



**City of Durham**  
**Public Works Department**  
**Stormwater Services Divisions**

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## Bio-Retention Area Design Summary

### Stormwater Management Construction Plan Review:

A complete stormwater management construction plan submittal includes a design summary for each stormwater BMP, design calculations, plans and specifications showing BMP, inlet and outlet structure details.

### I. PROJECT INFORMATION

Project Name: \_\_\_\_\_ Phase \_\_\_\_\_

PIN: \_\_\_\_\_ Case #: \_\_\_\_\_

Design Contact Person: \_\_\_\_\_ Phone #: (\_\_\_\_) \_\_\_\_-\_\_\_\_\_

Legal name of Owner: \_\_\_\_\_

Owner Contact: \_\_\_\_\_ Phone #: (\_\_\_\_) \_\_\_\_-\_\_\_\_\_

Owner Address: \_\_\_\_\_

Deed Book \_\_\_\_\_ Page # \_\_\_\_\_ or Plat Book \_\_\_\_\_ Page# \_\_\_\_\_ for BMP Property

For projects with multiple basins, specify which pond this worksheet applies to: \_\_\_\_\_

Drainage area	_____	ac	(on-site drainage to the area, 1-acre max <sup>1</sup> )
Impervious area	_____	ac	(on-site impervious area draining to facility)
Design runoff	_____	cfs	
Design treatment volume	_____	ft <sup>3</sup>	

<sup>1</sup> Assumes 100% impervious, larger areas may be considered if maximum sheet flow velocity is not exceeded

### *Bioretention Design*

Grass buffer strip width	_____	ft	(Max slope of 4:1 and minimum width of 10 feet or a forebay)
Size of cell area	_____	ft <sup>2</sup>	(Min 5% of drainage area with sand bed, 7% without bed)
Depth of ponding area	_____	ft	(6-inches max)
Width of cell	_____	ft	(Minimum width of 25-feet <sup>2</sup> )
Length of cell	_____	ft	(Minimum length of 2 times the width)
Inflow sheet flow velocity	_____	ft/s	(Maximum of 1-foot/second)
Mulch layer elevation	_____	ft	(Elevation of top of layer)
Planting soil top elevation	_____	ft	(Elevation of top of soil)
Depth of planting soil	_____	ft	(Minimum depth of 4-feet <sup>3</sup> )
Top of sand if applicable	_____	ft	(Elevation of top of sand)
Bottom elevation	_____	ft	(Elevation of bottom of cell)
Perforated pipe length	_____	ft	(Length of perforated pipe provided under cell layers)
Space between pipe runs	_____	ft	(Spacing between perforated pipe runs, max of 10-feet)

<sup>2</sup> Smaller widths may be accepted in urbanized areas or in retrofit situations. These designs will be evaluated on a case-by-case basis.

<sup>3</sup> Smaller depths may be accepted in urbanized areas or in retrofit situations. These designs will be evaluated on a case-by-case basis.

Longitudinal slope \_\_\_\_\_ ft (1% minimum longitudinal slope)  
 Diameter of pipe \_\_\_\_\_ in (Pipe diameter of perforated pipe, min of 6-inches)

**Emergency Spillway Information**

Emergency outlet elev. \_\_\_\_\_ ft (invert of emergency overflow weir)  
 Emergency spillway width \_\_\_\_\_ ft. side slopes \_\_\_\_:1 slope \_\_\_\_\_%

**II. REQUIRED ITEMS CHECKLIST**

The following checklist outlines design requirements. Initial in the space provided to indicate the following design requirements have been met and supporting documentation is attached.

**Applicant’s initials**

- \_\_\_\_\_ a. Runoff from landscaped areas and other non-impervious areas has been directed away from the bioretention area to the maximum extent practical.
- \_\_\_\_\_ b. Drainage area for bioretention area is less than 1-acre.
- \_\_\_\_\_ c. Plan specifies how all slopes draining to the bioretention area will be stabilized, note that the slopes must be stabilized before installation of the under drain system.
- \_\_\_\_\_ d. Construction sequencing shall be considered and a note added to the plan that states: “All sediment and erosion control practices shall be in place and the slopes draining to the bioretention area shall be stabilized before construction of the bioretention area begins.”
- \_\_\_\_\_ e. No side slopes draining to bioretention area greater than 3:1, promote sheet flow through the grass filter strip.
- \_\_\_\_\_ f. Riprap outlet protection, if provided, reduces flow to non-erosive velocities (provide calculations).
- \_\_\_\_\_ g. A recorded drainage easement is provided for each cell including access to the nearest right-of-way and is graded per Section 8.3, Stormwater Control Facilities (BMPs).
- \_\_\_\_\_ h. A plan view of the bioretention area with grading shown is provided.
- \_\_\_\_\_ i. A profile through the bioretention area and emergency spillway is provided.
- \_\_\_\_\_ j. Geotextile fabric is placed at the bottom of the excavated cell to prevent soil from getting into the underdrain system.
- \_\_\_\_\_ k. The underdrain system is wrapped in a gravel jacket and a geotextile fabric is placed between the bottom of the sand bed or planting soil and the top of the gravel jacket.
- \_\_\_\_\_ l. The pipe for the underdrain system shall be perforated Schedule 40 PVC.
- \_\_\_\_\_ m. The underdrain system shall connect to the outflow system at a point at least 1 foot inside the bioretention cell wall.
- \_\_\_\_\_ n. A non-perforated piping system is connected to the underdrain piping and extends to the surface of the planting soil for cleanouts.
- \_\_\_\_\_ o. Cleanouts are to be provided at the beginning of each pipe run and at all intersections.
- \_\_\_\_\_ p. A planting soil mixture specification and a soil characteristics table are provided. Maximum clay content in the soil mixture is 8.00%.
- \_\_\_\_\_ q. The hydraulic conductivity for the planting mixture is to be 1-inch to 2-inches per hour.
- \_\_\_\_\_ r. Mulch layer specification is provided; mulch is to be a 4-inch layer of coarse hardwood mulch with re-application rate specified.
- \_\_\_\_\_ s. Soil with a P index of less than or equal to 25 specified on plan.
- \_\_\_\_\_ t. A bioretention area landscape plan is provided including the transport of plant material, preparation of the planting pit, fertilization, installation of the plant material, type and number of plantings (note that there shall be a minimum of three species of trees and three species of

shrubs selected to insure diversity, their planting locations, post-installation inspection and maintenance guidelines.

**Note: Executed Stormwater Facility Operation and Maintenance Permit Agreement, payment of permit fee per facility and payment of surety are required prior to construction drawing approval.**