SECTION

1.3

UNIFIED STORMWATER SIZING CRITERIA

1.3.1 Overview

This section presents an integrated approach for meeting the stormwater runoff quality and quantity management requirements in the minimum standards for development (see Section 1.2) by addressing the key adverse impacts of stormwater runoff from a development site. The purpose is to provide a framework for designing a stormwater management system to:

- Remove stormwater runoff pollutants and improve water quality (Minimum Standard #2);
- Prevent downstream streambank and channel erosion (Minimum Standard #3);
- Reduce downstream overbank flooding (Minimum Standard #4); and
- Safely pass or reduce the runoff from extreme storm events (Minimum Standard #5).

For these objectives, an integrated set of engineering criteria, known as the *Unified Stormwater Sizing Criteria*, have been developed which are used to size and design structural stormwater controls. Table 1.3.1-1 below briefly summarizes the criteria.

Table 1.3.1-1 Summary of the Statewide Stormwater Sizing Criteria for Stormwater Control and Mitigation

Sizing Criteria	Description
Water Quality	Treat the runoff from 85% of the storms that occur in an average year. For Georgia, this equates to providing water quality treatment for the runoff resulting from a rainfall depth of 1.2 inches. Reduce average annual post-development total suspended solids loadings by 80%.
Channel Protection	Provide extended detention of the 1-year storm event released over a period of 24 hours to reduce bankfull flows and protect downstream channels from erosive velocities and unstable conditions.
Overbank Flood Protection	Provide peak discharge control of the 25-year storm event such that the post-development peak rate does not exceed the predevelopment rate to reduce overbank flooding.
Extreme Flood Protection	Evaluate the effects of the 100-year storm on the stormwater management system, adjacent property, and downstream facilities and property. Manage the impacts of the extreme storm event through detention controls and/or floodplain management.

Each of the unified stormwater sizing criteria are intended to be used in conjunction with the others to address the overall stormwater impacts from a development site. When used as a set, the unified criteria control the entire range of hydrologic events, from the smallest runoff producing rainfalls to the 100-year storm.

Figure 1.3.1-1 graphically illustrates the relative volume requirements of each of the unified stormwater sizing criteria as well as demonstrates that the criteria are "stacked" upon one another, i.e., the extreme flood protection volume requirement also contains the overbank flood protection volume, the channel protection volume and the water quality treatment volume. Figure 1.3.1-2 shows how these volumes would be stacked in a typical stormwater wet pond designed to handle all four criteria.

