

14-712 STORMWATER MANAGEMENT GUIDELINES

These guidelines will outline the way stormwater detention and water quality treatment will be calculated. Stormwater detention is a necessary part of most stormwater treatment BMPs and is required for most developments.

The Stormwater Ordinance of the City of Cookeville is posted at the City of Cookeville Public Works Department's website and must be read by anyone attempting to perform stormwater calculations with the City of Cookeville. It contains provisions for fees, right-of-entry, definitions, easements and penalties. A major purpose of the Stormwater Ordinance is to improve water quality, stormwater quantity as well as comply with the City's NPDES Permit for Discharges from Small Municipal Separate Storm Sewer Systems (MS4).

Stormwater Detention

Stormwater detention is required for any new development or re-development containing 5,000 square foot or more of impervious area. (Cookeville Municipal Code 14-608, Cookeville Zoning Code, Cookeville Subdivision Regulations). Where additions to the existing impervious area of the site bring the total area of impervious surface to 5,000 square foot or more, only the additional impervious area is required to provide detention.

Stormwater detention is defined as limiting the peak discharge rate for the post developed conditions to be no greater than the peak discharge rate for the predevelopment conditions. This must be accomplished using the 2-year, 5-year, and 10-year storms. The estimated design rainfall amounts for either 24-hour depths or intensities for any duration, can be found by accessing the following NOAA National Weather Service Atlas 14 data for Tennessee:

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

Redevelopment of property shall be evaluated using one of the following methods unless otherwise determined by the Public Works Department:

1. Rational method – evaluate the pre-development conditions using the appropriate meadow/pastureland runoff coefficient or as existing conditions, the more conservative condition shall be used.
2. USDA Technical Release Number 55 (TR-55) – evaluate the pre-development conditions as either grassland conditions or existing conditions, the more conservative conditions shall be used.

All hydrological and hydraulic computations for stormwater detention facilities must be prepared and stamped by a registered engineer (licensed in the state of Tennessee) and proficient in this field. Plans must show sufficient information to enable the builder to construct the facility as required.

A dry detention basin must have a minimum of 2% slope in the bottom of the basin in order to drain properly. Side slopes should generally be 3:1 (H:V) or flatter, unless traversable access has been designed. Detention basins and ponds must provide forebays comprising a minimum of 10% of the total design volume. Existing regional detention ponds are not subject to the forebay requirement.

Underground detention is the use of large underground structures to provide necessary volumes for attenuating stormwater peak flows. Underground structures generally provide little or no stormwater quality benefits. The following minimum requirements must be met before an underground storage facility will be considered for approval:

- The underground detention structure must provide adequate access for inspection from the surface. Public safety must be considered.
- The underground detention structure must be constructed of durable materials with a typical 100-year lifetime. Detention storage volume shall not include the porous space within a stone or gravel bed without soils reports stamped by a geotechnical engineer stating that infiltration into the soils should exceed ½” per hour infiltration rate.
- The underground detention structure shall be designed to have positive drainage into the receiving channel or stormwater sewer assuming there is a 10-year flood in the receiving facility.
- The underground detention structure shall not receive surface runoff directly from parking lots. Surface water shall be directed to a BMP that improves water quality such as an oil/water separator, grass filter strips (of sufficient size to filter the water quantity), or a proprietary water quality device approved by the Public Works Department.
- Design measures must be taken to trap and store sediments in locations where cleanout and maintenance can be easily performed. This generally requires that some type of water quality inlet or other stormwater treatment BMP must be installed upstream from the underground detention facility. Proprietary water quality devices must be approved by the Public Works Department using industry wide standards identified by TDEC.
- A detailed maintenance and inspection plan must be submitted and approved (including inspection schedules and guidelines). Evidence of responsibility and financial budgeting must be presented.

Stormwater Water Quality Treatment

The water quality treatment volume (WQTV) commonly referred to as the first flush volume is defined as the first portion of direct runoff from impervious surfaces at a new development or redevelopment project. The water quality treatment design storm is defined by the 1-year, 24-hour design storm event that can be found by accessing the following NOAA National Weather Service Atlas 14 data for Tennessee: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html.

