

**SECTION 33 40 00  
STORM DRAINAGE UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This Section specifies construction of outside, underground storm sewer systems. The storm sewer systems shall be complete and ready for operation, including all drainage structures, frames, grate and covers, connections to new buildings, structure service lines, existing storm sewer lines and existing drainage structures and all required incidentals.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 31 20 00, EARTH MOVING.
- C. Section 03 30 53, CAST-IN-PLACE CONCRETE.

**1.3 QUALITY ASSURANCE**

- A. Products Criteria:
  - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
- B. Manufacturers shall have manufacturing and quality control facilities capable of producing and assuring the quality of piping and structures specified.
- C. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to public storm sewer lines and the extension, and/or modifications to Public Utility systems.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit the following documentation to the Owner for review prior to commencement of the work of this Section:
  - 1. Manufacturers' documentation (including product data sheets) for all specified products.
  - 2. Shop drawings showing fabrication and construction details for drainage structures.
- C. At project completion, submit record (as-built) drawings showing installed system as specified in this Section.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. During loading, transporting and unloading, exercise care to prevent damage to all products furnished.
- B. Pipe shall be marked with manufacturer's identification symbol, size, date of manufacture, class of pipe, and applicable product Specification identification number.
- C. All materials shall be inspected upon delivery to the Site. Damaged or defective materials shall be rejected or repaired as determined by the Owner.

### 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
  - A48/A48M.....Standard Specification for Gray Iron Castings
  - A536 .....Standard Specification for Ductile Iron Castings
  - A615/A615M.....Standard Specification for Deformed and Plain-Billet Steel Bars  
for Concrete Reinforcement
  - C76 .....Standard Specification for Reinforced Concrete Culvert, Storm  
Drain and Sewer Pipe
  - C150 .....Standard Specification for Portland Cement
  - C443 .....Standard Specification for Joints for Concrete Pipe and  
Manholes, Using Rubber Gaskets
  - C478 .....Standard Specification for Precast Reinforced Concrete Manhole  
Sections
  - C857 .....Standard Practice for Minimum Structural Design Loading for  
Underground Precast Concrete Utility Structures
  - C923 .....Standard Specification for Resilient Connectors between  
Reinforced Concrete Manhole Structures, Pipes and Laterals
  - C990 .....Standard Specification for Joints for Concrete Pipe, Manholes,  
and Precast Box Sections Using Preformed Flexible Joint  
Sealants

- D1557 .....Standard Test Methods for Laboratory Compaction  
Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>  
(2700 kN m/m<sup>3</sup>))
- D2321 .....Standard Practice for Underground Installation of Thermoplastic  
Pipe for Sewers and Other Gravity-Flow Applications
- D3034 .....Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC)  
Sewer Pipe and Fittings
- D3212 .....Standard Specification for Joints for Drain and Sewer Plastic  
Pipes Using Flexible Elastomeric Seals
- F477 .....Standard Specification for Elastomeric Seals (Gaskets) for Joining  
Plastic Pipe

NOTE: ASTM test methods shall be the current version as of the date of advertisement of the project.

- C. Florida Department of Transportation Department (FDOT):  
Standard specifications for Highway Construction, January 2015.

## **PART 2 - PRODUCTS**

### **2.1 PIPING**

- A. Gravity Lines (Pipe and Appurtenances):
1. Concrete:
    - a. Reinforced pipe, ASTM C76. Class III. Joints shall be watertight flexible joints made with rubber-type gaskets conforming to ASTM C443.
  2. Polyvinyl Chloride (PVC):
    - a. Pipe and Fittings, Type PSM PVC Pipe, shall conform to ASTM D3034, Type PSM, SDR 35. Pipe and fittings shall have elastomeric gasket joints providing a watertight seal when tested in accordance with ASTM D3212. Gaskets shall conform to ASTM F477. Solvent welded joints shall not be permitted.

### **2.2 JOINTING MATERIAL**

- A. Concrete Pipe: Rubber gasket ASTM C443.
- B. Polyvinyl Chloride (PVC) Pipe:

1. PVC Plastic Pipe: Joints shall comply with ASTM D3212, Elastomeric Gaskets shall comply with ASTM F477 and as recommended by the manufacturer.

