

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**UNDERGROUND OUTLET**

(Feet)

**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 terraces, water and sediment control basins, diversions, waterways, surface drains, other similar practices or flow concentrations without causing damage by erosion or flooding.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies where:

- Disposal of surface water is necessary.
- An outlet is needed for a terrace, diversion, water and sediment control basin or similar practice and a surface outlet is impractical because of stability problems, topography, climatic conditions, land use or equipment traffic.
- The site is suitable for an underground outlet.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Use of this Standard requires compliance with all applicable federal, state, and local laws and regulations.

Fire resistant materials will be used for underground outlet components if fire is an expected hazard. All plastics must be UV resistant or protected from exposure to sunlight.

Components of underground outlets, including inlet collection boxes and conduit junction

boxes, will be designed with sufficient size to permit maintenance and cleaning operations.

**Capacity.** The design capacity of the underground outlet will be based on the requirements of the structure or practice it serves. The underground outlet can be designed to function as the only outlet for a structure or in conjunction with other types of outlets. The capacity of the underground outlet will be adequate for the intended purpose without causing inundation damage to crops, vegetation, or works of improvement.

The underground outlet will be designed to account for anticipated water surface conditions at the outlet during design flow.

Flood routing techniques may be used to determine the relationship between flooding duration, underground release rate, and basin storage volume.

Underground outlets may be designed for either pressure or gravity flow. If designed as a pressure system, all pipes and joints must be adequate to withstand the design pressure, including surge pressure and vacuum conditions.

For gravity flow systems, utilize a flow restricting device such as an orifice or weir to limit flow into the conduit or choose conduit sizes that are large enough to prevent pressure flow

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

**Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service State Office, or download it from the Field Office Technical Guide for your State.**

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

**Inlet.** An inlet can be a collection box, blind inlet (gravel), perforated riser, perforated conduit, or other appropriate device.

Open inlets must have a trash guard. Design the inlet to permit trash or debris entering the inlet to pass through the flow restricting device and conduit without plugging.

Perforated riser inlets will be durable, structurally sound, and resistant to damage by rodents or other animals. Perforations must be smooth, free of burrs, and have adequate capacity to prevent the riser from restricting flow in the underground outlet.

Blind inlets may be used instead of an open or above ground structure where such a design is practical and will not impede the function of supporting practices. Contributing cropland will be managed to minimize particle movement and sedimentation at the blind inlet.

**Conduit.** The minimum allowable diameter of conduits is 4 inches. Conduit joints will be hydraulically smooth and consistent with the manufacturer's recommendation for the conduit material and installation.

Design the underground outlet to ensure that maximum allowable loads on the conduit are not exceeded for the type and size of conduit. Depth of cover requirements will be assessed to prevent damage to the underground outlet from tillage operations and frost action.

Thrust blocking or anchoring will be provided where needed to prevent undesired movement of the conduit. Placement and bedding requirements for the conduit are required to ensure integrity of the installation.

The flow velocity in the conduit must not exceed the maximum allowable design velocity for the conduit materials and installation condition. Gravity flow systems must maintain a positive grade throughout the conduit length towards the outlet.

Refer to Indiana (IN) Field Office Technical Guide (FOTG) Standard (606) Subsurface Drain for criteria for design loading, thrust blocking, placement and bedding requirements, and minimum and maximum design velocity in the conduit.

**Materials.** All materials specified in Indiana IN FOTG Standard (606) Subsurface Drain, may be used for underground outlets. Materials must meet applicable site specific design requirements for leakage, external loading, and internal pressure including vacuum conditions.

Underground outlets will be conduits of continuous tubing, tile or pipe and may be perforated or non-perforated. Perforated conduit components of underground outlets will be designed to IN FOTG Standard (606) Subsurface Drain.

**Outlet.** The outlet must be stable and protected against erosion and undermining for the range of design flow conditions.

The outlet must consist of a continuous 10 foot section or longer of closed conduit with stiffness necessary to withstand expected loads or a headwall at the outlet. Use longer outlet sections for conduits 10 inches in diameter or greater:

- 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

Two-thirds of the pipe must 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.

All outlets will 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 large enough to restrict the flow in the conduit.

Use fire resistant materials if fire is an expected hazard.

A vertical outlet may be used to discharge water to the ground surface where topography does not allow adequate conduit cover using a

horizontal outlet, or where it is practical to discharge over a vegetated filter strip.

The vertical outlet (relief well) will be adequately perforated and placed in an envelope of coarsely graded aggregate to allow the system to drain during periods when not in use.

**Stabilization.** Reshape and regrade all disturbed areas so that they blend with the surrounding land features and conditions. For areas that will not be farmed, refer to IN FOTG Standard (342) Critical Area Planting for establishment of vegetation criteria. Permanent vegetation will be established on all disturbed areas as soon as possible after construction.

### CONSIDERATIONS

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, blind inlet designs, and filter areas.

Where perforated risers are used, often the risers are perforated below the surface of the ground to facilitate drainage. In this situation, if soil entry into the riser perforations is a problem, use an appropriately designed gravel or geotextile filter around the buried portion of the riser.

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

Pressure relief wells and vertical outlets, if not properly covered, can present a safety hazard for people or animals and may be damaged by field equipment. Pressure relief wells and vertical outlet locations should be identified with a high visibility marker.

The construction of an underground outlet in a riparian corridor can have an adverse effect on the visual resources of the corridor. Consider the visual quality of the riparian area when designing the underground outlet.

Consider potential effects of soil physical and soil chemical properties influence on area where a conduit or system of conduits are installed to convey surface water. Refer to soil survey data as a preliminary planning tool for assessment of areas. Consult the Web Soil Survey to obtain soil properties and qualities information.

### 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 will include:

- A plan view of the layout of the underground outlet.
- Typical cross sections and bedding requirements for the underground outlet.
- Profile of the underground outlet.
- Details of the inlet and outlet.
- Seeding requirements if needed.
- Construction specifications that describe in writing the site specific 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, especially immediately following significant runoff events, to keep inlets, trash guards, and collection boxes and structures clean and free of materials that can reduce flow.
- 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 Inspection of the outlet and animal guards to ensure proper functioning.
- Repair of eroded areas at the pipe outlet.
- Maintenance of adequate backfill over the conduit.
- To maintain the permeability of surface materials on blind inlets, periodic scouring or removal and replacement of the surface soil layer may be necessary.

#### **REFERENCES**

USDA, NRCS. National Engineering Handbook, Part 650 Engineering Field Handbook, Chapters 6, 8 & 14.