



STORMWATER SYSTEM SPECIFICATIONS

AGGREGATES

Infiltration Beds

1. All aggregates within infiltration beds shall be clean and thoroughly washed and shall meet the following:
 - a) Maximum wash loss of 0.5% (ASTM C117)
 - b) Minimum durability index of 35 (ASTM D3744)
 - c) Los Angeles Test Machine (L.A). abrasion loss, 30% maximum (ASTM C131 and C535)
 - d) Aggregate shall be 100% crushed material
 - e) Fractured faces, 1 side 98% minimum, 2 sides 90% minimum (ASTM D5821)
2. Unless otherwise approved by the Engineer, coarse aggregate for the infiltration beds shall be uniformly graded with the following gradation (AASHTO size no. 3)

U.S. Standard Sieve Size	Percent Passing
2 ½" (63 mm)	100
2" (50 mm)	90-100
1½" (37.5 mm)	35-70
1" (25 mm)	0-15
½" (12.5 mm)	0-5

3. Choker base coarse aggregate for infiltration beds shall have the following gradation (AASHTO size no. 57):

U.S. Standard Sieve Size	Percent Passing
1½" (37.5 mm)	100
1" (25 mm)	95-100
½" (12.5 mm)	25-60
4" (4.75 mm)	0-10
8" (2.36mm)	0-5





4. Bedding coarse aggregate for permeable pavers shall be washed, crusher run, free of fines, organics, and soluble salts, and have the following gradation (ASTM size no. 89):

U.S. Standard Sieve Size	Percent Passing
1½" (37.5 mm)	100
3/8"(0.945 mm)	90-100
4" (4.75 mm)	20-55
8" (2.36 mm)	5-30
16"	0-10
50"	0-5





BIORETENTION SOILS SPECIFICATION

BIORETENTION SOIL

General

Bioretention soil shall be a well-blended mixture of mineral aggregate and compost measured on a volume basis.

Landscape Bioretention Soil

Landscape bioretention soil shall consist of two parts compost (approximately 35 to 40 percent) by volume and three parts mineral aggregate (approximately 60 to 65 percent), by volume. The mixture shall be well blended to produce a homogeneous mix. Organic matter content shall be 8 to 10 percent, with the final mix to be determined by the Engineer based on samples and test results submitted.

Turf Bioretention Soil

Turf bioretention soil shall consist of one part compost by volume (approximately 30 to 35 percent), and two parts mineral aggregate (approximately 65 to 70 percent) by volume. The mixture shall be well blended to produce a homogeneous mix. Organic matter content shall be 4 to 6 percent, with the final mix to be determined by the Engineer based on samples and test results submitted.

Composted Material

Compost products shall be the result of the biological degradation and transformation of Type I or III feed stocks under controlled conditions designed to promote aerobic decomposition. Compost shall be stable with regard to oxygen consumption and carbon dioxide generation. Compost shall be mature with regard to its suitability for serving as a soil amendment or an erosion control BMP as defined below. The compost shall have a moisture content that has no visible free water or dust produced when handling the material.

Compost production and quality shall meet the following physical criteria:

1. Compost material shall be tested in accordance with Testing Methods for the Examination of Compost and Composting (TMECC) Test Method 02.02-B, "Sample Sieving for Aggregate Size Classification."

Compost shall meet the following:





	Minimum	Maximum
Percent passing 1"	99%	100%
Percent passing 5/8"	90%	100%
Percent passing 1/4"	40%	90%

2. The pH shall be between 5.5 and 8.0 when tested in accordance with TMECC 04.11-A, "1:5 Slurry pH."
3. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0 percent by weight as determined by TMECC 03.08-A, "Percent Dry Weight Basis."
4. Organic matter content should be between 45 and 65 percent dry weight basis as determined by TMECC 05.07A, "Loss-On-Ignition Organic Matter Method."
5. Soluble salt contents shall be less than 6.0 mmhos/cm tested in accordance with TMECC 04.10-A, "1:5 Slurry Method, Mass Basis."
6. Maturity shall be greater than 80 percent in accordance with TMECC 05.05-A, "Germination and Vigor."
7. Stability shall be 7 or below in accordance with TMECC 05.08-B, "Carbon Dioxide Evolution Rate."
8. The compost product must originate a minimum of 65 percent by volume from recycled plant waste. A maximum of 35 percent by volume of other approved organic waste, not including biosolids, may be substituted for recycled plant waste. The supplier shall provide written verification of feedstock sources.
9. The carbon to nitrogen ratio shall be less than 25:1 as determined using TMECC 04.01, "Total Carbon" and TMECC 04.02D, "Total Kjeldhal Nitrogen." The Engineer may specify a C:N ratio up to 35:1 for projects where the plants are entirely native species.
10. The Engineer may also evaluate compost for maturity using the Solvita Compost Maturity Test at time of delivery. Compost shall score a number 6 or above on the Solvita Compost Maturity Test.