## **2.3 MANHOLES, INLETS and catch basins**

- A. Manholes, inlets and catch basins shall be constructed of precast reinforced concrete rings, precast reinforced Sections, or cast-in-place concrete. Manholes, inlets and catch basins shall be in accordance with the details shown on the Drawings, and the following OWNER requirements:
  1. Precast Reinforced Concrete Rings: Rings or Sections shall have an inside diameter as indicated on the drawings, and shall be not less than 1200 mm (48 inches) in diameter. Wall thickness shall conform to requirements of ASTM C76, except that lengths of the Sections may be shorter as conditions require. Tops shall conform to ASTM C478. Top Section shall be eccentric cone type. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
  2. Precast Reinforced Concrete Manhole Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top Sections shall be eccentric unless otherwise indicated on the Drawings. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
  3. Flat top manhole tops shall be reinforced concrete as detailed on the Drawings.
  4. Precast Catch Basins: Concrete for precast Sections shall have a minimum compressive strength of 5,000 psi at 28 days, ASTM A615, Grade 60 reinforcing steel, rated for AASHTO HS20 loading with 30 percent impact, and conform to ASTM C857.
  5. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast Sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet ASTM C990.
  6. Frames and covers shall be gray cast iron conforming to ASTM A48. The frame and cover shall be rated for HS20 loading, and shall conform to the details shown on the Drawings. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.
  7. Manhole steps, if required, shall be polypropylene plastic coated on a No. 4 deformed rebar conforming to ASTM C478. Steps shall be a minimum of 10 inches wide and project a minimum of 5 inches away from the wall. The top surface of the step shall have a studded non-slip surface. Steps shall be placed at 12 inch centers.

- B. Frame and Cover for Gratings: Frame and cover for gratings shall be cast gray iron conforming to ASTM A48 or ductile iron conforming to ASTM A536. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the Drawings.

## **2.4 Concrete**

- A. Concrete shall have a minimum compressive strength of 3500 psi at 28 days. The cement shall be Type III conforming to ASTM C150. Concrete shall conform to the provisions of Section 03 30 53, CAST-IN-PLACE CONCRETE.

## **2.5 Reinforcing Steel**

- A. Reinforcing steel shall be deformed bars, ASTM A615, Grade 60 unless otherwise noted.

## **2.6 WARNING TAPE**

- A. Standard, 4-Mil polyethylene 3 inch wide tape non-detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

## **2.7 UNDERGROUND DETENTION VAULT**

- A. Underground detention vault shall be constructed of precast concrete fabricated in components (modules) ready for field installation. Furnish the required number of modules to fit within the overall underground detention vault dimensions shown on the Drawings and to provide a peak storage capacity of at least 12,600 cubic feet.
- B. Furnish access manholes at locations indicated on the Drawings, with frames and covers rated to AASHTO HS-20 loading and riser rings as required to bring to finish grade. Furnish openings for pipe connections at the required locations and elevations as indicated on the Drawings.
- C. Furnish concrete and reinforcing steel for outlet control structure in accordance with the material requirements of Section 03 30 00. Concrete mix shall be proportioned such that the 28-day compressive strength of moist-cured laboratory samples achieves not less than 4,000 pounds per square inch (psi).

## **PART 3 - EXECUTION**

### **3.1 Excavation For storm drains and drainage structures**

- A. Excavation of trenches and for appurtenances and backfilling for storm drains shall be in accordance with the applicable portions of Section 31 20 00, EARTH MOVING.

### **3.2 Pipe bedding**

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material.

### **3.3 GENERAL PIPING INSTALLATION**

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade.
- B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
- E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility.
- H. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches over the crown of the pipe.
- I. Install gravity sewer line in accordance with the provisions of these Specifications and the following standards:
  - 1. Reinforced Concrete Pipe: Comply with manufacturer's recommendations with gasketed joints.
  - 2. Polyvinyl Chloride (PVC) Piping: ASTM D2321.

