.1	1.1	30.3	0	0	1.4	100
Commercial	Commercial	2	0	12.4	10.5	0	0	6	0	69.2	0	0	0	100
	Commercial Downtown	0	0	55.7	0	2	0	11.4	0	30.9	0	0	0	100
	Shopping Center	0	0	25.4	0	2.1	0	0.6	0	71.4	0	0.4	0	100
	Strip Commercial	5.1	0	27.4	0	2.8	0	6	0	56.8	0	0	1.9	100
Institutional	Institutional	18	1.2	11.5	0	6.4	0	4.7	0	58.1	0	0	0	100
	School	0	0	49.1	0	6.5	0	9.5	0	34.9	0	0	0	100
Industrial	Light Industrial	3.8	0	30	3.3	3.7	0	1.9	0	48.1	0	0	9.3	100
	Medium Industrial	2.5	0	22.3	5.9	2.4	1.3	0.6	0.6	45.2	0	0	19.4	100
Other Urban	Cemetery	0	4.9	4.9	0	68.9	0	0.5	0	20.1	0.6	0	0	100
	Open Space	0	0	48.7	0	0	0	51.3	0	0	0	0	0	100
	Park	1.7	3.8	1.5	0	18.4	0	7.5	0	63.8	0	0	3.4	100

WDNR Standard Land Use Files

C. Baseline Conditions Analysis

Baseline conditions were modeled in SLAMM using the existing land use to evaluate the TSS loading assuming no BMPs are present. For example, the Village is assumed to be drained completely by storm sewer with no drainage swales. Also, no wet detention ponds, catch basin sumps, street sweeping, or infiltration practices were modeled for baseline conditions.

Table 3.02-4 shows baseline TSS loading for each subbasin within the NW and SW drainage basins. Basins that are not developed in their existing conditions (example NW5) result in a much lower unit load than currently developed areas (example IP).

Subbasin	Area (ac)	TSS Loading (lb)	Unit Load (lb/ac)
FS1	28	2,573	93
FS2	25	5,903	237
FS3	3	323	112
HP1	60	16,182	271
HP2	13	2,437	189
IP	69	20,306	296
NW1	73	3,433	47
NW2	106	1,283	12
NW3	148	2,327	16
NW4	22	579	26
NW5	387	6,309	16
NW8	80	4,129	52
NW8B	24	377	16
NW9	12	2,505	207
NW10	8	3,629	473
NW11	11	4,664	417
SW6	72	6,612	91
SW7	59	2,330	40
SW8A	8	1,213	153
SW12	90	5,040	56
SW13	200	2,084	10
SW13A	35	542	16
SW14	22	12,024	541
SW15	101	1,341	13
SW16	9	145	16
OS	23	363	16
WW1	14	3,897	282
WW2	15	2,735	184
WW3	24	4,579	193
WW4	13	198	16
	1,750	**120,062**	**69**

Table 3.02-4 Baseline Conditions SLAMM Analysis

D. Existing Conditions Analysis

Sediment loading was estimated for existing conditions to assess the effectiveness of current stormwater management practices in removing TSS from stormwater. Note that many of the existing stormwater facilities within the NW and SW Basins are dry detention basins (i.e., the Industrial Park Basin and Westwynde Basins). Currently, the WDNR does not give TSS removal credit for dry detention basins. Credit for sediment removal could be achieved if these dry basins are retrofitted to include "pretreatment" measures such as sediment forebays or bioretention cells.

Since much of the land in the NW and SW Basins remains undeveloped, the baseline conditions are for the most part equivalent to the existing conditions. However, the existing wet detention basin located at the northwest corner of Quench Drive and Prairie Street intersection was evaluated. Assuming a basin depth of 5 feet, the TSS removal efficiency was found to be approximately 41 percent. Table 3.02-5 shows existing conditions TSS loading and percent TSS reduction for each subbasin within the NW and SW drainage basins. The cumulative existing conditions TSS reduction for the entire NW and SW Basins is approximately 19 percent.

Subbasin	Area (ac)	TSS Loading (lb)		Reduction (%)	Unit Load (lb/ac)
		No Controls	With Controls		
FS1	28	2,573	1,518	41	55
FS2	25	5,903	3,483	41	140
FS3	3	323	190	41	66
HP1	60	16,182	9,548	41	160
HP2	13	2,437	1,438	41	112
IP	69	20,306	20,306	0	296
NW1	73	3,433	2,026	41	28
NW2	106	1,283	1,283	0	12
NW3	148	2,327	1,373	41	9
NW4	22	579	342	41	15
NW5	387	6,309	3,722	41	10
NW8	80	4,129	2,436	41	31
NW8B	24	377	222	41	9
NW9	12	2,505	1,478	41	122
NW10	8	3,629	2,141	41	279
NW11	11	4,664	2,752	41	246
SW6	72	6,612	6,612	0	91
SW7	59	2,330	2,330	0	40
SW8A	8	1,213	1,213	0	153
SW12	90	5,040	5,040	0	56
SW13	200	2,084	2,084	0	10
SW13A	35	542	542	0	16
SW14	22	12,024	12,024	0	541
SW15	101	1,341	1,341	0	13
SW16	9	145	145	0	16
OS	23	363	363	0	16
WW1	14	3,897	3,897	0	282
WW2	15	2,735	2,735	0	184
WW3	24	4,579	4,579	0	193
WW4	13	198	198	0	16
	1,750	**120,062**	**97,360**	**19%**	**69**

Table 3.02-5 Existing Conditions SLAMM Analysis

E. Future Conditions Analysis

Sediment loading was estimated for future conditions to assess how future development and proposed stormwater facilities such as regional detention basins, sedimentation and infiltration basins, and constructed greenways could increase TSS reductions in a fully built-out condition.

Future conditions were modeled using future land uses and the proposed regional detention basins as future BMPs. It is assumed the proposed regional detention basins would be designed to provide a TSS reduction of 80 percent. The existing wet detention basin located at the Quench Drive and Prairie Street intersection is assumed to provide the same removal percentage in a future conditions situation as in existing conditions circumstances. In future conditions, all land draining to the existing wet pond should be receiving pretreatment by regional facilities or on a per site basis. Table 3.02-6 shows future conditions loading given no controls and also with controls. Based on review of the results, the cumulative future conditions TSS reduction for the entire NW and SW Basins would be approximately 56 percent.

Subbasin	Area (ac)	TSS Loading (lb) No Controls	TSS Loading (lb) With Controls	Reduction (%)	Unit Load (lb/ac)
FS1	28	5,817	1,164	80	42
FS2	25	5,728	3,383	41	136
FS3	3	323	191	41	66
HP1	60	16,100	9,508	41	159
HP2	13	3,342	669	80	52
IP	69	32,765	32,765	0	477
NW1	73	18,514	3,706	80	51
NW2	106	11,802	11,802	0	111
NW3	148	16,455	3,294	80	22
NW4	22	2,478	1,463	41	65
NW5	387	109,219	21,864	80	57
NW8	80	24,797	14,643	41	183
NW8B	24	1,115	658	41	27
NW9	12	5,044	1,010	80	84
NW10	8	3,872	2,288	41	298
NW11	11	5,808	3,430	41	306
SW6	72	12,226	2,447	80	34
SW7	59	3,805	3,805	0	65
SW8A	8	1,472	1,472	0	185
SW12	90	11,168	2,236	80	25
SW13	200	24,980	5,000	80	25
SW13A	35	16,603	16,603	0	480
SW14	22	11,446	2,291	80	103
SW15	101	11,225	2,247	80	22
SW16	9	1,085	1,085	0	118
OS	23	789	789	0	34
WW1	14	3,530	3,530	0	255
WW2	15	2,825	2,825	0	190
WW3	24	5,244	5,244	0	221
WW4	13	2,575	2,575	0	205
	1,750	**372,152**	**163,988**	**56%**	**213**

Table 3.02-6 Future Conditions SLAMM Analysis

F. Sediment Loading Calculation Conclusions

Sediment loading calculations of current conditions show current stormwater management practices provide a removal efficiency of approximately 40 percent for the lands draining to the existing wet basin located at the Quench Drive and Prairie Street intersection. On a watershed-wide basis, the TSS reduction is estimated to be approximately 19 percent.

Providing stormwater facilities to serve as not only water quantity control but also water quality control would significantly increase the watershed-wide TSS reduction in a fully built-out future condition (from 19 percent to 56 percent). Capturing TSS from runoff in wet detention or sedimentation basins allows water infiltrating the ground to have less particulate matter and pollutants.

SECTION 4
REGIONAL STORMWATER MANAGEMENT ALTERNATIVES

4.01 INTRODUCTION

Stormwater runoff peak flow reduction is typically achieved through the construction of stormwater detention facilities. Implementation of stormwater detention facilities is an effective structural measure that allows increased peak runoff rates associated with future development to be temporarily stored and released at reduced and controlled rates. Detention basin release rates are typically established to limit postdeveloped peak runoff flows to not exceed predeveloped peak runoff flows or the safe carrying capacity of receiving conveyance facilities. Structural and nonstructural alternatives that may be employed to manage future stormwater needs for the Village are described in this section.

4.02 STRUCTURAL ALTERNATIVES CONSIDERED

The following structural practices were considered as potential measures to manage future stormwater needs in the NW and SW Basins. Figure 4.02-1 (included in pocket folder at the end of the report) shows the overall stormwater management plan including potential regional stormwater detention basins and stormwater conveyance greenways.

A. Regional Detention Basins

Potential regional detention basins have been preliminarily sized to handle up to a 100-year storm future conditions storm event, reducing peak flows to existing condition rates. Table 4.02-1 outlines the release rates (cfs/acre) used for each basin location and the corresponding storage volume (acre-feet) required. Figure 4.02-2 shows a typical proposed section of an infiltration basin with sediment forebay.

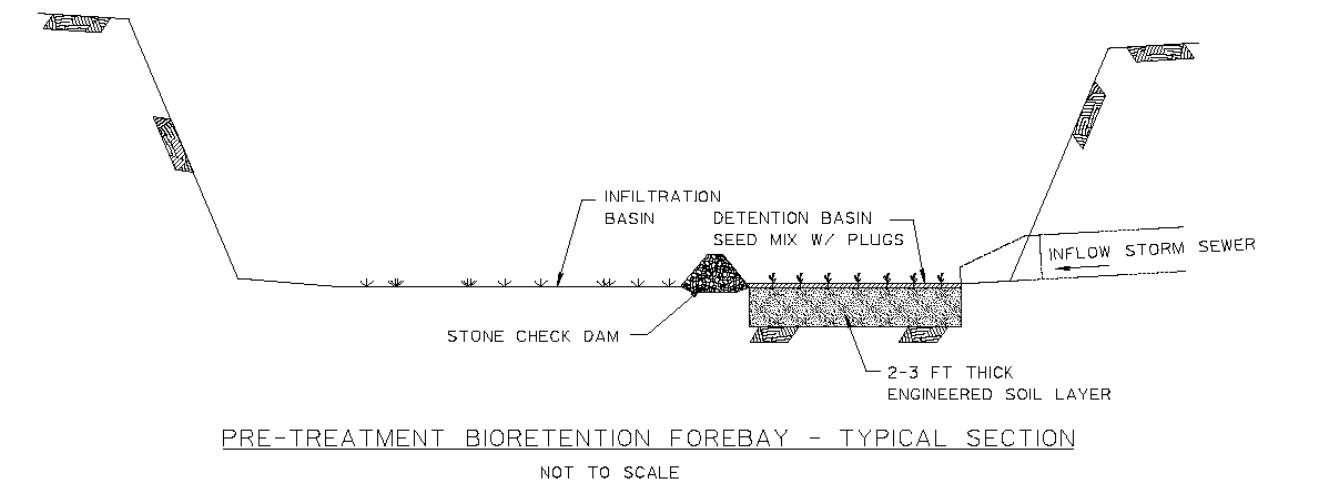


Figure 4.02-2 Infiltration Basin with Bioretention Sediment Forebay Typical Detail

As previously stated in this report, the WDNR does not offer TSS reduction credit for dry detention basins. Furthermore, the WDNR requires that stormwater infiltration basins have measures implemented to “pretreat” stormwater runoff before infiltrating to protect groundwater resources from potential contamination from stormwater-borne pollutants. The WDNR requires that the TSS loading to infiltration basins be reduced by 60 percent for residential development and 80 percent for nonresidential development. Pretreatment measures for these regional stormwater facilities may be provided by several different means. Clay-lined wet sediment forebays could be constructed at primary inflow locations of the basin. However, Village staff has indicated that stormwater facilities with permanent wet pools are undesirable.

An alternative to wet forebays could be construction of bioretention forebays that consist of an engineered soil layer, establishment of native vegetation, and placement of perforated underdrain piping. Alternatively, the infiltration basins could be constructed without any form of pretreatment measures and as new development occurs, developers would be required to construct on-site stormwater quality basins to remove TSS and stormwater-borne pollutants. For the purposes of this study, we have assumed implementation of bioretention sediment forebays for each of the regional stormwater facilities.

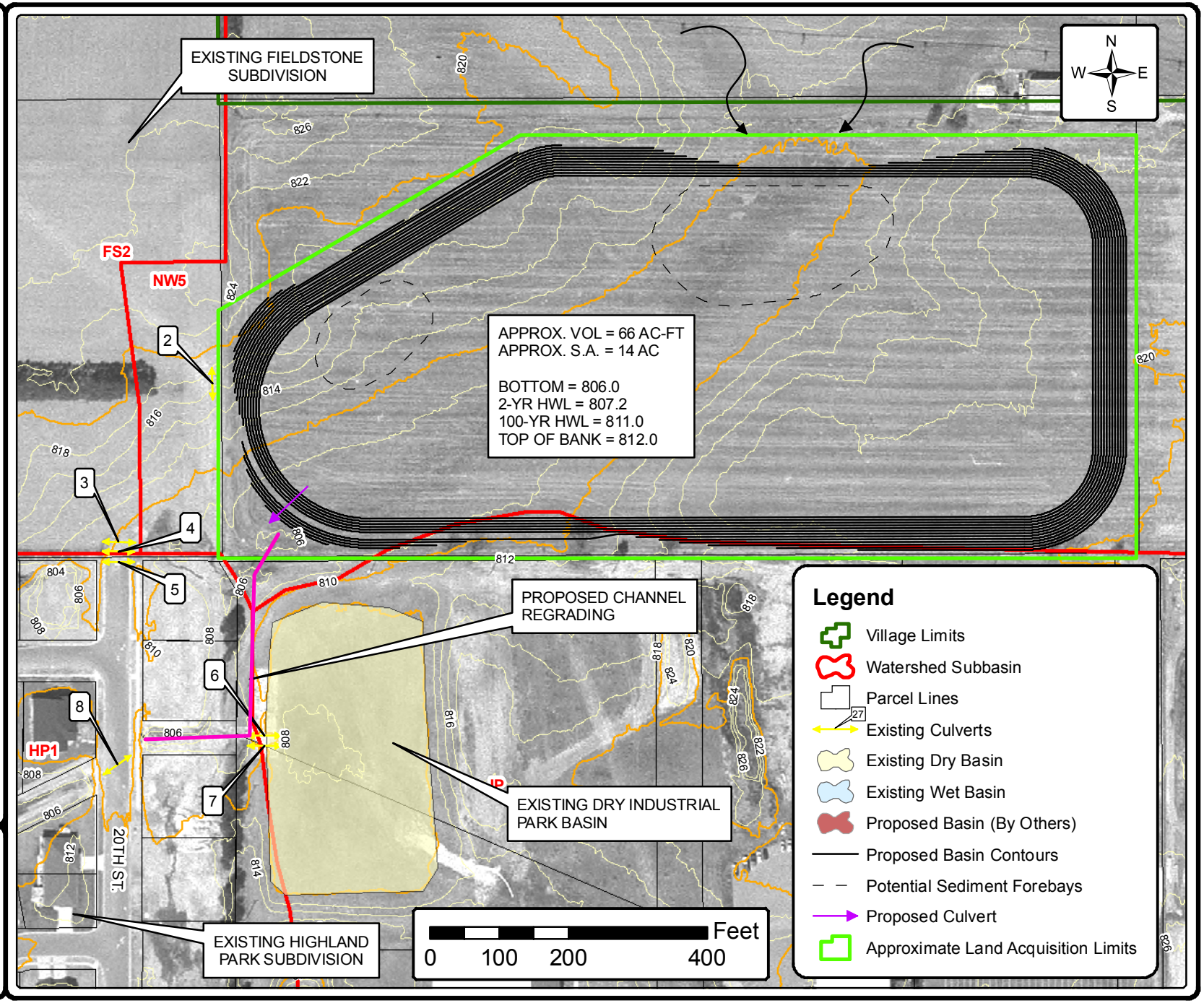
Basin Location	Basin ID	Tributary Area (ac)	Release Rates (cfs/ac)		Storage (ac-ft)	
			2-year	100-year	2-year	100-year
Northeast of Highland Park Subdivision	NE	460	0.16	0.99	11	66
Addition to Existing Industrial Park Basin	Combined NE	528	0.15	0.95	14	71
North of Fieldstone Subdivision	NW	148	0.03	0.35	8	24
South of Westwynde Subdivision	SE	221	0.07	0.38	8	19
Southeast of Westwynde Subdivison	SW	138	0.04	0.64	2	9
North of Sauk Prairie Road	SW13	141	0.01	0.30	7	23

Table 4.02-1 Summary of Basin Characteristics

It must be noted that several of the basins make land use assumptions not reflected in the adopted Village future land use plan. It is also understood the Village future land use plan may be updated when the comprehensive plan is reevaluated in 15 to 20 years. The Village should further evaluate the land use assumptions prior to proceeding with the design of these basins.

1. Northeast of Highland Park Subdivision (NE Basin)

This regional basin would serve approximately 460 acres of future residential, industrial, and commercial development. According to the future land use plan for the Village, this area is to remain as agriculture. However, for the purposes of this report, a combination of residential, industrial, and commercial development was assumed. This sizing of this basin utilized a 5-foot active storage depth in an effort to reduce the footprint of the basin. The basin has been sited on a parcel owned by Cramer and would occupy a surface area of approximately 14 acres. The total storage volume within the pond would be approximately 66 acre-feet. Care was taken to avoid conflict with an existing storage building located on the property. As part of the pond construction, a 400-lineal-foot drainage swale would need to be regraded immediately downstream of the outlet to the 20th Street box culvert. A conceptual plan for the NE basin is included as Figure 4.02-3.



NE BASIN

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.02-3
1381.019

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2. Combining Existing Industrial Park and Northeast of Highland Park Subdivision (Combined NE Basin)

A regional basin to serve both the northeast portion of the NW Basin and the Industrial Park has a tributary area of approximately 530 acres. The land use assumptions utilized in the preliminary sizing of the regional basin northeast of Highland Park Subdivision were also used for the sizing of the addition to the Industrial Park basin. The depth of the existing industrial park dry basin would need to be lowered in order to merge with the additional basin area.

The existing outfall structure present in the Industrial Park dry basin consists of twin 27-inch reinforced concrete pipes (RCPs) that have a total capacity of approximately 38 cfs. If the existing dry basin were to be combined and expanded to serve as a portion of the proposed regional basin, the capacity of the existing outlet structure would need to be increased accordingly. A conceptual plan for the Combined NE Basin is included as Figure 4.02-4.

3. Northwest of Fieldstone Subdivision (NW Basin)

This regional basin would serve approximately 150 acres of future residential development. According to the future land use plan for the Village, this area is to remain as agriculture. However, for the purposes of this report, residential development was assumed. This basin would be located on a parcel owned by Moley and Weiner. A conceptual plan for the NW Basin is included as Figure 4.02-5.