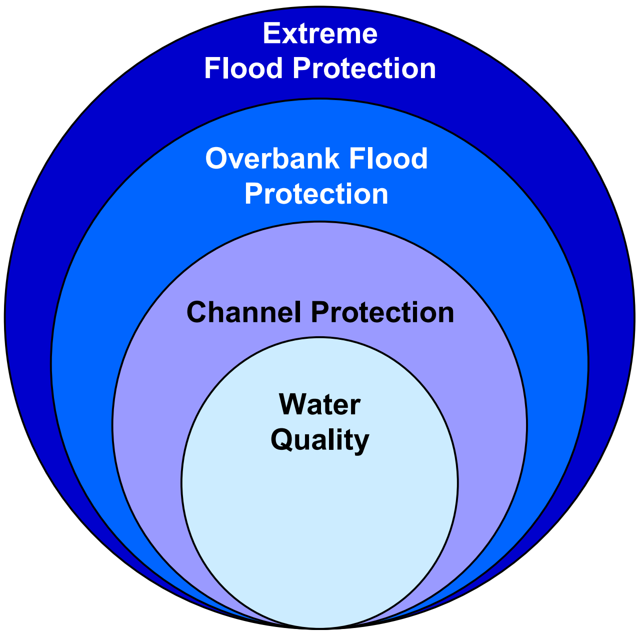

Figure 1.3.1-1 Representation of the Unified Stormwater Sizing Criteria

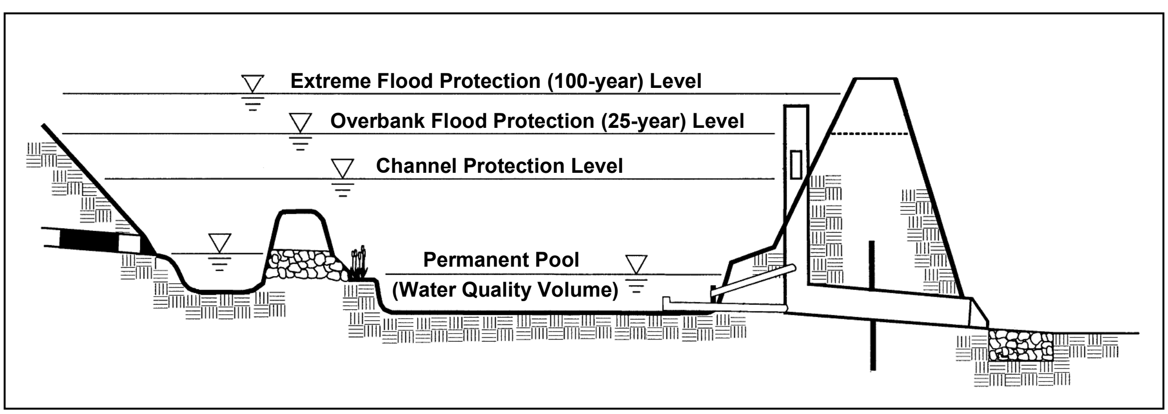

Figure 1.3.1-2 Unified Sizing Criteria Water Surface Elevations in a Stormwater (Wet) Pond

The following pages describe the four sizing criteria in detail and present guidance on how to properly compute and apply the required storage volumes.

1.3.2 Description of Unified Stormwater Sizing Criteria

1.3.2.1 Water Quality (WQ_v)

The Water Quality sizing criterion, denoted WQ_v, specifies a treatment volume required to remove a significant percentage of the total pollution load inherent in stormwater runoff by intercepting and treating the 85th percentile storm event, which is equal to 1.2 inches (i.e., all the runoff from 85% of the storms that occur on average during the course of a year and a portion of the runoff from all storms greater than 1.2 inches). The Water Quality Volume is a runoff volume that is directly related to the amount of impervious cover at a site.

In numerical terms, it is equivalent to a rainfall depth of 1.2 inches multiplied by the volumetric runoff coefficient (R_v) and the site area, and is calculated using the formula below:

$$WQ_V = \frac{1.2 R_V A}{12}$$

where:
WQ_v = water quality volume (in acre-feet)
R_v = 0.05 + 0.009(I) where I is percent impervious cover
A = site area in acres

Discussion

Hydrologic studies show that small-sized, frequently occurring storms account for the majority of rainfall events that generate stormwater runoff. Consequently, the runoff from these storms also accounts for a major portion of the annual pollutant loadings. Therefore, by treating these frequently occurring smaller rainfall events and a portion of the stormwater runoff from larger events, it is possible to effectively mitigate the water quality impacts from a developed area.

A water quality treatment volume (WQ_v) is specified to size structural control facilities to treat these small storms up to a maximum runoff depth and the "first flush" of all larger storm events. For Georgia, this maximum depth was determined to be the runoff generated from the 85th percentile storm event (i.e., the storm event that is greater than 85% of the storms that occur within an average year). The 85th percentile volume was considered the point of optimization between pollutant removal ability and cost-effectiveness. Capturing and treating a larger percentage of the annual stormwater runoff would provide only a small increase in additional pollutant removal, but would considerably increase the required size (and cost) of the structural stormwater controls.

A value of 1.2 inches for the 85th percentile storm was derived from a rainfall analysis for 12 locations across the state of Georgia and is an average value chosen for the entire state. Thus, the statewide water quality treatment volume is equal to the runoff from the first 1.2 inches of rainfall. A stormwater management system designed for the WQ_v will treat the runoff from all storm events of 1.2 inches or less, as well as the first 1.2 inches of runoff for all larger storm events.

