

**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 terraces, water and sediment control basins, diversions, waterways, surface drains, or other similar practices 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 but a surface outlet is impractical because of stability problems, topography, climatic conditions, land use, or equipment traffic; and

The site is suitable for an underground outlet.

CRITERIA

Capacity. The design capacity of the underground outlet is based on requirements of the structure or practice it serves. The underground outlet can be designed to function as the only outlet for a structure or it can be designed to function with other types of outlets. The capacity of the underground outlet for natural or constructed basins shall be adequate for the intended purpose without causing inundation damage to crops, vegetation, or works of improvements.

Underground outlets may be designed for either pressure or gravity flow. If a pressure

system is designed, all pipe and joints must be adequate to withstand the design pressure, including surges and vacuum. To fully utilize conduit capacity, design the inlet to provide maximum flow in the conduit. To prevent pressure flow or overloading of the conduit a flow restricting device such as an orifice or weir can be used to limit flow into the conduit.

If there are multiple structures flowing into an underground outlet, design the system so that upstream structures do not discharge into downstream inlet structures .

Pressure relief wells may be used to control pressure and allow excess flow to escape the conduit and flow over the ground 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.

Inlet. An inlet can be a collection box, a perforated riser, or other appropriate device. For perforated risers, use durable, structurally sound material that is resistant to damage by rodents or other animals. Use fire resistant materials for the inlet if fire is an expected hazard.

Inlets must have an appropriate trash guard to ensure that trash or other debris entering the inlet passes through the conduit without plugging.

Perforations in the inlet shall be smooth and without burrs or projections that will collect trash. Slots or holes in the perforated risers shall be adequate to provide twice the design flow in the conduit to compensate for possible plugging of some of the perforations.

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 the particle size of the surrounding soil and the desired flow rate. Refer to the National Engineering Handbook (NEH), Part 650, Engineering Field Handbook, Chapter 14 for the design of blind inlets.

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

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 Standard (CPS) Subsurface Drainage (606) for design criteria for safe velocity.

If junction boxes and other structures are needed, design them to allow cleaning and other maintenance activities. Maintain a downward grade 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 American Society for Testing and Materials (ASTM) standard. All materials specified in the CPS Subsurface Drainage (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, depending on 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 CPS Subsurface Drainage (606) for criteria for the design of filter media. Protect all exposed plastic materials from degradation due to exposure to sunlight.

Outlet. The outlet must be stable for 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 (such as hinging the guards) while blocking the entry of animals that cannot easily escape from the conduit.

Backfill. Conduits shall be bedded and backfilled the entire base width of the basin embankment or terrace ridge. Friable soil material shall be placed in 6-inch layers and compacted to a depth of 18 inches. The sides of the remaining trench shall be sloped no steeper than one horizontal to one vertical and backfill placed in six-inch layers and compacted. Mechanical compacting or other means of compacting shall be used. Moisture content of the backfill should be adjusted to aid compaction. Highly angular material which may bridge should not be used for backfill when piping is a concern.

Consideration must be given to prevent piping in the backfill along the pipeline to avoid failure. Protection can be provided by the use of anti-seep collars to increase the path of percolation.

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

CONSIDERATIONS

Pressure relief wells, if not properly covered, can present a safe hazard for people or animals stepping into the well. In addition, pressure relief wells can be easily damaged by

field equipment. To prevent accidents mark the location of pressure relief wells with a high visibility marker.

The rapid removal of water through an underground outlet will affect the water budget where it is installed. It can reduce infiltration. It can 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 making design decisions for the underground outlet and the structure or practice it serves.

If perforated pipe is used for the subsurface conduit, locate the practice so that it has a minimal effect to the hydrology of wetlands. Wetlands must be minimally affected or the impacts must be mitigated.

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

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.

Seasonal water sources can be very important for migratory waterfowl and other wildlife. The use of a water control structure, on the inlet of an underground outlet during noncropping times of the year, can allow water to pond in the structure to provide water for wildlife.

Underground outlets can provide a direct conduit to receiving waters for contaminated runoff from cropland. 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 in a riparian corridor can have an adverse affect on the visual resources of the corridor. Consider the visual quality of the riparian area when designing the underground outlet.

The construction of an underground outlet can disturb large areas and potentially affect cultural resources. Be sure to 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 type and depth of tillage that will likely occur when designing the depth of an underground outlet. A minimum of two 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;

Details of the inlet and outlet;

Seeding requirements if needed; and

Construction specifications that describe in writing the site-specific installation requirements of the underground outlet.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for the operator. The minimum requirements to be addressed in a written O&M 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 checking 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. NEH, Part 650, Engineering Field Handbook, Chapter 6 (Structures), Chapter 8 (Terraces), and Chapter 14 (Water Management (Drainage)).