4. Southwest of Westwynde Subdivision (SW Basin)

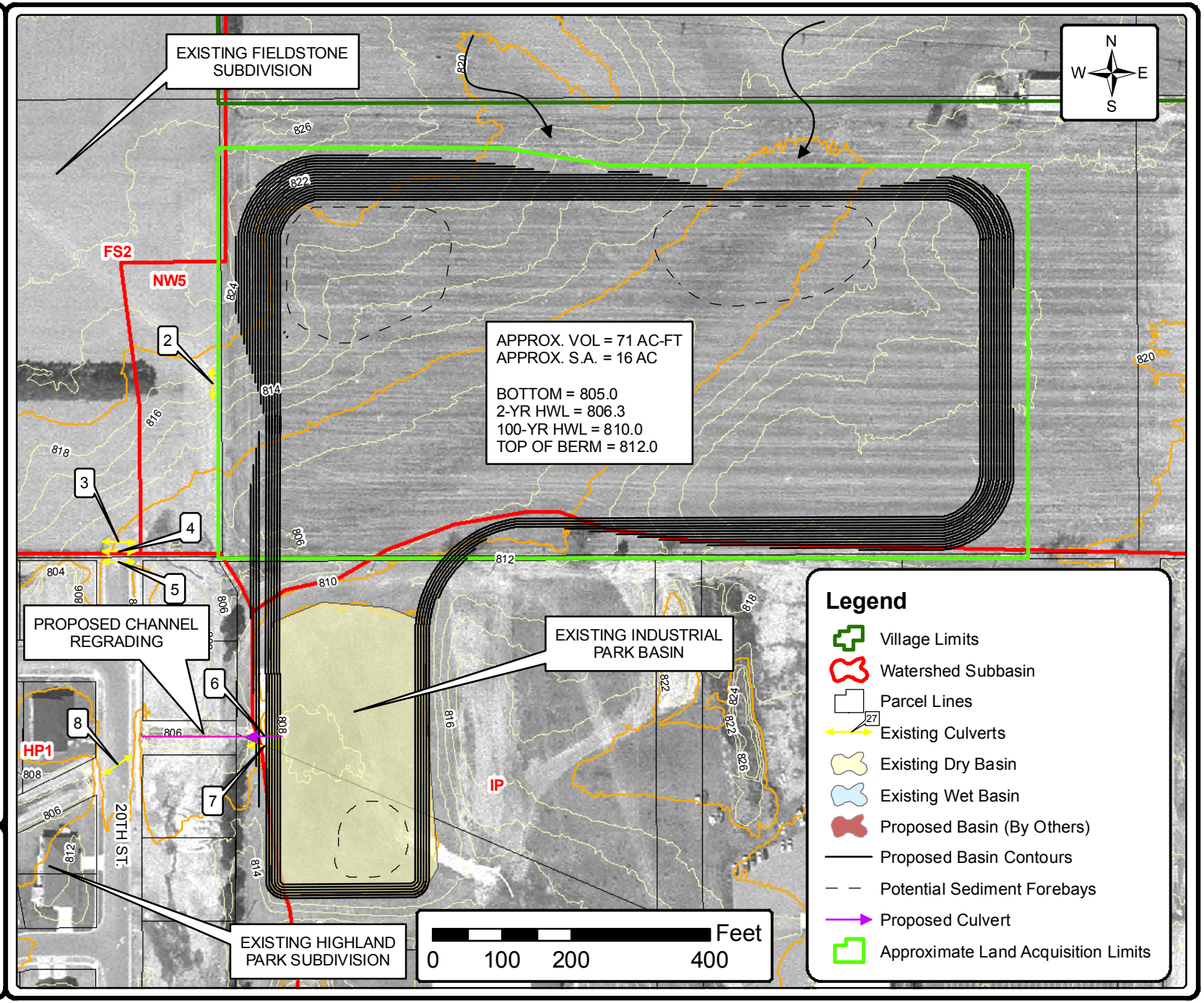
This regional basin would serve approximately 160 acres of commercial and agricultural areas located on the west portion of the SW Basin. According to the future land use plan for the Village, this area is to remain as agriculture. However, for the purposes of this report, additional commercial development consistent with adjacent areas was assumed. This regional basin would be sited on a parcel owned by Litscher. A conceptual plan for the SW Basin is included as Figure 4.02-6.

Given the existing topography at this particular location, a basin would fit within the natural swale and could discharge to the natural drainageway south of the Westwynde subdivision.

5. Southeast of Westwynde Subdivision (SE Basin)

According to the future land use plan adopted by the Village, a large portion of the SW Basin is planned for residential development. Approximately 140 acres of existing industrial and future residential lands would be served by this proposed regional basin. This basin would be located adjacent to existing residential parcels along Sauk Prairie Road and Lueders Road and would be sited on a parcel owned by the Weiss Living Trust. A conceptual plan for the SE Basin is included as Figure 4.02-7.

The discharge for this basin would need to be routed through existing residential parcels via a constructed storm sewer or drainage channel and eventually enter the existing 18-inch-diameter



COMBINED NE BASIN

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.02-4
1381.019

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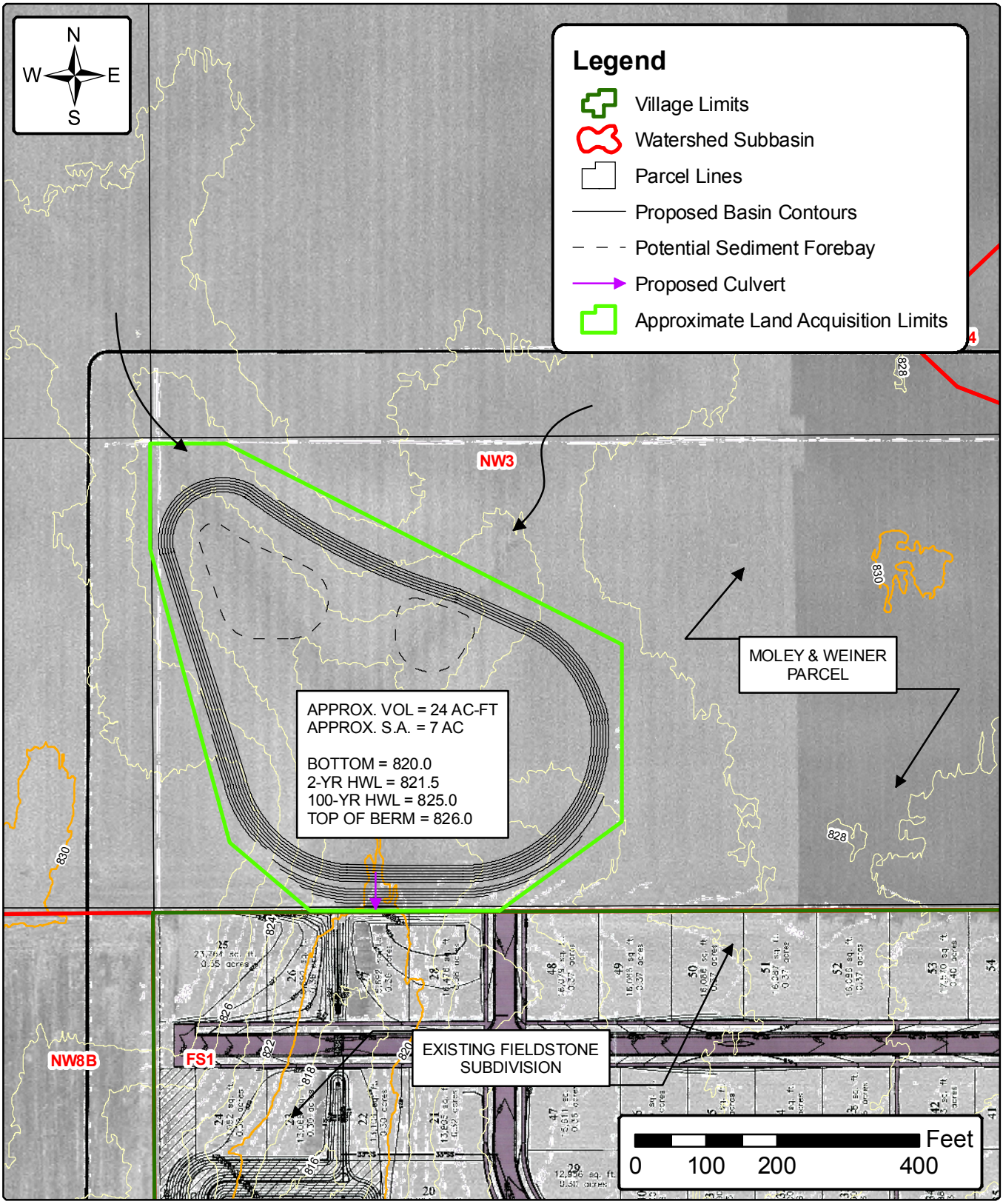
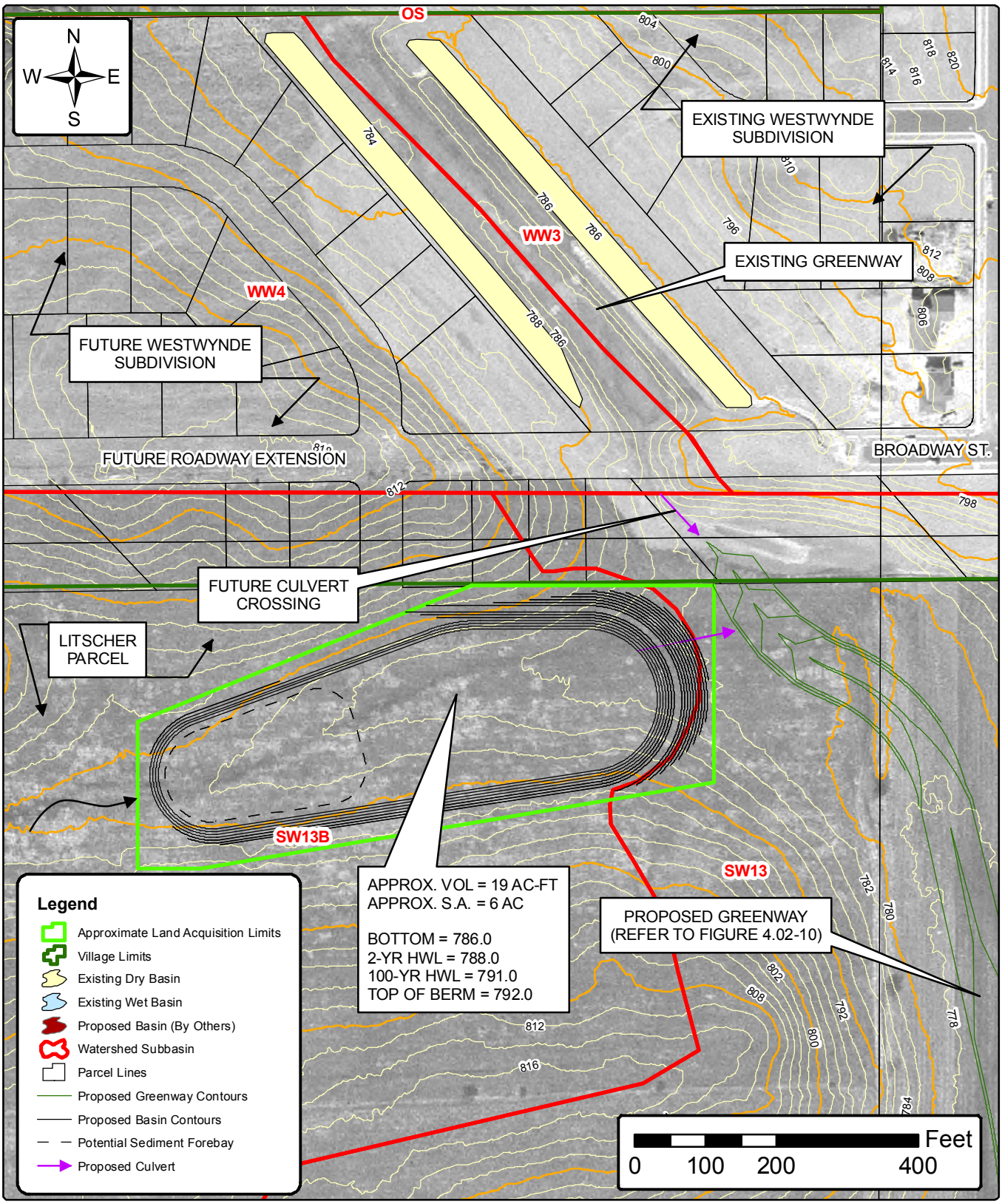


NW BASIN

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.02-5
1381.019



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SW BASIN

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

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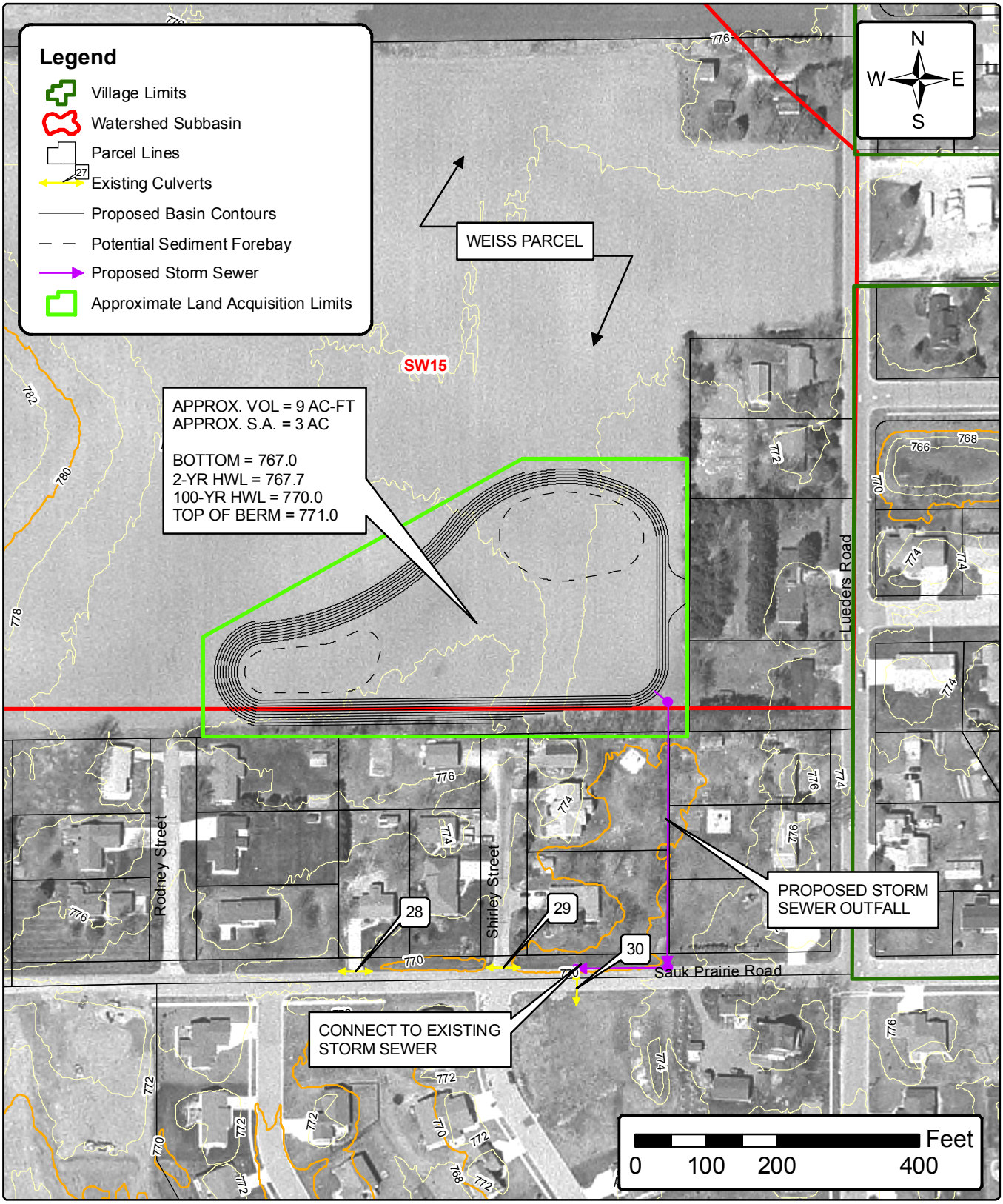
FIGURE 4.02-6
1381.019



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SE BASIN

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

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FIGURE 4.02-7
1381.019

Sauk City storm sewer system. Sauk City discharge requirements and the existing pipe capacity must be accounted for if this pond is taken to final design.

6. Potential SW13 Basin (SW13 Basin)

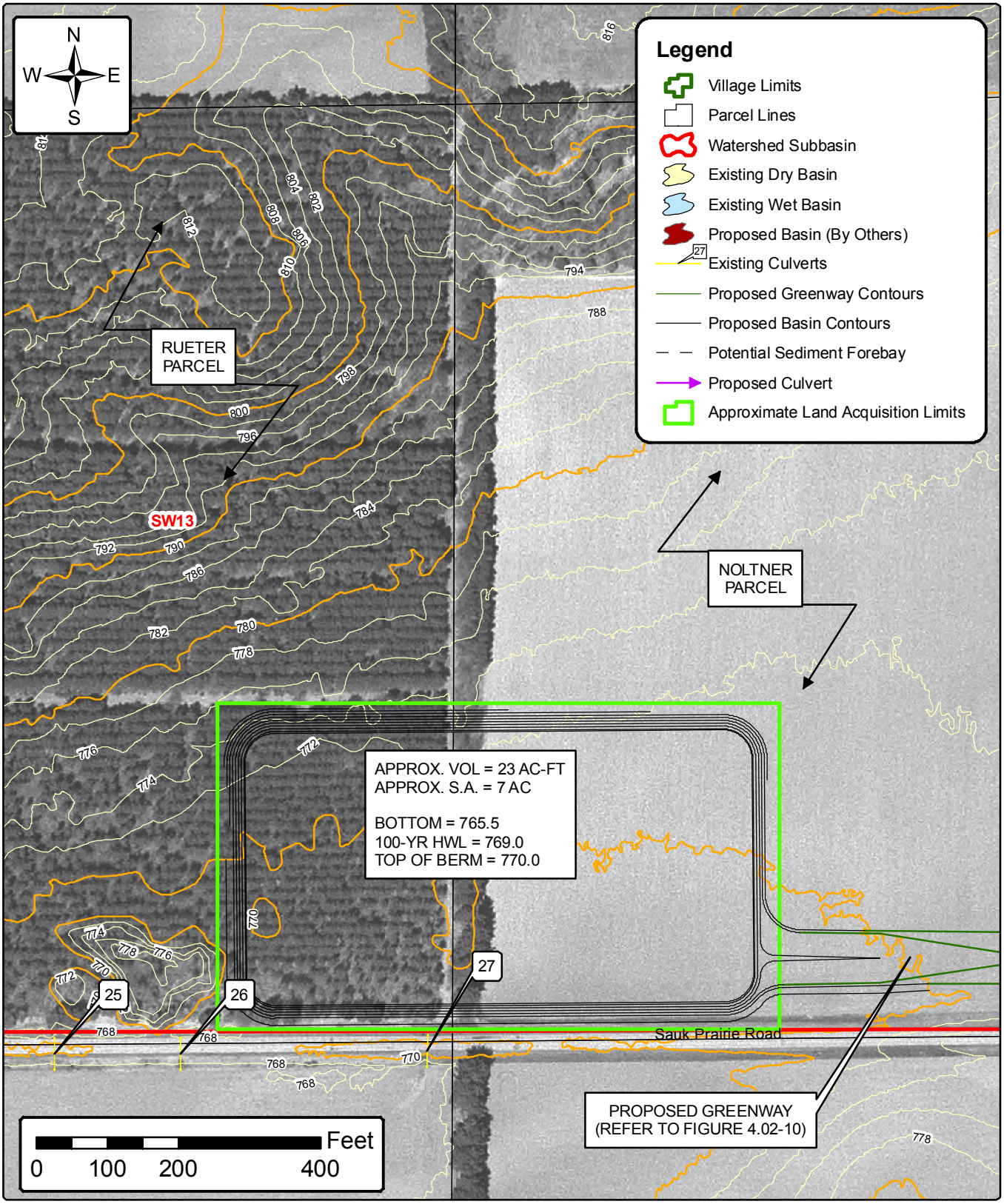
The area located immediately upstream of Sauk Prairie Road is an additional location where potential regional detention was evaluated. Based on preliminary estimates, a basin with approximately 23 acre-feet of storage volume would be required at this location and would likely need to occupy approximately 7 acres of surface area. A conceptual plan for the SW13 Basin is included as Figure 4.02-8. Note that in order for this pond to be implemented, it would function as an “on-line” detention basin, draining the entire 1,500-acre watershed. It is understood that the Sauk Prairie School District has purchased the 40-acre Noltner parcel immediately north of Sauk Prairie Road. The current layout would occupy approximately 4.7 acres of the School District property and approximately 2.3 acres of wooded land on the Rueter property immediately to the west. If regional detention is pursued at this location, the specific siting and size of the basin will need to be coordinated with the School District and possibly adjusted to accommodate future development plans.

B. Constructed Greenway

In an effort to facilitate future development located south of Westwynde Subdivision to Sauk Prairie Road, a proposed greenway likely will need to be implemented along the natural drainage path. As previously mentioned, the existing natural drainageway at this location is a wide and expansive swale with very little longitudinal slope. During heavy rainfall events, stormwater runoff flow inundates the swale to a width to as much as 500 to 1,000 feet. The goal in developing a plan for the greenway is to establish a deeper, more stable and defined drainageway that will safely convey anticipated 100-year peak flows through the corridor.