The volumetric runoff coefficient (R_v) was derived from a regression analysis performed on rainfall runoff volume data from a number of cities nationwide and is a shortcut method considered adequate for runoff volume calculation for the type of small storms normally considered in stormwater quality calculations. Figure 1.3.2-1 shows a plot of the Water Quality Volume versus impervious area percentage.

TSS Reduction Goal

This Manual follows the philosophy of removing pollutants to the "maximum extent practicable" through the use of a percentage removal performance goal. The approach taken in this Manual is to require treatment of the WQ_v from a site to reduce post-development total suspended solids (TSS) loadings by 80%, as measured on an average annual basis. This performance goal is based upon U.S. EPA guidance and has been adopted nationwide by many local and statewide agencies.

TSS was chosen as the representative stormwater pollutant for measuring treatment effectiveness for several reasons:

1. The use of TSS as an "indicator" pollutant is well established.
2. Sediment and turbidity, as well as other pollutants of concern that adhere to suspended solids, are a major source of water quality impairment due to urban development in Georgia watersheds.
3. A large fraction of many other pollutants of concern are either removed along with TSS, or at rates proportional to the TSS removal.
4. The 80% TSS removal level is reasonably attainable using well-designed structural stormwater controls (for typical ranges of TSS concentration found in stormwater runoff).

TSS is a good indicator for many stormwater pollutants. However, the removal performance for pollutants that are soluble or that cannot be removed by settling will vary depending on the structural control practice. For pollutants of specific concern, individual analyses of specific pollutant sources and the appropriate removal mechanisms should be performed.

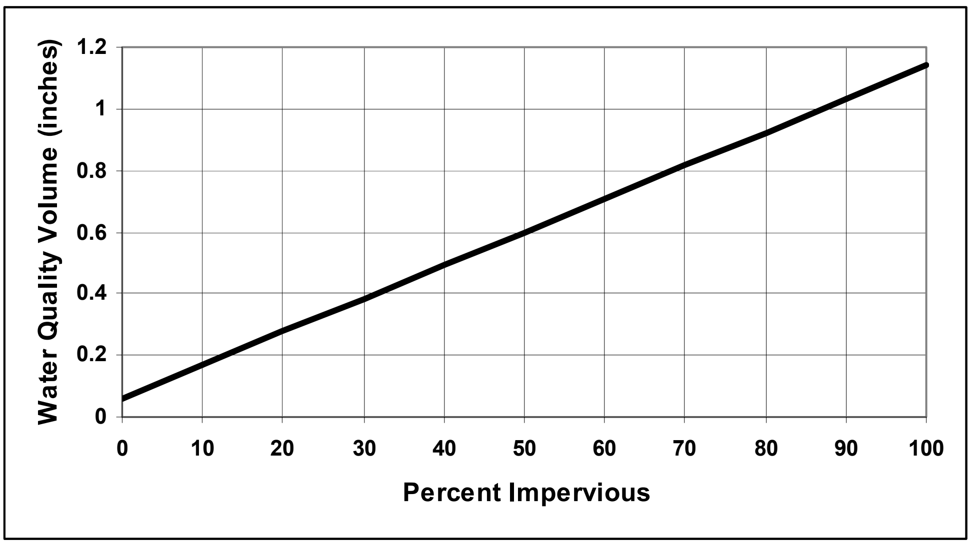

Figure 1.3.2-1 Water Quality Volume versus Percent Impervious Area

<u>Determining the Water Quality Volume (WQ_v)</u>

- *Measuring Impervious Area*: The area of impervious cover can be taken directly off a set of plans or appropriate mapping. Where this is impractical, NRCS TR-55 land use/impervious cover relationships can be used to estimate impervious cover. I is expressed as a percent value not a fraction (e.g., I = 30 for 30% impervious cover)
- *Multiple Drainage Areas*: When a development project contains or is divided into multiple drainage areas, WQ_v should be calculated and addressed separately for each drainage area.
- *Off-site Drainage Areas:* Off-site existing impervious areas may be excluded from the calculation of the WQ_v volume.
- *Credits for Site Design Practices*: The use of certain better site design practices may allow the WQ_v volume to be reduced through the subtraction of a site design "credit." These site design credits are described in Section 1.4.
- *Determining the Peak Discharge for the Water Quality Storm:* When designing off-line structural control facilities, the peak discharge of the water quality storm (Q_{wq}) can be determined using the method provided in Section 2.1.
- *Extended Detention of the Water Quality Volume:* The water quality treatment requirement can be met by providing a 24-hour drawdown of a portion of WQ_v in a stormwater pond or wetland

system (as described in Chapter 3). Referred to as water quality ED (extended detention), it is different than providing extended detention of the 1-year storm for the channel protection volume (CP_v). The ED portion of the WQv may be included when routing the CP_v.

