



SECTION 33 46 00

SUBDRAINAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. CONTRACTOR shall furnish all labor, tools, and equipment and perform all Work necessary for, or incidental to, the supply and installation of pipe underdrains as shown in the DRAWINGS and specified herein. This WORK includes trenching, placement of a geotextile fabric, rock, HDPE pipe, PVC pipe, and clean-outs to drain water from structure foundations. The WORK shall be coordinated with the work of all other trades and activities on the PROJECT.
- B. CONTRACTOR shall furnish and install all supplementary and miscellaneous items, appurtenances and devices incidental to or necessary for a complete installation.

1.02 RELATED SECTIONS

- A. The following is a list of SPECIFICATIONS which may be related to this section:
 - 1. Section 01 57 19, Temporary Environmental Controls
 - 2. Section 31 23 19, Dewatering.
 - 3. Section 31 23 33, Trenching and Backfilling.
 - 4. Section 31 25 00, Erosion and Sedimentation Controls

1.03 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M252, Standard Specification for Corrugated Polyethylene Drainage Pipe.
 - b. M294, Standard Specification for Corrugated Polyethylene Pipe, 300-mm to 1500-mm Diameter.
 - 2. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. D737, Standard Test Method for Air Permeability of Textile Fabrics.
 - c. D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - d. D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.



- e. D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- f. D3776, Standard Test Method for Mass per Unit Area (Weight) of Fabric.
- g. D3786, Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method.
- h. D3887, Standard Specification for Tolerances for Knitted Fabrics
- i. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- j. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- k. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- l. D4751, Standard Test Method for Determining the Apparent Opening Size of a Geotextile.
- m. D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
- n. D6241, Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products using a 50-mm Probe
- o. D6707, Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications
- p. F405, Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
- q. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.04 SUBMITTALS

- A. Submittals shall include as a minimum the following:
 - 1. Geotextile fabric.
 - 2. Rock gradation results.
 - 3. Polyethylene pipe and fittings (including slot perforation pattern).
 - 4. PVC pipe and fittings (including perforation pattern).
 - 5. Meter vault sections and lid (where required for clean-outs).



1.05 DELIVERY, STORAGE, AND HANDLING

- A. Geotextile: During shipment and storage, the rolls of fabric shall be protected against deterioration from the sun, mud, dirt, dust, and other deleterious conditions at all times.
- B. Keep Pipe shaded from direct sunlight prior to installation in the trench.

PART 2 PRODUCTS

2.01 GEOTEXTILE FABRIC

- A. The fabric shall have complete resistance to deterioration from ambient temperatures, acid, and alkaline conditions, and shall be indestructible to microorganisms and insects. The material shall be resistant to short-term (until placement) deterioration by ultraviolet light or protected until placement, as recommended by the manufacturer, such that no deterioration occurs.
- B. Fibers used in the manufacture of geotextiles, and the threads used in joining geotextiles by sewing, shall consist of long chain synthetic polymers composed of at least eighty five percent (85%) by weight polyolefins, polyesters, or polyamides. They shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including selvages.
- C. The property values shown below are not design values, but represent the minimum accepted physical characteristics of the geotextile required. The number represents a value to be confirmed by the manufacturer. These values represent minimum average roll values (for example, any roll tested shall meet or exceed the minimum values in the table).

Property	Value	Test Method
Grab Strength	120 lbs.	ASTM D4632
Grab Tensile Elongation	55%	ASTM D4632
Burst Strength	225 psi	ASTM D3786
Puncture Resistance	65 lbs.	ASTM D4833
Trapezoid Tear Strength	50 lbs.	ASTM D4533
Apparent Opening Size	70, U.S. Standard Sieve	ASTM D4751
Permittivity	1.7 sec. ⁻¹	ASTM D4491
Water Flow Rate	140 gal./min./ft. ²	ASTM D4491

- D. Geotextile fabric for pipe underdrains shall be Mirafi 140N or equivalent.



2.02 DRAIN SLEEVE

Property	Value	Test Method
Weight	3.5 – 3.9 oz./yd ² .	ASTM D3776
Thickness	0.040 in.	
Burst Strength (min)	120 psi	ASTM D3887
Puncture Resistance (min)	180 lbs.	ASTM D6241
Air Permeability	700 ft. ³ /ft. ² /min.	ASTM D737
Apparent Opening Size	30, U.S. Standard Sieve	ASTM D4751
Permittivity (min)	2.4 sec. ⁻¹	ASTM D4491
Water Flow Rate	300 gal/min/ft. ² (2" Constant Head)	ASTM D4491

2.03 ROCK BEDDING

- A. Unless otherwise shown in the DRAWINGS, rock shall consist of dense, clean, uniformly graded material with a maximum size of two (2) inches and less than five percent (5%) passing the three-eighths inch (3/8") sieve. Coarse concrete aggregate meeting the requirements of ASTM C33 No. 4 may be used.

