2. Stormwater Criteria, Planning, and Regulation

2.1 Stormwater Sizing Criteria

Introduction

Development projects applying for a Grading and Drainage Permit shall meet the following criteria related to stormwater runoff and protection of existing water bodies and properties. For the purposes of this Drainage Manual, predevelopment is defined as the existing conditions of the site at the time of development. The primary goal of this manual is to promote the health, safety, and welfare of the public. To achieve this goal, the objective of this manual is to:

- Reduce stormwater runoff pollutants and protect water quality.
- Reduce downstream overbank flooding and channel erosion.
- Safely convey the design storm and extreme storm events.

For the objectives outlined above, the following stormwater sizing criteria have been developed which are used to size and design structural stormwater controls. Table 2.1 briefly summarizes the criteria.

Table 2.1 Summary of Stormwater Sizing Criteria for Stormwater Control and Mitigation.

Sizing Criteria	Description
Water Quality	Provide water quality treatment for the runoff resulting from a rainfall depth of 1.2 inches.
Downstream Flood Protection	Provide peak discharge control of the 2-year, 5-year, 10-year, 25-year, and 100-year storm event such that the post-development peak rate does not exceed the pre-development rate. Extend analysis through the zone of influence based on the 10% rule for projects greater than 20 acres.
Level of Service	Based on the Master Street Plan, provide a level of service of: 100-year storm for Principal Arterials, as well as for Major and Minor Arterials, 25-year storm for all other streets. Analyze and provide a safe 100-year overflow path for all developments.

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

2.1.1 Water Quality (WQ_v)

In accordance with the City's Municipal Separate Storm Sewer System (MS4) general permit under NPDES Permit No. ARS000002, the stormwater management system should be designed to remove at least 80% of the total suspended solids (TSS) from stormwater flows which exceed predevelopment levels and be able to meet any other additional watershed- or site-specific water quality requirements.

The stormwater management system shall be capable of removing at least 80% of TSS from an equivalent onsite impervious area. Any onsite impervious area (draining to a common outlet point) may be treated to meet this requirement – parking areas are preferred due to highest pollutant removal opportunity.

Chapter 8 of this Drainage Manual outlines the methodology to select appropriate structural stormwater controls and design a system or "treatment train" that removes 80% of the TSS from 1.2 inches of rainfall, the Water Quality Treatment Volume (WQ_v). Chapter 8 also covers Low Impact Development (LID) strategies and Best Management Practices (BMPs) that may be utilized to meet the water quality requirement. LID strategies and BMPs shall be selected based on the targeted pollutant removal based off the type of development. Refer to Chapter 8 and Appendix C for information on BMP selection.

The Water Quality sizing criterion specifies a treatment volume, denoted WQ_v, required to size structural stormwater controls to meet the 80% TSS removal. For the City of Little Rock, this value is computed as 1.2 inches of rainfall over the catchment area multiplied by the runoff coefficient (R_v).

The Water Quality Volume is calculated using the formula below:

$$WQ_V = \frac{1.2 R_V A}{12} \qquad \textbf{Eq. 2.1}$$

Where: WQ_V = water quality volume (acre-feet)

$R_V = 0.05 + 0.009(I)$ where I is the percentage (%) impervious cover within the project area (post-development)

A = Project Area (acres)

Refer to Chapter 8 for detailed design guidance regarding water quality treatment.

2.1.2 Downstream Flood Protection

Downstream overbank flood protection shall be provided by controlling the post-development peak discharge rate to not exceed the pre-development rate for the 2-, 5-, 10-, 25-, and 100-year, 24-hour return frequency storm event. The NOAA Atlas 14 rainfall depths that correspond to these events are 4.19, 5.12, 5.94, 7.14, and 9.17 inches, respectively.

Existing floodplain areas should be preserved to the extent possible. At the discretion of the Design Review Engineer, analysis of floodplain impacts and additional detention or reduction in post-development peak discharge rates may be required for developments.

Determining the Overbank Flood Protection Volume

- *Peak-Discharge and Hydrograph Generation:* The hydrograph methods provided in Chapter 3 of this Drainage Manual shall be used to compute the peak discharge rate and runoff for the 2-, 5-, 10-, 25-, and 100-year, 24-hour storm. The runoff hydrographs shall be routed through the proposed detention/retention structures using appropriate software or methodology.

2.1.3 Level of Service

The stormwater system shall be designed to meet the Level of Service based on the Master Street Plan. The Level of Service for the roadway classifications are as follows:

Table 2.2 Design Storm Street Classification.

Street Classification	Design Storm
Principal Arterial	100-year Storm Event
Major and Minor Arterials	100-year Storm Event
All other Streets and Roads	25-year Storm Event

The hydraulic grade line (HGL) shall be calculated throughout the storm system to ensure the maximum HGL for the design storm is 1-foot below the throat of each roadway inlet. The starting HGL shall be based on the known or calculated tailwater elevation of the receiving channel or waterbody for the design event. The fully developed 100-year storm must be contained within the designated right of way.

Determining the Adequacy of the Stormwater Management System

- *On-site Storm System Sizing:* The Modified Rational method or SCS TR-55 hydrograph method provided in Chapter 3 shall be used to compute peak discharge rate and runoff for the design storm.
- *Downstream Analysis: Peak discharges at downstream locations shall be checked and evaluated for any increase in peak flow above pre-development conditions. The downstream check shall extend to the point where the developed site area comprises at least 10% of the total drainage area checked. If the post-developed discharges at the downstream checkpoints exceed pre-development conditions, mitigation measures shall be required by the City Engineer.*
- *System Check: As a final check, the 100-year, 24-hour storm event shall be routed through the drainage system and stormwater management facilities to determine the effects on the facilities, adjacent property, and downstream, and to confirm adequacy of finished floor elevations for structures. Emergency spillways for* structural stormwater controls should be designed to safely pass the fully developed 100-year flow. A positive overflow pathway shall be provided that conveys the flow without damaging structures, utilities, or infrastructure.

2.1.4 Pertinent Ordinances and Regulations

Refer to the following chapters of the City of Little Rock Municipal Code and additional documents for information related stormwater management within the City of Little Rock.

Chapter 13 – Floods

Chapter 29 – Stormwater Management and Drainage

Chapter 30 – Streets and Sidewalks

Chapter 31 – Subdivisions

NPDES Permit Number ARS000002

Kaylin Hills et al v. City of Little Rock Planning Commission, 60CV-18-8041, 2019