
BIORETENTION SYSTEM

These specifications compliment the bioretention system design portion of the Iowa Stormwater Management Manual in Chapter 2, Section 2E-4.

Sections of the following documents, as referenced within these specifications, are hereby made a part of these specifications:

- SUDAS Standard Specifications: The standard specifications issued by the Iowa Statewide Urban Design and Specifications Program effective at the date of publication of the Notice to Bidders, unless a different effective date is identified in the contract documents.
- Iowa DOT Standard Specifications for Highway and Bridge Construction: The Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction and the General Supplemental Specifications effective at the date of publication of the Notice to Bidders unless a different effective date is identified in the contract documents.
- American Society for Testing and Materials (ASTM) standards.
- American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Transportation Materials and Methods of Sampling and Testing.

PART 1 - GENERAL**1.01 SECTION INCLUDES**

Bioretention System

1.02 DESCRIPTION OF WORK

Construct bioretention system for storage and treatment of stormwater runoff.

1.03 SUBMITTALS

Comply with the requirements of the contract documents.

1.04 SUBSTITUTIONS

Comply with the requirements of the contract documents.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with the requirements of the contract documents.

1.06 SCHEDULING AND CONFLICTS

Comply with the requirements of the contract documents.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Class 10, Class 12, or Class 13 Excavation: Refer to SUDAS Section 2010, 1.08 for measurement and payment information for Class 10, Class 12, or Class 13 Excavation.

B. Filter Aggregate:

- 1. Measurement:** Each type of filter aggregate will be measured in tons based upon scale tickets for the material delivered and incorporated into the project.
- 2. Payment:** Payment will be made at the unit price per ton for each type of filter aggregate furnished and placed.
- 3. Includes:** Unit price includes, but is not limited to, furnishing, hauling, and placing filter aggregate material.

C. Underdrain:

- 1. Measurement:** Measurement will be in linear feet for each type and size of pipe installed. Pipe will be measured from end of pipe to end of pipe along the centerline of pipe, exclusive of outlets. The vertical height of cleanouts and observation wells will be included in the length of pipe measured. Lengths of elbows, tees, wyes and other fittings will be included in length of pipe measured.
- 2. Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe.
- 3. Includes:** Unit price includes, but is not limited to, furnishing and placing pipe and pipe fittings.

D. Underdrain Cleanout:

- 1. Measurement:** Each type and size of underdrain cleanout will be counted.
- 2. Payment:** Payment will be made at the unit price for each underdrain cleanout.
- 3. Includes:** Unit price includes, but is not limited to, furnishing and installing pipe, couplings, and fittings.

E. Engineering Fabric:

- 1. Measurement:** Measurement will be in square yards for the surface area covered with engineering fabric. Both horizontal and vertical areas covered with engineering fabric will be measured.
- 2. Payment:** Payment will be made at the unit price per square yard of engineering fabric.
- 3. Includes:** Unit price includes, but is not limited to, placing and securing filter fabric and any overlapped areas.

1.08 MEASUREMENT AND PAYMENT (Continued)**F. Filter Sand:**

1. **Measurement:** Measurement will be in tons based upon scale tickets for the material delivered and incorporated into the project.
2. **Payment:** Payment will be made at the unit price per ton of filter sand furnished and placed.
3. **Includes:** Unit price includes, but is not limited to, furnishing, hauling, and placing filter sand material.

G. Filter Soil Matrix:

1. **Measurement:** Measurement will be the plan quantity in cubic yards, without final field measurement. The plan quantity will be based upon the proposed excavated area to be filled with filter soil matrix, plus an additional 15% to account for anticipated shrinkage. Adjustments may be made to the plan quantities if agreed to by both the Engineer and the Contractor.
2. **Payment:** Payment will be made at the unit price per cubic yard of filter soil matrix.
3. **Includes:** Unit price includes, but is not limited to, furnishing, hauling, blending, and placing filter soil matrix layer. If compaction by soaking is specified for filter soil matrix, unit price includes supplying and applying water to compact the material.

H. Hardwood Mulch:

1. **Measurement:** Measurement will be the plan quantity in cubic yards, without final field measurement. Adjustments may be made to the plan quantities if agreed to by both the Engineer and the Contractor.
2. **Payment:** Payment will be made at the unit price per cubic yard of hardwood mulch.
3. **Includes:** Unit price includes, but is not limited to, supplying, hauling, and placing mulch.

PART 2 - PRODUCTS**2.01 UNDERDRAIN CLEANOUT**

- A. Pipe and Fittings:** Perforated or slotted 6 inch diameter pipe complying with one of the following.
1. Solid wall PVC pipe complying with ASTM D 1785, Schedule 40.
 2. Solid wall PVC pipe complying with ASTM D 3034, SDR 35.
 3. Corrugated PVC pipe complying with ASTM F 949, with a minimum pipe stiffness of 46 psi.
- B. Cap:** Provide PVC cleanout fitting with removable threaded plug.