Based on preliminary sizing, the proposed greenway would be approximately 3,500 feet in length with a slope of 0.003 ft/ft. Depending on the desired purpose of the greenway, trees, landscaping and/or native plantings could add aesthetic appeal. The addition of a multiuse path next to the greenway would also allow the greenway to be used as a recreation element. The typical section of the proposed greenway is shown in Figure 4.02-9. The riprap-lined low flow channel would convey smaller, more frequent storm events, whereas the high flow channel has the capacity to handle larger storm events that produce higher runoff flows. The high flow channel will tie in to the existing ground at a 4:1 (H:V) slope. On either side of the channel, a 10-foot-wide corridor has been indicated to facilitate access for maintenance of the channel.

S:\MAD\1300--1399\1381\019\Data\GIS\Figures\For Report\Figure 4.02-8 SW13 Basin.mxd



POTENTIAL SW13 BASIN

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.02-8
1381.019

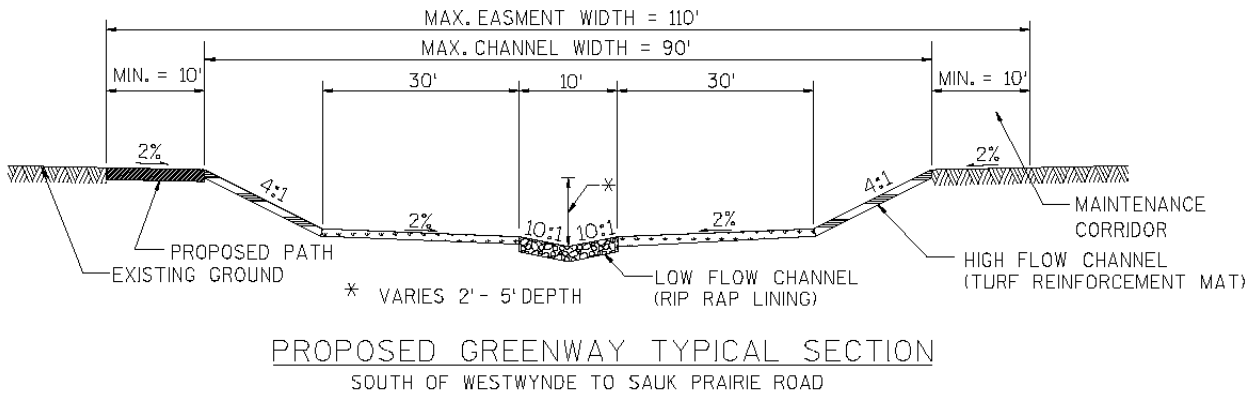


Figure 4.02-9 Greenway Proposed Typical Detail

The proposed greenway would be constructed at an elevation lower than the existing ground to eliminate the need for adjacent developments to place significant amounts of fill in order to positively drain adjacent lands. The upstream end of the greenway has a proposed elevation of 776.0 feet, and the proposed culvert in the Westwynde Subdivision (under Broadway Street) has an outlet invert of approximately 782.0 feet. Coordination between the culvert and swale construction would be refined during final design. The downstream end of the greenway has a proposed elevation of 766.0 feet. The existing culvert beneath Sauk Prairie Road has an invert elevation of approximately 765.0. Note that while the proposed greenway has been sized to safely convey peak flows for a 100-year storm event, the existing culverts at Sauk Valley Road have an approximate 5-year storm capacity. However, based on culvert hydraulic calculations, stormwater flows that exceed the capacity of these culverts can safely overflow Sauk Prairie Road without causing upstream flooding issues. Because the receiving natural drainageway located downstream of Sauk Prairie Road has many of the same physical characteristics of the upstream drainageway (i.e. flat slopes, expansive, no defined bed and bank), increasing the capacity of the culverts at Sauk Prairie Road would be difficult unless significant downstream channel improvements are implemented. Because this area is located outside of the Village of Prairie Du Sac's projected corporate limits, this project would likely need to be coordinated with the Town of Prairie Du Sac and Village of Sauk City.

Finally, the exact location of the proposed greenway will require close coordination and mapping of the existing West Side Sanitary Interceptor Sewer. Ideally, the sewer route would coincide with the planned bike path that would be part of the greenway construction (refer to Figure 4.02-10).

4.03 NONSTRUCTURAL ALTERNATIVE CONSIDERED

This section describes a nonstructural practice considered as a potential measure to manage future stormwater needs for the NW and SW Basins in the Village of Prairie Du Sac.

A. Introduction of Release Rate Limits

In lieu of constructing regional stormwater facilities prior to further development within the NW and SW Basins, appropriate stormwater release rate limits for sizing of on-site stormwater facilities could be adopted by the Village. This would place the responsibility of constructing stormwater management facilities to meet the discharge limits on future land developers. However, adopting a release rate limit

would not improve the current stormwater drainage conditions because the discharge limits are based on existing conditions.

For example, if a developer wanted to develop 100 acres in the northeast area of the NW Basin, a 2-year release rate of 0.05 cfs/acre would equate to a maximum release of stormwater from the site of 5 cfs. Similarly, a 100-year release rate of 0.20 cfs/acre would equate to a maximum 100-year flow from the site of 20 cfs. Sufficient stormwater detention would need to be provided for the development to achieve these stormwater release rates. Table 4.03-1 outlines the potential release rate limits for undeveloped subbasins within the NW and SW Basins.

Subbasin(s)	Release Rates (cfs/ac)	
	2-year	100-year
NW1/NW5	0.16	0.99
NW3	0.03	0.35
SW6/SW12/SW13B	0.07	0.38
SW13	0.01	0.30
SW13A	0.04	0.48
SW14/SW15	0.04	0.64

Table 4.03-1 Release Rates Summary

4.04 OPINION OF PROBABLE COST

Opinions of probable cost for potential structural stormwater management capital improvements are summarized in Table 4.04-1, based on 2009 costs. Opinions of probable cost include 15 percent contingencies, 12 percent engineering costs, and estimated land acquisition costs. Note that detailed cost opinion breakdowns for each project are included in Appendix B. Estimated land acquisition costs varied from $40,000 per acre to $60,000 per acre, depending on the size of the parcel to be acquired and whether the parcel is contiguous to existing development. Of course, actual land costs can vary greatly with changing market conditions.

Estimated construction costs for the regional detention basins and greenway considered earth excavation, restoration (per acre cost includes topsoil placement, seeding, and erosion mat), outlet structure, spillway (includes permanent erosion mat and seeding), and sediment forebays (bioretention basins according to detail shown in Figure 4.02-2). Review of the detailed cost opinions indicates that earth excavation makes up the largest component of the estimated construction costs. A $5 per cubic yard unit price was applied for earth excavation for each project. This unit price assumes that excess excavated material will generally be managed on lands contiguous to the construction site and that no hauling of excess material will be required. Additionally, it is assumed earth excavation activities will not involve significant dewatering or drying of material. If preliminary design of these structural measures proceeds, it is recommended that subsurface geotechnical explorations be performed.

Potential funding options for these capital projects, including development of cost-sharing models for future developers, are provided in Section 5 of this report.

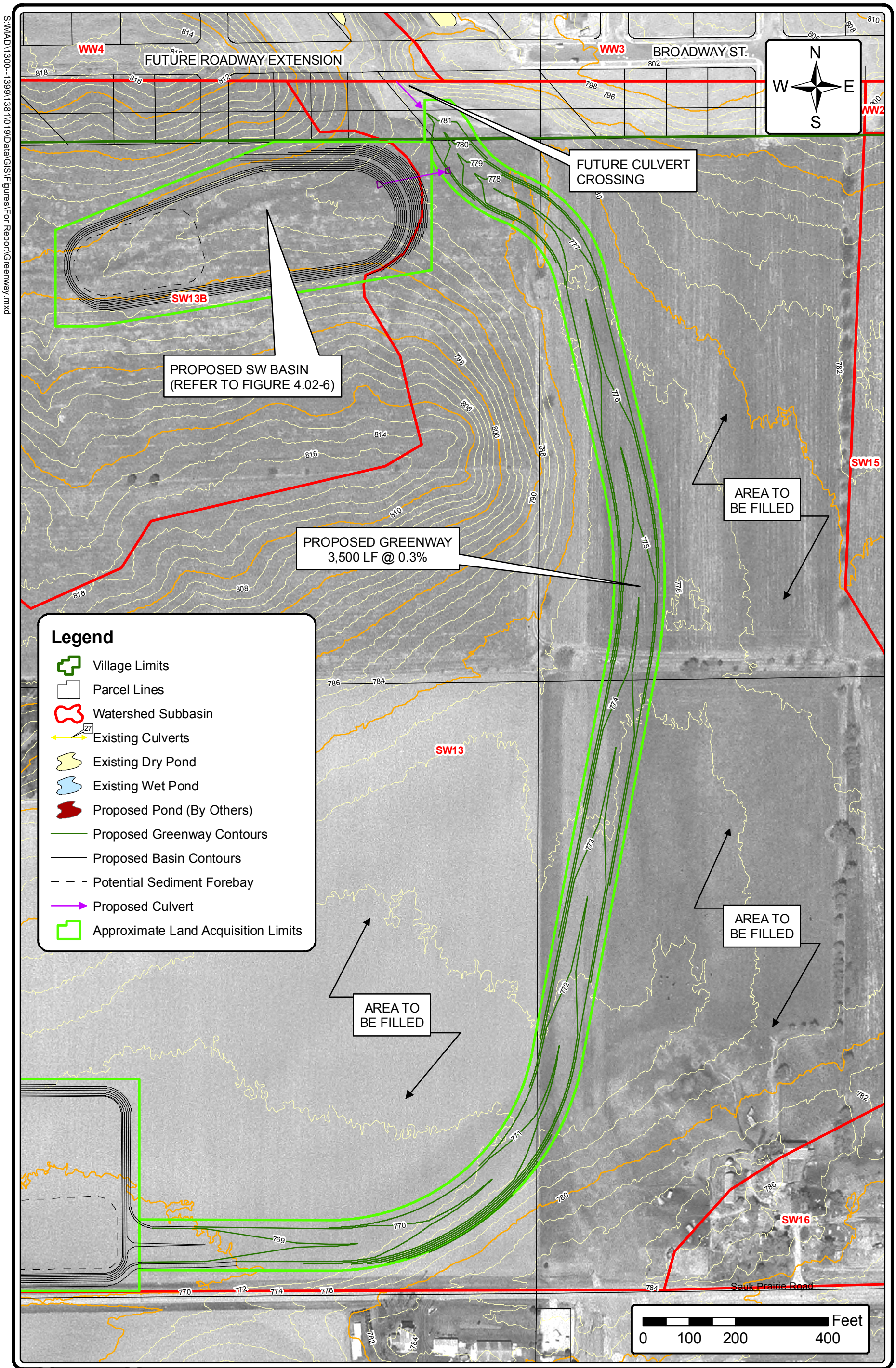


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FIGURE 4.02-10
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PROPOSED GREENWAY

WEST SIDE STORMWATER MANAGEMENT PLAN
VILLAGE OF PRAIRIE DU SAC
SAUK COUNTY, WISCONSIN

Project ID	Contstruction Cost	Land Acquistion Cost	Total Cost
NE Basin	$1,592,065	$1,038,000	$2,630,065
Combined NE Basin	$1,655,624	$930,000	$2,585,624
NW Basin	$440,994	$284,000	$724,994
SW Basin	$357,578	$244,000	$601,578
SE Basin	$517,130	$288,000	$805,130
SW13 Basin	$705,308	$498,000	$1,203,308
Greenway	$321,410	$492,000	$813,410

Table 4.04-1 Opinion of Probable Cost Summary for Structural Alternatives

SECTION 5
CONCLUSIONS

5.01 GENERAL

This section summarizes conclusions for the Village of Prairie du Sac to manage future stormwater needs in the NW and SW Basins of the Village.

5.02 STRUCTURAL PRACTICES

A. Regional Detention Basins

Six regional stormwater detention basin options have been evaluated as part of the West Side Stormwater Management Plan. Note that two of the options generally occupy the same regional detention basin site located northeast of the Highland Park Subdivision (NE Basin and Combined NE Basin). Note that the estimated land acquisition cost for the Combined NE Basin is slightly less than the NE Basin by approximately $108,000. However, the overall project cost for the Combined NE Basin is only approximately $44,000 less than the NE Basin. The Combined NE Basin is the preferred alternative of the two options because less land is necessary to acquire (15.5 acres versus 17.3 acres) and the total project cost is less.

B. Constructed Greenway

Of the future capital projects evaluated within the NW and SW Basins, construction of the greenway between the Fieldstone Subdivision and Sauk Prairie Road is likely the greatest need. Unless the greenway project is implemented, future development of adjacent lands within Subbasin SW13 would be very difficult and would likely require significant filling to obtain positive drainage.

5.03 NONSTRUCTURAL PRACTICES

A. Potential Ordinance Revisions

It is recommended that the Village refine the existing Construction Site Erosion Control and Stormwater Management ordinance in accordance with the WDNR model ordinance. The model ordinance includes current WDNR water quality (TSS reduction), peak discharge, and infiltration requirements. For new development, BMPs shall be installed to reduce, by the maximum extent practicable, the TSS loading by 80 percent. In addition, the BMPs shall also serve the purpose to reduce the peak runoff rate to the pre-development condition for the 2-year, 24-hour design storm. An example of the WDNR model ordinance can be found in Appendix C.

B. Discharge Limits

Table 4.03-1 in Section 4 presented recommended allowable 2-year and 100-year storm event release rates for each of the primary subbasins within the NW and SW Basins. If the Village chooses not to pursue implementation of regional stormwater facilities, establishment of these recommended release rates for future development would generally have a similar effect. However, stormwater detention would continue to be provided on a site-by-site basis.

5.04 FUNDING OPTIONS

A. Fees

Funding the proposed stormwater management capital improvement projects via the Village's Stormwater Utility is a potential option that may be considered. The design, construction, and future operation and maintenance of these projects would be initially paid for by the Stormwater Utility. However, the Stormwater Utility would have the ability to recover these costs from future private developers via a stormwater impact fee. A potential funding cost sharing model has been developed and is discussed in Section 5.05.

B. Grants

Financial assistance for local pollution control efforts is available through various WDNR loan and grant programs, including the Targeted Runoff Management (TRM) and Urban Nonpoint Source and Stormwater Management (UNPS&SW) programs. However, it should be noted that projects that are intended to serve future development are not eligible for the WDNR grant programs described below. If the Village intends on constructing new stormwater management facilities or wishes to retrofit an existing stormwater management facility that serves existing development, the project may be eligible for the following grant programs:

1. TRM grants are provided to control polluted runoff from both urban and rural sites. The grants are targeted at high-priority resource problems. Projects funded by TRM grants are site-specific and serve areas generally smaller in size than a subwatershed. The grant period is two years, with a possible one-year extension. The maximum cost-share rate available to TRM grant recipients is 70 percent of eligible costs, with the total of state funding not to exceed $150,000.

2. UNPS&SW planning grants can be used to pay for a variety of technical assistance activities. Eligible activities such as stormwater management planning, related information and education activities, ordinance and utility development, and enforcement are cost-shared at 70 percent. For a technical assistance activity to be eligible for funding under this program, the project must currently be in an urban area or an area projected to be urban within 20 years.

Eligible UNPS&SW construction grant costs may include such projects as stormwater detention ponds, filtration and infiltration practices, streambank stabilization, and shoreline stabilization. Eligible costs are cost-shared at 50 percent up to a maximum of $150,000. Design costs are also eligible as part of the total project costs and can be reimbursed at 50 percent. Design costs can be retroactively reimbursed provided the design is approved by the WDNR regional staff and the construction project is selected for funding.

Construction projects involving land acquisition and permanent easements can be awarded up to an additional $50,000 in cost-share funds (50 percent cost-share rate). Land acquisition can be retroactively reimbursed provided the parcel appraisal is approved by the WDNR appraisal reviewers and the construction project is selected for funding.

5.05 COST-SHARING MODEL

The following standards for setting up the stormwater impact fees should be followed:

1. The infrastructure that is being implemented must have a direct correlation to the need created by the development.
2. Developers shall not pay an impact fee that exceeds their fair share.
3. Developers shall not be charged impact fees for the same facility or infrastructure costs more than once.

A. Method 1–Per Acre of Future Development Served

For stormwater storage, conveyance, and treatment measures, an equitable cost-share apportionment could be based on tributary drainage area for future development. The cost-share amount would be calculated based on a per acre of drainage area basis. An example of how this cost-sharing method could be applied is presented below.

Example: A regional stormwater basin is constructed to drain a tributary drainage area of 250 acres, 200 acres of which consists of future development. The implementation cost of the basin is $800,000. The following cost-sharing model could be applied:

$$\frac{\text{Total Basin Implementation Cost}}{\text{Future Development Area Within Tributary Watershed}} = \text{Cost per Acre of Future Development}$$

$$\frac{\$800{,}000}{200 \text{ acres}} = \$4{,}000 \text{ per acre}$$

A summary of this same cost-sharing approach to the six NW and SW Basin regional stormwater facilities is shown in Table 5.05-1.

Project ID	Developed Tributary Area (ac)	Estimated Project Cost	Cost per Acre
NE Basin	437	$2,630,065	$6,018
Combined NE Basin	437	$2,585,624	$5,917
NW Basin	148	$724,994	$4,899
SW Basin	110	$601,578	$5,469
SE Basin	96	$805,130	$8,387
SW13 Basin	131	$1,203,308	$9,186
Greenway	131	$813,410	$6,209

Table 5.05-1 Summary of Method 1 Cost Sharing Approach

B. Method 2–Per Acre of Future Development Served and Percent Impervious

Note that Method 1 does not account for the impact that various land uses may have on the sizing of the stormwater facilities. For instance, commercial and industrial lands have a much higher percentage

of impervious area when compared to residential lands. For a more equitable cost-share model, the total impervious area for future development within the tributary drainage area could be used instead. Listed below is the same example presented above but applying the Method 2 cost-share model.

Example: A regional stormwater basin is constructed to drain a tributary drainage area of 250 acres, 200-acres of which consists of future development. This 200-acre watershed consists of 140 acres of zoned single-family residential (average impervious area = 38 percent) and 60 acres of zoned industrial (average impervious area = 72 percent). Note the percent impervious areas are based on accepted values contained within the TR-55 publication developed by the NRCS. The implementation cost of the basin is $800,000. The following cost-sharing model could be applied.

Land Use ID	Percent Impervious	Land Area (ac.)	Impervious Area (ac.)	Percent Impervious within Watershed
Residential	38	140	53.2	55.2
Industrial	72	60	43.2	44.8
Total		200	96.4	100.0

Table 5.05-2 Example Using Method 2 Cost Sharing Approach

1. Future Residential Lands Cost Share:

$$\frac{\text{(Residential \% Impervious in Watershed/100) x (Total Basin Implementation Cost)}}{\text{Future Residential Area in Watershed}} = \text{Cost per Acre of Future Residential Development}$$

$$\frac{\text{(55.2\%/100) x (\$800,000)}}{\text{140 acres}} = \text{\$3,154 per acre of Future Residential Development}$$

2. Future Industrial Lands Cost Share:

$$\frac{\text{(Industrial \% Impervious in Watershed/100) x (Total Basin Implementation Cost)}}{\text{Future Industrial Area in Watershed}} = \text{Cost per Acre of Future Industrial Development}$$

$$\frac{\text{(44.8\%/100) x (\$800,000)}}{\text{60 acres}} = \text{\$5,973 per acre of Future Industrial Development}$$

While the Method 2 cost-sharing approach is likely more equitable than the Method 1 approach, it is based on future land use zoning classifications that could change. If the future land use zoning classifications do change, the cost-sharing model would need to be updated accordingly. The Method 2 cost-sharing model approach was applied to each of the proposed stormwater management projects and the results are presented in Table 5.05-3.

