

**NATURAL RESOURCES CONSERVATION SERVICE**  
**CONSERVATION PRACTICE STANDARD**  
**UNDERGROUND OUTLET**

(Feet)

**Code 620**

**DEFINITION**

A conduit installed beneath the surface of the ground to collect surface water and convey it to a suitable outlet.

**PURPOSE**

Dispose of excess water from terraces, diversions, subsurface drains, surface drains, trickle tubes or principal spillways from dams (outside the dam area only), or other concentrations without causing damage by erosion or flooding.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies where:

- Excess surface water needs to be disposed.
- A buried outlet is needed for Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) Standard (362) Diversion, NRCS FOTG Standard (600) Terrace, or similar practices.
- An underground outlet can be installed that will safely dispose of excess water.
- Surface outlets are impractical because of stability problems, climatic conditions, land use, or equipment traffic or other factors.

**CRITERIA**

Planned work shall comply with all applicable Federal, State, and Local laws and regulations.

**Capacity.** The underground outlet shall be designed, alone or in combination with other practices, with adequate capacity to insure that the terrace, diversion, or other practices function according to the standard for the specific practice. The capacity of the underground outlet for natural or constructed basins shall be adequate for the intended purpose without causing excessive damage to crops, vegetation, or improvements.

**Inlet.** An inlet can be a collection box, a perforated riser, or other appropriate device. Its capacity shall be adequate to provide the maximum design flow in the conduit. Flow-control devices shall be installed as necessary. Perforated risers must be of durable material, structurally sound, and resistant to damage by rodents or other animals. If burning of vegetation is likely to create a fire hazard, the inlet shall be fire resistant. Collection boxes must be large enough to facilitate maintenance and cleaning operations. The inlet must have appropriate protection to insure that trash or other debris entering the inlet passes through the conduit without plugging. It must have an animal guard to prevent the entry of rodents or other animals.

Blind inlets (French Drains) are rock filled trenches with perforated tile in the bottom that can be used as inlets. The trenches shall be a minimum of 12" deep by 12" wide by the appropriate length necessary to reach the outlet and then filled with coarse aggregate material.

Do not use blind inlets in high siltation areas.

**Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.**

Install a 20' vegetated buffer around all blind inlets. See NRCS FOTG Standard (393) Filter Strip for requirements.

**Hydraulics.** Pressure-relief wells shall be designed and installed as needed to control pressure. If junction boxes and other structures are needed, they shall be designed and installed in a manner that facilitates cleaning and other maintenance activities.

Underground outlets shall be continuous conduits, tubing, or tile. Joints shall be hydraulically smooth, and the materials and methods used shall be recommended by the manufacturer. If a pressure system is used, joints shall be adequate to withstand the design pressure, including surges and vacuum. The maximum velocity must not exceed the safe velocity for the conduit materials and installation.

Lines shall be adequate to carry the design flow when the outlet and all inlets are operating at design capacity. Positive grade shall be maintained in all sections of an underground outlet. Capacity shall be based on the pipe size or on other flow control devices to prevent water from the upper inlets from discharging through the lower inlets. The minimum conduit diameter shall be 3 inches.

**Materials.** Materials shall meet or exceed the design requirements against leakage and shall withstand internal pressure or vacuum and external loading. Plastic, concrete, aluminum, and steel shall meet the requirements specified in the applicable American Society for Testing and Materials (ASTM) standard. All materials specified for NRCS FOTG Standard (606) Subsurface Drain can be used for underground outlets. Conduits can be perforated or nonperforated, depending on the design requirements. A filter wrap (sock) or equivalent shall be used if migration of soil particles around the conduit is anticipated. All exposed plastic materials shall be protected from degradation due to exposure to sunlight.

The outlet pipe and its installation shall conform to the following requirements:

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1. If plastic pipe is used, it shall meet one of the following:
  - Polyvinyl chloride (PVC) with standard dimension ratios (SDR) equal to 35 or less or schedule 40 or greater.
  - High-density polyethylene (HDPE) ASTM-D3350 flexural modulus cell class 4 or greater, conforming to ASTM-F714 for smooth wall HDPE or American Association of State Highway and Transportation Officials (AASHTO) M-250 or M-294 for double wall HDPE pipe. The materials will typically have a SDR value of 32.5 or less or pipe stiffness value of 34 pounds per square inch (psi) or greater, respectively.
2. If corrugated metal pipe is used, it shall meet one of the following:
  - Corrugated steel pipe will have a minimum thickness of 0.064 inches, conforming to ASTM A760, A762 and A885.
  - Corrugated aluminum pipe shall be a riveted or helical fabrication with a minimum thickness of 0.069 inches, conforming to ASTM B745 and B790.

