

**NATURAL RESOURCES CONSERVATION SERVICE
MISSOURI CONSTRUCTION SPECIFICATION**

SUBSURFACE DRAIN

FLEXIBLE CONDUIT

CODE 606

GENERAL

Construction operations shall be carried out in such a manner and sequence such that erosion and air and water pollution will be minimized and held within legal limits. Work shall comply with all required permits. A land disturbance permit from the Missouri Department of Natural Resources may be needed if the disturbed area is greater than one (1) acre in size.

The completed job shall present a workmanlike appearance and shall conform to the line, grades, and elevations shown on the drawings or as staked in the field.

All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used. The contractor shall be assured that all state laws concerning buried utilities are met prior to beginning work.

Construction shall be according to the requirements as specified for the job, in the plans and specifications.

All conduits shall be laid to line and grade in such a way that the side walls are continuously and uniformly supported with suitable bedding material. Such material shall be properly placed and compacted to provide lateral restraint against deflection and to protect the conduit against collapse during backfilling.

SITE PREPARATION

All trees, stumps, roots, brush, weeds, and other objectionable material in the work area shall be removed from the site and disposed of without degrading the environment or visual resources.

MATERIALS

The following specifications pertain to products currently acceptable for use as subsurface drains. These specifications are also to be applied in determining the quality of materials referenced by other standards:

Type	Specification
Plastic	
Corrugated polyethylene (PE) tubing and fittings 3-6 inches	ASTM F405
Corrugated polyethylene (PE) tubing and fittings 8-24 inches	ASTM F667
Polyvinyl chloride (PVC) corrugated sewer pipe with a smooth interior and fittings 4-8 inches	ASTM F949
Polyvinyl chloride (PVC) sewer pipe and fittings	ASTM D2729, ASTM D3034 type PSM or PSP
Metal	
Pipe, corrugated (aluminum alloy)	ASTM B745
Pipe, corrugated (iron or steel, zinc coated)	ASTM A760, A762, or A885

CONDUIT PERFORATIONS SPECIAL REQUIREMENTS

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

INSTALLATION

All materials shall be inspected and handled properly prior to installation. Material for subsurface drains shall be carefully inspected before the drains are installed. Plastic pipe and tubing shall be protected from hazard-causing deformation or warping. Plastic pipe and tubing with physical imperfections shall not be installed. A damaged section shall be removed and a suitable joint made connecting the retained sections. All material shall be satisfactory for its intended use and shall meet applicable specifications and requirements.

TRENCHING

Trench widths must be adequate for proper installation of the conduit, allow proper joining of sections, and allow proper placement of filter, envelope, or blinding materials. The trench bottom shall be constructed to proper grade before placement of the conduit.

Where rock is encountered the trench will be overexcavated a minimum of 6 inches and refilled to the proper grade with a suitable bedding material.

Provisions for safety during trenching operations shall be in compliance with the applicable safety and health regulations for construction - Occupational Safety and Health Administration (OSHA) regulations.

PLOW INSTALLATION

Plow installation has been satisfactorily used in many situations. Special care needs to be exercised relative to grade control and bedding conditions.

BEDDING

The trench bottom shall be smooth and free of clods and loose or exposed rock. Where a gravel envelope is not specified, the bottom of the trench 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.

In unstable soils a firm foundation shall be provided by overexcavation and backfilling with processed stone or gravel, suitably graded so as to act as a mat into which unstable soil will not penetrate.

FILTERS AND ENVELOPES

If a sand-gravel filter is specified, it shall be clean, hard, durable material and of the gradation specified.

When sand-gravel envelopes are used they will be of clean, hard, durable material with 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 1-1/2 inch.

PLACEMENT

Conduit will be placed in such a way that maximum stretch does not exceed 5 percent.

Fittings shall be installed in accordance with instructions furnished by the manufacturer. Couplers are recommended at all joints and fittings, at all changes in direction (where the centerline radius is less than three times the tubing diameter), at changes in diameter, and at junction(s) with another line.

