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# 1. Getting Started

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## 1.1 About the Developers Packet

The Developers Packet is a publication by the South Washington Watershed District (SWWD) to introduce developers to the rules and expectations set by the SWWD. A concise overview is provided by this publication, giving developers the proper initial orientation and guidance to confidently move forward in designing a project that is satisfactorily accepted.

A developer, or its agents, must address a myriad of regulations and navigate through a significant number of approval procedures before ever breaking ground. Often these appear as obstacles to a developer. Confusion and frustration can occur when there is conflicting requirements or unattained approvals due to poor accessibility to information. Thus this publication is intended for a developer when first beginning the city submittal process, to provide more clarity for rules and expectations between different levels of government.

This publication is intended to familiarize developers with where to access appropriate information from the SWWD, how to develop and present information to the SWWD, and illustrate tools and approaches. Through the document, two key symbols are used to help identify important requirements or concepts, as explained below:



This symbol is used to identify a concept that should be reviewed in order to understand a key process or critical rationale.



This symbol highlights a significant requirement of the watershed standards.

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## 1.2 Packet Contents

This publication contains the following summary content, abbreviated from other sources:

- ❖ Requirements of the SWWD;
- ❖ Application and project review process of the SWWD; and
- ❖ Key methods for site design and analysis preferred by the SWWD.

The sources of information supporting this publication include the SWWD's Watershed Management Plan, Watershed Rules, and Standards Manual. This publication is not intended to replace or supersede the rules and requirements currently adopted by the SWWD. The publication is an informational tool to help reach out to the development

community. All individuals executing projects in the watershed are expected to fully review and understand the rules of the SWWD and to comply accordingly.

It is important to note that contents of this publication intentionally do not cross-reference with requirements established by member cities of the watershed. Member cities are required to officially adopt the requirements of the watershed, thereby providing consistency to the development community for managing the impacts of urbanization. However, where necessary the contents of this packet provide mechanisms to “translate” between local controls where they may differ from watershed controls.

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## 1.3 Overview of the Watershed District

The SWWD is located entirely in Washington County and contains portions of eight cities and townships: Afton, Cottage Grove, Grey Cloud Island Township, Lake Elmo, Newport, Oakdale, St. Paul Park and Woodbury. The legal boundary of the SWWD encompasses more than 45,600 acres, or slightly more than 71 square miles.

The Mississippi River borders the west and south part of the watershed while numerous lakes, wetlands, and streams are located within the watershed. The SWWD’s activities focus on three dominant resource issues: water quantity, water quality, and natural resources. The mission of the SWWD reflects the cooperative resource management approach believed so critical by the Board of Managers. The mission of the SWWD is:

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*“To manage water and related resources of the South Washington Watershed District in cooperation with our citizens and communities.”*

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# 2. Watershed Standards

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## 2.1 Summary of Watershed Standards

The philosophy underlying the approach to the standards addresses variability within the watershed. The quality of resource types can vary, as can the physical characteristics, across the landscape. The philosophy generally ensures that projects are not required to more than their “fair share” to address water resource issues. At the same time, there are certain sensitive areas where more restrictive measures are required. The standards:

- ❖ Are variable because of a varying landscape;
- ❖ Are resource based (receiving water, and to some degree, groundwater); and,

- ❖ Include NPDES Phase II Permit as the minimum, including activities for construction sites as well as outcomes from Nondegradation Analyses within the watershed.

The watershed standards for resources are summarized Table 2.1. Note that other procedural requirements, such as submittal deadlines, are established for projects proposed in the watershed. These requirements can be found in the adopted Rules, and within this Developers Packet.

*Table 2.1 – Summary of standards and applicability to projects (adapted from Table 6.1 of 2007 WMP)*

<i>Standard</i>	<i>WMP Section</i>	<i>Applicability</i>	<i>General Comment</i>
NPDES Minimum Water Quality	N/A	All projects meeting criteria of NPDES Permit	
Stormwater Peak Runoff Rate	Section 6.6.2	New and redevelopment, public improvements	Maintain predevelopment rates, maximum CN of 62
Stormwater Runoff Volume	Section 6.6.3	New development only	Maintain existing annual infiltration capacity of site
Allowable Total Phosphorus Load	Section 6.6.4	New and redevelopment, public improvements	Relevant for drainage to lakes or Mississippi River
Wetland Protection Standard	Section 6.4.3	New and redevelopment, public improvements	Inundation, duration, bounce, and nutrient load criteria
Critical Storage Areas	Section 6.7	Not redevelopment	Maintain existing floodplain and flood storage capacities
Regional Assessment Locations	Section 6.8	New and redevelopment, public improvements	Review process by District at key watershed locations
Utilization of Infiltration	Section 6.9	New and redevelopment, public improvements	On-site infiltration limited to 10-acre drainage, or 1-inch runoff temporary storage
Open Channel Stability	Section 6.10	New and redevelopment, public improvements	Allowable velocity approach to ensure channel stability
Bluff Buffers	Section 6.11	Not public improvement	60-foot buffer for slopes exceeding 15% along a watercourse

Note that the volume control standard is based on an annual time scale. The Standards Manual provides further elaboration on how the volume control standard can be applied to a design-event approach or applied to sites poorly conducive to infiltration. Refer to:

- ❖ Section 1.2.3 Comparable Volume Control Standard; and,
- ❖ Section 1.2.4 Alternative Assessment for Volume Control.

## 2.2 Use of Standards Maps to Evaluate Site Requirements

Standards included in the SWWD 2007 WMP rely strongly on the use of maps to reflect the varying nature of resources across the watershed. The maps characterize the sensitivity or condition of a physical resource. Several maps included in the WMP also illustrate the management requirements associated with the resource, as expressed in the Plan's narrative. The maps, in conjunction with written standards, are used to assess requirements for projects.