2.02 FILTER AGGREGATE

- A. Type 1:** Provide aggregate complying with Iowa DOT Section 4115, Gradation No. 3, Class 2 durability gravel or crushed stone (AASHTO M 43/ASTM D 448, Size 57).
- B. Type 2:** Provide aggregate complying with one of the following:
1. 1/2 inch aggregate complying with Iowa DOT Section 4125, Gradation No. 20 (AASHTO M 43/ASTM D 448, Size 7).
 2. 3/8 inch aggregate complying with Iowa DOT Section 4125, Gradation No. 21 (AASHTO M 43/ASTM D 448, Size 8).

2.03 UNDERDRAIN

Provide slotted pipe(s) complying with the requirements for Type 1 Subdrain in SUDAS Section 4040. Provide 4 inch diameter pipe unless otherwise specified in the contract documents.

2.04 ENGINEERING FABRIC

Comply with Iowa DOT Section 4196, requirements for subsurface drainage.

2.05 FILTER SAND

Provide sand complying with Iowa DOT Section 4110, Gradation No. 1.

2.06 FILTER SOIL MATRIX

- A. Compost:** Provide compost complying with the requirements for mulch for pneumatic seeding in SUDAS Section 9010, 2.07.
- B. Sand:** Provide clean sand complying with Iowa DOT Section 4110, Gradation No. 1.

2.06 FILTER SOIL MATRIX (Continued)

- C. Mixture:** Thoroughly blend sand and compost materials to provide a mixture with 60 to 80% sand by volume.

2.07 WOOD MULCH

Provide hardwood or softwood mulch complying with the following:

- A. Shredded bark and shredded wood mixture containing no more than 50% wood chips.
- B. Produced by a mechanical debarker and chipping machine.
- C. Reasonably free from leaves, twigs, dust, toxic substances, and any other foreign material.

2.08 WATER

Supply potable water for compacting filter soil matrix. In lieu of potable water, supply clean, clear water, free of harmful contaminants, from a source approved by the Engineer.

PART 3 - EXECUTION**3.01 PRE-INSTALLATION PROTECTION**

- A. Complete grading, utility installation, and other earth disturbing operations prior to excavating for the bioretention system.
- B. Prior to installing the bioretention system, install sediment control practices upstream to protect the bioretention system from sediment in stormwater runoff from disturbed soil.

3.02 BIORETENTION SYSTEM INSTALLATION

- A. Excavate bioretention system area to the length, width, and depth specified in the contract documents. Do not compact the bioretention area subgrade and do not operate heavy machinery on the subgrade. Do not operate heavy machinery in the excavated area while placing filter soil matrix.
- B. Place the first 2 inches of the filter aggregate layer evenly over the bottom of the bioretention area.
 - 1. If engineering fabric is specified between the filter aggregate layer and the filter soil matrix, utilize Type 1 filter aggregate.
 - 2. If a filter sand layer is specified between the filter aggregate layer and the filter soil matrix, utilize Type 2 filter aggregate.
- C. If underdrain is specified in the contract documents, install slotted pipe on top of storage aggregate. Install cleanouts at locations specified in the contract documents.
- D. Place remaining filter aggregate to the elevation specified in the contract documents.
- E. If engineering fabric is specified in the contract documents, install over the top of the filter aggregate layer and up the sides of the excavation. Overlap adjacent strips of fabric a minimum of 6 inches.
- F. If a filter sand layer is specified in the contract documents, install over storage aggregate layer to the depth specified in maximum 8 inch lifts.
- G. Place filter soil matrix in 8 to 12 inch lifts to the elevation specified in the contract documents. Overfill area with filter soil matrix by 15% of the specified depth to allow for natural settlement.
- H. Avoid over compaction by allowing time for natural settlement. If the project schedule does not allow for natural settlement of soil and the contract documents require compaction by soaking, compact the filter soil matrix by soaking as described below:
 - 1. Apply water to uniformly saturate surface by spraying or sprinkling.
 - 2. Ensure entire bioretention area is saturated.

3.02 BIORETENTION SYSTEM INSTALLATION (Continued)

3. Add filter soil matrix as required to restore settled surface to finished elevation.

Uniformly grade and rake the top of the filter soil matrix to a flat, smooth, uniform surface.

- I. If contract documents specify seeding for the surface of the of bioretention system, install seeding as specified. Mulch seeded areas with bonded fiber matrix or rolled erosion control products as specified in the contract documents.
- J. When specified in the contract documents, place a 3 inch layer of hardwood mulch over area filled with filter soil matrix. Do not place hardwood mulch over seeded areas. If the contract documents specify plants for the surface of the filter soil matrix, install prior to placing mulch.
- K. Upon completion of bioretention system, immediately install sediment control practices upstream of bioretention area as required to protect the area from sediment in stormwater runoff from disturbed soil.
- L. Do not stockpile materials on or near the surface of the completed bioretention swale.
- M. Protect completed bioretention area from heavy machinery and other construction equipment.