

UNITED STATES DEPARTMENT OF AGRICULTURE
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: (1) excess surface water needs to be disposed of; (2) a buried outlet is needed for diversions, terraces, water and sediment control basin, or similar practices (See NRCS Conservation Practice Standards Code 362 - Diversions; Code 600 - Terraces; and Code 638 - Water and Sediment Control Basin); (3) an underground outlet can be installed that will safely dispose of excess water; and (4) surface outlets are impractical because of stability problems, climatic conditions, land use, or equipment traffic.

CRITERIA

Capacity. The underground outlet shall be designed, alone or in combination with other practices, with adequate capacity to insure that the terrace, diversion, water and sediment control basin, or other practices function according to the standard for the specific practice. For example, an underground outlet can be used in combination with a grassed waterway or a surface drain to carry part of the design flow. 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. Blind inlets can be used where they are effective. Collection boxes must be large enough to facilitate maintenance and cleaning operations. The inlet must have an appropriate trash guard to insure that trash or other debris entering the inlet passes through the conduit without plugging. It must also have an animal guard to prevent the entry of rodents or other animals.

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.

Hydraulics. 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 ASTM standard. All materials specified in NRCS Conservation Practice Standard Code 606 - Subsurface Drains can be used for underground outlets. Conduits, however, can be perforated or nonperforated, depending on the design requirements. A filter fabric wrap (sock) or equivalent shall be used if migration of soil particles around conduit is anticipated. All exposed plastic materials shall be protected from degradation due to exposure to sunlight.

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 a 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 to allow passage of debris. Where possible, outlets should be placed so that water moves through at least 50 ft. of vegetative filter after discharge from the pipe.

Protection. All disturbed areas shall be reshaped and regraded so that they blend with the surrounding land features and conditions. Visual resources must be given the same consideration as other design features. 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.

CONSIDERATIONS

Consider effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.

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

Evaluate 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 watercourses.

Consider effects on wetlands or water-related wildlife habitats.

Evaluate 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 the use of stilling wells (bubbling outlet) to reduce velocities and minimize erosion at the pipe outlet.

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.

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

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

CONSTRUCTION SPECIFICATIONS FOR UNDERGROUND OUTLET

Scope

This work shall consist of excavating, shaping, filling, and installing conduit and appurtenances to the lines and grades shown in the plans or as staked in the field and in accordance with recommendations of the manufacturer. Construction operations shall be done in such a manner that erosion, water, air, and noise pollution will be minimized and held within limits as established by state regulations.

General

The installing contractor shall certify that his installation complies with the requirements of these specifications, and shall name the source and quality of materials used.

Materials

All conduits and other materials used for underground outlets shall be satisfactory for intended use and shall meet the applicable material specifications and requirements.

Inspection and Handling of Materials

Material for underground outlets shall be given a careful inspection before installation. Where applicable, clay and concrete tile shall be checked for damage from freezing and thawing prior to installation. Plastic pipe and tubing shall be protected from hazards 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 replaced and retained sections. All material shall be satisfactory for its intended use and shall meet applicable specifications and requirements.

Specifications for Materials

All materials currently acceptable for installation as underground outlets shall meet the requirements of 606 Subsurface Drains. Large diameter corrugated polyethylene plastic tubing

and fittings (10", 12", and 15" diameter) will be allowed when all heavy-duty requirements in ASTM F405 are met.

Materials for stilling basin outlets shall be durable, corrosion resistant, fire resistant and suitable for the site, climatic and other controlling conditions. Acceptable materials include Reinforced Concrete (ASTM C-76), 14 gauge corrugated aluminum, 16 gauge corrugated steel, 1/4 inch welded steel, and cast in place reinforced concrete. Plastic pipe is not acceptable for vertical section of stilling wells.

Placement

The conduit of all underground outlets shall be laid to line and grade and bedded and backfilled with approved material to the ground surface as shown in the drawing or as described in the specification for the job. No reversals in grade of conduit will be permitted. 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. When completed, the conduit shall be at least 2 inches from rock. All outlet conduits will be installed with a minimum of 2 feet of soil cover.

Flexible conduits such as plastic pipe or tubing shall be installed in accordance with ASTM F449, "Standard Recommended Practice for Subsurface Installation of Corrugated Thermoplastic Tubing for Agricultural Drainage or Water Table Control."

Earth backfill material shall be placed in the trench in such a manner that displacement of the conduit will not occur and the backfilling will meet the requirements of the plans and specifications. The backfill should be mechanically compacted to insure that underground outlets located under terraces or diversion ridges do not fail. The terrace or diversion ridges constructed across gullies or depressions and over underground outlets shall be compacted by machinery travel

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or other means sufficient to insure proper functioning of the terrace and underground outlet. The surface of the finished terrace, diversion, or other structure shall be reasonably smooth and accommodate ordinary farm equipment. Storage terraces will be constructed with a minimum of 0.25 feet of settlement and 0.25 feet of freeboard.

Auxiliary Structures

Auxiliary structures will be installed at the location and to dimensions, line, and grades shown on the plans. A minimum of ten feet of rigid pipe without joints or perforations shall be used at the outlet end of the line. A flap gate or another specified type of animal guard will be installed. The rigid pipe is not required when a deep well outlet is used.

Construction

Construction will normally begin at the outlet end and proceed upstream. When the conduit is placed, inspected, and checked, suitable joint protection material will be placed over joints and the fill on the sides of conduit will be tamped to retain alignment. As soon as possible, the work area shall be restored to former conditions or as required in the plans and specifications for the job. Vegetation or other protective measures shall be established promptly.

Maintenance

A maintenance program will be followed by the landowner or landuser to ensure a useful life for underground outlet systems. Many systems fail because of neglect of the drain and outlet. Emphasis will be placed on control measures to keep sediment from entering the system, the outlet free of obstructions, erosion; and protection against destruction by equipment, animals, and fire.