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## 2.3 Understanding Data Access Procedures

### 2.3.1 Overview

The maps included in the WMP convey information across the entire watershed. Maps are intended to be actively used by project proponents when evaluating site design constraints. Map images are supported by databases containing detailed information. Project proponents can access and retrieve the data used to construct the maps, and use mapping or drafting software to select and identify resource information relative to their own area of interest.

Expectations are that the existing SWWD web page ([www.swwdmn.org](http://www.swwdmn.org)) will serve as the primary tool or mechanism for disseminating map and database information. This will be achieved through the development of new tools on the web page. These tools will enable users to identify an area of interest or view data sources to obtain more information. The following sections discuss concepts of the interactive tools that will be developed.

### 2.3.2 Subwatershed-Based Querying

An internet-based linked map will be created and structured based on five major subwatershed drainage areas. The linked map will be supported by lookup tables founded on the five major drainage areas. Users will be requested to select an area and once a subwatershed area is selected, users will be presented with a lookup table specific to the subwatershed. These lookup tables will provide users with standards, requirements, and other guidance information applicable to each specific drainage area. Hyperlinks will be used as the method to access plan requirements and maps, as well as retrieve database source information.

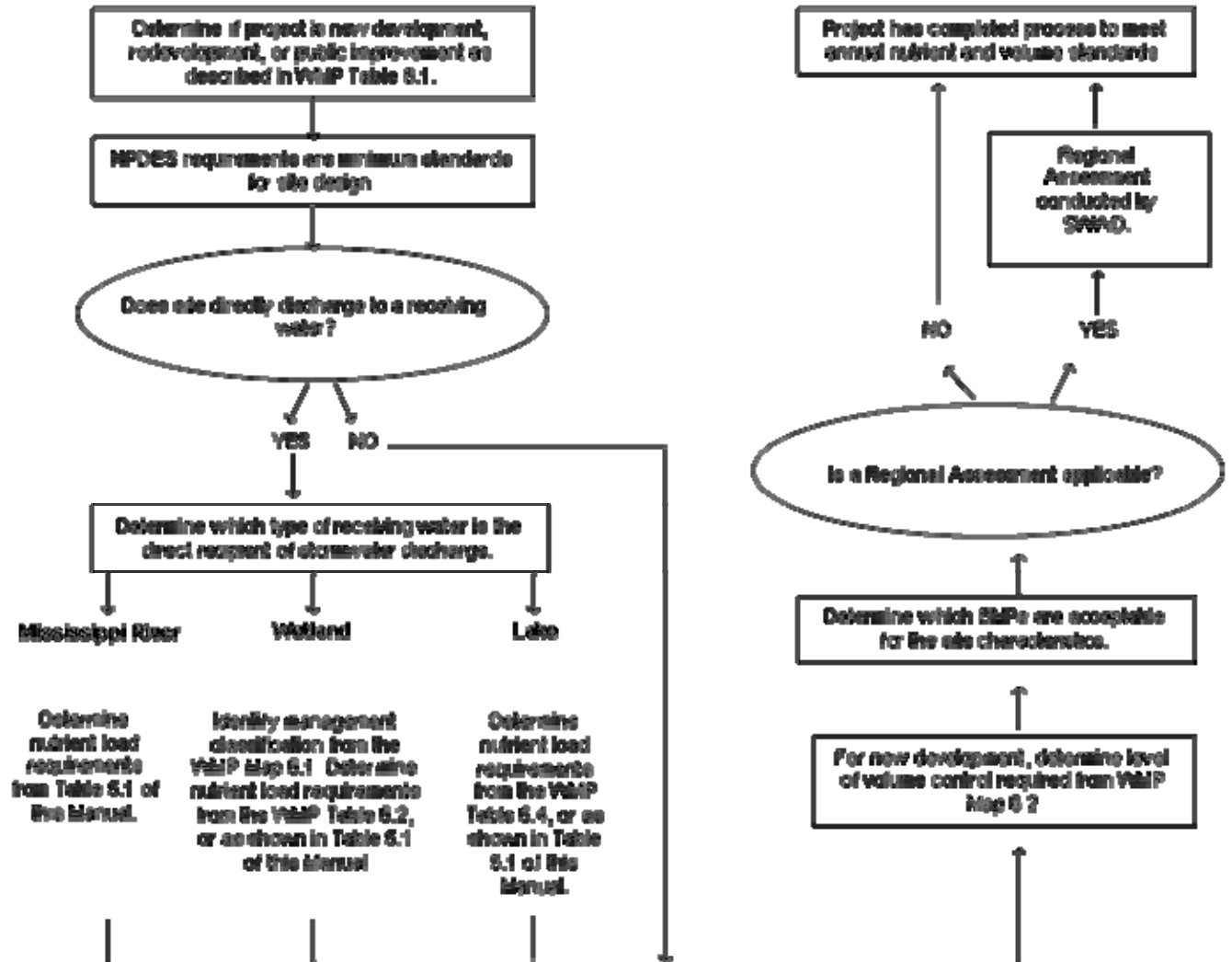
### 2.3.3 Recommended Process

Resources, and the required stormwater control requirements, vary across the watershed. It is intended that project proponents will evaluate the different resources affected by their proposed project, and understand the requirements associated with each resource at that location. All requirements must be met but the project proponent is responsible to determine which requirement is most limiting to their site design. The variability across the watershed means that the volume control requirement may be most limiting at one site while the nutrient load requirement may be most limiting at another site.

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Procedurally a project proponent may evaluate their various requirements in any order or fashion desired. However, a process is illustrated (Figure 2.1) to provide guidance on a recommended approach.

Figure 2.1 Recommended Approach for Assessing Site Requirements



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## 3. Site Impact Analysis

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Design professionals must use a practical approach to protect water quality from the effects of land development. A practical approach includes incorporating appropriate stormwater practices and methods. Thus, selection of BMPs should focus on design suitability (land use and landscape features) as well as targeted pollutant removal characteristics. Tables and decision trees, summarized in Section 4.2 of this Packet, can assist in quickly screening for the selection of appropriate or suitable practices and methods.