Caps are needed at the ends of lines. All fittings shall be compatible with the tubing materials. Where certain fittings are not available, handcut 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. Place selected bedding material, containing no hard object larger than 1-1/2 inches in diameter in the trench to a minimum depth of 6 inches over the conduit. The conduit will be held in place mechanically until secured by blinding.

BACKFILLING

Place backfill material so that displacement or deflection of the conduit will not occur. This is preferably on an angle, so the material flows down the front slope. Avoid large stones, frozen material, and dry clods that cause concentrated point loads on the tubing. The trench should be backfilled as soon as practical. When installing the tubing on a hot day, backfilling should be delayed until tubing temperature cools to the soil temperature.

CERTIFICATION

The installing contractor shall certify that the installation complies with the requirements of these specifications. The contractor shall provide the name(s) of the material source(s).

Additional Details:

606-4 SUBSURFACE DRAIN

PAGE LEFT BLANK ON PURPOSE

**NATURAL RESOURCES CONSERVATION SERVICE
MISSOURI CONSTRUCTION SPECIFICATION**

SUBSURFACE DRAIN

RIGID CONDUIT

CODE 606

GENERAL

Construction operations shall be carried out in such a manner and sequence such that erosion and air and water pollution will be minimized and held within legal limits. A land disturbance permit from the Missouri Department of Natural Resources may be needed if the disturbed area is greater than five acres in size.

The completed job shall present a workmanlike appearance and shall conform to the line, grades, and elevations shown on the drawings or as staked in the field.

All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used. The contractor shall be assured that all state laws concerning buried utilities are met prior to beginning work.

Construction shall be according to the requirements as specified for the job, in the plans and specifications.

SITE PREPARATION

All trees, stumps, roots, brush, weeds, and other objectionable material shall be removed from the site and disposed of without degrading the environment or visual resources.

INSTALLATION

All materials shall be inspected and handled properly prior to installation. Material for subsurface drains shall be carefully inspected before the drains are installed. Plastic pipe and tubing shall be protected from hazard-causing deformation or warping. Plastic pipe and tubing with physical imperfections shall not be installed. A damaged section shall be removed and a suitable joint made connecting the retained sections. Clay and concrete tile shall be checked for damage from freezing and thawing before it is installed. All material shall be satisfactory for its intended use and shall meet applicable specifications and requirements.

MATERIALS

The following specifications pertain to products currently acceptable for use as subsurface drains. These specifications are also to be applied in determining the quality of materials referenced by other standards:

Type	Specification
Vitrified clay	
Vitrified clay pipe, perforated, standard and extra strength	ASTM C700
Vitrified clay pipe, testing	ASTM C301
Concrete	
Concrete drain tile	ASTM C4
Concrete pipe for irrigation or drainage	ASTM C118
Concrete pipe or tile, determining physical properties of	ASTM C497
Concrete sewer, storm drain, and culvert pipe	ASTM C14
Reinforced concrete culvert, storm drain, and sewer pipe	ASTM C444
Perforated concrete pipe	ASTM C76
Portland cement	ASTM C150

CLAY AND CONCRETE DRAIN TILE SPECIAL REQUIREMENTS

If clay tile will not be exposed to freezing and thawing before or during installation and if the average frost depth will be less than 18 inches, the freezing and thawing and adsorption tests may be modified or waived.

The use of concrete tile in acid and sulfate soils shall be in accordance with the following limitations:

Acid soils:

Class of tile	Lower permissible limits of pH values	
	Organic and sandy soils	Medium and heavy-textured soils
ASTM C412		
Standard quality	6.5	6.0
Extra quality	6.0	5.5
Heavy duty extra quality	6.0	5.5
Special quality	5.5	5.0
ASTM C14, C118, C444	5.5	5.0

NOTE: Figures represent the lowest reading of pH values for soil or soil water at subsurface drain depth.