- WQ_v can be expressed in cubic feet by multiplying by 43,560.
- WQ_v can also be expressed in watershed-inches by removing the area (A) and the "12" in the denominator.

1.3.2.2 Channel Protection (CP_v)

The Channel Protection sizing criterion specifies that 24 hours of extended detention be provided for runoff generated by the 1-year, 24-hour rainfall event to protect downstream channels. The required volume needed for 1-year extended detention, denoted CP_v, is roughly equivalent to the required volume needed for peak discharge control of the 5- to 10-year storm.

- CP_v control is not required for post-development discharges less than 2.0 cfs.
- The use of nonstructural site design practices that reduce the total amount of runoff will also reduce the channel protection volume by a proportional amount.
- The channel protection criteria may be waived by a local jurisdiction for sites that discharge directly into larger streams, rivers, wetlands, lakes, estuaries, or tidal waters where the reduction in the smaller flows will not have an impact on streambank or channel integrity.

Discussion

The increase in the frequency and duration of bankfull flow conditions in stream channels due to urban development is the primary cause of streambank erosion and the widening and downcutting of stream channels. Therefore, channel erosion downstream of a development site can be significantly reduced by storing and releasing stormwater runoff from the channel-forming runoff events (which corresponds approximately to the 1-year storm event) in a gradual manner to ensure that critical erosive velocities and flow volumes are not exceeded.

Determining the Channel Protection Volume (CP_v)

- *CP_v Calculation Methods:* Several methods can be used to calculate the CP_v storage volume required for a site. Subsection 2.1.5.8 in Chapter 2 and Appendix D-1 illustrate the recommended average outflow method for volume calculation.
- *Hydrograph Generation:* The SCS TR-55 hydrograph methods provided in Section 2.1 can be used to compute the runoff hydrograph for the 1-year, 24-hour storm.
- *Rainfall Depths:* The rainfall depth of the 1-year, 24-hour storm will vary depending on location and can be determined from rainfall tables included in Appendix A for various locations across Georgia.
- *Multiple Drainage Areas*: When a development project contains or is divided into multiple drainage areas, CP_v may be distributed proportionally to each drainage area.
- *Off-site Drainage Areas:* Off-site drainage areas should be modeled as "present condition" for the 1-year storm event. If there are adequate upstream channel protection controls, then the off-site area can be modeled as "forested" or "natural" condition. A structural stormwater control located "on-line" will need to safely bypass any off-site flows.
- *Routing/Storage Requirements:* The required storage volume for the CP_v may be provided above the WQ_v storage in stormwater ponds and wetlands with appropriate hydraulic control structures for each storage requirement.
- *Control Orifices*: Orifice diameters for CP_v control of less than 3 inches are not recommended without adequate clogging protection (see Section 2.3).

1.3.2.3 Overbank Flood Protection (Q_{p25})

The Overbank Flood Protection criterion specifies that the post-development 25-year, 24-hour storm peak discharge rate, denoted Q_{p25}, not exceed the pre-development (or undisturbed natural conditions) discharge rate. This is achieved through detention of runoff from the 25-year event.

- Smaller storm events (e.g., 2-year and 10-year) are effectively controlled through the combination of the extended detention for the 1-year event (channel protection CP_v control) and the control of Q_{p25} for overbank channel protection.
- Larger storms (> 25-year) are partially attenuated through the control of Q_{p25}.
- The use of nonstructural site design practices that reduce the total amount of runoff will also reduce Q_{p25} by a proportional amount.