TABLE 5.05-3

SUMMARY OF METHOD 2 COST SHARING APPROACH

Land Use	Developed Tributary Area (ac)	Percent Impervious in Watershed	Proposed Project Cost	Cost per Acre
NE Basin				
Commercial	157	46%	$1,209,830	$7,706
Industrial	143	36%	$946,824	$6,621
Residential	137	18%	$473,412	$3,456
Total	**437**	**100%**	**$2,630,065**	**$6,018**
Combined NE Basin				
Commercial	157	46%	$1,189,387	$7,576
Industrial	143	36%	$930,825	$6,509
Residential	137	18%	$465,412	$3,397
Total	**437**	**100%**	**$2,585,624**	**$5,917**
NW Basin				
Commercial	0	0%	$0	$0
Industrial	0	0%	$0	$0
Residential	148	100%	$724,994	$4,899
Total	**148**	**100%**	**$724,994**	**$4,899**
SW Basin				
Commercial	33	47%	$284,333	$8,616
Industrial	5	6%	$38,268	$7,654
Residential	72	46%	$278,977	$3,875
Total	**110**	**100%**	**$601,578**	**$5,469**
SE Basin				
Commercial	0	0%	$0	$0
Industrial	0	0%	$0	$0
Residential	96	100%	$805,130	$8,387
Total	**96**	**100%**	**$805,130**	**$8,387**
SW13 Basin				
Commercial	9	14%	$168,463	$18,718
Industrial	0	0%	$0	$0
Residential	122	86%	$1,034,845	$8,482
Total	**131**	**100%**	**$1,203,308**	**$9,186**
Greenway				
Commercial	9	14%	$113,877	$12,653
Industrial	0	0%	$0	$0
Residential	122	86%	$699,532	$5,734
Total	**131**	**100%**	**$813,410**	**$6,209**

APPENDIX A
WETLANDS AND NAVIGABLE STREAMS

Jefferson, Jen

From: Schure, Jeff J - DNR [Jeff.Schure@Wisconsin.gov]
Sent: Tuesday, April 28, 2009 11:12 AM
To: Jefferson, Jen
Cc: Shubak, Mark
Subject: RE: Prairie du Sac Navigability Determination

Based upon a site visit completed on April 27, 2009. There are on navigable waterways associated with the area marked on the map. Therefore the question, if online ponds can be constructed, does not apply. There are no ch 30 issues in relation to this drainage area.

Jeff J. Schure
Water Management Specialist
Bureau of Watershed Management
Wisconsin Department of Natural Resources
http://dnr.wi.gov/org/water/fhp/waterway/
(☎) phone: (608) 275-3228
(☎) fax: (608) 275-3338
(✉) e-mail: Jeff.Schure@dnr.state.wi.us

From: Jefferson, Jen [mailto:Jen.Jefferson@strand.com]
Sent: Monday, April 27, 2009 11:25 AM
To: Schure, Jeff J - DNR
Cc: Shubak, Mark
Subject: Prairie du Sac Navigability Determination

Jeff,

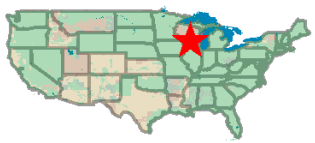
Per our discussion regarding Prairie du Sac, I have attached a map showing the area/drainage way where a navigability determination is requested (highlighted in blue). The drainage way south of County Highway PF appears to be an intermittent stream on the Water Surface Viewer and flows south from a pond just north of County Highway PF toward Sauk Prairie Road. The drainage way to the north does not show up on the Water Surface Viewer but flows in a southwestern direction toward the pond just to the north of County Highway PF. A navigability determination is needed for both drainage ways.

Strand is investigating the possibility of providing regional stormwater management facilities for undeveloped areas (NW Basin and SW Basin) which drain to an unnamed drainage way on the west side of Prairie du Sac. What is your input regarding the ability to construct ponds online and/or offline of the drainage way south of County Highway PF?

Please call me at (414.431.1788 ext. 102) or contact me via email with any questions. We look forward to hearing your determination.

Thanks,
Jen

Prairie du Sac, WI



Legend

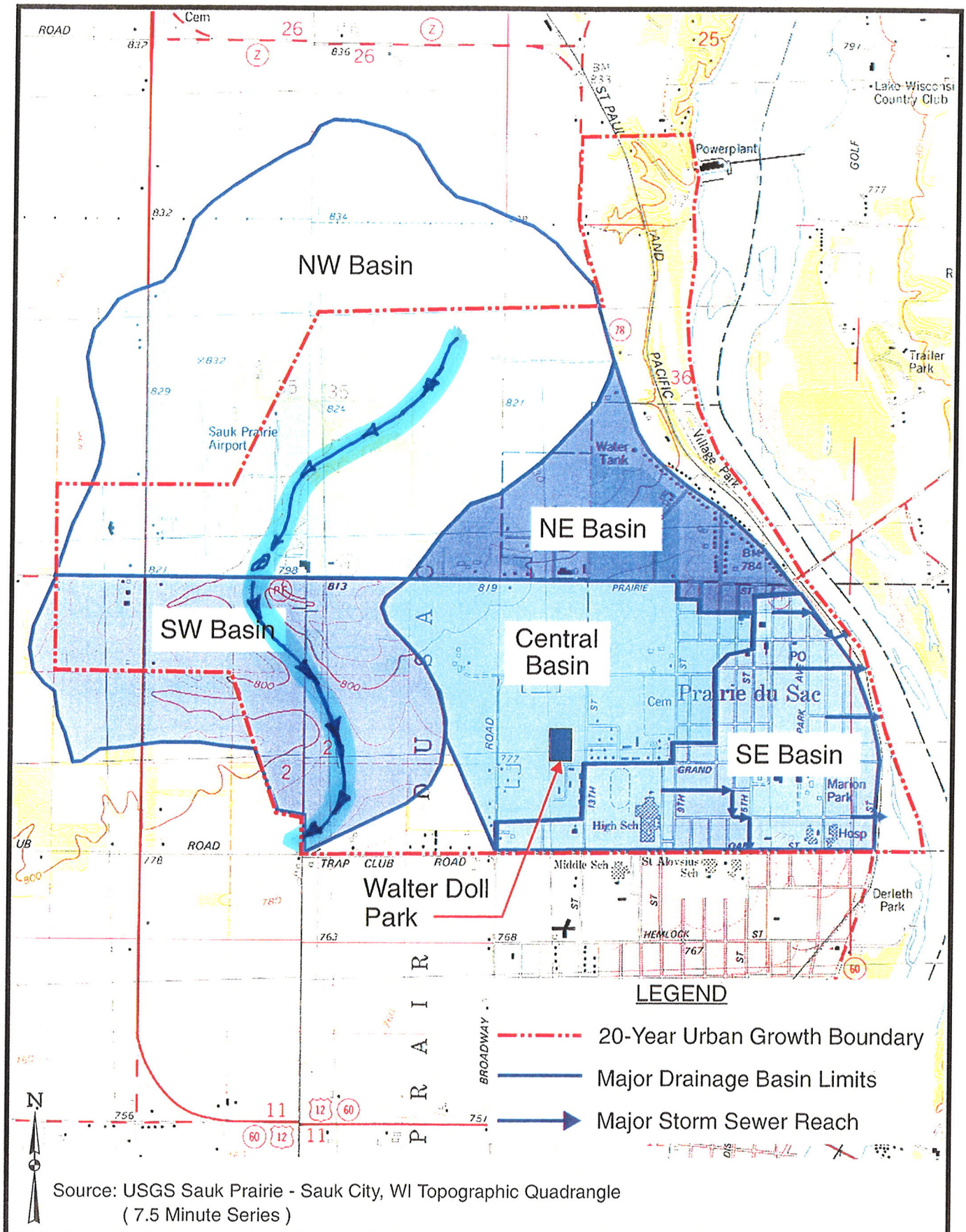
- Interstate
- Major Roads
- Other Road
- Interstate
- State highway
- US highway
- Roads
- Cities
- USGS Quad Index 24K
- Lower 48 Wetland Polygons
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine
- Lower 48 Available Wetland Data
- Non-Digital
- Digital
- No Data
- Scan
- NHD Streams
- Counties 100K
- States 100K
- South America
- North America

N

Scale: 1:33,875

Map center: 43° 17' 10" N, 89° 44' 16" W

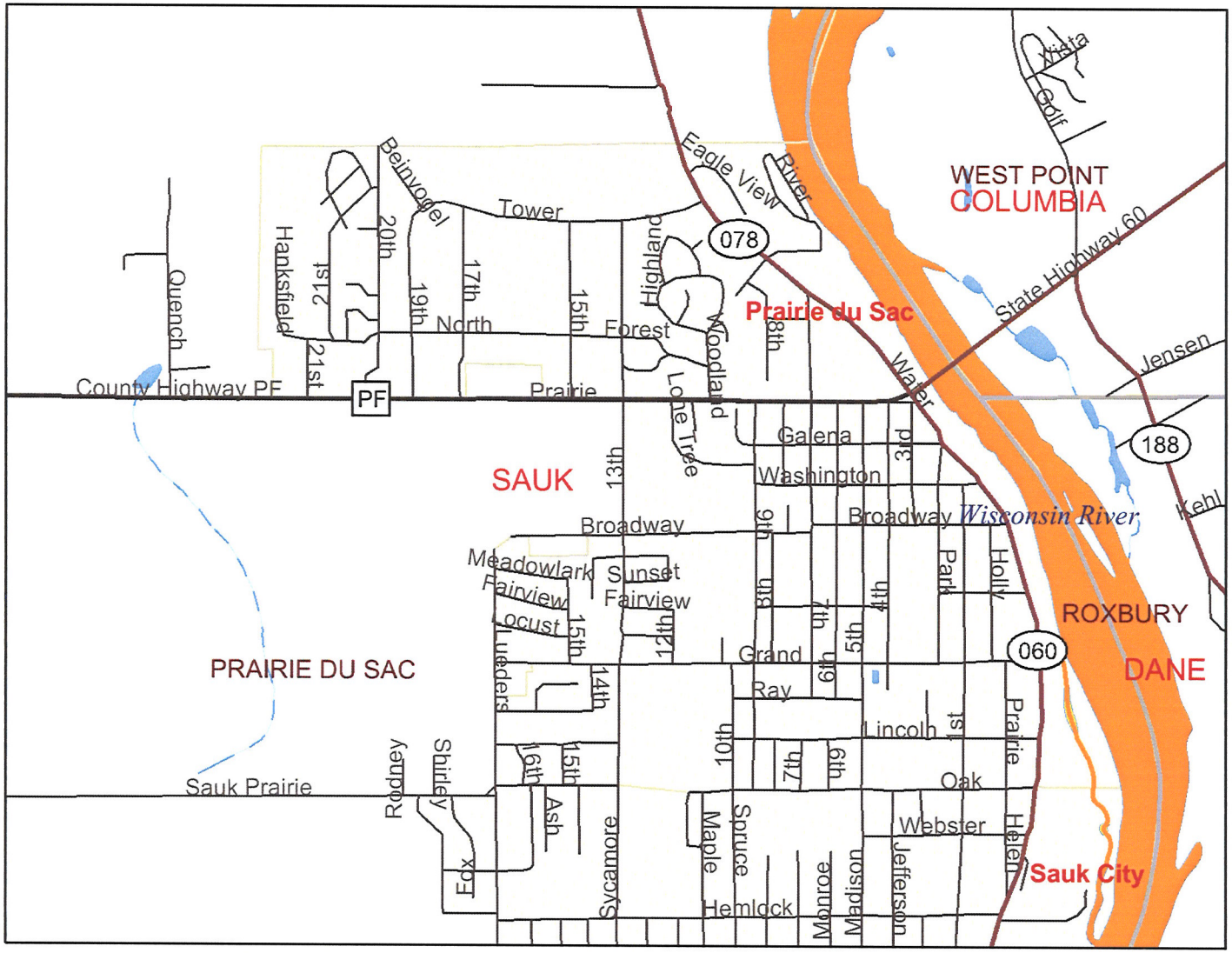
This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.



Source: USGS Sauk Prairie - Sauk City, WI Topographic Quadrangle
(7.5 Minute Series)

Figure 1.03-1 Scale: 1" = 2000' 381-750	Village of Prairie du Sac Stormwater Management Study Study Limits	STRAND ASSOCIATES, INC.

Map Created on Apr 25, 2009



Legend

Major Highways

- Interstate
- State Highway
- U.S. Highways
- County Roads
- Local Roads
- 24K County Boundaries

Civil Towns

- Civil Town
- PRF Other Public Rights Features
- PRF Sensitive Areas of Lakes

ASNRI Outstanding and Exceptional Streams

- ERW
- ORW
- ORW

ASNRI Outstanding and Exceptional Lakes

- ERW
- ORW
- ORW
- ASNRI Wild and Scenic Rivers

ASNRI Trout Streams

- Class I Trout
- Class II Trout
- Class III Trout
- ASNRI Wild Rice Streams
- ASNRI Wild Rice Areas
- ASNRI Quality Wetland Streams
- ASNRI Quality Wetland Areas

N

Scale: 1:20,722

0 2000 4000 6000 ft.

This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.

APPENDIX B
COST OPINIONS

NE Basin				
Opinion of Probable Cost				
Item	**Unit**	**Unit Cost**	**Quantity**	**Item Cost**
Excavation	CY	$5.00	159,615	$798,076
Restoration	Acre	$5,000	15	$76,500
Outlet Structure	EACH	$15,000	1	$15,000
Spillway	EACH	$10,000	1	$10,000
Sediment Forebays	SF	$5	67,300	$336,500
			15% Contigency	$185,411
			Subtotal	$1,421,487
			12% Engineering	$170,578
Land Acquisition	EACH	$60,000	17.3	$1,038,000
			Grand Total	$2,630,065

Earth Excavation Summary

Elevation	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Sum Volume (ac-ft)		
806.0	12.21				0.0		
		12.15	1.0	12.1			
807.0	12.08				12.1		
		11.58	1.0	11.6			
808.0	11.07				23.7		
		10.73	1.0	10.7			
809.0	10.38				34.4		
		9.74	1.0	9.7			
810.0	9.09				44.2		
		8.93	1.0	8.9			
811.0	8.76				53.1		
		8.41	1.0	8.4			
812.0	8.05				61.5		
		7.81	1.0	7.8			
813.0	7.57				69.3		
		7.30	1.0	7.3			
814.0	7.03				76.6		
		6.72	1.0	6.7			
815.0	6.40				83.3		
		6.07	1.0	6.1			
816.0	5.74				89.4		
		5.26	1.0	5.3			
817.0	4.78				94.7		
		4.27	1.0	4.3		CU. FT.	CY
818.0	3.76				98.9	4,309,609	159,615

Combined NE Basin				
Opinion of Probable Cost				
Item	**Unit**	**Unit Cost**	**Quantity**	**Item Cost**
Excavation	CY	$5.00	147,434	$737,172
Restoration	Acre	$5,000	18	$92,000
Outlet Structure	EACH	$15,000	1	$15,000
Spillway	EACH	$10,000	1	$10,000
Sediment Forebays	SF	$5	86,250	$431,250
			15% Contigency	$192,813
			Subtotal	$1,478,236
			12% Engineering	$177,388
Land Acquisition	EACH	$60,000	15.5	$930,000
			Grand Total	$2,585,624

Earth Excavation Summary

Elevation	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Sum Volume (ac-ft)		
806.0	13.07				0.0		
		13.25	1.0	13.3			
807.0	13.43				13.3		
		12.57	1.0	12.6			
808.0	11.70				25.8		
		10.89	1.0	10.9			
809.0	10.07				36.7		
		8.80	1.0	8.8			
810.0	7.53				45.5		
		7.31	1.0	7.3			
811.0	7.09				52.8		
		6.82	1.0	6.8			
812.0	6.54				59.6		
		6.30	1.0	6.3			
813.0	6.06				65.9		
		5.80	1.0	5.8			
814.0	5.53				71.7		
		5.24	1.0	5.2			
815.0	4.95				77.0		
		4.66	1.0	4.7			
816.0	4.36				81.6		
		3.93	1.0	3.9			
817.0	3.49				85.5		
		3.09	1.0	3.1			
818.0	2.68				88.6		
		1.73	1.0	1.7			
819.0	0.77				90.4		
		0.64	1.0	0.6			
820.0	0.50				91.0		
		0.40	1.0	0.4		CU. FT.	CY
821.0	0.30				91.4	3,980,731	147,434

NW Basin				
Opinion of Probable Cost				
Item	**Unit**	**Unit Cost**	**Quantity**	**Item Cost**
Excavation	CY	$5.00	29,677	$148,386
Restoration	Acre	$5,000	6	$30,000
Outlet Structure	EACH	$15,000	1	$15,000
Spillway	EACH	$10,000	1	$10,000
Sediment Forebays	SF	$5	27,800	$139,000
			15% Contigency	$51,358
			Subtotal	$393,744
			12% Engineering	$47,249
Land Acquisition	Acre	$40,000	7.1	$284,000
			Grand Total	$724,994

Earth Excavation Summary

Elevation	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Sum Volume (ac-ft)		
820.0	4.56				0.0		
		4.49	1.0	4.5			
821.0	4.42				4.5		
		4.17	1.0	4.2			
822.0	3.91				8.7		
		3.66	1.0	3.7			
823.0	3.41				12.3		
		2.94	1.0	2.9			
824.0	2.46				15.3		
		1.92	1.0	1.9			
825.0	1.38				17.2		
		1.23	1.0	1.2		CU. FT.	CY
826.0	1.07				18.4	801,286	29,677

SW Basin				
Opinion of Probable Cost				
Item	**Unit**	**Unit Cost**	**Quantity**	**Item Cost**
Excavation	CY	$5.00	7,575	$37,873
Restoration	Acre	$5,000	5	$24,000
Outlet Structure	EACH	$15,000	1	$15,000
Spillway	EACH	$10,000	1	$10,000
Sediment Forebays	SF	$5	38,150	$190,750
			15% Contigency	$41,643
			Subtotal	$319,266
			12% Engineering	$38,312
Land Acquisition	EACH	$40,000	6.1	$244,000
			Grand Total	$601,578

Earth Excavation Summary

Elevation	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Sum Volume (ac-ft)		
786.0	1.89				0.0		
		1.74	1.0	1.7			
787.0	1.58				1.7		
		1.36	1.0	1.4			
788.0	1.13				3.1		
		0.91	1.0	0.9			
789.0	0.69				4.0		
		0.50	1.0	0.5			
790.0	0.31				4.5		
		0.20	1.0	0.2		CU. FT.	CY
791.0	0.08				4.7	204,514	7,575

SE Basin				
Opinion of Probable Cost				
Item	**Unit**	**Unit Cost**	**Quantity**	**Item Cost**
Excavation	CY	$5.00	35,050	$175,248
Restoration	Acre	$5,000	4	$19,000
Outlet Structure	EACH	$15,000	1	$15,000
Spillway	EACH	$10,000	1	$10,000
Storm Sewer	LF	$50	400	$20,000
Sediment Forebays	SF	$5	32,450	$162,250
			15% Contigency	$60,225
			Subtotal	$461,723
			12% Engineering	$55,407
Land Acquisition	EACH	$60,000	4.8	$288,000
			Grand Total	$805,130

Earth Excavation Summary

Elevation	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Sum Volume (ac-ft)		
767.0	2.64				0.0		
		2.71	1.0	2.7			
768.0	2.78				2.7		
		2.85	1.0	2.9			
769.0	2.92				5.6		
		3.00	1.0	3.0			
770.0	3.07				8.6		
		3.15	1.0	3.1			
771.0	3.22				11.7		
		2.88	1.0	2.9			
772.0	2.54				14.6		
		2.40	1.0	2.4			
773.0	2.26				17.0		
		2.11	1.0	2.1			
774.0	1.95				19.1		
		1.70	1.0	1.7			
775.0	1.44				20.8		
		0.95	1.0	0.9		CU. FT.	CY
776.0	0.45				21.7	946,341	35,050

SW13 Basin				
Opinion of Probable Cost				
Item	**Unit**	**Unit Cost**	**Quantity**	**Item Cost**
Excavation	CY	$5.00	53,220	$266,099
Restoration	Acre	$5,000	8	$40,000
Outlet Structure	EACH	$15,000	1	$15,000
Spillway	EACH	$10,000	1	$10,000
Sediment Forebays	SF	$5	43,300	$216,500
			15% Contigency	$82,140
			Subtotal	$629,739
			12% Engineering	$75,569
Land Acquisition	EACH	$60,000	8.3	$498,000
			Grand Total	$1,203,308

Earth Excavation Summary

Elevation	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Sum Volume (ac-ft)		
765.5	6.24				0.0		
		6.29	0.5	3.1			
766.0	6.33				3.1		
		6.43	1.0	6.4			
767.0	6.53				9.6		
		6.64	1.0	6.6			
768.0	6.75				16.2		
		6.89	1.0	6.9			
769.0	7.02				23.1		
		5.19	1.0	5.2			
770.0	3.35				28.3		
		2.68	1.0	2.7			
771.0	2.01				31.0		
		1.34	1.0	1.3			
772.0	0.67				32.3		
		0.50	1.0	0.5			
773.0	0.32				32.8		
		0.19	1.0	0.2		CU. FT.	CY
774.0	0.06				33.0	1,436,936	53,220

Greenway				
Opinion of Probable Cost				
Item	**Unit**	**Unit Cost**	**Quantity**	**Item Cost**
Excavation	CY	$5.00	19,158	$95,792
Restoration	Acre	$5,000	7	$35,000
Rip Rap	CY	$25	2,500	$62,500
TRM	SY	$7.50	7,500	$56,250
			15% Contigency	$37,431
			Subtotal	$286,973
			12% Engineering	$34,437
Land Acquisition	Acre	$60,000	8.2	$492,000
			Grand Total	$813,410

Earth Excavation Summary

Elevation	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Sum Volume (ac-ft)		
769.0	0.40				0.0		
		0.55	1.0	0.6			
770.0	0.70				0.6		
		0.81	1.0	0.8			
771.0	0.91				1.4		
		1.01	1.0	1.0			
772.0	1.11				2.4		
		1.30	1.0	1.3			
773.0	1.49				3.7		
		1.40	1.0	1.4			
774.0	1.30				5.1		
		1.43	1.0	1.4			
775.0	1.55				6.5		
		1.57	1.0	1.6			
776.0	1.59				8.1		
		1.54	1.0	1.5			
777.0	1.49				9.6		
		1.00	1.0	1.0			
778.0	0.51				10.6		
		0.50	1.0	0.5			
779.0	0.49				11.1		
		0.45	1.0	0.4			
780.0	0.40				11.5		
		0.34	1.0	0.3		CU. FT.	CY
781.0	0.27				11.9	517,275	19,158

APPENDIX C
WDNR MODEL ORDINANCES

APPENDIX B: MODEL POST-CONSTRUCTION STORM WATER MANAGEMENT ZONING ORDINANCE

TABLE OF CONTENTS

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S.03 Purpose and Intent

(1) Purpose

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MODEL POST-CONSTRUCTION STORM WATER MANAGEMENT ZONING ORDINANCE

Note to Users: *This model ordinance includes the use of brackets [ ] around phrases that are to be filled in by the municipality. For example, the phrase [administering authority] is frequently used. Where the municipality chooses to have the ordinance administered by the City Engineer, the phrase [administering authority] should be replaced by "City Engineer". In a few places, the model ordinance includes phrases in brackets that are underlined [_____]. In these cases, one of the underlined phrases should be selected verbatim. For example, if the phrase includes statutory citations, several underlined choices may be given such as [59.693, 60.627, 61.354, or 62.234]. A county would replace the phrase in brackets with "59.693", since that is the appropriate citation for the county to use.*

AN ORDINANCE TO CREATE CHAPTER [NUMBER] OF THE [CODE OR ORDINANCE] OF THE [NAME OF MUNICIPALITY] RELATING TO THE CONTROL OF POST-CONSTRUCTION RUNOFF

FOREWORD.