The compost supplier shall test all compost products within 90 calendar days prior to application. Samples shall be collected using the Seal of Testing Assurance (STA) sample collection protocol. The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org. The sample shall be





sent to an independent STA Program approved laboratory. The compost supplier shall pay for the test. A copy of the approved independent STA Program laboratory test report shall be submitted to the Engineer prior to initial application of the compost. Seven days prior to application, the Contractor shall submit a sample of each type of compost to be used on the project to the Engineer.

Compost not conforming to the above requirements or taken from a source other than those tested and accepted shall be immediately removed from the project and replaced at no cost to the Owner.

The Contractor shall submit the following information to the Engineer for approval:

1. Written verification from the supplier and laboratory analyses that the materials comply with the processes, testing, and standards specified in these Specifications. An independent STA Program certified laboratory shall perform the analysis.
2. A list of the feedstock by percentage present in the final compost product.
3. A copy of the producer's STA certification as issued by the U.S. Composting Council.

Acceptance shall be based upon a satisfactory Test Report from an independent STA Program certified laboratory and the sample(s) submitted to the Engineer.





STORMWATER SYSTEM SPECIFICATIONS

CONTROL STRUCTURES

Manufacturers

1. Nyloplast
2. Other Engineer Approved Manufacturers

Properties

1. Storm Drain Inlets, Trench Drains, and Structures: Concrete Construction: Concrete construction shall be in accordance with latest edition of TDOT Standard Specifications for Road and Bridge Construction.
 - a) Precast and Cast-in-Place Concrete Inlets and Trench Drains: Precast concrete inlets may be substituted for cast-in-place structures and shall be constructed as specified for cast-in-place. Precast structures may be used only in those areas where there is no conflict with existing underground structures that may necessitate revision of inverts. Concrete structures shall be placed on a 6- or 8-inch bed of compacted coarse aggregate Size No. 2A as indicated on the plans and details. Reinforcement steel, if required for handling, shall have a minimum of 2-inch cover. Handling devices, if used, shall be removable and the holes filled with concrete. Concrete structures will be modified to provide 18 inches of sediment storage and bottom leaching basins, open to gravel sumps in subgrade.
 - b) All polyvinyl chloride (PVC) inline drains shall be as manufactured by Nyloplast or other approved manufacturer and as noted on site detail drawings or approved equals.
 - c) Inline drains shall be sized as shown on the plans or as required for necessary pipe connections and have standard grates. All PVC inline drains shall be manufactured with black colored PVC.
 - d) Trench drain grates/covers and frames shall be sized as shown on the plans. Trench drain grates and covers shall be bolted to the frame.
2. Compression Joints
 - a) All ductile iron pipes and fittings used in the construction of sewers, including bends and wye branches, shall have gasket joints. Unless otherwise noted in the Special Specifications, the pipe and fittings shall have push-on joints. The gaskets shall be manufactured and tested in accordance with the American National Standard for Rubber-Gasket Joints for Cast Iron and Ductile Iron





Pressure Pipes and Fittings, ANSI A21.11 (AWWA C11 1).

- b) The outside edges of field cut pipes and fittings shall be beveled back 1/8 inch from the cut edges on a 30-degree angle in order to avoid damaging the gasket.

3. Trash Screens

Trash screens shall be stainless steel with 0.05- to 2.5-centimeter (0.19- to 1-inch) openings.

4. Weir Plates

a) Stainless Steel Weir Plates

- (1) Weirs shall be as specified herein and have the characteristics and dimensions shown in the Contract Drawings.
- (2) Stainless steel weir plates shall be fabricated of stainless steel having a minimum thickness of ¼ inch and shall have adequate strength to prevent distortion during normal handling, during installation, and while in service.