The process of selecting which BMPs are appropriate for use in specific areas of the District is also influenced by the resource requirements established in watershed standards. A combination of several BMPs may ultimately be required to meet the resource standard set forth. The BMP decision analysis is not complete until a site impact analysis is completed.



A site impact analysis determines the nutrient or volume control endpoint for any given site based on the resource standards established. A site impact analysis should consider the following steps as a guide for assessing site design requirements:

1. Identify the type of project and locate the project in the watershed.

The District crosses multiple soil types and contains certain areas that have limiting factors such as a well head protection area or karst areas. This will narrow the variety of BMPs that are appropriate for your project. Only new development projects have a mandatory volume control standard, as opposed to redevelopment or public improvement projects

2. Understand, incorporate or address NPDES requirements.

This is the minimum standard for construction activities and serves as the baseline for stormwater runoff mitigation. Watershed requirements are in addition to this regulation.

3. Determine the downstream receiving water (e.g., do you drain to a lake, wetland, or Mississippi River) and required level of nutrient control.

Different standards for nutrient control are established for different receiving water bodies. This step will determine the stringency of the nutrient load reduction required for the project. Required load reductions that are greater than 60% means volume control will be needed to meet the standard.



For each wetland management class, standards have been developed for allowable stormwater runoff inflows (water quality standard, specifically TP), and allowable alterations to wetland hydroperiod (volume control standard). See Table 6.3 in the Watershed Management Plan for a summary of the wetland protection standards.

Lakes are classified by the SWWD based upon monitoring data that reveals the waterbody's current level of nutrient enrichment and clarity and its susceptibility to change due to adverse watershed inputs. See Table 6.4 in the Watershed Management Plan for a summary of lake nutrient load standards, and for the Mississippi River.

4. Determine the required level of volume control based on predevelopment conditions.

Volume control across the watershed varies based on soil type and existing land use. Every new development project is required to incorporate volume control to meet existing annual hydrologic conditions. Estimated post-development runoff volumes are expressed as a fraction of rainfall and compared to the map of annual runoff coefficients. This step will determine the stringency of the runoff volume reduction required for the project.

Predevelopment conditions are based on land use classes as developed by the Metropolitan Council for the year 2000, which was integral to Map 6.2 in the WMP showing estimated annual runoff coefficients. Predevelopment conditions for new development, re-development, and public improvements are also defined in Table 6.1 of the WMP.

5. Determine the annual nutrient load and runoff coefficient from the proposed project.

Use the preferred modeling methods in Standards Manual Chapter 5 to determine the site impacts before any mitigation measures. Estimate the annual nutrient load and runoff volume generated by the proposed project, based upon the unmitigated proposed conditions.

6. Determine and design to meet the limiting site design requirement.

Each new development project will be required to provide runoff volume control measures, and often to provide nutrient control measures. In many cases, regardless of the type of project, volume control in order to meet a required nutrient load reduction may in fact be the limiting site design requirement. A spreadsheet tool is available to assist with this assessment. An example is provided in Appendix A of the Standards Manual.

The most important tool in assisting the site impact analysis is the SWWD website. The website will provide downloadable maps, spreadsheets, and example calculations for the site impact analysis to aide the BMP selection process. The geographic location of the site will indicate which wetland or lake may ultimately receive the stormwater from the development. The use of maps and other tools to be implemented on the website is described in further in Chapter 3 of the Standards Manual.

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## 4. Site Impact Mitigation Tools

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### 4.1 Overview

This Section is intended to provide guidance and establish consistency regarding selection, design, and evaluation of site design elements to meet the required stormwater runoff volume and nutrient controls as specified in Chapter 6 of the Watershed Management Plan. The site design elements include structural and nonstructural urban Best Management Practices (BMPs).

The information presented is not intended to be an exhaustive analysis of selecting, designing and evaluating urban BMPs. Rather, the focus of this section is specifically those BMPs believed most useful and appropriate for attaining the standards of the SWWD within their Watershed Management Plan. The content is customized to reflect the specific aspects of site design elements which are of paramount concern to the watershed, such as design criteria and performance estimation. Because the intention is not to duplicate the content of the many existing urban stormwater design manuals, only the information considered relevant to the SWWD is presented here.

For a broader discussion of stormwater Best Management Practices, the reader is encouraged to obtain and review the publications used for developing this Section. The content presented here is based primarily on the following sources:

- ❖ The 2005 Minnesota Stormwater Manual Version 1.0 (Minnesota Pollution Control Agency)
- ❖ Considerations in the Design of Treatment Best Management Practices (BMPs) to Improve Water Quality (US EPA, 2002)
- ❖ The International Stormwater Best Management Practice (BMP) Database (1999-2005) (American Society of Civil Engineers)

Other stormwater references previously published for Minnesota including:

- ❖ Urban Small Sites Best Management Practice Manual (Metropolitan Council, 2001)
- ❖ Protecting Water Quality in Urban Areas (Minnesota Pollution Control Agency, 2000)

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### 4.2 BMP Decision Analysis

The District recognizes that there are a variety of BMPs from which to choose when constructing new development (e.g., residential, commercial, or industrial), during redevelopment, or public improvement projects. Not all BMPs are appropriate for all areas of the District, and a “one-size-fits-all” approach for mitigating impacts of developments can be problematic due to variations in land use, resource vulnerability, and environmental

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concerns. It is the Districts intent to provide a framework for a holistic approach (i.e., structural and nonstructural) to selecting multiple site design elements that can reduce the stormwater runoff impact associated with developments and redevelopments. Therefore, the SWWD is providing guidance on the appropriateness of various BMPs from a landscape context, specific to the District. However, it is ultimately the responsibility of the design professional to ensure that site design elements are engineered and incorporated in a manner consistent with applicable regulations and standard practices.