- J. Warning tape shall be continuously placed 12 inches above storm sewer piping.

### **3.4 DRAINAGE STRUCTURES**

A. General:

1. Circular Structures:

- a. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top Section will be at the required elevation. Cutting the conical top Section is not acceptable.
- b. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

B. Rectangular Structures:

1. Concrete work for cast-in-place reinforced concrete structures shall be constructed in accordance with Section 03 30 53, CAST-IN-PLACE CONCRETE, and as specified in Section 609 of the AHTD Standard Specifications.
2. Precast concrete base Section of structures shall be set on an 8-inch thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D1557. Set precast concrete Section(s) on base Section (as applicable) true and plumb. Seal all joints with preform flexible gasket material.

- C. Do not construct cast-in-place concrete structures when air temperature is 32 degrees F or below.

- D. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer Section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly.

Construct invert channels by one of the listed methods:

1. Forming directly in concrete base of structure.
2. Building up with brick and mortar.

- E. Floor of structure outside the invert channels shall be smooth and slope toward channels not less than 1:12 (1 inch per foot) nor more than 1:6 (2 inches per foot). Bottom slab and benches shall be concrete.

- F. The wall that supports access steps shall be 90 degrees vertical from the floor of structure to manhole cover. Install steps per the manufacturer's recommendations. Steps shall not move or flex when used. All loose steps shall be replaced by the Contractor.
- G. Install each drop inlet and catch basin frame and grate on a mortar bed, and flush with the finish pavement. Frames and covers shall be traffic rated and not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall at finish grade. Install an 8-inch thick by 12-inch diameter concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

### **3.5 CONSTRUCTION OF UNDERGROUND DETENTION VAULT**

- A. After excavation and placement of granular base, survey and mark the required outer dimensions and other required locations for proper placement of modules.
- B. Install modules to the configuration and dimensions indicated on the Drawings, in accordance with the manufacturer's written instructions and as approved by the COTR.
- C. Connect storm drainage pipes to modules at the required locations and elevations indicated on the Drawings and as recommended by the vault manufacturer.
- D. Manholes shall be constructed so that the top is flush with finish grade. Install riser rings (if required), frame and cover and accessories for a complete, watertight installation.
- E. Outlet control structure shall be constructed within the required module at location indicated on the Drawings. Concrete and reinforcing steel shall conform to Section 03 30 53.
- F. Place soil backfill on sides and on top of installed modules and manholes as specified in Section 31 20 00, EARTH MOVING. Soil backfill shall consist of Engineered Fill.
- G. Place and compact backfill on top of installed modules to the required thickness. Placement and compaction of backfill shall be performed using equipment and methods that will not damage the structure. Grade the top of backfill to the required finish elevations shown on the Drawings.
- H. All traffic (with the exception of lightweight construction equipment) shall be kept away from the limits of excavation until the underground detention vault construction is complete and final surface materials are in place.
- I. The Contractor shall not allow the flow of construction stormwater containing sediment to enter the underground detention vault. If sediment is deposited in the vaults, the Contractor shall remove the sediment at no cost to the Government.



### **3.6 INSPECTION OF SEWERS**

- A. Thoroughly flush out before inspection. Vacuum sumps clean of any sediment and/or debris.
- B. Inspect and obtain the Owner's approval.

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**SECTION 33 46 13**  
**FOUNDATION DRAINAGE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies foundation drainage system, including installation, backfill, and cleanout extensions, to place of connection to onsite storm water facilities.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: For each type of filter fabric, pipe, and fitting indicated
- C. Product Data: Certifications from the manufacturers attesting that materials meet specification requirements.