The intent of this ordinance is to reduce the amount of post-construction storm water and associated pollutants reaching waters of the state. Use of this ordinance by municipalities will foster the consistent statewide application of post-construction performance standards for new development and redevelopment contained in subchapters III and IV of chapter NR 151, Wis. Adm. Code.

The [governing body] of the [name of municipality] does hereby ordain that Chapter [number] of the [code or ordinance] of the [name of municipality] is created to read as follows:

[CHAPTER]
POST-CONSTRUCTION STORM WATER MANAGEMENT

S.01 AUTHORITY.

(1) This ordinance is adopted by the [governing body] under the authority granted by s. [59.693, for counties; 60.627, for towns; 61.354, for villages; or 62.234, for cities], Wis. Stats. This ordinance supersedes all provisions of an ordinance previously enacted under s. [59.69, 60.62, 61.35, or 62.23], Wis. Stats., that relate to storm water management regulations. Except as otherwise specified in s. [59.693, 60.627, 61.354, or 62.234], Wis. Stats., s. [59.69, 60.62, 61.35, or 62.23], Wis. Stats., applies to this ordinance and to any amendments to this ordinance.

(2) The provisions of this ordinance are deemed not to limit any other lawful regulatory powers of the same governing body.

(3) The [governing body] hereby designates the [administering authority] to administer and enforce the provisions of this ordinance.

(4) The requirements of this ordinance do not pre-empt more stringent storm water management requirements that may be imposed by any of the following:
   (a) Wisconsin Department of Natural Resources administrative rules, permits or approvals including those authorized under ss. 281.16 and 283.33, Wis. Stats.
   (b) Targeted non-agricultural performance standards promulgated in rules by the Wisconsin Department of Natural Resources under s. NR 151.004, Wis. Adm. Code.

S.02 FINDINGS OF FACT.

The [governing body] finds that uncontrolled, post-construction runoff has a significant impact upon water resources and the health, safety and general welfare of the community and diminishes the public enjoyment and use of natural resources. Specifically, uncontrolled post-construction runoff can:

(1) Degrade physical stream habitat by increasing stream bank erosion, increasing streambed scour, diminishing groundwater recharge, diminishing stream base flows and increasing stream temperature.

(2) Diminish the capacity of lakes and streams to support fish, aquatic life, recreational and water supply uses by increasing pollutant loading of sediment, suspended solids, nutrients, heavy metals, bacteria, pathogens and other urban pollutants.

(3) Alter wetland communities by changing wetland hydrology and by increasing pollutant loads.

(4) Reduce the quality of groundwater by increasing pollutant loading.

(5) Threaten public health, safety, property and general welfare by overtaxing storm sewers, drainage ways, and other minor drainage facilities.

(6) Threaten public health, safety, property and general welfare by increasing major flood peaks and volumes.

(7) Undermine floodplain management efforts by increasing the incidence and levels of flooding.

S.03 PURPOSE AND INTENT.

(1) PURPOSE. The general purpose of this ordinance is to establish long-term, post-construction runoff management requirements that will diminish the threats to public health, safety, welfare and the aquatic environment. Specific purposes are to:

(a) Further the maintenance of safe and healthful conditions.

(b) Prevent and control the adverse effects of storm water; prevent and control soil erosion; prevent and control water pollution; protect spawning grounds, fish and aquatic life; control building sites, placement of structures and land uses; preserve ground cover and scenic beauty; and promote sound economic growth.

(c) Control exceedance of the safe capacity of existing drainage facilities and receiving water bodies; prevent undue channel erosion; control increases in the scouring and transportation of particulate matter; and prevent conditions that endanger downstream property.

(2) INTENT. It is the intent of the [governing body] that this ordinance regulates post-construction storm water discharges to waters of the state. This ordinance may be applied on a site-by-site basis. The [governing body] recognizes, however, that the preferred method of achieving the storm water performance standards set forth in this ordinance is through the preparation and implementation of comprehensive, systems-level storm water management plans that cover hydrologic units, such as watersheds, on a municipal and regional scale. Such plans may prescribe regional storm water devices, practices or systems, any of which may be designed to treat runoff from more than one site prior to discharge to waters of the state. Where such plans are in conformance with the performance standards developed under s. 281.16, Wis. Stats., for regional storm water management measures and have been approved by the [governing body], it

is the intent of this ordinance that the approved plan be used to identify post-construction management measures acceptable for the community.

S.04 APPLICABILITY AND JURISDICTION.

(1) APPLICABILITY.

(a) Where not otherwise limited by law, this ordinance applies after final stabilization to a site of land disturbing construction activity meeting any of the criteria in this paragraph, unless the site is otherwise exempt under paragraph (b).

1. A post construction site that had 5 or more acres of land disturbing construction activity.
2. A post-development construction site that had one or more acres of land disturbing construction activity after March 10, 2003.

Note to Users: The 5- and 1-acre land disturbance thresholds are consistent with state and federal laws regarding applicability of construction site erosion control permits.

(b) A site that meets any of the criteria in this paragraph is exempt from the requirements of this ordinance.

1. A redevelopment post-construction site with no increase in exposed parking lots or roads.
2. A post-construction site with less than 10% connected imperviousness based on complete development of the post-construction site, provided the cumulative area of all parking lots and rooftops is less than one acre.
3. Nonpoint discharges from agricultural facilities and practices.
4. Nonpoint discharges from silviculture activities.
5. Routine maintenance for project sites under 5 acres of land disturbance if performed to maintain the original line and grade, hydraulic capacity or original purpose of the facility.
6. Underground utility construction such as water, sewer and fiberoptic lines. This exemption does not apply to the construction of any above ground structures associated with utility construction.

(c) Notwithstanding the applicability requirements in paragraph (a), this ordinance applies to post-construction sites of any size that, in the opinion of the [administering authority], is likely to result in runoff that exceeds the safe capacity of the existing drainage facilities or receiving body of water, that causes undue channel erosion, that increases water

pollution by scouring or the transportation of particulate matter or that endangers property or public safety.

(2) JURISDICTION.

This ordinance applies to [post construction sites within the boundaries and jurisdiction of the [name of the municipality]].

or

[post construction sites within the boundaries and jurisdiction of the [name of municipality]], as well as the extraterritorial division of land subject to an ordinance enacted pursuant to s. 236.45(2) and (3) Wis. Stats.]

or

[post construction sites within the boundaries and jurisdiction of the [name of the municipality]], as well as all lands located within the extraterritorial plat approval jurisdiction of the [name of municipality], even if plat approval is not involved.]

Note to Users: These options differ in the amount of land area covered by this ordinance and may have ramifications for enforcement authority. For counties, the first option will be the only option since counties do not have extraterritorial authority. Under s. 59.693(10), Wis. Stats., if a county storm water management ordinance exists at the time of annexation, then the municipal ordinance must be at least as restrictive as the county ordinance.

(3) EXCLUSIONS.

This ordinance is not applicable to activities conducted by a state agency, as defined under s. 227.01 (1), Wis. Stats., but also including the office of district attorney, which is subject to the state plan promulgated or a memorandum of understanding entered into under s. 281.33 (2), Wis. Stats.

Note to Users: The Wisconsin Department of Transportation (WisDOT) has entered into a memorandum of understanding with the Wisconsin Department of Natural Resources that satisfies s. 281.33 (2), Wis. Stats., such that activities directed and supervised by WisDOT are exempt from this model ordinance.

S.05 DEFINITIONS.

(1) "Administering authority" means a governmental employee, or a regional planning commission empowered under s. [59.693; 60.627; 61.354; 62.234], Wis. Stats., that is designated by the [governing body] to administer this ordinance.

(2) “Agricultural facilities and practices” has the meaning given in s. 281.16, Wis. Stats.

(3) “Average annual rainfall” means a calendar year of precipitation, excluding snow, which is considered typical.

(4) “Best management practice” or “BMP” means structural or non-structural measures, practices, techniques or devices employed to avoid or minimize sediment or pollutants carried in runoff to waters of the state.

(5) “Business day” means a day the office of the [administering authority] is routinely and customarily open for business.

(6) “Cease and desist order” means a court-issued order to halt land disturbing construction activity that is being conducted without the required permit.

(7) “Combined sewer system” means a system for conveying both sanitary sewage and storm water runoff.

(8) “Connected imperviousness" means an impervious surface that is directly connected to a separate storm sewer or water of the state via an impervious flow path.

(9) “Design storm” means a hypothetical discrete rainstorm characterized by a specific duration, temporal distribution, rainfall intensity, return frequency, and total depth of rainfall.

(10) “Development” means residential, commercial, industrial or institutional land uses and associated roads.

(11) “Division of land” means the creation from one parcel of [number] or more parcels or building sites of [number] or fewer acres each in area where such creation occurs at one time or through the successive partition within a 5 year period.

(12) “Effective infiltration area” means the area of the infiltration system that is used to infiltrate runoff and does not include the area used for site access, berms or pretreatment.

(13) “Erosion” means the process by which the land’s surface is worn away by the action of wind, water, ice or gravity.

(14) "Exceptional resource waters" means waters listed in s. NR 102.11, Wis. Adm. Code.

(15) “Extraterritorial” means the unincorporated area within 3 miles of the corporate limits of a first, second, or third class city, or within 1.5 miles of a fourth class city or village.

(16) "Final stabilization" means that all land disturbing construction activities at the construction site have been completed and that a uniform, perennial, vegetative cover has been established, with a density of at least 70% of the cover, for the unpaved areas and areas not covered by permanent structures, or employment of equivalent permanent stabilization measures.

(17) “Financial guarantee” means a performance bond, maintenance bond, surety bond, irrevocable letter of credit, or similar guarantees submitted to the [administering authority] by the responsible party to assure that requirements of the ordinance are carried out in compliance with the storm water management plan.

(18) “Governing body” means town board of supervisors, county board of supervisors, city council, village board of trustees or village council.

(19) “Impervious surface” means an area that releases as runoff all or a large portion of the precipitation that falls on it, except for frozen soil. Rooftops, sidewalks, driveways, parking lots and streets are examples of areas that typically are impervious.

(20) “In-fill area” means an undeveloped area of land located within existing development.

(21) “Infiltration” means the entry of precipitation or runoff into or through the soil.

(22) “Infiltration system” means a device or practice such as a basin, trench, rain garden or swale designed specifically to encourage infiltration, but does not include natural infiltration in pervious surfaces such as lawns, redirecting of rooftop downspouts onto lawns or minimal infiltration from practices, such as swales or road side channels designed for conveyance and pollutant removal only.

(23) “Karst feature” means an area or surficial geologic feature subject to bedrock dissolution so that it is likely to provide a conduit to groundwater, and may include caves, enlarged fractures, mine features, exposed bedrock surfaces, sinkholes, springs, seeps or swallets.

(24) “Land disturbing construction activity” means any man-made alteration of the land surface resulting in a change in the topography or existing vegetative or non-vegetative soil cover, that may result in runoff and lead to an increase in soil erosion and movement of sediment into waters of the state. Land disturbing construction activity includes clearing and grubbing, demolition, excavating, pit trench dewatering, filling and grading activities.

(25) “Maintenance agreement” means a legal document that provides for long-term maintenance of storm water management practices.

(26) “MEP” or “maximum extent practicable” means a level of implementing best management practices in order to achieve a performance standard specified in this ordinance which takes into account the best available technology, cost effectiveness and other competing issues such as human safety and welfare, endangered and threatened resources, historic properties and geographic features. MEP allows flexibility in the way to meet the performance standards and may vary based on the performance standard and site conditions.

(27) “New development” means development resulting from the conversion of previously undeveloped land or agricultural land uses.

(28) “Off-site” means located outside the property boundary described in the permit application.

(29) “On-site” means located within the property boundary described in the permit application.

(30) "Ordinary high-water mark" has the meaning given in s. NR 115.03(6), Wis. Adm. Code.

(31) “Outstanding resource waters” means waters listed in s. NR 102.10, Wis. Adm. Code.

(32) “Percent fines” means the percentage of a given sample of soil, which passes through a # 200 sieve.

Note to Users: Percent fines can be determined using the "American Society for Testing and Materials", volume 04.02, "Test Method C117-95 Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Material Aggregates by Washing". Copies can be obtained by contacting the American society for testing and materials, 100 Barr Harbor Drive, Conshohocken, PA 19428-2959, or phone 610-832-9585, or on line at: "http://www.astm.org/".

(33) "Performance standard" means a narrative or measurable number specifying the minimum acceptable outcome for a facility or practice.

(34) "Permit" means a written authorization made by the [administering authority] to the applicant to conduct land disturbing construction activity or to discharge post-construction runoff to waters of the state.

(35) "Permit administration fee" means a sum of money paid to the [administering authority] by the permit applicant for the purpose of recouping the expenses incurred by the authority in administering the permit.

(36) "Pervious surface" means an area that releases as runoff a small portion of the precipitation that falls on it. Lawns, gardens, parks, forests or other similar vegetated areas are examples of surfaces that typically are pervious.

(37) "Pollutant" has the meaning given in s. 283.01(13), Wis. Stats.

(38) "Pollution" has the meaning given in s. 281.01(10), Wis. Stats.

(39) "Post-construction site" means a construction site following the completion of land disturbing construction activity and final site stabilization.

(40) "Pre-development condition" means the extent and distribution of land cover types present before the initiation of land disturbing construction activity, assuming that all land uses prior to development activity are managed in an environmentally sound manner.

(41) "Preventive action limit" has the meaning given in s. NR 140.05(17), Wis. Adm. Code.

(42) "Redevelopment " means areas where development is replacing older development.

(43) "Responsible party" means any entity holding fee title to the property or other person contracted or obligated by other agreement to implement and maintain post-construction storm water BMPs.

(44) "Runoff" means storm water or precipitation including rain, snow or ice melt or similar water that moves on the land surface via sheet or channelized flow.

(45) "Separate storm sewer" means a conveyance or system of conveyances including roads with drainage systems, streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all of the following criteria:

(a) Is designed or used for collecting water or conveying runoff.

(b) Is not part of a combined sewer system.

(c) Is not draining to a storm water treatment device or system.

(d) Discharges directly or indirectly to waters of the state.

(46) “Site” means the entire area included in the legal description of the land on which the land disturbing construction activity occurred.

(47) “Stop work order” means an order issued by the [administering authority] which requires that all construction activity on the site be stopped.

(48) “Storm water management plan” means a comprehensive plan designed to reduce the discharge of pollutants from storm water after the site has under gone final stabilization following completion of the construction activity.

(49) “Storm water management system plan” is a comprehensive plan designed to reduce the discharge of runoff and pollutants from hydrologic units on a regional or municipal scale.

(50) "Technical standard" means a document that specifies design, predicted performance and operation and maintenance specifications for a material, device or method.

(51) “Top of the channel” means an edge, or point on the landscape, landward from the ordinary high-water mark of a surface water of the state, where the slope of the land begins to be less than 12% continually for at least 50 feet. If the slope of the land is 12% or less continually for the initial 50 feet, landward from the ordinary high-water mark, the top of the channel is the ordinary high-water mark.

(52) “TR-55” means the United States Department of Agriculture, Natural Resources Conservation Service (previously Soil Conservation Service), Urban Hydrology for Small Watersheds, Second Edition, Technical Release 55, June 1986.

(53) “Type II distribution” means a rainfall type curve as established in the “United States Department of Agriculture, Soil Conservation Service, Technical Paper 149, published 1973”. The Type II curve is applicable to all of Wisconsin and represents the most intense storm pattern.

(54) “Waters of the state” has the meaning given in s. 281.01 (18), Wis. Stats.

S.06 TECHNICAL STANDARDS.

The following methods shall be used in designing the water quality, peak flow shaving and infiltration components of storm water practices needed to meet the water quality standards of this ordinance:

(1) Technical standards identified, developed or disseminated by the Wisconsin Department of Natural Resources under subchapter V of chapter NR 151, Wis. Adm. Code.

(2) Where technical standards have not been identified or developed by the Wisconsin Department of Natural Resources, other technical standards may be used provided that the methods have been approved by the [administering authority].

(3) In this ordinance, the following year(s) and location(s) [has or have] been selected as average annual rainfall(s): [Madison, 1981 (Mar. 12-Dec. 2); Green Bay, 1969 (Mar. 29-Nov. 25);

Milwaukee, 1969 (Mar. 28-Dec. 6); Minneapolis, 1959 (Mar. 13-Nov. 4); Duluth, 1975 (Mar. 24 – Nov. 19)]

Note to Users: Of the five locations listed, the location closest to a project site best represents the average annual rainfall for that site.

S.07 PERFORMANCE STANDARDS.

(1) RESPONSIBLE PARTY. The responsible party shall implement a post-construction storm water management plan that incorporates the requirements of this section.

(2) PLAN. A written storm water management plan in accordance with S.09 shall be developed and implemented for each post-construction site.

(3) REQUIREMENTS. The plan required under sub. (2) shall include the following:

(a) TOTAL SUSPENDED SOLIDS. BMPs shall be designed, installed and maintained to control total suspended solids carried in runoff from the post-construction site as follows:

1. For new development, by design, reduce to the maximum extent practicable, the total suspended solids load by 80%, based on the average annual rainfall, as compared to no runoff management controls. No person shall be required to exceed an 80% total suspended solids reduction to meet the requirements of this subdivision.
2. For redevelopment, by design, reduce to the maximum extent practicable, the total suspended solids load by 40%, based on the average annual rainfall, as compared to no runoff management controls. No person shall be required to exceed a 40% total suspended solids reduction to meet the requirements of this subdivision.
3. For in-fill development under 5 acres that occurs within 10 years after the effective date of this rule …[revisor insert date], by design, reduce to the maximum extent practicable, the total suspended solids load by 40%, based on an average annual rainfall, as compared to no runoff management controls. No person shall be required to exceed a 40% total suspended solids reduction to meet the requirements of this subdivision.
4. For in-fill development that occurs 10 or more years after the effective date of this rule…[revisor insert date], by design, reduce to the maximum extent practicable, the total suspended solids load by 80%, based on an average annual rainfall, as compared to no runoff management controls. No person shall be required to

exceed an 80% total suspended solids reduction to meet the requirements of this subdivision.