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*The design professional is ultimately responsible for appropriate use of site design elements.*

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This section presents screening tools to assess various soil, geologic, environmental, and land use factors which can pose substantive problems for the implementation of specific BMPs within the SWWD; i.e., potential exclusion areas for certain BMPs because of an increased risk of poor performance or failure. The omission of a specific BMP within this section is not intended to exclude the use of that BMP within the watershed. The information presented is intended to provide guidance on the logic and review process used by the SWWD to evaluate the appropriate of various BMPs when completing development reviews. Adhering to the recommendations presented is expected to result in a more timely and streamlined review process by the SWWD.

The first recommended screening tool for BMP selection evaluates land use. Different land use factors can influence the suitability of BMP applications. A generalized suitability assessment of land use types and BMP applications is shown in Table 4.1. While the level of detail in this table is coarse, it illustrates that all land uses have certain limitations for structural BMP applications.

At a more refined level of detail, a second recommended screening tool for BMP selection evaluates landform physical features. This is illustrated in Table 4.2 which captures the general physical factors which can impact BMP applications. The table shows that certain physical factors, such as depth to water table or soil type, can restrict the ability to successfully incorporate a BMP.

Similar to information presented in Table 4.2, a decision tree is presented in Figure 4.1 to illustrate BMP screening based on watershed characteristics. The decision tree captures physical factors such as soil type, drainage area, and bedrock / water table depth. This decision tree is quite useful because it illustrates that some nonstructural BMPs, such as disconnecting impervious area flow paths, can be universally applied despite limiting physical factors in the watershed.

Table 4.1 Land Use and BMP selection.\*

BMP Type	BMP Design	Rural	Residential	Roadways and Highways	Commercial / High Density	Hotspots	Ultra Urban
Pond	Micropool ED	✓	✓	✓	⊘	△	☒
	Wet Pond	✓	✓	✓	⊘	△	☒
	Wet ED Pond	✓	✓	✓	⊘	△	☒
	Multiple Pond	✓	✓	⊘	⊘	△	☒
	Pocket Pond	✓	⊘	✓	⊘	☒	☒
Wetland	Shallow Marsh	✓	✓	⊘	⊘	△	☒
	ED Wetland	✓	✓	⊘	⊘	△	☒
	Pond/Wetland	✓	✓	☒	⊘	△	☒
	Pocket Marsh	✓	⊘	✓	⊘	☒	☒
Infiltration	Infiltration Trench	⊘	⊘	✓	✓	☒	⊘
	Shallow I-Basin	⊘	⊘	⊘	⊘	☒	⊘
Filters	Surface Sand Filter	☒	⊘	✓	✓	▽	✓
	Underground SF	☒	☒	⊘	✓	✓	✓
	Perimeter SF	☒	☒	⊘	✓	✓	✓
	Organic SF	☒	⊘	✓	✓	▽	✓
	Pocket Sand Filter	☒	⊘	✓	✓	▽	✓
	Bioretention	⊘	⊘	✓	✓	▽	✓
Open Channels	Dry Swale	✓	⊘	✓	⊘	▽	⊘
	Wet Swale	✓	☒	✓	☒	☒	☒
	Grass Channel	✓	⊘	✓	⊘	☒	⊘
✓	Yes. Good option in most cases.						
⊘	Depends. Suitable under certain conditions, or may be used to treat a portion of the site.						
☒	No. Seldom or never acceptable.						
△	Acceptable option, but may require a pond liner to reduce risk of groundwater contamination						
▽	Acceptable option, if not designed as an exfilter						

\*Adapted from The Stormwater Managers Resource Center STP Selection Matrix 1. (www.stormwatercenter.net)

Table 4.2 Physical Feasibility and BMP selection.\*

BMP Type	BMP Design	Soils	Water Table	Drainage Area (acres)	Site Slope	Head (ft)	
Pond	Micropool ED	HSG A soils may require pond liner.	2 foot separation if hotspot or aquifer	10 min*	No more than 15%	6 to 8 ft	
	Wet Pond			25 min*			
	Wet ED Pond						
	Multiple Pond	OK	below WT	5 max**		4 ft	
Wetland	Shallow Marsh	HSG A soils may require liner.	2 foot separation	25 min	No more than 8%	3 to 5 ft	
							if hotspot
	ED Wetland	OK	below WT	5 max		2 to 3 ft	
Infiltration	Infiltration Trench	$f_c > 0.5$ inch/hr	4 feet	5 max	No more than 6%	1 ft	
	Shallow I-Basin			10 max		3 ft	
Filters	Surface Sand Filter	OK	2 feet	10 max **	no more than 6%	5 ft	
	Underground SF			2 max **		5 to 7ft	
	Perimeter SF			2 max **		2 to 3 ft	
	Organic SF			5 max**		2 to 4 ft	
	Pocket Sand Filter			5 max **		2 to 5 ft	
	Bioretention	Made Soil		5 ft			
Open Channels	Dry Swale	Made Soil	2 feet	5 max	No more than 4%	3 to 5 ft	
	Wet Swale	OK	below WT	5 max		1 ft	
	Grass Channel	OK	2 feet	5 max		1 ft	