**1.3 RELATED WORK**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - M006-08-UL.....Standard Specification for Fine Aggregate for Hydraulic Cement Concrete, Single User Digital Publication
  - M252-08-UL.....Corrugated Polyethylene Drainage Pipe
  - M288-06-UL.....Geotextile Specification for Highway Applications
- C. American Society for Testing and Materials (ASTM):
  - D448-08 .....Standard Classification for Sizes of Aggregate for Road and Bridge Construction
  - D2321-08 .....Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2751-(2005).....	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
D2729-03 .....	Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D2737-03 .....	Standard Specification for Polyethylene (PE) Plastic Tubing
D3034-08 .....	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D4216-06 .....	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly (Vinyl Chloride) (CPVC) Building Products Compounds
F477-08.....	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F758-95(2000)e1 .....	Standard Specification for Smooth-Wall Poly (Vinyl Chloride)(PVC)Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.
F949-(2006a) .....	Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

Pipe for foundation drainage system shall be of the type and size indicated. Appropriate transitions, adapters, or joint details shall be used where pipes of different types or materials are connected.

**A. Perforated Drainage Pipe:**

1. Perforated, PE pipe and fittings per ASTM D2737, in DN 100 to DN 150 (NPS 4 to NPS 6). Joints shall be coupling type.
2. Perforated, PE pipe and fittings per ASTM D2737, in DN 200 to DN 600 (NPS 8 to NPS 24). Joints shall be coupling type.
3. Perforated, PVC sewer pipe and fittings per ASTM D2729, in DN 100 (NPS 4) only. Joints shall be bell-and-spigot, loose type.

**B. Cleanout Extension: ASTM A74, cast iron pipe or ASTM A746 ductile iron. Gravity Sewer pipes shall have a neoprene gasket joints and long sweep elbow fittings. Cleanouts for pre-placed**

crypt field underdrains shall be as indicated on the drawings and shall be set so as to not interfere with mowing operations. Plastic tops for the crypt field cleanouts shall be provided with concrete anchorage with all features set so as to not cause damage to the mowers.

C. Drainage Conduit:

1. Pipe, fittings, and couplings shall be perforated and smooth PVC complying with ASTM D4216 and ASTM D2729.
2. Pipe size shall be 200 mm (8 inches) and have a high minimum flow rate equal to a DN 100 (NPS 4) pipe.
3. Fittings shall be PVC with DN 100 (NPS 4) outlet connection.
4. Couplings shall be PVC.

D. Geotextile to be installed as part of subsurface drainage pipe trenches and beneath riprap shall be a continuous filament polypropylene nonwoven needle-punched fabric, Survivability Class 2 (as defined in AASHTO M 288), meeting or exceeding the following specifications:

Property	Test Method	Test Value <sup>(1)</sup>
Grab Tensile Strength	ASTM D 4632	158 lb
Grab Tensile Elongation	ASTM D 4632	50 %
Trapezoid Tear Strength	ASTM D 4533	56 lb
Puncture (CBR) Strength	ASTM D 6241	320 lb
Permittivity	ASTM D 4491	0.2 sec <sup>-1</sup>
AOS	ASTM D 4751	0.60 mm (No. 30 U.S. Sieve) (max.)
Ultraviolet Resistance ( % strength retained at 500 hours)	ASTM D 4355	50 %

<sup>(1)</sup> Minimum Average Roll Value (unless otherwise noted) in weakest principal direction

E. Geotextile to be installed under aggregate surfacing shall be a continuous filament polypropylene nonwoven needle-punched fabric, Survivability Class 1 (as defined in AASHTO M 288), meeting or exceeding the following specifications:

Property	Test Method	Test Value <sup>(1)</sup>
Grab Tensile Strength	ASTM D 4632	200 lb
Grab Tensile Elongation	ASTM D 4632	50 %
Trapezoid Tear Strength	ASTM D 4533	80 lb

Puncture (CBR) Strength	ASTM D 6241	435 lb
Permittivity	ASTM D 4491	0.2 sec <sup>-1</sup>
AOS	ASTM D 4751	0.60 mm (No. 30 U.S. Sieve) (max.)
Ultraviolet Resistance ( % strength retained at 500 hours)	ASTM D 4355	50 %

<sup>(1)</sup> Minimum Average Roll Value (unless otherwise noted) in weakest principal direction

F. Drainage Material:

1. Bedding: Crushed stone, 20 mm (3/4 inch) to 25 mm (No. 4) per ASTM D448.
2. Fill to 300 mm (1 foot) above pipe: Crushed stone, 20 mm (3/4 inch) to 25 mm (No. 4) per ASTM D448.