- b) Anchor bolts shall be used for mounting the weir plates. Anchor bolts shall have a minimum diameter of ¼ inch.

5. Epoxy Mortar

- a) The following products may be acceptable epoxy mortar gel, provided they meet all material requirements:

- (1) Meta Bond HM Gel, as manufactured by American Meta Seal Company, 509 Washington Avenue, Carlstadt, NJ 07072
- (2) Sikadur 31 Hi-Mod Gel, as manufactured by Sika Corporation, Box 297, Lyndhurst, NJ 07071
- (3) Thermal-Chem Mortar Resin Gel (Product No. 304), as manufactured by Thermal-Chem, Inc., 1400 Louis Avenue, Elkgrove, IL 60007

- b) The following products may be acceptable epoxy bonding agents, provided they meet all material requirements:

- (1) Meta Bond HM, or Meta Bond HM Gel, as manufactured by American Meta Seal Company
- (2) Sikastix 370, Sikadur Hi-Mod, or Sikadur 31 Hi-Mod Gel, as manufactured by Sika Corporation
- (3) Thermal-Chem Mortar Resin (Product No. 3), or Thermal-Chem Mortar Resin Gel (Product No. 304), as manufactured by Thermal-Chem, Inc.





- c) The shrink epoxy mortar gel and bonding agent shall meet the following requirements:
 - (1) 100 percent solids formulation
 - (2) Tensile strength no less than 3000 psi after 7 days and 73°F, per ASTM D 638
 - (3) Tensile elongation no greater than 7 percent per ASTM D 638
 - (4) Compressive strength no less than 3000 psi after 24 hours at 73°F, and no less than 6000 psi after 7 days at 73°F per ASTM D 695

- d) Sand shall be oven-dry silica sand and meet the following gradations:
 - (1) At least 70 percent by weight passing #20 sieve
 - (2) No more than 35 percent by weight passing #40 sieve

- e) Epoxy mortar shall be composed of epoxy mortar gel and sand mixed at a 1:1 ratio by loose volume, or according to the manufacturer's instructions.





STORMWATER SYSTEM SPECIFICATIONS

GEOTEXTILES

Geotextile Filter Fabric – Geotextile (drainage filter fabric) shall be nonwoven needle-punched material and shall conform to the following:

Manufacturers

1. TenCate Mirafi 160N
2. Other Engineer Approved Manufacturers

Properties

1. Grab Tensile Strength – ASTM D4632 – minimum 150 lbs
2. Grab Tensile Elongation – ASTM D4632 – 50%
3. Puncture Strength – ASTM D6241 – minimum 90 lbs
4. Trapezoid Tear – ASTM D4533 – 60 lbs
5. Apparent Opening Size – ASTM D4751 – 60 to 70 U.S. Sieve
6. Flow Rate – ASTM D4491 – 110 gal/min/ft²
7. UV Resistance – ASTM D4355 – 70%
8. Permittivity – ASTM D4491 – 1.5/sec





STORMWATER SYSTEM SPECIFICATIONS

IMPERVIOUS LINERS

Manufacturers

1. Solmax 230 (30 mil)
2. Other Engineer Approved Manufacturers

Properties

1. Thickness – ASTM D5199 or D5994 – 30 mils
2. Break Stress – ASTM D6693 – 77 lbs/in
3. Break Elongation – ASTM D6933 – 350%
4. Puncture Resistance – ASTM D6241 – 90 or 410 lbs
5. Tear Resistance – ASTM D1004 – 80 lbs
6. Dimensional Stability – ASTM D1204 – 3%
7. Density – ASTM D1505

Miscellaneous

Adhesives: Provide types of adhesive primers, compounds, solvents, and tapes recommended in writing by impervious liner manufacturer for binding, for sealing of seams in liner, and for sealing penetrations through the impervious liner.

Fabrication

1. Fabricate impervious membrane liner panels from sheets in sizes as large as possible with factory-sealed seams, consistent with limitations of weight and installation procedures. Minimize field seaming.
2. Factory-fabricated seams shall be made with 2-inch overlap plus or minus ¼ inch by an automated thermal high-pressure process.