5. Notwithstanding subds. 1. to 4., if the design cannot achieve the applicable total suspended solids reduction specified, the storm water management plan shall include a written and site-specific explanation why that level of reduction is not attained and the total suspended solids load shall be reduced to the maximum extent practicable.

Note to Users: Pollutant loading models such as SLAMM, P8 or equivalent methodology may be used to evaluate the efficiency of the design in reducing total suspended solids.

(b) PEAK DISCHARGE.

1. By design, BMPs shall be employed to maintain or reduce the peak runoff discharge rates, to the maximum extent practicable, as compared to pre-development conditions for the 2-year, 24-hour design storm applicable to the post-construction site. Pre-development conditions shall assume “good hydrologic conditions” for appropriate land covers as identified in TR-55 or an equivalent methodology. The meaning of “hydrologic soil group” and “runoff curve number” are as determined in TR-55. However, when pre-development land cover is cropland, rather than using TR-55 values for cropland, the runoff curve numbers in Table 1 shall be used.

Table 1 – Maximum Pre-Development Runoff Curve Numbers for Cropland Areas				
Hydrologic Soil Group	A	B	C	D
Runoff Curve Number	56	70	79	83

Note to Users: The curve numbers in Table 1 represent mid-range values for soils under a good hydrologic condition where conservation practices are used and are selected to be protective of the resource waters.

2. This subsection of the ordinance does not apply to any of the following:

   a. A post-construction site where the change in hydrology due to development does not increase the existing surface water elevation at any point within the downstream receiving water by more than 0.01 of a foot for the 2-year, 24-hour storm event.

Note to Users: Hydraulic models such as HEC-RAS or another methodology may be used to determine the change in surface water elevations.

b. A redevelopment post-construction site.

c. An in-fill development area less than 5 acres.

Note to Users: The intent of the peak discharge standard is to minimize streambank erosion, under bank-full conditions. For water quantity concerns, the post-development peak flow rate for the 10, 25, 50 and 100 year – 24 hour storm events should also be controlled either at or below pre-development discharge rates. This has not been addressed in this model ordinance but may need to be included in the local ordinance to address flood control issues.

(c) INFILTRATION. BMPs shall be designed, installed, and maintained to infiltrate runoff to the maximum extent practicable in accordance with the following, except as provided in subds. 5. through 8.

1. For residential developments one of the following shall be met:

   a. Infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 90% of the pre-development infiltration volume, based on an average annual rainfall. However, when designing appropriate infiltration systems to meet this requirement, no more than 1% of the project site is required as an effective infiltration area.

   b. Infiltrate 25% of the post-development runoff from the 2 year -24 hour design storm with a type II distribution. Separate curve numbers for pervious and impervious surfaces shall be used to calculate runoff volumes and not composite curve numbers as defined in TR-55. However, when designing appropriate infiltration systems to meet this requirement, no more than 1% of the project site is required as an effective infiltration area.

2. For non-residential development, including commercial, industrial and institutional development, one of the following shall be met:

   a. Infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 60% of the pre-development infiltration volume, based on an average annual rainfall. However, when designing appropriate infiltration systems to meet this requirement, no more than 2% of the project site is required as an effective infiltration area.

b. Infiltrate 10% of the runoff from the 2 year - 24 hour design storm with a type II distribution. Separate curve numbers for pervious and impervious surfaces shall be used to calculate runoff volumes, and not composite curve numbers as defined in TR-55. However, when designing appropriate infiltration systems to meet this requirement, no more than 2% of the project site is required as an effective infiltration area.

3. Pre-development condition shall be the same as in par. (b).

Note to Users: A model that calculates runoff volume, such as SLAMM, P8, or an equivalent methodology may be used.

4. Before infiltrating runoff, pretreatment shall be required for parking lot runoff and for runoff from new road construction in commercial, industrial and institutional areas that will enter an infiltration system. The pretreatment shall be designed to protect the infiltration system from clogging prior to scheduled maintenance and to protect groundwater quality in accordance with subd. 8. Pretreatment options may include, but are not limited to, oil/grease separation, sedimentation, biofiltration, filtration, swales or filter strips.

Note to Users: To achieve the infiltration requirement for the parking lots or roads, maximum extent practicable should not be interpreted to require significant topography changes that create an excessive financial burden. To minimize potential groundwater impacts, it is desirable to infiltrate the cleanest runoff. To achieve this, a design may propose greater infiltration of runoff from low pollutant sources such as roofs, and less from higher pollutant source areas such as parking lots.

5. Exclusions. The runoff from the following areas are prohibited from meeting the requirements of this paragraph:
   a. Areas associated with tier 1 industrial facilities identified in s. NR 216.21(2)(a), Wis. Adm. Code, including storage, loading, rooftop and parking.
   b. Storage and loading areas of tier 2 industrial facilities identified in s. NR 216.21(2)(b), Wis. Adm. Code.

      Note to Users: Runoff from tier 2 parking and rooftop areas may be infiltrated but may require pretreatment.

c. Fueling and vehicle maintenance areas.

d. Areas within 1000 feet upgradient or within 100 feet downgradient of karst features.

e. Areas with less than 3 feet separation distance from the bottom of the infiltration system to the elevation of seasonal high groundwater or the top of bedrock, except this subd. 5.e. does not prohibit infiltration of roof runoff.

f. Areas with runoff from industrial, commercial and institutional parking lots and roads and residential arterial roads with less than 5 feet separation distance from the bottom of the infiltration system to the elevation of seasonal high groundwater or the top of bedrock.

g. Areas within 400 feet of a community water system well as specified in s. NR 811.16(4), Wis. Adm. Code, or within 100 feet of a private well as specified in s. NR 812.08(4), Wis. Adm. Code, for runoff infiltrated from commercial, industrial and institutional land uses or regional devices for residential development.

h. Areas where contaminants of concern, as defined in s. NR 720.03(2), Wis. Adm. Code are present in the soil through which infiltration will occur.

i. Any area where the soil does not exhibit one of the following soil characteristics between the bottom of the infiltration system and the seasonal high groundwater and top of bedrock: at least a 3-foot soil layer with 20% fines or greater; or at least a 5-foot soil layer with 10% fines or greater. This does not apply where the soil medium within the infiltration system provides an equivalent level of protection. This subd. 5.i. does not prohibit infiltration of roof runoff.

Note to Users: The areas listed in subd. 5 are prohibited from infiltrating runoff due to the potential for groundwater contamination.

6. Exemptions. The following are not required to meet the requirements of this paragraph:

a. Areas where the infiltration rate of the soil is less than 0.6 inches/hour measured at the site.

b. Parking areas and access roads less than 5,000 square feet for commercial and industrial development.

c. Redevelopment post-construction sites.

d. In-fill development areas less than 5 acres.

e. Infiltration areas during periods when the soil on the site is frozen.

f. Roads in commercial, industrial and institutional land uses, and arterial residential roads.

7. Where alternate uses of runoff are employed, such as for toilet flushing, laundry or irrigation, such alternate use shall be given equal credit toward the infiltration volume required by this paragraph.

8. a. Infiltration systems designed in accordance with this paragraph shall, to the extent technically and economically feasible, minimize the level of pollutants infiltrating to groundwater and shall maintain compliance with the preventive action limit at a point of standards application in accordance with ch. NR 140, Wis. Adm. Code. However, if site specific information indicates that compliance with a preventive action limit is not achievable, the infiltration BMP may not be installed or shall be modified to prevent infiltration to the maximum extent practicable.

b. Notwithstanding subd. par. a., the discharge from BMPs shall remain below the enforcement standard at the point of standards application.

(d) PROTECTIVE AREAS.

1. "Protective area" means an area of land that commences at the top of the channel of lakes, streams and rivers, or at the delineated boundary of wetlands, and that is the greatest of the following widths, as measured horizontally from the top of the channel or delineated wetland boundary to the closest impervious surface. However, in this paragraph, "protective area" does not include any area of land adjacent to any stream enclosed within a pipe or culvert, such that runoff cannot enter the enclosure at this location.

a. For outstanding resource waters and exceptional resource waters, and for wetlands in areas of special natural resource interest as specified in s. NR 103.04, 75 feet.

b. For perennial and intermittent streams identified on a United States geological survey 7.5-minute series topographic map, or a county soil survey map, whichever is more current, 50 feet.

c. For lakes, 50 feet.

d. For highly susceptible wetlands, 50 feet. Highly susceptible wetlands include the following types: fens, sedge meadows, bogs, low prairies, conifer swamps, shrub swamps, other forested wetlands, fresh wet meadows, shallow marshes, deep marshes and seasonally flooded

basins. Wetland boundary delineations shall be made in accordance with s. NR 103.08(1m). This paragraph does not apply to wetlands that have been completely filled in accordance with all applicable state and federal regulations. The protective area for wetlands that have been partially filled in accordance with all applicable state and federal regulations shall be measured from the wetland boundary delineation after fill has been placed.

e. For less susceptible wetlands, 10 percent of the average wetland width, but no less than 10 feet nor more than 30 feet. Less susceptible wetlands include degraded wetlands dominated by invasive species such as reed canary grass.

f. In subd. 1.a., d. and e., determinations of the extent of the protective area adjacent to wetlands shall be made on the basis of the sensitivity and runoff susceptibility of the wetland in accordance with the standards and criteria in s. NR 103.03.

g. For concentrated flow channels with drainage areas greater than 130 acres, 10 feet.

2. This paragraph applies to post-construction sites located within a protective area, except those areas exempted pursuant to subd. 4.

3. The following requirements shall be met:

a. Impervious surfaces shall be kept out of the protective area to the maximum extent practicable. The storm water management plan shall contain a written site-specific explanation for any parts of the protective area that are disturbed during construction.

b. Where land disturbing construction activity occurs within a protective area, and where no impervious surface is present, adequate sod or self-sustaining vegetative cover of 70% or greater shall be established and maintained. The adequate sod or self-sustaining vegetative cover shall be sufficient to provide for bank stability, maintenance of fish habitat and filtering of pollutants from upslope overland flow areas under sheet flow conditions. Non-vegetative materials, such as rock riprap, may be employed on the bank as necessary to prevent erosion, such as on steep slopes or where high velocity flows occur.

Note to Users: It is recommended that seeding of non-aggressive vegetative cover be used in the protective areas. Vegetation that is flood and drought tolerant and can provide long-term bank stability because of an extensive root

system is preferable. Vegetative cover can be measured using the line transect method described in the University of Wisconsin Extension publication number A3533, titled “Estimating Residue Using the Line Transect Method”.

c. Best management practices such as filter strips, swales, or wet detention basins, that are designed to control pollutants from non-point sources may be located in the protective area.

Note to Users: Other regulations, such as ch. 30, Wis. Stats., and chs. NR 103, 115, 116 and 117, Wis. Adm. Code, and their associated review and approval process may apply in the protective area.

4. This paragraph does not apply to:
   a. Redevelopment post-construction sites.
   b. In-fill development areas less than 5 acres.
   c. Structures that cross or access surface waters such as boat landings, bridges and culverts.
   d. Structures constructed in accordance with s. 59.692(1v), Wis. Stats.
   e. Post-construction sites from which runoff does not enter the surface water, except to the extent that vegetative ground cover is necessary to maintain bank stability.

Note to Users: A vegetated protective area to filter runoff pollutants from post-construction sites described in subd. 4.e. is not necessary since runoff is not entering the surface water at that location. Other practices, necessary to meet the requirements of this section, such as a swale or basin, will need to be designed and implemented to reduce runoff pollutants before the runoff enters a surface water of the state.

(e) FUELING AND VEHICLE MAINTENANCE AREAS. Fueling and vehicle maintenance areas shall, to the maximum extent practicable, have BMPs designed, installed and maintained to reduce petroleum within runoff, such that the runoff that enters waters of the state contains no visible petroleum sheen.

Note to Users: A combination of the following BMPs may be used: oil and grease separators, canopies, petroleum spill cleanup materials, or any other structural or non-structural method of preventing or treating petroleum in runoff.

(f) SWALE TREATMENT FOR TRANSPORTATION FACILITIES. [OPTIONAL]

1. Applicability. Except as provided in subd. 2., transportation facilities that use swales for runoff conveyance and pollutant removal meet all of the requirements of this section, if the swales are designed to the maximum extent practicable to do all of the following:

   a. Be vegetated. However, where appropriate, non-vegetative measures may be employed to prevent erosion or provide for runoff treatment, such as rock riprap stabilization or check dams.

   Note to Users: It is preferred that tall and dense vegetation be maintained within the swale due to its greater effectiveness at enhancing runoff pollutant removal.

   b. Carry runoff through a swale for 200 feet or more in length that is designed with a flow velocity no greater than 1.5 feet per second for the peak flow generated using either a 2-year, 24-hour design storm or a 2-year storm with a duration equal to the time of concentration as appropriate. If a swale of 200 feet in length cannot be designed with a flow velocity of 1.5 feet per second or less, then the flow velocity shall be reduced to the maximum extent practicable.

   Note to Users: Check dams may be included in the swale design to slow runoff flows and improve pollutant removal. Transportation facilities with continuous features such as curb and gutter, sidewalks or parking lanes do not comply with the design requirements of this paragraph. However, a limited amount of structural measures such as curb and gutter may be allowed as necessary to account for other concerns such as human safety or resource protection.

2. Exemptions. The [administering authority] may, consistent with water quality standards, require other provisions of this section be met on a transportation facility with an average daily travel of vehicles greater than 2500 and where the initial surface water of the state that the runoff directly enters is any of the following:

   a. An outstanding resource water.
   b. An exceptional resource water.
   c. Waters listed in s. 303(d) of the federal clean water act that are identified as impaired in whole or in part, due to nonpoint source impacts.

d. Waters where targeted performance standards are developed under s. NR 151.004, Wis. Adm. Code, to meet water quality standards.

Note to Users: The Department of Natural Resource's regional storm water staff can determine if additional BMPs, beyond a water quality swale, are needed under this paragraph.

(4) GENERAL CONSIDERATIONS FOR ON-SITE AND OFF-SITE STORM WATER MANAGEMENT MEASURES. The following considerations shall be observed in managing runoff:

(a) Natural topography and land cover features such as natural swales, natural depressions, native soil infiltrating capacity, and natural groundwater recharge areas shall be preserved and used, to the extent possible, to meet the requirements of this section.

(b) Emergency overland flow for all storm water facilities shall be provided to prevent exceeding the safe capacity of downstream drainage facilities and prevent endangerment of downstream property or public safety.

(5) LOCATION AND REGIONAL TREATMENT OPTION.

(a) The BMPs may be located on-site or off-site as part of a regional storm water device, practice or system.

(b) Post-construction runoff within a non-navigable surface water that flows into a BMP, such as a wet detention pond, is not required to meet the performance standards of this ordinance. Post-construction BMPs may be located in non-navigable surface waters.

(c) Except as allowed under par. (d), post-construction runoff from new development shall meet the post-construction performance standards prior to entering a navigable surface water.

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(d) Post-construction runoff from any development within a navigable surface water that flows into a BMP is not required to meet the performance standards of this ordinance if:

1. The BMP was constructed prior to the effective date of this ordinance and the BMP either received a permit issued under ch. 30, Stats., or the BMP did not require a ch. 30, Wis. Stats., permit; and

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2. The BMP is designed to provide runoff treatment from future upland development.

(e) Runoff from existing development, redevelopment and in-fill areas shall meet the post-construction performance standards in accordance with this paragraph.

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1. To the maximum extent practicable, BMPs shall be located to treat runoff prior to discharge to navigable surface waters.

2. Post-construction BMPs for such runoff may be located in a navigable surface water if allowable under all other applicable federal, state and local regulations such as ch. NR 103, Wis. Adm. Code and ch. 30, Wis. Stats.

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Note to Users: This allows the location of BMPs in navigable surface waters where necessary to augment management practices upstream of the navigable surface water to meet the performance standards.

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(f) The discharge of runoff from a BMP, such as a wet detention pond, or after a series of such BMPs is subject to this chapter.

Note to Users: This section does not supersede any other applicable federal, state or local regulation such as ch. NR 103, Wis. Adm. Code and ch. 30, Wis. Stats.

(g) The [administering authority] may approve off-site management measures provided that all of the following conditions are met:

1. The [administrating authority] determines that the post-construction runoff is covered by a storm water management system plan that is approved by the [name of municipality] and that contains management requirements consistent with the purpose and intent of this ordinance.

2. The off-site facility meets all of the following conditions:

a. The facility is in place.

b. The facility is designed and adequately sized to provide a level of storm water control equal to or greater than that which would be afforded by on-site practices meeting the performance standards of this ordinance.

c. The facility has a legally obligated entity responsible for its long-term operation and maintenance.

(h) Where a regional treatment option exists such that the [administering authority] exempts the applicant from all or part of the minimum on-site storm water management requirements, the applicant shall be required to pay a fee in an amount determined in negotiation with the [administering authority]. In determining the fee for post-construction runoff, the [administering authority] shall consider an equitable distribution of the cost for land, engineering design, construction, and maintenance of the regional treatment option.

(6) ALTERNATE REQUIREMENTS. The [administering authority] may establish storm water management requirements more stringent than those set forth in this section if the [administering authority] determines that an added level of protection is needed to protect sensitive resources.

S.08 PERMITTING REQUIREMENTS, PROCEDURES AND FEES.

(1) PERMIT REQUIRED. No responsible party may undertake a land disturbing construction activity without receiving a post-construction runoff permit from the [administering authority] prior to commencing the proposed activity.

(2) PERMIT APPLICATION AND FEES. Unless specifically excluded by this ordinance, any responsible party desiring a permit shall submit to the [administering authority] a permit application made on a form provided by the [administering authority] for that purpose.

(a) Unless otherwise excepted by this ordinance, a permit application must be accompanied by a storm water management plan, a maintenance agreement and a non-refundable permit administration fee.

(b) The storm water management plan shall be prepared to meet the requirements of SS.07 and 09, the maintenance agreement shall be prepared to meet the requirements of S.10, the financial guarantee shall meet the requirements of S.11, and fees shall be those established by the [governing body] as set forth in S.12.

(3) REVIEW AND APPROVAL OF PERMIT APPLICATION. The [administering authority] shall review any permit application that is submitted with a storm water management plan, maintenance agreement, and the required fee. The following approval procedure shall be used:

(a) Within [number] business days of the receipt of a complete permit application, including all items as required by sub. (2), the [administering authority] shall inform the applicant whether the application, plan and maintenance agreement are approved or disapproved based on the requirements of this ordinance.

(b) If the storm water permit application, plan and maintenance agreement are approved, or if an agreed upon payment of fees in lieu of storm water management practices is made, the [administering authority] shall issue the permit.

(c) If the storm water permit application, plan or maintenance agreement is disapproved, the [administering authority] shall detail in writing the reasons for disapproval.

(d) The [administering authority] may request additional information from the applicant. If additional information is submitted, the [administering authority] shall have

[number] business days from the date the additional information is received to inform the applicant that the plan and maintenance agreement are either approved or disapproved.

(e) Failure by the [administering authority] to inform the permit applicant of a decision within [number] business days of a required submittal shall be deemed to mean approval of the submittal and the applicant may proceed as if a permit had been issued.

(4) PERMIT REQUIREMENTS. All permits issued under this ordinance shall be subject to the following conditions, and holders of permits issued under this ordinance shall be deemed to have accepted these conditions. The [administering authority] may suspend or revoke a permit for violation of a permit condition, following written notification of the responsible party. An action by the [administering authority] to suspend or revoke this permit may be appealed in accordance with S.14.

(a) Compliance with this permit does not relieve the responsible party of the responsibility to comply with other applicable federal, state, and local laws and regulations.

(b) The responsible party shall design and install all structural and non-structural storm water management measures in accordance with the approved storm water management plan and this permit.

(c) The responsible party shall notify the [administering authority] at least [number] business days before commencing any work in conjunction with the storm water management plan, and within [number] business days upon completion of the storm water management practices. If required as a special condition under sub. (5), the responsible party shall make additional notification according to a schedule set forth by the [administering authority] so that practice installations can be inspected during construction.