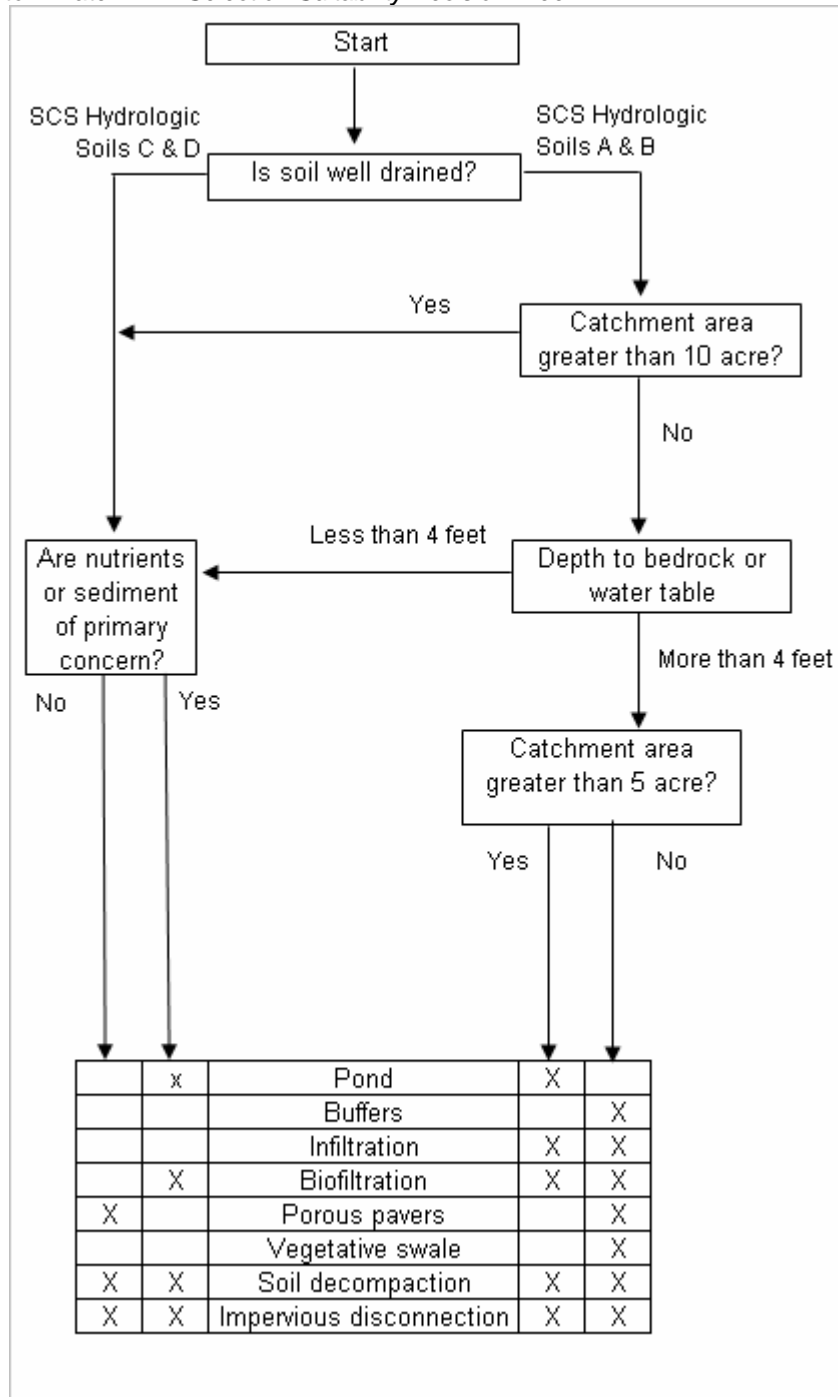
Notes: OK= not restricted, WT= water table, PT = pretreatment,  $f_c$  =soil permeability

\* unless adequate water balance and anti-clogging device installed

\*\* drainage area can be larger in some instances.

\*Adapted from The Stormwater Managers Resource Center STP Selection Matrix 2.  
(www.stormwatercenter.net)

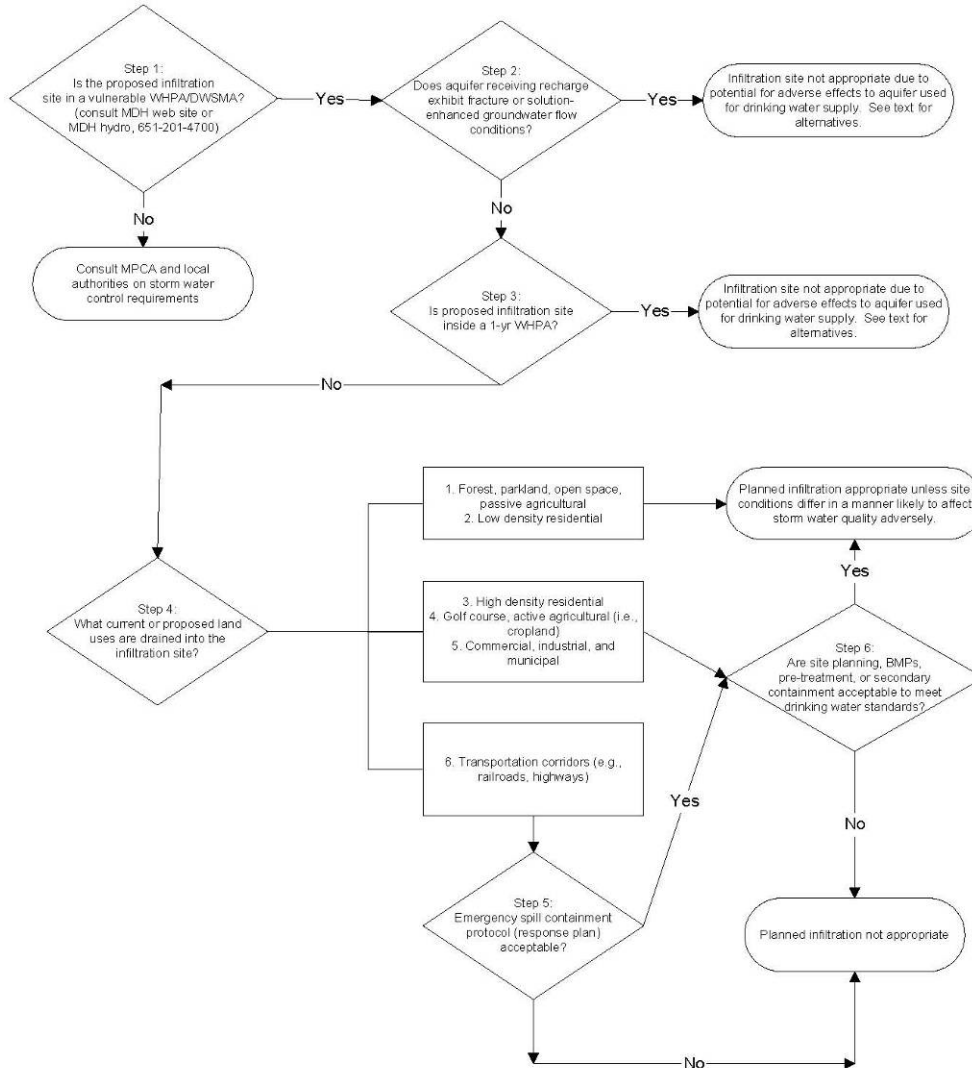
Figure 4.1 Stormwater BMP Selection Suitability Decision Tree