G. Concrete Sand: AASHTO M006.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Trenching and Excavation

Perform required trenching and excavation in accordance with Section 31 00 00 EARTHWORK. Keep trenches dry during installation of drainage system. Changes in direction of drain lines shall be made with 1/8 bends. Use wye fittings at intersections.

B. Bedding

Place graded bedding, minimum 6 inches in depth, in the bottom of trench for its full width and length compacted as specified prior to laying of foundation drain pipe. Each section shall rest firmly upon the bedding, through the entire length, with recesses formed for bell joints. Except for recesses for bell joints, the bedding shall fully support the lower quadrant of the pipe.

C. Pipe Laying

1. Lay drain lines to true grades and alignment with a continuous fall in the direction of flow. Bells of pipe sections shall face upgrade. Clean interior of pipe thoroughly before being laid. When drain lines are left open for connection to discharge lines, the open ends shall be temporarily closed and the location marked with wooden stakes. Perforated pipe shall be laid with perforations facing down. Any length that has had its grade or joints disturbed shall be removed and re-laid at no additional cost to the Government. Perforated corrugated polyethylene drainage tubing and plastic piping shall be installed in accordance

- with manufacturer's specifications and as specified herein. Tubing and piping with physical imperfections shall not be installed.
2. Prior to installation of bedding materials or piping, examination of excavation and subgrades are to be observed by the Resident Engineer. Invert elevation of drain pipe shall not be higher than top of lowest floor elevation nor lower than a 45 degree line projected from bottom of any adjacent footing. Lay drain lines and firmly bed in granular material a minimum of 75 mm (3 inches) below invert to top of pipe to true grades and alignment with bells facing upgrade, and to slope uniformly between elevations shown on foundation drainage drawings. Keep trenches dry until pipe is in place and granular material backfill is completed to 300 mm (1 foot) above top of pipe, unless otherwise noted.
  3. Install gaskets, seals, sleeves, and couplings according to manufacturers written instructions and per the applicable standard:
    - a. PE and PVC pipe installation shall be per ASTM D2321 and ASTM F758.
    - b. PE joint construction shall be per ASTM D2737 and AASHTO HB17, Division II, Section 26.4.2.4, "Joint Properties."
    - c. PVC joint construction shall be per ASTM D3034 with elastomeric seals gaskets per ASTM D2321.
    - d. Perforated PVC joint construction shall be per ASTM D2729, with loose bell and spigot joints.
  4. Lay perforated pipe with perforations down. Lay plain end pipe with closed joints held in place with two No. 9 spring steel wire clips at each joint or by standard clay collars.
  5. For foundation subdrainage, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 900 mm (3 feet), unless otherwise indicated.
  6. For underslab subdrainage, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
  7. Install cleanout extensions where shown on the Contract Documents.
  8. Prior to backfilling, check drain lines to assure free flow. Remove obstructions and recheck lines until satisfactory.
- D. Jointing
- Perforated and porous types of drain pipes shall be laid with closed joints.

- E. Backfilling: Place a minimum of 300 mm (12 inches) of granular material, hand tamped, extending in width a minimum of 600 mm (2 feet) from building wall. Then place a minimum of 150 mm (6 inches) of concrete sand, well tamped. Continue backfill with concrete sand to within 900 mm (3 feet) of finished grade in planting areas. Remainder of backfill shall be comparable to existing adjacent soils. In bituminous and concrete paving areas, backfill to the bottom of the base course with pervious material. Where foundation drain is within 600 mm (2 feet) of finished grade, one-half of fill shall be made with crushed stone.
1. Filter fabric may be substituted for sand layer.
  2. Vertical drainage mat in conjunction with geotextile may be substituted for sand and drainage material.
  3. When drain lines are left open for connection to discharge line, the open ends shall be temporarily closed and their location marked with wooden stakes.

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