(d) Practice installations required as part of this ordinance shall be certified "as built" by a licensed professional engineer. Completed storm water management practices must pass a final inspection by the [administering authority] or its designee to determine if they are in accordance with the approved storm water management plan and ordinance. The [administering authority] or its designee shall notify the responsible party in writing of any changes required in such practices to bring them into compliance with the conditions of this permit.

(e) The responsible party shall notify the [administering authority] of any significant modifications it intends to make to an approved storm water management plan. The [administering authority] may require that the proposed modifications be submitted to it for approval prior to incorporation into the storm water management plan and execution by the responsible party.

(f) The responsible party shall maintain all storm water management practices in accordance with the storm water management plan until the practices either become the responsibility of the [governing body], or are transferred to subsequent private owners as specified in the approved maintenance agreement.

(g) The responsible party authorizes the [administering authority] to perform any work or operations necessary to bring storm water management measures into conformance with the approved storm water management plan, and consents to a special assessment or charge against the property as authorized under subch. VII of ch. 66, Wis. Stats., or to charging such costs against the financial guarantee posted under S.11.

(h) If so directed by the [administering authority], the responsible party shall repair at the responsible party's own expense all damage to adjoining municipal facilities and drainage ways caused by runoff, where such damage is caused by activities that are not in compliance with the approved storm water management plan.

(i) The responsible party shall permit property access to the [administering authority] or its designee for the purpose of inspecting the property for compliance with the approved storm water management plan and this permit.

(j) Where site development or redevelopment involves changes in direction, increases in peak rate and/or total volume of runoff from a site, the [administering authority] may require the responsible party to make appropriate legal arrangements with affected property owners concerning the prevention of endangerment to property or public safety.

(k) The responsible party is subject to the enforcement actions and penalties detailed in S.13, if the responsible party fails to comply with the terms of this permit.

(5) PERMIT CONDITIONS. Permits issued under this subsection may include conditions established by [administering authority] in addition to the requirements needed to meet the performance standards in S.07 or a financial guarantee as provided for in S.11.

(6) PERMIT DURATION. Permits issued under this section shall be valid from the date of issuance through the date the [administering authority] notifies the responsible party that all storm water management practices have passed the final inspection required under sub. (4)(d).

S.09 STORM WATER MANAGEMENT PLAN.

(1) PLAN REQUIREMENTS. The storm water management plan required under S.08 (2) shall contain at a minimum the following information:

(a) Name, address, and telephone number for the following or their designees: landowner; developer; project engineer for practice design and certification; person(s)

responsible for installation of storm water management practices; and person(s) responsible for maintenance of storm water management practices prior to the transfer, if any, of maintenance responsibility to another party.

(b) A proper legal description of the property proposed to be developed, referenced to the U.S. Public Land Survey system or to block and lot numbers within a recorded land subdivision plat.

(c) Pre-development site conditions, including:

1. One or more site maps at a scale of not less than 1 inch equals [number] feet. The site maps shall show the following: site location and legal property description; predominant soil types and hydrologic soil groups; existing cover type and condition; topographic contours of the site at a scale not to exceed [number] feet; topography and drainage network including enough of the contiguous properties to show runoff patterns onto, through, and from the site; watercourses that may affect or be affected by runoff from the site; flow path and direction for all storm water conveyance sections; watershed boundaries used in hydrology determinations to show compliance with performance standards; lakes, streams, wetlands, channels, ditches, and other watercourses on and immediately adjacent to the site; limits of the 100 year floodplain; location of wells and wellhead protection areas covering the project area and delineated pursuant to s. NR 811.16, Wis. Adm. Code.

2. Hydrology and pollutant loading computations as needed to show compliance with performance standards. All major assumptions used in developing input parameters shall be clearly stated. The geographic areas used in making the calculations shall be clearly cross-referenced to the required map(s).

(d) Post-development site conditions, including:

1. Explanation of the provisions to preserve and use natural topography and land cover features to minimize changes in peak flow runoff rates and volumes to surface waters and wetlands.

2. Explanation of any restrictions on storm water management measures in the development area imposed by wellhead protection plans and ordinances.

3. One or more site maps at a scale of not less than 1 inch equals [number] feet showing the following: post-construction pervious areas including vegetative cover type and condition; impervious surfaces including all buildings, structures, and pavement; post-construction topographic contours of the site at a scale not to exceed [number] feet; post-construction drainage network including enough of the contiguous properties to show runoff patterns onto, through, and from the

site; locations and dimensions of drainage easements; locations of maintenance easements specified in the maintenance agreement; flow path and direction for all storm water conveyance sections; location and type of all storm water management conveyance and treatment practices, including the on-site and off-site tributary drainage area; location and type of conveyance system that will carry runoff from the drainage and treatment practices to the nearest adequate outlet such as a curbed street, storm drain, or natural drainage way; watershed boundaries used in hydrology and pollutant loading calculations and any changes to lakes, streams, wetlands, channels, ditches, and other watercourses on and immediately adjacent to the site.

4. Hydrology and pollutant loading computations as needed to show compliance with performance standards. The computations shall be made for each discharge point in the development, and the geographic areas used in making the calculations shall be clearly cross-referenced to the required map(s).

5. Results of investigations of soils and groundwater required for the placement and design of storm water management measures. Detailed drawings including cross-sections and profiles of all permanent storm water conveyance and treatment practices.

(e) A description and installation schedule for the storm water management practices needed to meet the performance standards in S.07.

(f) A maintenance plan developed for the life of each storm water management practice including the required maintenance activities and maintenance activity schedule.

(g) Cost estimates for the construction, operation, and maintenance of each storm water management practice.

(h) Other information requested in writing by the [administering authority] to determine compliance of the proposed storm water management measures with the provisions of this ordinance.

(i) All site investigations, plans, designs, computations, and drawings shall be certified by a [licensed professional engineer] to be prepared in accordance with accepted engineering practice and requirements of this ordinance.

(2) ALTERNATE REQUIREMENTS. The [administering authority] may prescribe alternative submittal requirements for applicants seeking an exemption to on-site storm water management performance standards under S.07 (5).

S.10 MAINTENANCE AGREEMENT.

(1) MAINTENANCE AGREEMENT REQUIRED. The maintenance agreement required under S.08 (2) for storm water management practices shall be an agreement between the [administering authority] and the responsible party to provide for maintenance of storm water practices beyond the duration period of this permit. The maintenance agreement shall be filed with the County Register of Deeds as a property deed restriction so that it is binding upon all subsequent owners of the land served by the storm water management practices.

(2) AGREEMENT PROVISIONS. The maintenance agreement shall contain the following information and provisions and be consistent with the maintenance plan required by S.09(1)(f):

(a) Identification of the storm water facilities and designation of the drainage area served by the facilities.

(b) A schedule for regular maintenance of each aspect of the storm water management system consistent with the storm water management plan required under S.08 (2).

(c) Identification of the responsible party(s), organization or city, county, town or village responsible for long term maintenance of the storm water management practices identified in the storm water management plan required under S.08 (2).

(d) Requirement that the responsible party(s), organization, or city, county, town or village shall maintain storm water management practices in accordance with the schedule included in par. (b).

(e) Authorization for the [administering authority] to access the property to conduct inspections of storm water management practices as necessary to ascertain that the practices are being maintained and operated in accordance with the agreement.

(f) A requirement on the [administering authority] to maintain public records of the results of the site inspections, to inform the responsible party responsible for maintenance of the inspection results, and to specifically indicate any corrective actions required to bring the storm water management practice into proper working condition.

(g) Agreement that the party designated under par. (c), as responsible for long term maintenance of the storm water management practices, shall be notified by the [administering authority] of maintenance problems which require correction. The specified corrective actions shall be undertaken within a reasonable time frame as set by the [administering authority].

(h) Authorization of the [administering authority] to perform the corrected actions identified in the inspection report if the responsible party designated under par. (c) does not make the required corrections in the specified time period. The [administering authority] shall enter the amount due on the tax rolls and collect the money as a special charge against the property pursuant to subch. VII of ch. 66, Wis. Stats.

S.11 FINANCIAL GUARANTEE.

(1) ESTABLISHMENT OF THE GUARANTEE. The [administering authority] may require the submittal of a financial guarantee, the form and type of which shall be acceptable to the [administering authority]. The financial guarantee shall be in an amount determined by the [administering authority] to be the estimated cost of construction and the estimated cost of maintenance of the storm water management practices during the period which the designated party in the maintenance agreement has maintenance responsibility. The financial guarantee shall give the [administering authority] the authorization to use the funds to complete the storm water management practices if the responsible party defaults or does not properly implement the approved storm water management plan, upon written notice to the responsible party by the [administering authority] that the requirements of this ordinance have not been met.

(2) CONDITIONS FOR RELEASE. Conditions for the release of the financial guarantee are as follows:

(a) The [administering authority] shall release the portion of the financial guarantee established under this section, less any costs incurred by the [administering authority] to complete installation of practices, upon submission of "as built plans" by a licensed professional engineer. The [administering authority] may make provisions for a partial pro-rata release of the financial guarantee based on the completion of various development stages.

(b) The [administering authority] shall release the portion of the financial guarantee established under this section to assure maintenance of storm water practices, less any costs incurred by the [administering authority], at such time that the responsibility for practice maintenance is passed on to another entity via an approved maintenance agreement.

S.12 FEE SCHEDULE.

The fees referred to in other sections of this ordinance shall be established by the [administering authority] and may from time to time be modified by resolution. A schedule of the fees established by the [administering authority] shall be available for review in [location].

S.13 ENFORCEMENT.

(1) Any land disturbing construction activity or post-construction runoff initiated after the effective date of this ordinance by any person, firm, association, or corporation subject to the ordinance

provisions shall be deemed a violation unless conducted in accordance with the requirements of this ordinance.

(2) The [administering authority] shall notify the responsible party by certified mail of any non-complying land disturbing construction activity or post-construction runoff. The notice shall describe the nature of the violation, remedial actions needed, a schedule for remedial action, and additional enforcement action which may be taken.

(3) Upon receipt of written notification from the [administering authority] under sub. (2), the responsible party shall correct work that does not comply with the storm water management plan or other provisions of this permit. The responsible party shall make corrections as necessary to meet the specifications and schedule set forth by the [administering authority] in the notice.

(4) If the violations to a permit issued pursuant to this ordinance are likely to result in damage to properties, public facilities, or waters of the state, the [administering authority] may enter the land and take emergency actions necessary to prevent such damage. The costs incurred by the [administering authority] plus interest and legal costs shall be billed to the responsible party.

(5) The [administering authority] is authorized to post a stop work order on all land disturbing construction activity that is in violation of this ordinance, or to request the [municipal attorney, corporation counsel] to obtain a cease and desist order in any court with jurisdiction.

(6) The [administering authority] may revoke a permit issued under this ordinance for non-compliance with ordinance provisions.

(7) Any permit revocation, stop work order, or cease and desist order shall remain in effect unless retracted by the [administering authority] or by a court with jurisdiction.

(8) The [administering authority] is authorized to refer any violation of this ordinance, or of a stop work order or cease and desist order issued pursuant to this ordinance, to the [municipal attorney, corporation counsel] for the commencement of further legal proceedings in any court with jurisdiction.

(9) Any person, firm, association, or corporation who does not comply with the provisions of this ordinance shall be subject to a forfeiture of not less than [number] dollars or more than [number] dollars per offense, together with the costs of prosecution. Each day that the violation exists shall constitute a separate offense.

(10) Compliance with the provisions of this ordinance may also be enforced by injunction in any court with jurisdiction. It shall not be necessary to prosecute for forfeiture or a cease and desist order before resorting to injunctional proceedings.

Note to Users: Injunctional orders are authorized pursuant to s. 59.69(11), 61.35, or 62.23(8), Wis. Stats., for counties, villages and towns with village powers, and cities respectively.

(11) When the [administering authority] determines that the holder of a permit issued pursuant to this ordinance has failed to follow practices set forth in the storm water management plan, or has failed to comply with schedules set forth in said storm water management plan, the [administering authority] or a party designated by the [administering authority] may enter upon the land and perform the work or other operations necessary to bring the condition of said lands into conformance with requirements of the approved plan. The [administering authority] shall keep a detailed accounting of the costs and expenses of performing this work. These costs and expenses shall be deducted from any financial security posted pursuant to S.11 of this ordinance. Where such a security has not been established, or where such a security is insufficient to cover these costs, the costs and expenses shall be entered on the tax roll as a special charge against the property and collected with any other taxes levied thereon for the year in which the work is completed.

S.14 APPEALS.

(1) BOARD OF [APPEALS or ADJUSTMENT]. The board of [appeals or adjustment], created pursuant to section [number] of the [name of municipality] ordinances pursuant to s. [59.694, or 60.65 or 61.354(4)(b) or 62.23(7)(e)], Wis. Stats, shall hear and decide appeals where it is alleged that there is error in any order, decision or determination made by the [administering authority] in administering this ordinance. The board shall also use the rules, procedures, duties, and powers authorized by statute in hearing and deciding appeals. Upon appeal, the board may authorize variances from the provisions of this ordinance that are not contrary to the public interest, and where owing to special conditions a literal enforcement of the ordinance will result in unnecessary hardship.

(2) WHO MAY APPEAL. Appeals to the board of [appeals or adjustments] may be taken by any aggrieved person or by an officer, department, board, or bureau of the [name of municipality] affected by any decision of the [administering authority].

S.15 SEVERABILITY.

If any section, clause, provision or portion of this ordinance is judged unconstitutional or invalid by a court of competent jurisdiction, the remainder of the ordinance shall remain in force and not be affected by such judgment.

S.16 EFFECTIVE DATE.

This ordinance shall be in force and effect from and after its adoption and publication. The above and foregoing ordinance was duly adopted by the [governing body] of the [name of municipality] on the [number] day of [month], [year].

Approved: _____

Attested _____

Published on [day, month, year].

APPENDIX A: MODEL CONSTRUCTION SITE EROSION CONTROL ZONING ORDINANCE

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MODEL CONSTRUCTION SITE EROSION CONTROL ZONING ORDINANCE

Note to Users: *This model ordinance includes the use of brackets [ ] around phrases that are to be filled in by the municipality. For example, the phrase [administering authority] is frequently used. Where the municipality chooses to have the ordinance administered by the City Engineer, the phrase [administering authority] should be replaced by "City Engineer". In a few places, the model ordinance includes phrases in brackets that are underlined [_____]. In these cases, one of the underlined phrases should be selected verbatim. For example, if the phrase includes statutory citations, several underlined choices may be given such as [59.693, 60.627, 61.354, or 62.234.] A county would replace the phrase in brackets with "59.693", since that is the appropriate citation for the county to use.*

AN ORDINANCE TO CREATE CHAPTER [NUMBER] OF THE [CODE OR ORDINANCE] OF THE [NAME OF MUNICIPALITY] RELATING TO THE CONTROL OF CONSTRUCTION SITE EROSION RESULTING FROM LAND DISTURBING CONSTRUCTION ACTIVITIES

FOREWORD.

The intent of this ordinance is to require use of best management practices to reduce the amount of sediment and other pollutants resulting from land disturbing construction activities on sites that do not include the construction of a building and is otherwise regulated by the Wisconsin Department of Commerce in s. COMM 21.125 or COMM 50.115, Wis. Adm. Code. Use of this ordinance will foster consistent, statewide application of the construction site performance standards for new development and redevelopment contained in subchapters III and IV of ch. NR 151, Wis. Adm. Code.

The [governing body] of the [name of municipality] does hereby ordain that Chapter [number] of the [code or ordinance] of the [name of municipality] is created to read as follows:

[CHAPTER]

CONSTRUCTION SITE EROSION

S.01 AUTHORITY.

(1) This ordinance is adopted under the authority granted by [s. 59.693, Wis. Stats., for counties; s. 60.627, Wis. Stats., for towns; s. 61.354, Wis. Stats., for villages; s. 62.234, Wis. Stats., for cities]. This ordinance supersedes all provisions of an ordinance previously enacted under s. [59.69, 60.62, 61.35, or 62.23], Wis. Stats., that relate to construction site erosion control. Except as otherwise specified in s. [59.693, 60.627, 61.354, or 62.234] Wis. Stats., s. [59.69, 60.62, 61.35, or 62.23], Wis. Stats., applies to this ordinance and to any amendments to this ordinance.

(2) The provisions of this ordinance are deemed not to limit any other lawful regulatory powers of the same governing body.

(3) The [governing body] hereby designates the [administering authority] to administer and enforce the provisions of this ordinance.

(4) The requirements of this ordinance do not pre-empt more stringent erosion and sediment control requirements that may be imposed by any of the following:

(a) Wisconsin Department of Natural Resources administrative rules, permits or approvals including those authorized under ss. 281.16 and 283.33, Wis. Stats.

(b) Targeted non-agricultural performance standards promulgated in rules by the Wisconsin Department of Natural Resources under s. NR 151.004, Wis. Adm. Code.

S.02 FINDINGS OF FACT.

The [governing body] finds that runoff from land disturbing construction activity carries a significant amount of sediment and other pollutants to the waters of the state in [name of municipality].

S.03 PURPOSE.

It is the purpose of this ordinance to further the maintenance of safe and healthful conditions; prevent and control water pollution; prevent and control soil erosion; protect spawning grounds, fish and aquatic life; control building sites, placement of structures and land uses; preserve ground cover and scenic beauty; and promote sound economic growth, by minimizing the amount of sediment and other pollutants carried

by runoff or discharged from land disturbing construction activity to waters of the state in the [name of municipality].

S.04 APPLICABILITY AND JURISDICTION.

(1) APPLICABILITY.

(a) This ordinance applies to the following land disturbing construction activities except as provided under sub. (b):

1. A construction site, which has 5 or more acres of land disturbing construction activity.
2. A construction site, which has one or more acres of land disturbing construction activity after March 10, 2003.

Note to Users: The 5- and 1-acre land disturbance thresholds are consistent with state and federal laws regarding applicability of construction site erosion control permits.

(b) This ordinance does not apply to the following:

1. Land disturbing construction activity that includes the construction of a building and is otherwise regulated by the Wisconsin Department of Commerce under s. COMM 21.125 or COMM 50.115, Wis. Adm. Code.
2. A construction project that is exempted by federal statutes or regulations from the requirement to have a national pollutant discharge elimination system permit issued under chapter 40, Code of Federal Regulations, part 122, for land disturbing construction activity.
3. Nonpoint discharges from agricultural facilities and practices.
4. Nonpoint discharges from silviculture activities.
5. Routine maintenance for project sites under 5 acres of land disturbance if performed to maintain the original line and grade, hydraulic capacity or original purpose of the facility.

(c) Notwithstanding the applicability requirements in paragraph (a), this ordinance applies to construction sites of any size that, in the opinion of the [administering authority], are likely to result in runoff that exceeds the safe capacity of the existing drainage facilities or receiving body of water, that causes undue channel erosion, that increases water pollution by scouring or the transportation of particulate matter or that endangers property or public safety.

Note to Users: The municipality may want to consider separate legal authority to address situations where persons other than the responsible party destroy or render ineffective BMPs constructed to meet the performance standards of this ordinance.

(2) JURISDICTION.

This ordinance applies to [land disturbing construction activity on construction sites located within the boundaries and jurisdiction of the [name of municipality]].

or

[land disturbing construction activities on lands within the boundaries and jurisdiction of the [name of municipality], as well as the extraterritorial division of land subject to an ordinance enacted pursuant to s. 236.45(2) and (3), Wis. Stats].

or

[land disturbing construction activities on lands within the boundaries and jurisdiction of the [name of municipality], as well as all lands located within the extraterritorial plat approval jurisdiction of [name of municipality], even if plat approval is not involved.]

Note to Users: These options differ in the amount of land area covered by this ordinance and may have ramifications for enforcement authority. For counties, the first option will be the only option since counties do not have extraterritorial authority. Under s. 59.693(10), Wis. Stats., if a county ordinance exists at the time of annexation, then the municipal ordinance must be at least as restrictive as the county ordinance.

(3) EXCLUSIONS.

This ordinance is not applicable to activities conducted by a state agency, as defined under s. 227.01 (1), Wis. Stats., but also including the office of district attorney, which is subject to the state plan promulgated or a memorandum of understanding entered into under s. 281.33 (2), Wis. Stats.

Note to Users: The Wisconsin Department of Transportation (WisDOT) has entered into a memorandum of understanding with the Wisconsin Department of Natural Resources that satisfies s. 281.33 (2), Wis. Stats., such that activities directed and supervised by WisDOT are exempt from this model ordinance.

S.05 DEFINITIONS.