Adapted from Idaho Department of Environment Quality, and based on page 181 of Urban Runoff Quality Management (1998, Water Environment Federation and American Society of Civil Engineers).

The use of infiltration practices to control runoff volume and nutrient loads has been subject to considerable scrutiny. Thus, materials of a very high level of detail are available to help screen the suitability of using this type of BMP. A flow chart by the Minnesota Department of Health is presented in Figure 4.2 to help design professionals further evaluate the suitability of applying infiltration BMPs in a watershed. Also, see Section 3.5 of the Standards Manual for a discussion on using maps to help assess suitability for local infiltration.

Figure 4.2 Infiltration Suitability Screening Guide



\*This figure is a Minnesota Department of Health flow chart for evaluating proposed stormwater infiltration projects in areas with vulnerable groundwater.

One additional screening tool for BMP selection is provided in Table 4.3. This table shows a general rating of BMPs for their ability to mitigate the affects of development, redevelopment, and public improvements. The table illustrates which BMPs can be used to mitigate the increase in pollutant load, the increase in peak discharge, and the increase in annual runoff volume. Incorporation of site design elements not presented in this table (or Manual) will be considered on a case-by-case basis.

*Table 4.3 General Summary of BMP Efficiency for Site Mitigation*

<i>Best Management Practice</i>	<i>Ability for Volume Reduction</i>	<i>Ability for Nutrient Reduction</i>
Detention Ponds	None	Moderate
Buffers	None	None
On-site Infiltration	High	High
Regional Infiltration	Not Preferred	Not Preferred
Biofiltration	None	High
Porous Pavers	High	High
Swales	Low	Low
Soil Decompaction	Moderate	Moderate
Impervious Disconnection	Moderate	Moderate

*\*Numeric values are presented in Table 4.4.*

## 4.3 Overview of BMP Design

Sections of the Standards Manual are available to provide specific guidance on the design and evaluation of BMPs to mitigate water quality impacts. The sections include BMPs most commonly used or anticipated in the watershed. Other BMPs may be incorporated on projects, subject to SWWD review and acceptance. Thus the SWWD encourages innovative approaches for water quality management. However, this component of the Standards Manual establishes consistency and uniformity in design, evaluation, and implementation.

In the Standards Manual, a brief definition is provided to illustrate each BMP. Design criteria are presented which reflect the SWWD's desired components for BMP engineering approaches, and performance estimation and benefits are quantified. The performance estimation (i.e., pollutant removal efficiency) of an urban BMP is usually estimated based upon computer models when designing and sizing the BMP. Less often, empirical evidence through the collection and analysis of monitoring data within the field can be



used for performance estimation. Once constructed, a BMP may perform differently—sometimes less efficiently than anticipated—compared to modeled estimates which rely on theory and mathematical equations. Precipitation and environmental factors also influence the performance of a BMP.

Recognizing these circumstances, the SWWD has established an expected range for estimated annual benefit for any given BMP mitigating the affects of stormwater runoff. A summary table (Table 4.4) illustrates BMP allowable performance estimation and empirically derived typical performance.

Table 4.4 Expected Benefits for Site Design Elements (BMPs)

Best Management Practice for Site Design	Expected Range for Estimated Annual Benefit:		Empirical Typical Nutrient (TP) Pollutant Removal Efficiency
	Volume Reduction	Nutrient (TP) Load Reduction	
Detention Ponds	0	60%	50% <sup>1</sup>
Buffers	0		
On-site infiltration, ½-inch	90 - 100%		65% <sup>2</sup>
On-site infiltration, 1-inch	90 - 100%		
Regional infiltration	Case by case evaluation		
Biofiltration / Sand filter	0	60%	50% <sup>3</sup>
Porous Pavers, ½-inch	90 - 100%		n/a
Porous Pavers, 1-inch	90 - 100%		n/a
Swales, Dry	60%	60%	8 – 99% <sup>4</sup>
Swales, Conventional	15%	30%	34% <sup>5</sup>
Soil Decompaction	25 – 30%		n/a
Impervious Disconnection	10 - 15%	15 - 20%	n/a
Tandem: Decompaction and Disconnection	35 - 40%	40 - 45%	n/a

NOTE:

- (A) ½-inch means runoff volume equal to ½-inch depth spread across the entire *contributing* area (pervious and impervious).
- (B) 1-inch means runoff volume equal to 1-inch depth spread across the entire *impervious* area.

1. From Minnesota Stormwater Manual Table 10.6 for Flow-Through Pond.
2. From Minnesota Stormwater Manual Table 10.6 for Infiltration.

3. From Minnesota Stormwater Manual Table 10.6 for Bioretention, Underdrain.
4. From California Stormwater BMP Handbook, Section TC-30, page 4.
5. From US EPA BMP Design Considerations (2002) Table 4-1.

NOTE: Extensive summaries of runoff reduction and pollutant reduction percentages are available in: Center for Watershed Protection & Chesapeake Stormwater Network Technical Memorandum: The Runoff Reduction Method. (2008).