Sulfate soils:

Type of tile and cement (minimum)		Permissible maximum limit of sulfates, singly or in combination (ppm)
Tile:	ASTM C412 Special quality C14, C118, C444	7,000
Cement:	ASTM C150, Type V	
Tile:	ASTM C412 Extra quality, Heavy-duty extra quality C14, C118, C444	3,000
Cement:	ASTM C150, Type II or V	
Tile:	ASTM C412 Standard quality C14, C118, C444	1,000
Cement:	ASTM C150, any type	

NOTE: Figures represent the highest reading of sulfates for soil or soil water at subsurface drain depth.

Bell and spigot, tongue and groove, and other types of pipe that meet the strength, absorption, and other requirements of clay or concrete tile as specified in the preceding paragraphs, except for minor imperfections in the bell, the spigot tongue, or the groove, and ordinarily classed by the industry as "seconds," may be used for drainage conduits, provided that the pipe is otherwise adequate for the job.

TRENCHING

Trench widths must be adequate for proper installation of the conduit; must allow proper joining of sections; and must allow proper placement of filter, envelope, or blinding materials. The trench width will be a minimum of 3 to 6 inches on both sides of conduit. The trench bottom shall be constructed to proper grade and shape before placement of the conduit.

Where rock is encountered the trench will be over excavated a minimum of 6 inches and refilled to the proper grade with a suitable bedding material.

Provisions for safety during trenching operations shall be in compliance with the applicable safety and health regulations for construction (OSHA regulations).

BEDDING

If unstable soil conditions are encountered, the trench bottom must be stabilized before placement of conduit. Where necessary the unstable material will be removed and replaced with sand-gravel or a similar suitable stabilizing material. Where an envelope is not specified, the bottom of the trench shall be shaped to ensure good alignment of the conduit.

Where the conduit is to be laid in a rock trench, or where rock is exposed at the bottom of the trench, the rock shall be removed below grade enough that the trench may be backfilled, compacted, and bedded; and when completed, the conduit shall be a minimum of 6 inches from rock.

FILTERS AND ENVELOPES

If a sand-gravel filter is specified, it shall be of clean, hard durable material and of the gradation specified.

When sand-gravel envelopes are used they will be of clean, hard, durable material with 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 1 ½ inches ASTM C33 fine aggregate for concrete will meet these requirements.

PLACEMENT

All conduits shall be laid to line and grade and covered with the specified blinding, envelope, or filter material to a depth of not less than 3 inches around the drain. Blinding material shall contain no hard objects larger than 1-½ inches in diameter.

When a sand-gravel filter is specified, all openings in the conduit must be covered with at least 3 inches of filter material except that the top of the conduit and the side filter material may be covered with a sheet of plastic or similar impervious material. The impervious sheet will be covered with at least 3 inches of blinding material.

Joints between drain tile shall not exceed 1/8-inches except in sandy soils, where the closest possible fit must be obtained, and in organic soils where some of the more fibrous types make it desirable to increase slightly the space between tile.

606-8 SUBSURFACE DRAIN

BACKFILL

Backfill will be placed in such a manner as to avoid displacement of the conduit. Backfill should be moved into the trench at an angle so that material slows down the front slope of previously placed material. Backfill shall not contain frozen material, stones, clods, or objects large enough to damage the conduit. The trench should be backfilled as soon as possible after blinding.

CERTIFICATION

The installing contractor shall certify that the installation complies with the requirements of these specifications. The contractor shall provide the name(s) of the material source(s).

Additional Details:

**NATURAL RESOURCES CONSERVATION SERVICE
MISSOURI OPERATION AND MAINTENANCE**

SUBSURFACE DRAIN

CODE 606

OPERATION AND MAINTENANCE ACTIVITIES

A maintenance program shall be established by the landowner/user to maintain the functional capacity of the subsurface drain. Items to consider are:

- Keep inlets, trash guards, collection boxes, and structures clean and free of materials that can reduce the flow.
- Repair all broken or crushed lines to insure proper functioning of the drain.
- Repair or replace broken or damaged inlets, breathers, or vents damaged by livestock or machinery.
- Periodically inspect outlet conduit and animal guards for proper functioning.

Additional Details:
