Requirements for All SCMs

The following chapter from the NCDEQ Stormwater Design manual (Part A, last updated 1/3/2017) is accepted in the SCM Manual with the following exceptions:

MDC	Description
A-1: Runoff Treatment and Volume Match	See Chapter 3 of the Charlotte-Mecklenburg SCM Design manual for sizing calculations. In Charlotte-Mecklenburg, SCMs are required to provide runoff treatment at a minimum. Item A-1 is not adopted with this manual.
A-4: Built-Upon Area	See Chapter 2: Ordinances of the Charlotte-Mecklenburg SCM Design Manual and applicable Post-Construction Administrative Manuals for BUA guidance. Item A-4 is not adopted with this manual (and not included).
A-5: Embankments	In addition to the requirements listed in A-5, the following requirements will apply to all SCMs with embankments that are designed to hold water, even if the embankment is designed to hold water only during a storm event. **Embankment Fill Materials** The following parameters apply to materials used to construct embankments: • Borrow material shall be classified as ML, MH, SC, SM, CL or CH soils according to the Unified Soil Classification System (ASTM D2487) or any mixture of these soils. • Borrow materials shall have a liquid limit (LL) between 40 and 60 and a plasticity index (PI) between 15 and 30 (ASTM D4318). • Materials shall be free of topsoil, organic material, roots, stumps, brush, rocks larger than 3 inches, subsoil, debris, vegetation, and other foreign matter. • All material clods will be broken down with tillers and/or discs to provide a homogeneous soil that is free of clay clods greater than 3 inches in diameter. **Embankment Construction** The following steps apply to construction of an embankment: <u>Step 1: Subgrade Preparation</u> • Compact subgrade to density requirements for subsequent fill materials. • Cut out soft areas of subgrade not capable of compaction in place. • Scarify subgrade surface to depth of 6 inches. • Proof roll subgrade to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material. <u>Step 2: Seepage Key Placement</u> • Seepage key trench will be located between embankment abutments. • Seepage key shall extend to a minimum depth of 4 feet or as required through geotechnical seepage analysis. A minimum bottom trench width shall be 10 feet and the trench sidewalls shall be sloped or benched to promote stability and bonding between the sidewall soils and seepage key fill.

Step 3: Embankment Fill Placement

- Embankment fill shall be constructed at 3(horizontal):1(vertical) or as shown on the drawings. Demonstration of appropriate safety factors against failure through geotechnical analysis shall be required for slopes steeper than 3(horizontal):1(vertical).
- Fill soils shall be placed in loose lifts not to exceed 8 inches in thickness and be compacted to a minimum of 95 percent of the soils Standard Proctor (ASTM D698) maximum dry density, or as specified on the Drawings.
- Compacted moisture content shall be between 3 percent below and 3 percent above the optimum moisture content for all fill placed, or as otherwise approved by Engineer.
- Fill soils should be placed in continuous, horizontal layers from abutment to abutment. Existing slopes greater than 4(horizontal):1(vertical) shall be benched to promote bonding of newly placed fill with existing soils. Benching shall be performed at maximum of 2 feet vertical intervals and shall extend a minimum of 4 feet horizontally or as specified on Drawings.
- Within the upper 12 inches of embankment, fill soils should be compacted to 100% of its Standard Proctor (ASTM D698) maximum dry density.
- Fill against supported structures. Do not fill against unsupported structures.
- Place fill simultaneously on each side of unsupported structures until supports are in place.
- Place a minimum of six inches of topsoil across dam embankment to promote vegetative growth.

Step 4: Outlet Pipe Fill Placement

- Outlet pipes that penetrate an earthen embankment must be a rigid pipe material, typically Reinforced Concrete Pipe (RCP).
- Seepage shall be minimized through the use of anti-seep measures. Common designs are anti-seep collars or filter and drainage diaphragms
- Fill of the culverts shall be placed and compacted in 6-inch thick loose lifts around the drop inlets and up to 2 feet above the culverts.
- Compaction shall be performed by hand tampers or small hand operated compactors.
- Compaction shall be at a minimum 95 percent of the Standard Proctor (ASTM D698) maximum dry density. Compacted moisture content shall be between 3 percent below and 3 percent above the optimum moisture content for all fill placed, or as otherwise approved by Engineer.
- Additional compaction of lifts 2 feet or greater above culverts shall conform to the Embankment Fill Placement section of this specification.