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## 5. Methods For Calculations and Submittals

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### 5.1 Stormwater Hydrology

The District has determined applicable rainfall depths and recurrence intervals for use in hydrologic design. These values are presented in Table 5.1 for use in the evaluation and design of all major stormwater facilities in the District. Major stormwater facilities generally include natural or artificial channels, and detention basins (wet or dry). In contrast, minor stormwater facilities are considered as streets, curb and gutter systems, or roadside swales.

Table 5.1 – Applicable rainfall depths for hydrologic design

	2-Year	10-Year	100-Year
Rainfall Depth	2.8"	4.2"	6.3"
Probability	50%	10%	1%

#### 5.1.1 Acceptable Tools

At minimum, the Natural Resources Conservation Service (formerly, Soil Conservation Service) methodology for estimating watershed runoff and peak flow (i.e. a hydrograph) shall be used to evaluate event-based hydrology. Tools based on the rational method or other deviations from the runoff hydrograph procedure are not acceptable. A variety of proprietary software packages are available for this use, such as HydroCAD or PondPack. Analysis by any commonly used software package will be acceptable provided that it is used in conformance with District Methods specified below.

## 5.1.2 District Methods

### 5.1.2.1 Curve Number Selection



A runoff curve number (CN) value shall be selected from, or based on, values from Table 2-2 from SCS TR-55. Antecedent moisture condition II shall be assumed for all design event modeling. A weighted curve number is allowable for subwatershed modeling related to flood hydrology (2-inch depth rainfall or greater). Refer to Section 4.3.2.4 of the Manual for CN values related to small storm hydrology.

For predevelopment conditions, the allowable range for a CN to reflect undeveloped conditions should fall within values of 52 – 62 and must not exceed a value of 62. Hydrologic soil groups for CN value selection shall be determined based on soil survey maps. However, CN values listed under hydrologic soil group A will generally not be accepted where developed conditions are modeled (either as an existing developed condition or a future proposed condition). This accounts for soil compaction during mass grading and construction activities.

No exceptions are allowed to curve number selection for projects which incorporate the use of soil decompaction methods to improve infiltration, decreasing the frequency and magnitude of runoff volumes. In this circumstance, standard engineering practice for the evaluation and design of conveyance infrastructure is of paramount importance.

### 5.1.2.2 Time of Concentration



The preferred methods for calculating time of concentration ( $T_c$ ) is to explicitly determined a value for each subwatershed that is modeled. Under no circumstance will “direct entry” of  $T_c$  be accepted; travel times must be computed. Travel time ( $T_t$ ) is the time it takes water to travel from one location to another in a watershed.  $T_t$  is a component of  $T_c$ , which is time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed.  $T_c$  shall be computed by summing all the travel times for consecutive components of the drainage conveyance system.

### 5.1.2.3 Flood Hydrology Design Events

Refer to Section 4.1.3 in the Manual for the analysis of design storm events relating to flood hydrology.

### 5.1.2.4 Small Storm Hydrology and Runoff Depths

Small storm hydrology refers to a water quality concept that typically the bulk of annual pollutant loading is derived from storms of approximately one-inch in depth or less. Many structural devices are often sized for to address this small storm concept. However, the use of a composite (weighted) curve number is inadequate for accurate hydrologic runoff computations of small storms.

Pervious and impervious watershed areas shall be isolated for each subwatershed and modeled separately for any storm event less than two inches in depth (approximately equivalent to a 2-year frequency and 6-hour duration). All impervious areas will generally be modeled as 100% directly connected to the conveyance system, which is a fundamental assumption of TR-55.

For infiltration basin analysis, calculation of runoff depth for a storm event is required. The total runoff volume (as computed per Section 4.3.2.4 in the Manual) shall be divided by the total contributing impervious area to determine a runoff depth.

### 5.1.2.5 Infiltration Rates

Use of a static infiltration rate in event-based models can be based on soil types and published NRCS infiltration rates. Based on the District's field monitoring data, average infiltration rates for constructed infiltration systems are approximately 0.65 inches per hour (see "infiltration rates" under Section 4.3 of the Manual).

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## 5.2 Stormwater Quality

### 5.2.1 Applicable Tools

The District will accept the P8 Urban Catchment Model as the preferred tool for analyzing allowable nutrient loads. P8 model release version 3.4 is the basis of this current manual volume. The P8 model is free for download at <http://www.walker.net/p8/>. It is expected that project designers and engineers will retrieve and install the relevant files from this website to begin the modeling assessment.

For tools other than P8, users must be able to demonstrate consistency in model inputs and methodology in comparison to the preferred tool. Refer to Standards Manual Sections 5.2 and 5.3 for further discussion of acceptable tools and methodology.

### 5.2.2 Preferred Methods for Modeling

#### 5.2.2.1 P8 Model Adjustments for SWWD

The SWWD has determined adjusted parameters within the P8 model release version 3.4 to reflect site-specific conditions, and to fully address the issue of watershed wide consistency in modeling. These adjustments incorporate results from establishing the SWWD volume control standard (Map 6.2 of the WMP) as well as runoff volume monitoring data analyzed within the WMP. In this way, projects using a "calibrated" P8 model would predict post-project runoff volumes at a scale consistent with the pre-development runoff volume standard established by the SWWD for new development.

To create an adjusted P8 model is available on the SWWD website, the following steps are required:

- ❖ Setting the impervious runoff coefficient (Rv) to 0.55;
- ❖ Setting the pervious CN to 45; and
- ❖ Removing 25% of the original overall impervious fraction (i.e. directly connected) and placing the removed fraction into what is considered indirectly connected impervious.

Further discussion and screen captures showing the relevant adjustments are provided in Appendix A of the Standards Manual. For more detailed background information on the P8 model, please consult the model developer's web site at <http://www.walker.net/p8/>.