Control of Q_{p25} is not intended to serve as a stand-alone design standard, but is intended to be used in conjunction with the channel protection AND extreme flood protection criteria. If detention is designed for only the 25-year storm, smaller runoff events will simply pass through the outlet structure with little attenuation. If the channel protection criterion is not used, then for overbank flood protection, peak flow attenuation of the 2-year (Q_{p2}) through the 25-year (Q_{p25}) return frequency storm events must be provided.

Discussion

The purpose of overbank flood protection is to prevent an increase in the frequency and magnitude of damaging out-of-bank flooding (i.e., flow events that exceed the capacity of the channel and enter the floodplain). It is intended to protect downstream properties from flooding at middle-frequency storm events.

This criterion may be adjusted by a local jurisdiction for areas where all downstream conveyances are designed to handle runoff from the full buildout 25-year storm, or where it can be demonstrated that no downstream flooding will occur as a result of a proposed development (see 2.1.9). In this case, the overbank flood protection criterion may be waived by a local jurisdiction in lieu of provision of safe and effective conveyance to a major river system, lake, wetland, estuary, or tidal waters that have capacity to handle flow increases at the 25-year level.

Determining the Overbank Flood Protection Volume (Q_{p25})

- *Peak-Discharge and Hydrograph Generation:* The SCS TR-55 or USGS hydrograph methods provided in Section 2.1 can be used to compute the peak discharge rate and runoff for the 25-year, 24-hour storm.
- *Rainfall Depths:* The rainfall depth of the 25-year, 24-hour storm will vary depending on location and can be determined from rainfall tables included in Appendix A for various locations across Georgia.
- *Off-site Drainage Areas:* Off-site drainage areas should be modeled as “present condition” for the 25-year storm event and do not need to be included in Q_{p25} estimates, but can be routed through a structural stormwater control.
- *Downstream Analysis:* Downstream areas should be checked to ensure there is no peak flow increase above pre-development conditions to the point where the site area is 10% of the total drainage to that point.

1.3.2.4 Extreme Flood Protection (Q_f)

The Extreme Flood Protection criterion specifies that all stormwater management facilities be designed to safely handle the runoff from the 100-year, 24-hour return frequency storm event, denoted Q_f. This is accomplished either by:

(1) Controlling Q_f through on-site or regional structural stormwater controls to maintain the existing 100-year floodplain. This is done where residences or other structures have already been constructed within the 100-year floodplain fringe area; or
(2) By sizing the on-site conveyance system to safely pass Q_f and allowing it to discharge into a receiving water whose protected full buildout floodplain is sufficiently sized to account for extreme flow increases without causing damage.

Local flood protection (levees, floodwalls, floodproofing, etc.) and/or channel enlargements may be substituted as appropriate, as long as adequate conveyance and structural safety is ensured through the measure used, and stream environmental integrity is adequately maintained.

Discussion

The intent of the extreme flood protection is to prevent flood damage from infrequent but large storm events, maintain the boundaries of the mapped 100-year floodplain, and protect the physical integrity of the structural stormwater controls as well as downstream stormwater and flood control facilities.

It is recommended that Q_f be used in the routing of runoff through the drainage system and stormwater management facilities to determine the effects on the facilities, adjacent property, and downstream. Emergency spillways of structural stormwater controls should be designed appropriately to safely pass the resulting flows.

Determining the Extreme Flood Protection Criteria (Q_{p25})

- *Peak-Discharge and Hydrograph Generation:* The SCS TR-55 or USGS hydrograph methods provided in Section 2.1 can be used to compute the peak discharge rate and runoff for the 100-year, 24-hour storm.
- *Rainfall Depths:* The rainfall depth of the 100-year, 24-hour storm will vary depending on location and can be determined from rainfall tables included in Appendix A for various locations across Georgia.
- *Off-site Drainage Areas:* Off-site drainage areas should be modeled as “full buildout condition” for the 100-year storm event to ensure safe passage of future flows.
- *Downstream Analysis:* If Q_f is being detained, downstream areas should be checked to ensure there is no peak flow increase above pre-development conditions to the point where the site area is 10% of the total drainage to that point.