2.04 HDPE PIPE AND FITTINGS

- A. ADS Heavy Duty Pipe meeting ASTM F405 with slotted or circular perforations providing a minimum inlet area as required by AASHTO M252 or AASTO M294 Class 2 perforations.. The slotted perforation pattern shall be in accordance with AASHTO M252 or AASHTO M294 Class 2 perforations providing a flow rate for six-inch (6") diameter pipe of ninety four hundredths (0.94) GPM at a one-foot (1') pressure head. The pipe is available in ten-foot (10') joints, one hundred (100), and one thousand five hundred (1,500) linear foot rolls. The pipe shall include a factory-installed drain sleeve that meets the requirements of ASTM D6707 (ADS Drain-Sleeve or approved equal).
- B. HDPE pipe and fittings shall be made in accordance with ASTM F405.
- C. HDPE pipe shall be Type S or approved equal.

2.05 PVC PIPE AND FITTINGS

- A. Specifications and Dimensions:
- PVC pipe and fittings shall be made in accordance with ASTM D1784.
 - The pipe shall be designed, manufactured, tested, inspected and marked in accordance with the provisions of this SPECIFICATION and ASTM D3034. The minimum wall thickness shall be SDR 35.
 - Nominal pipe lengths of pipe shall be twenty (20) feet, with shorter lengths provided as required by DRAWINGS, alignment, and grade.



B. Joint Type:

1. Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint. The joint shall comply with the requirements of ASTM D3212.
2. Gaskets shall meet the requirements of ASTM F477.
3. Solvent-cement joints are strictly prohibited.

C. Perforations:

1. PVC piping shown on the DRAWINGS to be perforated shall be perforated to the pattern shown on the DRAWINGS. If no pattern is shown on the DRAWINGS, four (4) one-quarter inch (1/4") diameter holes shall be provided at six-inch (6") centers at the quarter points of the pipe. No perforation shall be made within six (6) inches from either end of the pipe.
2. Laterals, drain lines away from the structure, and the top ten (10) feet of cleanout risers shall have a solid wall.

2.06 METER VAULT

- A. The precast concrete meter vault sections and lid shall be to the dimensions shown on the DRAWINGS. The vault shall be furnished by Amcor or equivalent. The lid shall be blank and not be labeled "water."

PART 3 EXECUTION

3.01 TRENCHING

- A. The underdrain shall be trenched into the native soil a maximum of six (6) inches if so shown on the DRAWINGS to the grades shown on the DRAWINGS. The trenches shall slope uniformly at the grade shown on the DRAWINGS.

3.02 GEOTEXTILE FABRIC

- A. All perforated pipe shall be wrapped with geotextile fabric.
- B. Perforated pipe in cleanout risers shall be wrapped in geotextile fabric. Suitable means shall be found to seal the seam and maintain the position of the fabric during backfilling.
- C. Care shall be taken not to tear any geotextile fabric during backfilling.

3.03 ROCK

- A. Rock shall be placed on the geotextile fabric to the depth shown prior to placement of the underdrain pipe. After the pipe is in place, rock shall be placed along and over the top of the pipe in a manner that shall not damage the pipe.

3.04 HDPE PIPE AND FITTINGS

- A. The pipe shall be installed in accordance with the manufacturer's written instructions, a copy of which shall be maintained on site during pipe installation.



3.05 PVC PIPE AND FITTINGS

- A. General: When laying PVC pipe out on a curve, the joints may be deflected up to seventy five percent (75%) of the maximum value permitted by the manufacturer of the pipe. Tighter curves shall be made by either using shorter lengths of pipe or by using manufactured bends.
- B. Perforated Pipe: Perforated pipe shall be placed in the rock bedding as shown on the DRAWINGS.
- C. Solid Pipe: Solid PVC pipe shall be placed on six (6) inches of sand bedding, unless the native soil is capable of providing uniform support as approved by ENGINEER or shown on the DRAWINGS.

3.06 CLEAN-OUTS

- A. The clean-out risers shall be protected from damage during the backfilling operations.
- B. The ring and cap shall be secured in place with a reinforced concrete collar as shown on the DRAWINGS.

END OF SECTION