### 5.2.2.2 Annual Precipitation

A continuous simulation model must use at least one full year of precipitation to assess nutrient load and runoff volume criteria. It is preferred to use a hydrologic water year which begins October 1 and terminates September 30. For the P8 Urban Catchment Model, the year reflecting "normal" conditions is the 1979 water year, starting October 1, 1978. This is used because the total rainfall depth is 29.5 inches, very similar to the 30-inch precipitation depth stated in for deterministic modeling in Section 4.2.2.1. The frequency distribution of rainfall depths for 1979 is also consistent with calculated normal conditions for Hastings Dam station.

### 5.2.2.3 Annual Runoff Coefficients

The linear equation between percent impervious and annual runoff volume (expressed as an Rv) shown in Section 5.2.2.2 is generally captured well by the adjusted P8 model. No assumption should be made in reducing the impervious fraction to account for non-connected imperviousness, unless simulating impervious disconnection as a proposed Best Management Practice. This is because the P8 model has already been pre-adjusted to site-specific conditions for the SWWD.

### 5.2.2.4 Event Mean Concentrations

Default values for event mean concentrations are provided in the P8 Urban Catchment model. For total phosphorus (TP), the default value of 0.300 mg/L corresponds well with values presented in the Minnesota Stormwater Manual (MSM) Table 8.7 for residential land use. For other land uses, the runoff TP concentration in the P8 model should be scaled (up or down) to generally reflect the values shown in Table 8.7. Instructions for adjusting the runoff TP concentration are noted within the model's user manual and help tools. As noted in Section 5.3.1, if using other District-approved continuous modeling tools, it must be demonstrated in model outputs that unmitigated runoff concentrations are reasonably consistent with Table 8.7 of the MSM.

### 5.2.2.5 Best Management Practices

Details are presented in the Standards Manual for guidance on modeling various site design elements. Some tools are more adept than others at modeling the benefit of site design elements. However, some site design elements such as soil decompaction or buffer strips are not included in any currently available model.

It is intended that the designers and technical professionals use their judgment and training to adequately construct models for evaluating project impacts and the benefits of site design elements. However, there are certain methods that need to be established to ensure uniform evaluation of site design elements. Where no specific methods are set, it is generally intended that no value is gained by specifying preferred methods for accounting. Instead, expected ranges for estimated annual benefit for any given BMP mitigating the affects of stormwater runoff are intended to help screen site design elements which and corroborate modeling estimates.

## 5.3 Watershed Review Process

### 5.3.1 Overview of Review Criteria

A District review/permit is required for the following activities within the District:

- ❖ Land alterations, such as grading or filling which remove, cover or disturb a surface area of one acre or more
- ❖ All work within the waters or floodplain of the District
- ❖ Subdivisions, plats and developments within a floodplain of the District
- ❖ Projects which result in the augmentation or diversion of stormwater to a receiving water body
- ❖ Work involving the filling or other modification of certain wetland areas

### 5.3.2 Submittals

The following items should be submitted at least 14 days prior to a regularly scheduled SWWD Board meeting (second Tuesday of each month) to:

*Matt Moore, SWWD Administrator  
8301 Valley Creek Road  
Woodbury, MN 55125  
Tel: 651.714.3729  
Fax: 651.714.3721*

*mmoore@ci.woodbury.mn.us*

#### *Required Review Submittals*

A complete District Review requires the following submittals:

- ❖ Existing Conditions Plan (full size)
- ❖ Grading and Utility Plan (2 copies – full size)
- ❖ Erosion Control Plan for the project
- ❖ Engineering design calculations (See below)
- ❖ Engineering design details
- ❖ Landscape/Vegetation Plan
- ❖ Soils borings and locations on site

As a part of the review, the following information will be required to assist in evaluating the impacts of the projects on the resources of the District.

Engineering and Hydrologic/Hydraulic Calculations

- ❖ Total Project Area and area of disturbance
- ❖ Volume of all constructed, or modified water bodies

- ❖ Areas of delineated wetlands and of wetland impacts resulting from project
- ❖ Drainage divides and areas for existing and proposed conditions (electronic format as specified in WMP)
- ❖ Hydrologic model results for existing and proposed conditions using a 24 hour Type II storm event for return periods of 2, 10 and 100 years for a return period of 100 years
- ❖ The normal water surface elevation, 100 year flood elevation, dead storage volume, and flood storage volume for all ponds, or other water bodies involved
- ❖ CN values and supporting data used for calculation
- ❖ Floodplain alteration calculations
- ❖ Water quality calculations (P8 – Urban Catchment Model preferred) using SWWD design worksheet
- ❖ Rating curves for all outlets from water bodies within the development

#### Infiltration Practices

- ❖ Construction details and specifications
- ❖ Timing of construction of infiltration practices
- ❖ Operation and Maintenance Plan
- ❖ Calculations and supporting data for infiltration practices used in overall hydrologic calculations

### 5.3.3 Administrative Procedure

#### *Fees*

The SWWD has adopted Rules which allow for the collection of fees associated with development reviews. An escrow can be obtained from a developer (rate to be determined) to cover the costs of the District's review, administrative, and inspection costs. In addition, an application fee can also be required (set annually by Board of Managers). A letter of credit can also be required proportional to the size and type of the development, to ensure the project is completed in accordance with SWWD Rules and Regulations. At this time, the SWWD does not collect any fees.

#### *Timing*

A complete submittal including all necessary supporting documentation (see Required Review Submittals in Guide to SWWD Rules and Review) should be submitted to the SWWD 14 days prior to a regularly scheduled Board meeting at which an application is to be considered. The District technical professional and administrator will coordinate with the applicant during the review process to ensure all SWWD rules and regulations are met.

The development proposal is placed on the Board agenda when all required information is received and all SWWD rules and regulations are met or a variance is requested in written form. A written report will be submitted to the managers at least two days prior to the Board meeting.

The Board will act on a complete submittal (see Required Review Submittals in Guide to SWWD Rules and Review) within 60 days or as required by the Wetland Conservation Act.