

# SUBSURFACE DRAIN (CODE 606)

## SCOPE

The work shall consist of furnishing and installing perforated drainage pipe or tubing and necessary fittings and appurtenances.

## GENERAL

Subsurface drainage materials and installation shall comply with the requirements of this specification. The quality of pipe or tubing materials shall be confirmed by an ASTM or ASSHTO identification stamped or affixed to the product. The contractor shall also identify the source and gradation of imported granular materials.

## MATERIALS

### Inspecting and handling materials

Drain pipe delivered to the job site shall be handled and stored by means that provide adequate support to the pipe. Deformation and warping shall be avoided. Unless the pipe is UV protected, it shall be covered with opaque material when stored outdoors for more than 15 days. Care shall be taken to prevent impact blows, abrasion, gouges, or cuts, particularly when the temperature drops below 40 degrees Fahrenheit. The manufacturer's handling and storage requirements shall be followed.

Materials for subsurface drains shall be carefully inspected before the drains are installed. Plastic pipe with physical imperfections shall not be installed. A damaged section shall be removed and a suitable joint made connecting the retained sections.

### Materials

The following ASTM and AASHTO standard specifications pertain to products  
USDA-NRCS-Montana

currently accepted for use as subsurface drains.

Type	Standard <sup>1</sup> Specification
Corrugated polyethylene (PE) tubing and fittings 3-6 in	ASTM-F-405
Corrugated polyethylene (PE) tubing and fittings 8-24 in	ASTM-F-667
Corrugated polyethylene (PE) drainage pipe 3-10 in	AASHTO-M-252
Corrugated polyethylene (PE) drainage pipe 12-60 in	ASSHTO-M-294
Dual wall high density polyethylene (HDPE) pipe and fittings 3-6 in	ASTM-F-405
Dual wall high density polyethylene (HDPE) pipe and fittings 8-24 in	ASTM-F-667
Corrugated polyvinyl chloride (PVC) pipe and fittings	ASTM-D-3034
Polyvinyl chloride (PVC) dual wall sewer pipe and fittings	ASTM-F-949
Polyvinyl chloride (PVC) sewer pipe and fittings	ASTM-D-2729 or ASTM-D-3034 <sup>1</sup>

<sup>1</sup>Standard specifications can be obtained from the American Society for Testing and Materials can be ordered at [www.astm.org](http://www.astm.org) or the American Association of State and Highway Transportation Officials at [www.asshto.org](http://www.asshto.org).

### Drain Pipe Perforations

Where perforated conduit is required, the water inlet area shall be at least 1 in<sup>2</sup>/ft. of conduit length. Round perforations shall not exceed 3/16-inch diameter except where filters, envelopes, or other protection is provided for organic soils, where a maximum hole diameter of 1/2 inch may be used. Slot perforations shall not exceed 1/8 inch in width.

To protect the outlet (UV, fire, ice, impact) a sleeve of corrugated metal pipe shall be considered. It shall have a minimum thickness of 16 gauge (0.064 inch) and length of 10 feet. Plastic pipe shall be

inserted into the corrugated metal pipe sleeve a minimum of 2 feet. The joint shall be mortared to form a watertight seal unless a factory type fitting is used to join the tubing and outlet pipe.

A hinged animal guard must be installed at the downstream end of the corrugated metal pipe.

## **INSTALLATION**

### Backhoe Excavation

Unless otherwise specified, excavation and subsequent installation of subsurface drains shall begin at the outlet end and progress upstream. The trench shall be constructed to the line, grade, and cross section shown on the drawings.

Flexible conduits require uniform lateral support to prevent excessive deflection. For pipe diameters less than 30 inches, the maximum trench width shall be 36 inches to reduce the potential expansion of backfill around the haunch zone. The minimum trench width shall be the diameter of the pipe plus 6 inches to ensure uniform flow of backfill around the pipe.

Trench slopes, trench shields, shoring and bracing, or other suitable OSHA methods shall be used to safeguard human life and prevent damage to existing improvements. These features shall be furnished, placed, and subsequently removed by the contractor.

### Plow Excavation

Grade control and bedding conditions shall be closely inspected during plow installation. Boulders, cobbles, or cemented soils can cause the plow to jump and lose grade. These hard points can also puncture or dimple and deform the pipe. Hard points shall be identified and removed during pipe installation as described in the Pipe Bedding Section.

During plow installation, lateral pipe connections to the main line shall be left exposed to ensure that the plow does not pull the connection apart. Sufficient pipe shall be hand placed and backfilled beyond the connection to ensure proper pipe feed through the plow shoe.

### Pipe Bedding

Drain pipe shall not be laid on a rock foundation. Boulders, cobbles, or cemented soils at the required pipe grade can puncture or dimple and deform the pipe. Hard points shall be identified and removed during pipe installation. During hard point removal, the trench bottom shall be over-excavated at least 6 inches below grade, then backfilled and compacted to grade with an approved sand/gravel/clay material.

If the bottom of the trench does not provide a firm foundation for the pipe, the trench bottom shall be over-excavated at least 6 inches below grade, then backfilled and compacted with an approved sand/gravel material to stabilize the trench bottom.