1.3.3 Meeting the Unified Stormwater Sizing Criteria Requirements

1.3.3.1 Introduction

There are two primary approaches for managing stormwater runoff and addressing the unified stormwater sizing criteria requirements on a development site:

- **The use of better site design practices to reduce the amount of stormwater runoff and pollutants generated and/or provide for natural treatment and control of runoff; and**
- **The use of structural stormwater controls to provide treatment and control of stormwater runoff**

This subsection introduces both of these approaches. Stormwater better site practices are discussed in-depth in Section 1.4, while structural stormwater controls are covered in Chapter 3.

1.3.3.2 Site Design as the First Step in Addressing Unified Stormwater Sizing Criteria Requirements

Using the site design process to reduce stormwater runoff and pollutants should always be the first consideration of the site designer and engineer in the planning of the stormwater management system for a development.

Through the use of a combination of approaches collectively known as *stormwater better site design* practices and techniques, it is possible to reduce the amount of runoff and pollutants that are generated, as well as provide for at least some nonstructural on-site treatment and control of runoff. Better site design concepts can be viewed as both water quantity and water quality management tools and can reduce the size and cost of required structural stormwater controls—sometimes eliminating the need for them entirely. The site design approach can result in a more natural and cost-effective stormwater management system that better mimics the natural hydrologic conditions of the site, has a lower maintenance burden and provides for more sustainability.

Better site design includes:

- Conserving natural features and resources
- Using lower impact site design techniques
- Reducing impervious cover
- Utilizing natural features for stormwater management

For each of the above categories, there are a number of practices and techniques that aim to reduce the impact of urban development and stormwater runoff from the site. These better site design practices are described in detail in Section 1.4.

For several of the better site design practices, there is a direct economic benefit to their implementation for both stormwater quality and quantity through the application of site design "credits." In terms of the unified stormwater sizing criteria, Table 1.3.3-1 shows how the use of nonstructural site design practices can provide a reduction in the amount of stormwater runoff that is required to be treated and/or controlled through the application of site design credits.

Table 1.3.3-1 Reductions or "Credits" to the Unified Stormwater Sizing Criteria through the Use of Better Site Design Practices

Sizing Criteria	Potential Benefits of the Use of Better Site Design Practices
Water Quality (WQ_v)	• Better site design practices that reduce the total amount of runoff will also reduce WQ_v by a proportional amount. • Certain site design practices will allow for a further reduction to the Water Quality Volume. The site design credits are discussed in Section 1.4.
Channel Protection, Overbank Flood Protection, and Extreme Flood Protection (CP_v, Q_{p25}, Q_f)	• The use of better site design practices that reduce the total amount of runoff will also reduce CP_v, Q_{p25}, and Q_f by a proportional amount. • Floodplain preservation may allow waiving of overbank flood and/or extreme flood protection requirements.

1.3.3.3 Recommended Structural Stormwater Control Practices

Structural stormwater controls (sometimes referred to as *structural best management practices* or *BMPs*) are constructed stormwater management facilities designed to treat stormwater runoff and/or mitigate the effects of increased stormwater runoff peak rate, volume, and velocity due to urbanization.

This Manual recommends a number of structural stormwater controls for meeting unified stormwater sizing criteria. The recommended controls are divided into three categories: *general application*, *limited application*, and *detention* structural controls.

General Application Controls

General application structural controls are recommended for use with a wide variety of land uses and development types. These structural controls have a demonstrated ability to effectively treat the Water Quality Volume (WQ_v) and are presumed to be able to remove 80% of the total annual average TSS load in typical post-development urban runoff when designed, constructed and maintained in accordance with recommended specifications. Several of the general application structural controls can also be designed to provide water quantity control; i.e., downstream channel protection (CP_v), overbank flood protection (Q_{p25}) and/or extreme flood protection (Q_f). General application controls are the recommended stormwater management facilities for a site wherever feasible and practical.

There are six types of general application controls, which are summarized below. Detailed descriptions of each structural control along with design criteria and procedures are provided in Section 3.2.

