

CITY OF MEMPHIS – STANDARD CONSTRUCTION SPECIFICATIONS
SECTION 02620 UNDERDRAINS

PART 1 – SCOPE

1.01 This Work shall consist of the furnishing and placing of street underdrains and lateral underdrains at the depths, locations and grades shown on the Plans or as directed by the Owner. Street underdrains shall be either gravel type consisting of underdrain gravel in a prepared trench, gravel type with pipe consisting of perforated pipe and underdrain gravel in a prepared trench or filter cloth type with pipe consisting of filter cloth, perforated pipe and underdrain gravel in a prepared trench. Lateral underdrains shall consist of nonperforated pipe extending from the street underdrain to an acceptable point of discharge as shown on the Plans or as directed by the Owner. The work shall include all necessary excavation and backfill, together with such work and materials as may be necessary to make connections with other drainage structures.

PART 2 – MATERIALS AND EQUIPMENT

2.01 MATERIALS

A. Filter Cloth and Fasteners: The filter cloth material shall be previous sheets of strong, rot proof plastic fabric meeting the following specifications:

<u>Physical Property</u>	<u>Test Method</u>	<u>Acceptance Test Results</u>
Tensile Strength, wet, lbs	ASTM D-1682	90 (min)
Elongation, wet, %	ASTM D-1682	40 (min)
Coefficient of water Permeability, cm/scc	Constant Head	0.10
Puncture Strength, lbs	ASTM D-751	40 (min)
Pore Size – EOS	Corps of Engineers	40 (max)
U.S. Standard Sieve	CW-02215	

1. The Contractor shall furnish a certified Laboratory test report from an approved testing lab with each shipment of materials. Lab test reports shall include actual numerical test data obtained on this product.
2. Pins may be any commercially available pin 6 inches in length capable of retaining a washer.
3. Washers may be any commercially available washer 2 inches in diameter and compatible with the pin.

B. Underdrain Gravel: Underdrain gravel shall be crushed stone or washed gravel meeting the quality requirements of ASTM D692 and one of the following grading requirements:

Amounts Finer than Each Sieve Size, Percentage by Weight for Square Opening Sieves

<u>1 1/2"</u>	<u>1"</u>	<u>3/4"</u>	<u>1/2"</u>	<u>3/8"</u>	<u>No. 4</u>	<u>No. 8</u>	<u>No. 16</u>
100	95-100	--	25 – 60	----	0 – 10	0 – 5	----
----	100	90 – 100	20 – 55	0 – 15	0 – 5	-----	----
----	----	100	90 – 100	40 – 70	0 – 15	0 – 5	----
----	----	100	90 – 100	40 – 75	5 – 25	0 – 10	0 – 5
----	----	----	100	85 – 100	10 – 30	0 – 10	0 – 5

C. Underdrain Pipe

1. Perforated and non-perforated pipe and fittings shall be of the diameter or diameters specified on the Plans or as directed by the Owner and of only one pipe material for the entire

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job meeting on of the requirements described below, with the material to be approved by the Owner.

2. Perforated and non-perforated plastic or polyethelene corrugated drainage pipe or tubing and fittings shall meet the requirements of ASTM F 405 for Heavy Duty Tubing. Tubing having an elongation greater than 5 percent but less than 10 percent shall be deemed acceptable provided minimum pipe stiffness requirements are met when tested in accordance with ASTM F 405, Section 8.5, except that a 12 inch base shall be used.

3. Perforated an non-perforated corrugated steel pipe and pipe fittings and specials shall be fabricated from zinc coated (galvanized) sheets having a thickness of 0.052 inch and shall meet the requirements of AASHTO M 36 for the size specified.

2.02 EQUIPMENT

A. Equipment necessary to excavate the underdrain trench, place the underdrain material, backfill the trench, and make connections to other drainage structures and all equipment necessary to perform all parts of the Work shall be on the job site sufficiently ahead of the start of construction operations to be examined and approved by the Owner.

PART 3 – CONSTRUCTION REQUIREMENTS

3.01 UNDERDRAIN PIPE

A. The trench to receive the underdrain material shall be excavated at the locations and to the dimensions shown on the Plans or as directed by the Owner. The trench shall be deep enough to intercept the water bearing strata, and in no case shall it be less than 16 inches deep. The bottom and sides of the trench shall be finished smooth and uniform. The sides and bottom of the trenches for filter cloth type underdrains shall be free of sharp objects, obstructions, depressions, and debris which might damage the filter cloth during installation.

B. The material removed from the trench shall be removed from the area and disposed of outside of the right-of-way at locations obtained by the Contractor unless the Owner authorizes its disposition within the job site.

C. Where a lateral underdrain is constructed on a roadway on a continuous down grade, 10 feet of nonporous material measured along the roadway shall be left in place between the outlet end of the higher underdrain line and the dead end of the successive lower underdrain line, to prevent the flow of water along the roadway rather than out the lateral underdrain.

3.02 GRAVEL TYPE UNDERDRAIN

A. Underdrain gravel shall be placed in the trench in layers not exceeding 6 inches to the depth specified on the Plans. Each layer shall be well tamped with an approved tamp.

B. Suitable nonporous backfill material shall be placed in layers not exceeding 6 inches (loose measurement) and each layer thoroughly tamped to a density at least equal to that of the existing material adjacent to the trench.

C. Gravel type under drains require the use of perforated pipe in at least the last 10 feet of the under drain line connected to a non-perforated lateral underdrain pipe by means of an elbow of the same material as the pipe.

3.03 GRAVEL TYPE UNDERDRAIN WITH PIPE

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- A. Unless otherwise shown on the Plans, a 2 inch layer of underdrain gravel shall be spread on the bottom of the trench, compacted and brought to uniform grade.
- B. The pipe shall be embedded firmly in the layer of gravel. Bell and spigot, and tongue and groove pipe shall be laid with the bell or groove end upgrade and with the spigot or tongue fully entered into the adjoining bell or groove. Perforated pipe shall be laid with the flow sector and perforations at the bottom. Pipe joints shall be sealed according to approved procedures and by use of materials approved by the Owner.
- C. Dead ends of pipe underdrains shall be closed with a suitable plug of concrete placed over and around the end and held firmly in place. The underdrain line shall be connected to a non-perforated lateral underdrain pipe by means of an elbow of the same material as the pipe.
- D. After the pipe has been laid and approved, the backfilling shall be carefully done so that the pipe will not become displaced. The backfilling around the pipe shall be with the underdrain gravel specified. Unless otherwise designated on the Plans, the gravel backfill shall be a minimum of 6 inches on each side of the pipe and 6 inches over the pipe. The gravel around the pipe shall be thoroughly tamped with an approved tamp. The backfill above the underdrain gravel shall be of suitable nonporous material placed in layers not exceeding 6 inches (loose measurement) and thoroughly compacted with mechanical tamp, hand tamp or roller to a density at least equal to that of the existing material adjacent to the trench.

3.04 FILTER CLOTH TYPE UNDERDRAIN WITH PIPE

- A. The filter cloth shall be placed with the long dimension parallel to the centerline of the underdrain and shall be laid loosely without wrinkles or creases. When more than one width of filter cloth is necessary, the joints shall be overlapped a minimum of 12 inches. Securing pins with washers shall be inserted through both strips of overlapped material and into the material beneath, until the washer bears against the cloth and secures it firmly to the base material. These securing pins shall be inserted through the overlapped cloth at not greater than 2 foot intervals along a line through the midpoint of the overlap. Joints may be sewn instead of using pins to secure overlapping material.
- B. The filter cloth shall be installed in such a manner that all splice joints perpendicular to the trench are provided with a minimum overlap of 3 feet. The cloth shall be placed such that the upstream strip overlaps the downstream strip. The overlap of the closure at the top of the trench shall be at least 10 inches and secured with mechanical ties. Where lateral underdrain passes through the fabric, a separate piece of fabric of sufficient size to be wrapped around the pipe and flared against the side of the filled drain fabric shall be used. Field splices of filter cloth shall be anchored with securing pins as directed to insure the required overlap is maintained.
- C. The cloth shall be protected at all times during construction from contamination by surface runoff, and any cloth so contaminated shall be removed and replaced with uncontaminated cloth at the Contractor's expense. Any damage to the cloth during its installation shall be replaced by the Contractor at his own expense. Gravel overlaying the cloth shall not be dropped on the cloth from a height greater than 3 feet.
- D. After the filter cloth has been properly placed, a 2 inch layer of underdrain gravel shall be spread on the bottom of the trench, brought to a uniform grade, and compacted. Care shall be taken during the gravel placement operation as well as the pipe installation to prevent damage to the filter cloth. To repair a torn, punctured, or otherwise damaged section, a piece of filter cloth is cut large enough to cover the damaged area and overlap all around the damaged area a minimum of 12 inches and sewn to the cloth.
- E. The perforated pipe shall be placed at the locations and grades shown on the Plans or as directed by the Owner. The pipe shall be embedded firmly in the layer of gravel. Bell and spigot

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and tongue and groove pipe shall be laid with eh bell or groove end upgrade and with the spigot or tongue fully entered into the adjoining bell or groove. Perforated pipe shall be laid with the flow sector and perforations at the bottom. Pipe joints shall be sealed according to the approved procedures and by use of materials approved by the Owner.

F. Dead ends of pipe underdrains shall be closed with a suitable plug of concrete placed over and around the end and held firmly in place or by use of an approved fitting. The underdrain pipe shall be connected to a non-perforated lateral underdrain pipe by means of an elbow of the same material as the pipe.

G. After the pipe has been laid and approved, the backfilling shall be carefully done so that the pipe will not become displaced. The backfilling around the pipe shall be with the underdrain gravel specified. Unless otherwise designated on the Plans, the gravel backfill shall be a minimum of 6 inches on each side of the pipe and 6 inches over the pipe. The gravel around the pipe shall be thoroughly tamped with an approved tamp.

H. The gravel shall be brought to the finished grade of the underdrain and compacted by the use of a vibratory compactor to the satisfaction of the Owner before making the filter cloth closure at the top of the trench.

I. The backfill above the filter cloth closure shall be of suitable nonporous material placed in layers not exceeding 6 inches (loose measurement) and thoroughly compacted with mechanical tamp, hand tamp or roller to a density at least equal to that of the existing material adjacent to the trench.

3.05 LATERAL UNDERDRAIN

A. Lateral underdrain outlets and connections to drainage structures shall be constructed at locations shown on the Plans or as directed by the Owner.

B. The width of the lateral underdrain trench shall be kept to a minimum. The pipe shall be non-perforated and installed with care and the backfill material placed in layers and compacted to the satisfaction of the Owner.

C. The end of the lateral underdrain pipe shall be beveled to fit the slope of the drainage structure or surface grade where applicable. When the outlet of the lateral underdrain discharges at grade, the end shall be covered with wire screens of ½ inch openings. The screens are to be securely and satisfactorily attached to the end of the pipe.

3.06 CLEANOUTS

A. Cleanouts for underdrain systems shall be installed at the locations shown on the Plans or as directed the Owner, to the details shown on the Plans or in the Design Standards.

PART 4 – MEASUREMENT

4.01 GRAVEL TYPE UNDERDRAIN

Gravel type underdrains shall be measured for payment by the linear foot, complete in place.

4.02 GRAVEL TYPE UNDERDRAIN WITH PIPE

Gravel type underdrains with pipe shall be measured for payment by the linear foot, complete in place.

4.03 FILTER CLOTH TYPE UNDERDRAIN WITH PIPE

Filter cloth type underdrains with pipe shall be measured for payment by the linear foot, complete in place.

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4.04 LATERAL UNDERDRAIN

Lateral underdrains shall be measured for payment by the linear foot, complete in place.

4.05 CLEANOUTS

Cleanouts shall be measured by the unit, per each, complete in place.

PART 5 – PAYMENT

5.01 GRAVEL TYPE UNDERDRAIN

The accepted quantities of gravel type underdrain shall be paid for at the contract unit price per linear foot, which price will be full compensation for excavation; removal and disposal of excavated material; placing and compacting underdrain gravel; placement of 10 feet of perforated pipe at lower end of underdrain line; and connection of the lateral underdrain, complete in place.

5.02 GRAVEL TYPE UNDERDRAIN WITH PIPE

The accepted quantities of gravel type underdrain with pipe shall be paid for at the contract unit price per linear foot, which price will be full compensation for excavation; removal and disposal of excavated material; placing and compacting underdrain gravel; placement of perforated pipe; and connection of the lateral underdrain, complete in place.

5.03 FILTER CLOTH TYPE UNDERDRAIN WITH PIPE

The accepted quantities of gravel type underdrain with pipe shall be paid for at the contract unit price per linear foot, which price will be full compensation for excavation; removal and disposal of excavated material; placing, securing, and repairing filter cloth; placing and compacting underdrain gravel; placement of perforated pipe; and connection of the lateral underdrain, complete in place.

5.04 LATERAL UNDERDRAIN

The accepted quantities of lateral underdrain shall be paid for at the contract unit price per linear foot, which price will be full compensation for excavation, furnishing and placing of the outlet pipe, backfill of the trench and compaction, disposal of excess material, and returning the shoulder and slope to the previously existing condition or required cross-section, complete in place.

5.05 CLEANOUTS

The accepted quantities of cleanouts shall be paid at the contract price per each, which price will be full compensation for furnishing materials and installing the cleanout, complete in place.

5.06 PAYMENT WILL BE MADE UNDER:

<u>Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
02620-01	GRAVEL TYPE UNDERDRAIN	Linear Foot
02620-02	GRAVEL TYPE UNDERDRAIN WITH PIPE	Linear Foot
02620-02.____	Type and Size	Linear Foot
02620-03	FILTER CLOTH TYPE UNDERDRAIN WITH PIPE	Linear Foot
02620-03.____	Type and Size	Linear Foot
02620-04	LATERAL UNDERDRAIN	Linear Foot
02620-04.____	Type and Size	Linear Foot
02620-05	CLEANOUTS	Each
02620-05.____	Type and Size	Each

END OF SECTION 02620