The trench bottom shall be smooth and free of clods and loose or exposed rock particles greater than 1-½ inches. When a granular envelope is not specified, the trench bottom shall be shaped to conform to the pipe. The groove may be semi-circular, trapezoidal, or a 90 degree “V” shape (90 degree “V” suitable for 3-8 inches only) and shall be of such dimensions that the bottom quarter of the pipe is below the contact points of the groove.

### Filters and Bedding Envelopes

Granular or polyester sock filters are used to keep native soil material from moving through pipe perforations. If a granular filter is specified, it shall meet the requirements for ASTM C-33, Fine Aggregate for Concrete Sand.

If the pipe depth exceeds 7 feet, a granular bedding shall be used to ensure adequate lateral support to prevent excessive deflection or collapse. When granular bedding is used, it shall be clean, hard, durable material that flows well around the pipe. It shall have less than 5 percent passing the No. 200 sieve, not more than 30 percent passing the No. 60 sieve, and with a maximum size of ½-inch.

Unless otherwise specified, the installation of filter and bedding envelopes shall be as shown in Figures 1a, 1b and 1c.

#### Placement

Conduit shall be placed in such a way that long-term deflection does not exceed 5 percent.

Fittings shall be installed in accordance with instructions by the manufacturer or the applicable ASTM. Couplers are recommended at all joints and fittings, at all changes in direction (where the centerline radius is less than three times tubing diameter), at changes in diameter, and at junction with another line. All split fittings shall be securely fastened with nylon cords or plastic zip ties before backfill is placed. The ends of all buried pipe lines shall be supplied with end caps.

All fittings and adhesives shall be compatible with the pipe. Where certain fittings are not available, hand cut holes are acceptable provided care is taken when making the connection not to create a means of obstructing flow, catching debris, or allowing soil to enter the line. Unless otherwise specified, selected bedding material shall be placed in the trench to minimum depth of 4-6 inches over the conduit as shown in Figure 1a, 1b or 1c.

The conduit shall be mechanically held in place, if necessary, to prevent jacking above grade during backfill operations.

#### Backfilling

Place backfill material so that displacement, deflection, or collapse of the pipe will not occur. Backfill dumping should be avoided. Backfill should be installed on a slope into the trench so the material flows onto the pipe. Avoid large stones, frozen material, and dry clods that cause concentrated point loads on the pipe. The trench should be backfilled as soon as practical to provide protection and to prevent floatation. When installing the tubing on a hot day, backfilling should be delayed until tubing temperature cools to the soil temperature.

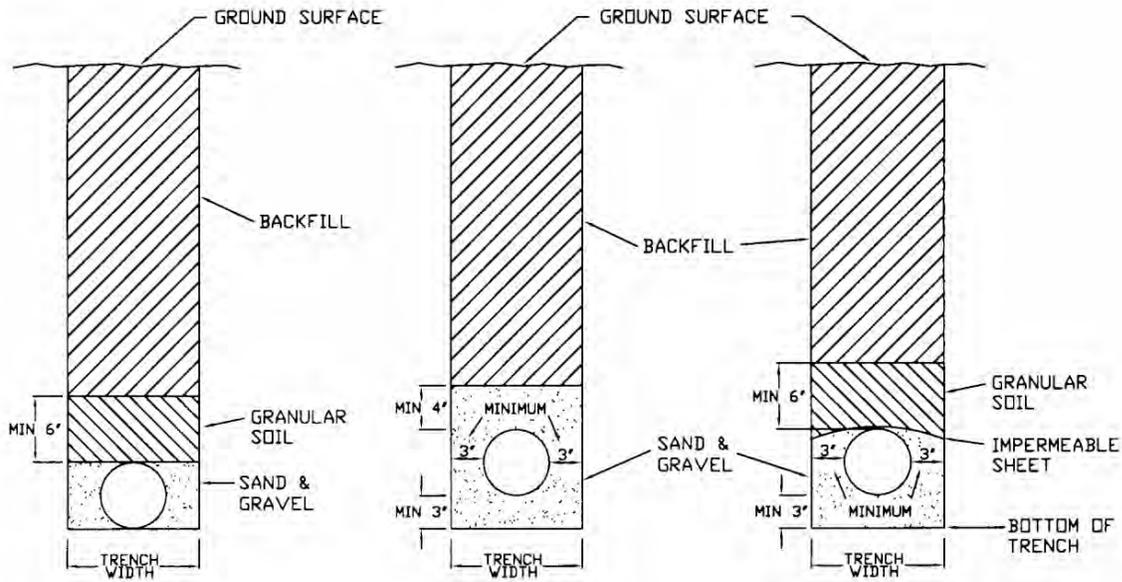


Figure 1a. Tubing Encased in Sand and Gravel Envelope for Support.

Figure 1b. Tubing Encased in Sand and Gravel Envelope Designed as a Filter.

Figure 1c. Tubing Encased in Sand and Gravel Envelope Designed as a Filter with an Impermeable Sheet such as Plastic.

Floatation

Sufficient bedding or backfill shall be installed over the pipe during construction to prevent floatation. In some instances, water must rise above the pipe in order to develop sufficient head to push the flow rate through the pipe perforations. This flow rate may not fill the drain pipe to full capacity, leaving a void which can float the pipe off grade. In some instances, the buoyancy force can float the drain pipe through a substantial amount of backfill material.