<u>Stormwater Ponds</u>

Stormwater ponds are constructed stormwater retention basins that have a permanent pool (or micropool) of water. Runoff from each rain event is detained and treated in the pool. Pond design variants include:

- Wet Pond
- Wet Extended Detention Pond
- Micropool Extended Detention Pond
- Multiple Pond Systems

<u>Stormwater Wetlands</u>

Stormwater wetlands are constructed wetland systems used for stormwater management. Stormwater wetlands consist of a combination of shallow marsh areas, open water and semi-wet areas above the permanent water surface. Wetland design variants include:

- Shallow Wetland
- Extended Detention Shallow Wetland
- Pond/Wetland Systems
- Pocket Wetland

<u>Bioretention Areas</u>

Bioretention areas are shallow stormwater basins or landscaped areas that utilize engineered soils and vegetation to capture and treat stormwater runoff. Runoff may be returned to the conveyance system, or allowed to fully or partially exfiltrate into the soil.

<u>Sand Filters</u>

Sand filters are multi-chamber structures designed to treat stormwater runoff through filtration, using a sand bed as the primary filter media. Filtered runoff may be returned to the conveyance system, or allowed to fully or partially exfiltrate into the soil. The two sand filter design variants are:

- Surface Sand Filter
- Perimeter Sand Filter

Infiltration Trenches

An infiltration trench is an excavated trench filled with stone aggregate used to capture and allow infiltration of stormwater runoff into the surrounding soils from the bottom and sides of the trench.

Enhanced Swales

Enhanced swales are vegetated open channels that are explicitly designed and constructed to capture and treat stormwater runoff within dry or wet cells formed by check dams or other means. The two types of enhanced swales are:

- Dry Swale
- Wet Swale/Wetland Channel

Limited Application Controls

Limited application structural controls are those that are recommended only for limited use or for special site or design conditions. Generally, these practices: (1) cannot alone achieve the 80% TSS removal target, (2) are intended to address hotspot or specific land use constraints or conditions, and/or (3) may have high or special maintenance requirements that may preclude their use. Limited application controls are typically used for *water quality treatment only*. Some of these controls can be used as a pretreatment measure or in series with other structural controls to meet pollutant removal goals. Limited application structural controls should be considered primarily for commercial, industrial or institutional developments.

The following limited application controls are provided for consideration in this Manual. Each is discussed in detail with appropriate application guidance in Section 3.3.

Biofilters

- Filter Strip
- Grass Channel

Filtering Practices

- Organic Filter
- Underground Sand Filter

Wetland Systems

- Submerged Gravel Wetland

Hydrodynamic Devices

- Gravity (Oil-Grit) Separator

Porous Surfaces

- Modular Porous Paver Systems
- Porous Concrete

Chemical Treatment

- Alum Treatment System

Proprietary Systems

- Commercial Stormwater Controls

Detention Controls

Detention structural controls provide only water quantity control (CP_v, Q_{p25}, and/or Q_f), and are typically used downstream of a general application or limited application structural control. Types of detention controls include:

- Dry Detention and Dry Extended Detention Basins
- Multi-purpose Detention Areas
- Underground Detention

A detailed discussion of each of the detention controls, as well as design criteria and procedures can be found in Section 3.4.

1.3.3.4 Using Structural Stormwater Controls to Meet Unified Stormwater Sizing Criteria Requirements

Structural stormwater controls should be considered after all reasonable attempts have been made to minimize stormwater runoff and maximize its control and treatment through the better site design methods. Once the need for structural controls has been established, one or more appropriate controls will need to be selected to handle the stormwater runoff storage and treatment requirements calculated using the unified stormwater sizing criteria. Guidance for choosing the appropriate structural stormwater control(s) for a site is provided in Section 3.1.

Table 1.3.3-2 summarizes the stormwater management suitability of the various structural controls in addressing the unified stormwater sizing criteria. Given that many structural controls cannot meet all of the sizing criteria, typically two or more controls are used in series to form what is known as a stormwater "treatment train." Section 3.1 provides guidance on the use of a treatment train as well as calculating the pollutant removal efficiency for structural controls in series.