**Outlet.** The outlet shall be sufficiently stable for all anticipated flow conditions. It shall be designed for the maximum anticipated water surface at design flow. A continuous section of closed conduit or headwall can be used at the outlet. If a closed conduit is used, it shall be durable and strong enough to withstand all anticipated loads, including those caused by ice. Outlets shall not be placed in areas of active erosion. If fire is a hazard, the outlet shall be fire resistant. All outlets must have animal guards to prevent the entry of rodents or other animals. Animal guards must be hinged rather than rigid when passage of debris is a concern.

The outlet pipe and its installation shall conform to the following requirements:

1. Two-thirds of the pipe shall be buried in the ditch bank and the cantilevered section must extend to the toe of the ditch side slope or the side slope must be protected from erosion. The

minimum length of the pipe will normally be 8 feet. For conduits 10 inches in diameter or greater, longer outlet sections shall be considered, such as:

- 10 inches and 12 inches in diameter, use 12 feet.
- 15 inches and 18 inches in diameter, use 16 feet.
- Use 20 feet of outlet pipe for all diameters larger than 18 inches.

**Fabrication.** Inlet holes shall be smooth and burr free. Holes shall not remove more than 50 percent of material in any horizon or vertical row of holes. For inlets fabricated from metal or smooth plastic, 1" x 4" slots may be used in lieu of ¾" or 1" diameter holes as long as the openings provide an adequate cross-sectional area.

Holes larger than 5/16" diameter that are more than 6" below the channel bottom shall be covered with plastic, fiberglass, nylon, gravel, or other filter material to prevent soil from entering the inlet.

Other combinations of the number and size of holes may be used if they provide the necessary openings. Other materials and methods of fabrication may be used for the inlet, tee and other appurtenances as long as the functional capabilities of the inlet are satisfied.

**Protection.** All disturbed areas shall be reshaped and regraded so that they blend with the surrounding land features and conditions. Areas that are not to be farmed or covered by structural works shall be established to vegetation or otherwise protected from erosion as soon as practicable after construction.

All conduits and underground appurtenances shall be installed deep enough to prevent damage from tillage equipment.

If ice or floating debris may damage the outlet pipe, the outlet shall be recessed to the extent that the cantilevered part of the pipe will be protected from the current in the outlet channel.

If burning vegetation on the outlet ditch bank is likely to create a fire hazard, the material from which the outlet pipe is fabricated shall be fire resistant. If the fire hazard is great, the outlet shall be fireproof.

## CONSIDERATIONS

Consider effects on the volume of downstream flow that might cause undesirable environmental, social, or economic effects.

Evaluate and consider the potential use for water management.

Consider effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that would be carried by runoff.

Consider effects on the visual quality of downstream water resources.

Consider the construction-related effects on the quality of downstream water resources.

Consider effects on wetlands or water-related wildlife habitats.

Consider and evaluate the potential impact on water quality due to agri-chemicals in outflow.

Consider depth of underground outlet in regard to tillage equipment depth and maintenance, if applicable.

Consider bedding tile with pea gravel and using larger material at the surface with blind inlets.

Consider making the minimum depth for blind inlets to be 3 times the tile size.

Consider using blind inlets instead of risers in pasture situations to prevent damage from livestock.

Consider using a vegetated buffer around all inlets to act as a filter.

## PLANS AND SPECIFICATIONS

Plans and specifications for installing underground outlets shall be in keeping with this standard and shall describe the requirements for installing the practice to achieve its intended purpose.

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## OPERATION AND MAINTENANCE

Underground outlets shall be maintained by:

- Keeping inlets, trash guards, and collection boxes and structures clean and free of materials that can reduce the flow.
- Repairing leaks and broken or crushed lines to insure proper functioning of the conduit.
- Checking outlet conduit and animal guards to ensure proper functioning of the conduit.
- Keeping adequate backfill over the conduit.
- Repairing any eroded areas at the pipe outlet.

A 885 – Standard Specification for Steel Sheet, Zinc and Aramid Fiber Composite Coated for Corrugated Steel Sewer, Culvert, and Under Drain Pipe.

B 745 – Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.

B 790 – Standard Practice for Structural Design of Corrugated Aluminum Pipe, Pipe-Arches, and Arches for Culverts, Storm Sewers, and Other Buried Conduits.

D 3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

F 714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

American Association of State Highway and Transportation Officials (AASHTO)

M-250 - Smooth Wall High-Density Polyethylene Pipe.

M-294 – Double Wall High-Density Polyethylene Pipe.

## REFERENCES

Indiana NRCS Field Office Technical Guide, Practice Standards Subsurface Drain, 606; Diversion, 362; Terrace, 600; Filter Strip, 393.

American Society for Testing and Materials (ASTM) Standards:

A 760 – Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.

A 762 – Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains.

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