

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

UNDERGROUND OUTLET

(Ft.)

CODE 620

DEFINITION

A conduit or system of conduits installed beneath the surface of the ground to convey surface water to a suitable outlet.

PURPOSE

To carry water to a suitable outlet from diversions, waterways, subsurface drains or other similar practices without causing damage by erosion or flooding.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Disposal of excess surface water is necessary to reduce ponding or flooding.
- A buried outlet is needed for Diversions (362), Subsurface Drain (606), or similar practice.
- A surface outlet is considered impractical due to site specific conditions.

CRITERIA

Capacity. The design capacity of the underground outlet is based on structure requirements or the practice it serves. The underground outlet can be designed to function as the principal outlet for the structure or can be designed to function with other types of outlets. The capacity of the underground outlet for natural or constructed basins shall provide adequate drainage for the intended purpose without causing soil sedimentation, or crop damage.

Underground outlets may be designed for either pressure or gravity flow. If a pressure system is designed, all pipe and joints must

adequately withstand design pressure, surges, and vacuum. Thrust blocks shall be designed and installed as needed. To fully utilize conduit capacity, design the inlet to provide maximum flow in the conduit. To prevent pressure flow or conduit overloading, a flow restricting device such as an orifice or weir can be used.

Pressure-relief wells may be used to allow excess flow to escape the conduit and flow over the surface. Only use pressure relief wells where there is a stable outlet for the flow from the relief well. Cover pressure relief wells with a grate or other appropriate covering to prevent the entry of small animals and debris.

If there are multiple structures flowing into an underground outlet, design the system so that upstream structures do not discharge into those downstream, unless the downstream structure is designed to accommodate the additional flow.

Inlet. An inlet can be a collection box, a perforated riser, or other appropriate device. Inlets must have an appropriate trash guard to ensure that debris entering the inlet passes through the conduit without plugging.

Design collection boxes large enough to allow maintenance and cleaning operations. Use blind inlets where the installation of an open or above ground structure is impractical. Design the blind inlet with a graded granular filter around the conduit. Design the filter based on desired flow rate and particle size of the surrounding soil. Refer to NEH Part 650, Engineering Field Handbook, Chapter 14 for the design of blind inlets

For perforated risers, use durable, structurally sound material that is fire resistant and resistant to damage by rodents or other animals.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service [Rhode Island](#) State Office or download it from the Rhode Island [electronic Field Office Technical Guide \(EFOTG\)](#).

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Conduit. Underground outlets shall be conduits of tubing, tile or pipe. The minimum allowable conduit diameter is 4 inches. Design hydraulically smooth joints using materials and methods recommended by the manufacturer of the conduit. All conduits shall have a 2 foot minimum cover.

The maximum design velocity must not exceed the safe velocity for the conduit materials and installation according to the conduit manufacturer's recommendation. Refer to Conservation Practice 606, Subsurface Drainage for design criteria for safe velocity.

When junction boxes and other structures are needed, design them to allow cleaning and other maintenance activities. Maintain downward grades towards the outlet in all sections of the underground outlet.

Materials. Plastic, concrete, aluminum, and steel pipe shall meet the requirements specified in the applicable ASTM standard. All materials specified in Rhode Island NRCS Conservation Practice Standard, Subsurface Drainage, code 606 can be used for underground outlets. Materials must meet applicable site specific design requirements for leakage, external loading, internal pressure or vacuum.

Underground outlet conduits can be perforated or nonperforated, as specified by the design requirements. Use a filter fabric wrap (sock) or appropriately designed granular filter if migration of soil particles into the conduit is anticipated. Design the filter based on the particle size of the surrounding soil to prevent rapid clogging of the filter. Refer to Rhode Island NRCS Conservation Practice Standard Subsurface Drainage, code 606 for criteria for the design of filter media. Protect all exposed plastic materials from degradation with a metal pipe stub or sleeve.

Outlet. The outlet must be stable enough to handle anticipated design flow conditions from the underground outlet. Design the underground outlet for water surface conditions at the outlet expected during the design flow conditions.

The outlet must consist of a continuous 10 foot section or longer of closed conduit or a headwall at the outlet. If a closed conduit is used, the material must be durable and strong enough to withstand anticipated loads, including those caused by ice. Do not design outlets to be placed in areas of active erosion. Use fire resistant materials if fire is an expected hazard. All outlets must have animal guards to prevent the entry of rodents or other animals. Design animal guards to allow passage of debris while blocking the entry of animals that cannot easily escape from the conduit.

Stabilization. Reshape and regrade all disturbed areas to blend with the surrounding land features and conditions. Revegetate and protect disturbed areas that will not be farmed from erosion, as soon as possible following construction.

CONSIDERATIONS

Mark the location of pressure relief wells with a high visibility marker to prevent accidents or well damage. Pressure relief wells, can present a safety hazard for people or animals stepping into the well, if not properly covered.

The rapid removal of water through an underground outlet will affect the water budget where it is installed. It can reduce infiltration, increase or decrease peak flows to receiving waters and reduce long term flows into the same waters. Consider these long term environmental, social, and economic effects when planning and damaging underground outlet and the structure or practice it serves.

When perforated pipe is used for the subsurface conduit, locate the practice so it has a minimal effect on the wetland hydrology

To prevent sedimentation in the conduit, underground outlets should be designed with a minimum velocity of 1.4 ft/sec.

Where perforated risers are used, the risers are often perforated below the surface of the ground to facilitate drainage. In this situation, use an appropriately designed gravel or

geotextile filter around the buried portion of the riser to prevent soil entry into the riser perforations.

Underground outlets can provide a direct conduit to receiving waters for contaminated runoff from crop land. Underground outlets and the accompanying structure or practice should be installed as part of a conservation system that addresses issues such as nutrient and pest management, residue management and filter areas.

The construction of an underground outlet can disturb large areas and potentially affect cultural resources. Follow state cultural resource protection policies before construction begins.

If an installation in a crop field is too shallow, tillage equipment can damage an underground outlet. Consider the tillage type and depth that will likely occur when designing the depth of an underground outlet. A minimum of 2 feet of cover is recommended over all conduits.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for underground outlets that describe the requirements for applying this practice according to this standard. The plans and specifications for an underground outlet may be incorporated into the plans and specifications for the structure or practice it serves. As a minimum the plans and specifications shall include:

- A plan view of the layout of the underground outlet.
- Typical cross sections or bedding requirements for the underground outlet.
- Profile of the underground outlet with grades
- Details of the inlet and outlet.
- Seeding requirements and specifications.

- Site specific construction specifications that describe the installation requirements of the underground outlet.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator. The minimum requirements to be addressed in a written operation and maintenance plan are:

- Periodic inspections, immediately following significant runoff events, and keeping inlets, trash guards, collection boxes and structures free from flow inhibiting materials or debris.
- Prompt repair or replacement of damaged components.
- Repair or replacement of inlets damaged by farm equipment.
- Repair of leaks and broken or crushed lines to insure proper functioning of the conduit.
- Periodic checking of the outlet and animal guards to ensure proper functioning.
- Repair of eroded areas at the pipe outlet.
- Maintain adequate backfill over conduit.
- Maintain permeability of surface materials on blind inlets by periodic scouring or removal and replacement of the surface soil layer.

REFERENCES

USDA, NRCS. National Engineering Handbook, Part 650

USDA, NRCS. Engineering Field Handbook, Chapters 6, 8, 14.

Rhode Island NRCS Conservation Practice Standards

Critical Area Planting, (342)

Subsurface Drainage, (606)