Table 1.3.3-2 Suitability of Structural Stormwater Controls to Meet Unified Stormwater Sizing Criteria

Structural Stormwater Control	Water Quality Volume (WQ_v)	Channel Protection (CP_v)	Overbank Flood Protection (Q_{p25})	Extreme Flood Protection (Q_f)
General Application				
Stormwater Ponds	✓	✓	✓	✓
Stormwater Wetlands	✓	✓	✓	✓
Bioretention Areas	✓	✪	●	●
Sand Filters	✓	✪	●	●
Infiltration Trenches	✓	✪	●	●
Enhanced Swales	✓	✪	✪	●
Limited Application				
Biofilters	O	●	●	●
Filtering Practices	✓	●	●	●
Wetland Systems	✓	●	●	●
Hydrodynamic Devices	O	●	●	●
Porous Surfaces	✓	✪	●	●
Chemical Treatment	✓	●	●	●
Proprietary Systems	*	*	*	*
Detention Controls	●	✓	✓	✓

✓ = Able to meet stormwater sizing criterion (for water quality, this control is presumed to meet the 80% TSS reduction goal when sized to treat the WQ_v and designed, constructed and maintained properly)

O = Typically provides partial treatment of WQ_v. May be used in pretreatment and as part of a "treatment train"

✪ = Can be incorporated into the structural control in certain situations

● = Not typically able or used to meet stormwater sizing criterion

* = The application and performance of specific commercial devices and systems must be provided by the manufacturer and should be verified by independent third-party sources and data

1.3.3.5 Typical Steps in Addressing the Unified Stormwater Sizing Criteria

Each development site is unique in how stormwater management objectives are met. The type of development, physical site conditions, location in the watershed, and other factors determine how the minimum stormwater management standards and unified stormwater sizing criteria are addressed.

Figure 1.3.3-1 provides a flowchart for the typical steps in stormwater management system design using the unified stormwater sizing criteria. This is a subset of the stormwater site planning process detailed in Section 1.5.

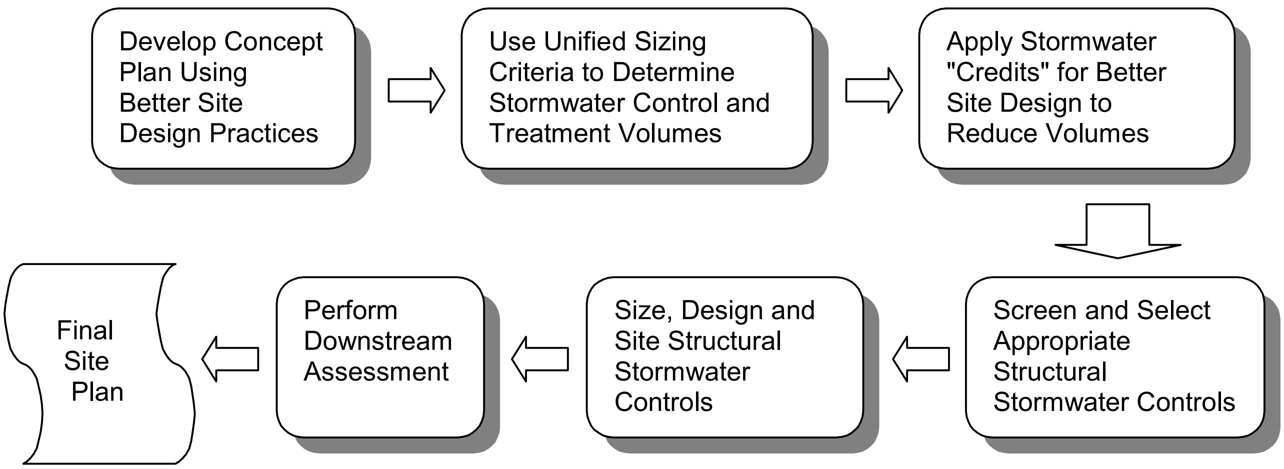

Figure 1.3.3-1 Typical Stormwater Management System Design Process