Depending on the type of permanent stormwater control measure (SCM) proposed for stormwater treatment at new development and redevelopment projects, the quantity of the WQTV or the first flush volume required to be treated is defined by the table below:

Water Quality Treatment Volume and the Corresponding SCM Treatment Type for the 1-year, 24-hour design storm		
SCM Treatment Type Proposed	WQTV Required	Notes
Infiltration, evaporation, transpiration, and/or reuse	Runoff generated from the first 1 inch of the design storm	Examples include, but not limited to, bioretention, stormwater wetlands, and infiltration systems with no underdrains
Biologically active filtration, with an underdrain	Runoff generated from the first 1.25 inches of the design storm	To achieve biologically active filtration, SCMs must provide minimum of 12 inches of internal water storage
Sand or gravel filtration, settling ponds, extended detention ponds, and wet ponds	Runoff generated from the first 2.5 inches of the design storm or the first 75% of the design storm, whichever is less	Examples include, but are not limited to, sand filters, permeable pavers, and underground gravel detention systems.
Hydrodynamic separation, baffle box settling, other flow-through manufactured treatment devices (MTDs), and treatment trains using MTDs	Maximum runoff generated from the entire design storm	Flow-through MTDs must provide an overall treatment efficiency of at least 80% TSS reduction.

The WQTV or first flush volume must be captured and released over a minimum of 24 hours and a maximum of 72 hours. No first flush runoff of impervious surfaces shall bypass the treatment facility. Stormwater recharge by infiltrating the first flush volume into the soil on site is the preferable method of first flush treatment. Infiltration may be accomplished by the use of Bioretention basins, rain gardens, bio swales, green parking for overflow lots, or other methods pre-approved by the Director of Public Works or his designee. Infiltration of the first flush may not be possible if the site is located on unsuitable soils. Where infiltration of stormwater is not possible or ill advised, treatment of the WQTV or first flush is defined as a practice or structure

that removes 80% Total Suspended Solids (TSS) and other anticipated pollutants such as oil and grease.

To reach the required 80% TSS removal, multiple SCMs can be proposed on new development and redevelopment sites in a treatment train. Treatment train calculations must be submitted as defined by TDEC NPDES permit Section 4.2.5.2.

Site design standards for all new construction and redevelopment disturbing one acre or more are recommended to use in combination or alone, stormwater management measures that are designed, built and maintained to infiltrate, evapotranspire, harvest and/or use the first flush of every rainfall event preceded by 72 hours of no measurable precipitation. The first flush of rainfall should be 100% managed with no discharge to surface waters.

Stormwater management measures that are often referred to as green infrastructure that can infiltrate the first flush of rainfall are the goal that TDEC is aiming for that they term runoff reduction. Green infrastructure includes many practices including; rain gardens, bioretention, infiltration swales, etc.

Some sites are not suitable for infiltration methods and infiltration requirements may be set aside on such sites, with prior agreement by the Public Works Department. Limitations to using runoff reduction methods include, but are not limited to:

1. Where the potential for introducing pollutants into the ground water exists, unless pretreatment is provided;
2. Where pre-existing soil contamination is present in areas subject to contact with infiltrated runoff;
3. The presence of sinkholes or other karst features on the site or in close proximity;
4. Insufficient infiltration capacity of soils;
5. An extensive presence of shallow ground water table, shallow bedrock or other restrictive layers; and
6. Presence of contractive or expansive soils in close proximity to structures.

Pre-development infiltration capacity of the soils at the site must be taken into account in selection of runoff reduction management measures.

Incentive standards for redevelopment sites: a 10% reduction in volume of rainfall to be managed for any of the following types of development. Such credits are additive such that a maximum reduction of 50% of the standard one inch is possible for a project that meets all 5 criteria:

1. Redevelopment
2. Brownfield redevelopment
3. High density (>7 units per acre)

4. Vertical density (>18 units per acre)
5. Mixed use

For all projects that cannot meet 100% of the first flush runoff reduction requirement unless subject to the incentive standards, the remainder of the first flush rainfall must be treated prior to discharge with a practice or technology documented to remove 80% total suspended solids (TSS). The treatment practice or technology must be designed, installed and maintained to continue to meet this performance standard.

In addition to the runoff reduction requirement for the first flush rainfall, minimum volume controls are required to detain those storms greater than the 1 yr, 24 hr depth as outlined above in the Stormwater Detention section.