(1) "Administering authority" means a governmental employee, or a regional planning commission empowered under s. [59.693; 60.627; 61.354; 62.234], Wis. Stats., that is designated by the

[governing body] to administer this ordinance.

(2) “Agricultural facilities and practices ” has the meaning in s. 281.16(1), Wis. Stats.

(3) “Average annual rainfall” means a calendar year of precipitation, excluding snow, which is considered typical.

(4) "Best management practice” or “BMP” means structural or non-structural measures, practices, techniques or devices employed to avoid or minimize soil, sediment or pollutants carried in runoff to waters of the state.

(5) “Business day” means a day the office of the [administering authority] is routinely and customarily open for business.

(6) “Cease and desist order” means a court-issued order to halt land disturbing construction activity that is being conducted without the required permit.

(7) “Construction site” means an area upon which one or more land disturbing construction activities occur, including areas that are part of a larger common plan of development or sale where multiple separate and distinct land disturbing construction activities may be taking place at different times on different schedules but under one plan.

(8) “Division of land” means the creation from one parcel of [number] or more parcels or building sites of [number] or fewer acres each in area where such creation occurs at one time or through the successive partition within a 5 year period.

(9) “Erosion” means the process by which the land’s surface is worn away by the action of wind, water, ice or gravity.

(10) “Erosion and sediment control plan” means a comprehensive plan developed to address pollution caused by erosion and sedimentation of soil particles or rock fragments during construction.

(11) “Extraterritorial” means the unincorporated area within 3 miles of the corporate limits of a first, second, or third class city, or within 1.5 miles of a fourth class city or village.

(12) “Final stabilization” means that all land disturbing construction activities at the construction site have been completed and that a uniform perennial vegetative cover has been established, with a density of at least 70 percent of the cover, for the unpaved areas and areas not covered by permanent structures, or that employ equivalent permanent stabilization measures.

(13) “Governing body” means town board of supervisors, county board of supervisors, city council, village board of trustees or village council.

(14) “Land disturbing construction activity” means any man-made alteration of the land surface resulting in a change in the topography or existing vegetative or non-vegetative soil cover, that may result in runoff and lead to an increase in soil erosion and movement of sediment into waters of the state. Land disturbing construction activity includes clearing and grubbing, demolition, excavating, pit trench dewatering, filling and grading activities.

(15) “MEP” or “maximum extent practicable” means a level of implementing best management

practices in order to achieve a performance standard specified in this chapter which takes into account the best available technology, cost effectiveness and other competing issues such as human safety and welfare, endangered and threatened resources, historic properties and geographic features. MEP allows flexibility in the way to meet the performance standards and may vary based on the performance standard and site conditions.

(16) "Performance standard" means a narrative or measurable number specifying the minimum acceptable outcome for a facility or practice.

(17) "Permit" means a written authorization made by the [administering authority] to the applicant to conduct land disturbing construction activity or to discharge post-construction runoff to waters of the state.

(18) "Pollutant" has the meaning given in s. 283.01 (13), Wis. Stats.

(19) "Pollution" has the meaning given in s. 281.01 (10), Wis. Stats.

(20) "Responsible party" means any entity holding fee title to the property or performing services to meet the performance standards of this ordinance through a contract or other agreement.

(21) "Runoff" means storm water or precipitation including rain, snow or ice melt or similar water that moves on the land surface via sheet or channelized flow.

(22) "Sediment" means settleable solid material that is transported by runoff, suspended within runoff or deposited by runoff away from its original location.

(23) "Separate storm sewer" means a conveyance or system of conveyances including roads with drainage systems, streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all of the following criteria:

(a) Is designed or used for collecting water or conveying runoff.

(b) Is not part of a combined sewer system.

(c) Is not draining to a storm water treatment device or system.

(d) Discharges directly or indirectly to waters of the state.

(24) "Site" means the entire area included in the legal description of the land on which the land disturbing construction activity is proposed in the permit application.

(25) "Stop work order" means an order issued by the [administering authority] which requires that all construction activity on the site be stopped.

(26) "Technical standard" means a document that specifies design, predicted performance and operation and maintenance specifications for a material, device or method.

(27) "Waters of the state" has the meaning given in s. 281.01 (18), Wis. Stats.

S.06 TECHNICAL STANDARDS.

(1) DESIGN CRITERIA, STANDARDS AND SPECIFICATIONS. All BMPs required to comply with this ordinance shall meet the design criteria, standards and specifications based on any of the following:

(a) Applicable design criteria, standards and specifications identified in the *Wisconsin Construction Site Best Management Practice Handbook,* WDNR Pub. WR-222 November 1993 Revision.

(b) Other design guidance and technical standards identified or developed by the Wisconsin Department of Natural Resources under subchapter V of chapter NR 151, Wis. Adm. Code.

(c) For this ordinance, average annual basis is calculated using the appropriate annual rainfall or runoff factor, also referred to as the R factor, or an equivalent design storm using a type II distribution, with consideration given to the geographic location of the site and the period of disturbance.

Note to Users : The USLE and its successors RUSLE and RUSLE2, utilize an R factor which has been developed to estimate annual soil erosion, averaged over extended time periods. The R factor can be modified to estimate monthly and single-storm erosion. A design storm can be statistically calculated to provide an equivalent R factor as an average annual calculation.

(2) OTHER STANDARDS. Other technical standards not identified or developed in sub. (1), may be used provided that the methods have been approved by the [administering authority].

S.07 PERFORMANCE STANDARDS.

(1) RESPONSIBLE PARTY. The responsible party shall implement an erosion and sediment control plan, developed in accordance with S. 09, that incorporates the requirements of this section.

(2) PLAN. A written plan shall be developed in accordance with S. 09 and implemented for each construction site.

Note to Users: The written plan may be that specified within s. NR 216.46, the erosion control portion of a construction plan or other plan.

(3) EROSION AND OTHER POLLUTANT CONTROL REQUIREMENTS. The plan required under sub. (2) shall include the following:

(a) BMPs that, by design, achieve to the maximum extent practicable, a reduction of 80% of the sediment load carried in runoff, on an average annual basis, as compared with no

sediment or erosion controls until the construction site has undergone final stabilization. No person shall be required to exceed an 80% sediment reduction to meet the requirements of this paragraph. Erosion and sediment control BMPs may be used alone or in combination to meet the requirements of this paragraph. Credit toward meeting the sediment reduction shall be given for limiting the duration or area, or both, of land disturbing construction activity, or other appropriate mechanism.

Note to Users: Soil loss prediction tools that estimate the sediment load leaving the construction site under varying land and management conditions, or methodology identified in subch. V. of ch. NR 151, Wis. Adm. Code, may be used to calculate sediment reduction.

(b) Notwithstanding par. (a), if BMPs cannot be designed and implemented to reduce the sediment load by 80%, on an average annual basis, the plan shall include a written and site-specific explanation as to why the 80% reduction goal is not attainable and the sediment load shall be reduced to the maximum extent practicable.

(c) Where appropriate, the plan shall include sediment controls to do all of the following to the maximum extent practicable:

1. Prevent tracking of sediment from the construction site onto roads and other paved surfaces.
2. Prevent the discharge of sediment as part of site de-watering.
3. Protect the separate storm drain inlet structure from receiving sediment.

(d) The use, storage and disposal of chemicals, cement and other compounds and materials used on the construction site shall be managed during the construction period, to prevent their entrance into waters of the state. However, projects that require the placement of these materials in waters of the state, such as constructing bridge footings or BMP installations, are not prohibited by this paragraph.

(4) LOCATION. The BMPs used to comply with this section shall be located prior to runoff entering waters of the state.

Note to Users: While regional treatment facilities are appropriate for control of post-construction pollutants, they should not be used for construction site sediment removal.

(5) ALTERNATE REQUIREMENTS. The [administering authority] may establish storm water management requirements more stringent than those set forth in this section if the [administering authority] determines that an added level of protection is needed for sensitive resources.

S.08 PERMITTING REQUIREMENTS, PROCEDURES AND FEES.

(1) PERMIT REQUIRED. No responsible party may commence a land disturbing construction activity subject to this ordinance without receiving prior approval of an erosion and sediment control plan for the site and a permit from the [administering authority].

(2) PERMIT APPLICATION AND FEES. At least one responsible party desiring to undertake a land disturbing construction activity subject to this ordinance shall submit an application for a permit and an erosion and sediment control plan that meets the requirements of S.09 and shall pay an application fee of [amount] to the [administering authority]. By submitting an application, the applicant is authorizing the [administering authority] to enter the site to obtain information required for the review of the erosion and sediment control plan.

(3) REVIEW AND APPROVAL OF PERMIT APPLICATION. The [administering authority] shall review any permit application that is submitted with an erosion and sediment control plan, and the required fee. The following approval procedure shall be used:

(a) Within [number] business days of the receipt of a complete permit application, as required by sub. (2), the [administering authority] shall inform the applicant whether the application and plan are approved or disapproved based on the requirements of this ordinance.

(b) If the permit application and plan are approved, the [administering authority] shall issue the permit.

(c) If the permit application or plan is disapproved, the [administering authority] shall state in writing the reasons for disapproval.

(d) The [administering authority] may request additional information from the applicant. If additional information is submitted, the [administering authority] shall have [number] business days from the date the additional information is received to inform the applicant that the plan is either approved or disapproved.

(e) Failure by the [administering authority] to inform the permit applicant of a decision within [number] business days of a required submittal shall be deemed to mean approval of the submittal and the applicant may proceed as if a permit had been issued.

(4) SURETY BOND. As a condition of approval and issuance of the permit, the [administering authority] may require the applicant to deposit a surety bond or irrevocable letter of credit to guarantee a good faith execution of the approved erosion control plan and any permit conditions.

(5) PERMIT REQUIREMENTS. All permits shall require the responsible party to:

(a) Notify the [administering authority] within 48 hours of commencing any land disturbing construction activity.

(b) Notify the [administering authority] of completion of any BMPs within 14 days after their installation.

(c) Obtain permission in writing from the [administering authority] prior to any modification pursuant to S.09(3) of the erosion and sediment control plan.

(d) Install all BMPs as identified in the approved erosion and sediment control plan.

(e) Maintain all road drainage systems, stormwater drainage systems, BMPs and other facilities identified in the erosion and sediment control plan.

(f) Repair any siltation or erosion damage to adjoining surfaces and drainage ways resulting from land disturbing construction activities and document repairs in a site erosion control log.

(g) Inspect the BMPs within 24 hours after each rain of 0.5 inches or more which results in runoff during active construction periods, and at least once each week, make needed repairs and document the findings of the inspections in a site erosion control log with the date of inspection, the name of the person conducting the inspection, and a description of the present phase of the construction at the site.

(h) Allow the [administering authority] to enter the site for the purpose of inspecting compliance with the erosion and sediment control plan or for performing any work necessary to bring the site into compliance with the control plan. Keep a copy of the erosion and sediment control plan at the construction site.

(6) PERMIT CONDITIONS. Permits issued under this section may include conditions established by [administering authority] in addition to the requirements set forth in sub. (5), where needed to assure compliance with the performance standards in S.07.

(7) PERMIT DURATION. Permits issued under this section shall be valid for a period of 180 days, or the length of the building permit or other construction authorizations, whichever is longer, from the date of issuance. The [administering authority] may extend the period one or more times for up to an additional 180 days. The [administering authority] may require additional BMPs as a condition of the extension if they are necessary to meet the requirements of this ordinance.

(8) MAINTENANCE. The responsible party throughout the duration of the construction activities shall maintain all BMPs necessary to meet the requirements of this ordinance until the site has undergone final stabilization.

S.09 EROSION AND SEDIMENT CONTROL PLAN, STATEMENT, AND AMENDMENTS.

(1) EROSION AND SEDIMENT CONTROL PLAN.

(a) An erosion and sediment control plan shall be prepared and submitted to the [administering authority].

(b) The erosion and sediment control plan shall be designed to meet the performance standards in S.07 and other requirements of this ordinance.

(c) The erosion and sediment control plan shall address pollution caused by soil erosion and sedimentation during construction and up to final stabilization of the site. The erosion and sediment control plan shall include, at a minimum, the following items:

1. The name(s) and address(es) of the owner or developer of the site, and of any consulting firm retained by the applicant, together with the name of the applicant's principal contact at such firm. The application shall also include start and end dates for construction.
2. Description of the site and the nature of the construction activity, including representation of the limits of land disturbance on a United States Geological Service 7.5 minute series topographic map.
3. A sequence of construction of the development site, including stripping and clearing; rough grading; construction of utilities, infrastructure, and buildings; and final grading and landscaping. Sequencing shall identify the expected date on which clearing will begin, the estimated duration of exposure of cleared areas, areas of clearing, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation.
4. Estimates of the total area of the site and the total area of the site that is expected to be disturbed by construction activities.
5. Estimates, including calculations, if any, of the runoff coefficient of the site before and after construction activities are completed.
6. Calculations to show the expected percent reduction in the average annual sediment load carried in runoff as compared to no sediment or erosion controls.
7. Existing data describing the surface soil as well as subsoils.
8. Depth to groundwater, as indicated by Natural Resources Conservation Service soil information where available.
9. Name of the immediate named receiving water from the United States Geological Service 7.5 minute series topographic maps.

(d) The erosion and sediment control plan shall include a site map. The site map shall include the following items and shall be at a scale not greater than 100 feet per inch and at a contour interval not to exceed five feet.

1. Existing topography, vegetative cover, natural and engineered drainage systems, roads and surface waters. Lakes, streams, wetlands, channels, ditches and other watercourses on and immediately adjacent to the site shall be shown. Any identified 100-year flood plains, flood fringes and floodways shall also be shown.
2. Boundaries of the construction site.
3. Drainage patterns and approximate slopes anticipated after major grading activities.
4. Areas of soil disturbance.
5. Location of major structural and non-structural controls identified in the plan.
6. Location of areas where stabilization practices will be employed.
7. Areas which will be vegetated following construction.
8. Areal extent of wetland acreage on the site and locations where storm water is discharged to a surface water or wetland.
9. Locations of all surface waters and wetlands within one mile of the construction site.
10. An alphanumeric or equivalent grid overlying the entire construction site map.

(e) Each erosion and sediment control plan shall include a description of appropriate controls and measures that will be performed at the site to prevent pollutants from reaching waters of the state. The plan shall clearly describe the appropriate control measures for each major activity and the timing during the construction process that the measures will be implemented. The description of erosion controls shall include, when appropriate, the following minimum requirements:

1. Description of interim and permanent stabilization practices, including a practice implementation schedule. Site plans shall ensure that existing vegetation is preserved where attainable and that disturbed portions of the site are stabilized.
2. Description of structural practices to divert flow away from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from the site. Unless otherwise specifically approved in writing by the [administering authority], structural measures shall be installed on upland soils.
3. Management of overland flow at all sites, unless otherwise controlled by outfall controls.
4. Trapping of sediment in channelized flow.
5. Staging construction to limit bare areas subject to erosion.
6. Protection of downslope drainage inlets where they occur.
7. Minimization of tracking at all sites.
8. Clean up of off-site sediment deposits.
9. Proper disposal of building and waste materials at all sites.

10. Stabilization of drainage ways.
11. Control of soil erosion from dirt stockpiles.
12. Installation of permanent stabilization practices as soon as possible after final grading.
13. Minimization of dust to the maximum extent practicable.

(f) The erosion and sediment control plan shall require that velocity dissipation devices be placed at discharge locations and along the length of any outfall channel, as necessary, to provide a non-erosive flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected.

Note to Users: The plan requirements of this subsection will meet the erosion control plan requirements of s. NR 216.46, Wis. Adm. Code, when prepared in accordance with good engineering practices and the design criteria, standards and specifications outlined in the *Wisconsin Construction Site Best Management Practice Handbook* (WDNR Pub. WR-222 November 1993 Revision).

(2) EROSION AND SEDIMENT CONTROL PLAN STATEMENT. For each construction site identified under S.04 (1)(c), an erosion and sediment control plan statement shall be prepared. This statement shall be submitted to the [administering authority]. The control plan statement shall briefly describe the site, including a site map. Further, it shall also include the best management practices that will be used to meet the requirements of the ordinance, including the site development schedule.

(3) AMENDMENTS. The applicant shall amend the plan if any of the following occur:

(a) There is a change in design, construction, operation or maintenance at the site which has the reasonable potential for the discharge of pollutants to waters of the state and which has not otherwise been addressed in the plan.

(b) The actions required by the plan fail to reduce the impacts of pollutants carried by construction site runoff.

(c) The [administering authority] notifies the applicant of changes needed in the plan.

S.10 FEE SCHEDULE.

The fees referred to in other sections of this ordinance shall be established by the [administering authority] and may from time to time be modified by resolution. A schedule of the fees established by the [administering authority] shall be available for review in [location].

S.11 INSPECTION.

If land disturbing construction activities are being carried out without a permit required by this ordinance, the [administering authority] may enter the land pursuant to the provisions of ss. 66.0119(1), (2), and (3), Wis. Stats.

S.12 ENFORCEMENT.

(1) The [administering authority] may post a stop-work order if any of the following occurs:

(a) Any land disturbing construction activity regulated under this ordinance is being undertaken without a permit.

(b) The erosion and sediment control plan is not being implemented in a good faith manner.

(c) The conditions of the permit are not being met.

Note to Users: The [administering authority] should inspect any construction site that holds a permit under this chapter at least once a month during the period starting March 1 and ending October 31 and at least 2 times during the period starting November 1 and ending February 28 to ensure compliance with the approved sediment and erosion control plan.

(2) If the responsible party does not cease activity as required in a stop-work order posted under this section or fails to comply with the erosion and sediment control plan or permit conditions, the [administering authority] may revoke the permit.

(3) If the responsible party, where no permit has been issued, does not cease the activity after being notified by the [administering authority], or if a responsible party violates a stop-work order posted under sub. (1), the [administering authority] may request the [district attorney, city attorney, town attorney, village attorney or county corporation counsel] to obtain a cease and desist order in any court with jurisdiction.

(4) The [administering authority, or the board of appeals or adjustment] may retract the stop-work order issued under sub. (1) or the permit revocation under sub. (2).

(5) After posting a stop-work order under sub. (1), the [administering authority] may issue a notice of intent to the responsible party of its intent to perform work necessary to comply with this ordinance. The [administering authority] may go on the land and commence the work after issuing the notice of intent. The costs of the work performed under this subsection by the [administering authority], plus interest at the rate authorized by [administrative authority] shall be billed to the

responsible party. In the event a responsible party fails to pay the amount due, the clerk shall enter the amount due on the tax rolls and collect as a special assessment against the property pursuant to subch. VII of ch. 66, Wis. Stats.

(6) Any person violating any of the provisions of this ordinance shall be subject to a forfeiture of not less than [amount] nor more than [amount] and the costs of prosecution for each violation. Each day a violation exists shall constitute a separate offense.

(7) Compliance with the provisions of this ordinance may also be enforced by injunction in any court with jurisdiction. It shall not be necessary to prosecute for forfeiture or a cease and desist order before resorting to injunctional proceedings.

Note to Users: Injunctional orders are authorized pursuant to s. 59.69(11), 61.35, or 62.23(8), Wis. Stats., for counties, villages and towns with village powers, and cities respectively.

S.13 APPEALS.

(1) BOARD OF [APPEALS or ADJUSTMENT]. The board of [appeals or adjustment] created pursuant to section [number] of the [county's, town's, city's or village's] ordinance pursuant to [s. 59.694, 60.65, 61.354(4)(b) or 62.23(7)(e)], Wis. Stats.:

(a) Shall hear and decide appeals where it is alleged that there is error in any order, decision or determination made by the [administering authority] in administering this ordinance except for cease and desist orders obtained under S.12 (3).

(b) Upon appeal, may authorize variances from the provisions of this ordinance which are not contrary to the public interest and where owing to special conditions a literal enforcement of the provisions of the ordinance will result in unnecessary hardship; and

(c) Shall use the rules, procedures, duties and powers authorized by statute in hearing and deciding appeals and authorizing variances.

(2) WHO MAY APPEAL. Appeals to the board of [appeals or adjustment] may be taken by any aggrieved person or by any office, department, board, or bureau of the [name of municipality] affected by any decision of the [administering authority].

S.14 SEVERABILITY.

If a court of competent jurisdiction judges any section, clause, provision or portion of this ordinance unconstitutional or invalid, the remainder of the ordinance shall remain in force and not be affected by such judgment.

S.15 EFFECTIVE DATE.

This ordinance shall be in force and effect from and after its adoption and publication. The above and foregoing ordinance was duly adopted by the [governing body] of the [name of municipality] on the [number] day of [month], [year].

Approved: _____

Attested _____

Published on [day, month, and year].