	Step 6: Field Quality Control
	• Laboratory Testing
	  ○ Perform laboratory material tests in accordance with ASTM D422, ASTM D698, ASTM D2216, and ASTM D4318.
	  ○ Test at a frequency of every 500 cubic yards of embankment fill material placed, when materials using for embankment fill change, and/or as directed by the Engineer.
	  ○ Sample size shall be 50-lb.
	• In Place Compaction and Natural Moisture Content Tests
	  ○ Perform in place compaction tests in accordance with ASTM D1556, ASTM D2922, or ASTM D2937 and natural moisture content test in accordance with ASTM D2216.
	  ○ Frequency of compaction/natural moisture content tests:
	  ○ Embankment Fill: Each lift at a minimum frequency of 1 per 2,500 sq. ft.
	  ○ Pipe Installation: Each lift at a minimum frequency of 1 per 30 LF of pipe.
	• When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
	
	If applicable, all embankments shall be designed per the North Carolina Dam Safety Law of 1967.
	
	Allowable Variances
	Embankment specifications may be modified based on site-specific geotechnical investigation and engineering design.

A-5: Outlets	• A water-tight seal must be provided between all riser and pipe joint connections to minimize leakage. • Outlet boxes are required to consist of cast in place or precast concrete structure. • Outlet pipes that penetrate an earthen embankment must be a rigid pipe material, typically Reinforced Concrete Pipe (RCP).
A-6: Construction	Design professional will be required to provide an SCM inspection with the As-Built submittal. The design professional should be aware of the SCM construction and include applicable photographs for final inspection.
A-7: SCM Operation & Maintenance	See the Ordinance or Regulations and Administrative manuals of the applicable local jurisdiction for the following requirements: • Access and Maintenance Easements • Inspection and Maintenance Agreements • Inspection and Maintenance Record Keeping For the City of Charlotte, see Article 25.7 F for Easement requirements and Article 25.7 B for Operation and Maintenance agreement requirements. Refer to the Post-Construction Stormwater Regulations Administrative Manual and the Post Construction Controls Best Management Practices Maintenance Handbook of the Charlotte Stormwater Website for additional information regarding SCM maintenance: Stormwater Regulations - City of Charlotte (charlottenc.gov)

A-8: Guidance on SCM Selection	A primary SCM is required to treat the 1" storm for any high-density development.
A-9: Vegetated Setbacks	Refer to ordinances, regulations, and administrative manuals of the applicable local jurisdiction.

Additional Requirements: Goose Creek Watershed

The Goose Creek Watershed district is subject to additional storm water treatment requirements in accordance with 15A NCAC 2B.0600Site Specific Water Quality Management Plan for the Goose Creek Watershed (as implemented in Mint Hill's Post-Construction Ordinance) and the Goose Creek Water Quality Recovery Plan. The additional water quality treatment requirements of these ordinances include:

- Promotion of storm water infiltration and groundwater recharge for the purposes of maintaining base flow; and
- Reduction of fecal coliform to the maximum extent practicable.

To accomplish the provisions above, the following SCMs have been approved for use within the Goose Creek Watershed:

- Infiltration Trench
- Bioretention
- Treatment Swale
- Wetland
- Wet Pond
- Sand Filter

However, if the soil infiltration rate of site soils is 0.52 in/hr or greater, structural SCMs that promote infiltration must be used. The following SCMs must be used (individually or in combination with other allowable SCMs) to meet the storm water treatment requirements:

- Infiltration Trench
- Bioretention
- Treatment Swale

The soil infiltration rate (hydraulic conductivity) can be initially determined from NRCS soil texture classification but must be determined using field geotechnical tests. A minimum of three tests per acre is required to determine soil suitability and location of infiltration SCMs.