NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

DIVERSION

(Ft.)

CODE 362

DEFINITION

A channel constructed across the slope generally with a supporting ridge on the lower side.

PURPOSE

This practice may be applied as part of a resource management system to support one or more of the following purposes.

- Break up concentrations of water on long slopes, on undulating land surfaces, and on land that is generally considered too flat or irregular for terracing.
- Divert water away from farmsteads, agricultural lands, agricultural waste systems, and other improvements.
- Collect or direct water for water-spreading or water-harvesting systems.
- Increase or decrease the drainage area above ponds.
- Protect terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above.
- Intercept surface and shallow subsurface flow.
- Reduce runoff damages from upland runoff.
- Reduce erosion and runoff on urban or developing areas and at construction or mining sites.
- Divert water away from active gullies or critically eroding areas.
- Supplement water management on conservation cropping or stripcropping systems.

CONDITIONS WHERE PRACTICE APPLIES

This applies to all cropland and other land uses where surface runoff water control and or management is needed. It also applies where soils and topography are such that the diversion can be constructed and a suitable outlet is available or can be provided.

CRITERIA

Capacity Diversions as temporary measures, with an expected life span of less than 2 years, shall have a minimum capacity for the peak discharge from the 2-year frequency, 24-hour duration storm.

Diversions that protect agricultural land shall have a minimum capacity for the peak discharge from a 10-year frequency, 24 -hour duration storm. Freeboard shall not be less than 0.3 feet.

Diversions designed to protect areas such as urban areas, buildings, roads, and animal waste management systems shall have a minimum capacity for the peak discharge from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour duration storm. Freeboard shall be not less than 0.3 ft.

Design depth is the channel storm flow depth plus freeboard, where required.

The design capacity of the diversion shall be based on SCS-TP-61, "Handbook of Channel Design for Soil and Water Conservation" or other similar design procedures. Capacities for the diversion channels are shown in the Engineering Field Handbook (EFH), Chapter 9.

The diversion shall be divided into design reaches to meet changes in drainage area, cross-section, or grade.

Cross Section The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes. The steepest constructed slope of a vegetated front or back ridge slope is 2 (H): 1(V) or flatter. Farmable ridge and cut slope must be 5(H): 1(V) or flatter.

The ridge shall have a minimum top width of 4 feet at the design depth. The ridge height shall include a settlement factor of 0.1 times the ridge height or 0.5 feet, whichever is greater.

The ridge top width may be 3 feet at the design depth for diversions with less than 10 acres drainage area above cropland, pastureland, or woodland.

The top of the constructed ridge at any point shall not be lower than the design depth plus the specified overfill for settlement.

The minimum cross-section shall meet the specified dimensions. Where a diversion crosses a gully or swale and the settled fill height is 8 feet or more or when the total storage is 2 AC-FT or more, this section shall meet the requirements of Practice Standard 378, Pond.

The design depth at culvert crossings shall be the culvert headwater depth for the design storm plus freeboard.

Grade and Velocity Channel grades may be uniform or variable. Channel velocity shall not exceed that considered non-erosive for the soil and planned vegetation or lining.

Maximum channel velocities for permanently vegetated channels shall not exceed those recommended in the NRCS Engineering Field Handbook (EFH) Part 650, Chapter 7, or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels.

When the capacity is determined by the formula Q = A V and the V is calculated by using Manning's equation, the highest expected value of "n" shall be used.

Care shall be taken in design at breaks in grade, changes in alignment, intersections with other channels and on curves for impacts on channel capacity and velocity.

Location The outlet conditions, topography, land use, cultural operations, cultural resources, and soil type shall determine the location of the diversion.

If a series of diversions is needed down a slope, consider slope length and land use in determining diversion spacing. Diversions in cultivated fields must be aligned to permit use of modern farming equipment.

When diversions are used to intercept subsurface flow or seepage, they should be located using information from exploration borings to determine the location/elevations of the water-bearing strata. Their locations, spacing and depth will be based on the location of the seepage outcrop(s). Where prolonged seepage will prevent the establishment of vegetation, a subsurface drain will be installed parallel to the diversion.

Where a subsurface drain is used along with the diversion in order to establish and maintain satisfactory vegetative cover, the design, materials, and installation procedures will conform to Subsurface Drain-Standard 606. The grade of the subsurface drain shall be at least 1 foot below the grade of the diversion and offset from the diversion centerline at least ¼ the design top width.

Protection Against Sedimentation Diversions normally should not be used below high sediment producing areas. When they are, a practice or combination of practices needed to prevent damaging accumulations of sediment in the channel shall be installed. This may include practices such as land treatment erosion control practices, cultural or tillage practices, vegetated filter strip, or structural measures. Install practices in conjunction with or before the diversion construction.

If movement of sediment into the channel is a problem, the design shall include extra capacity for sediment or periodic removal as outlined in the operation and maintenance plan.

Outlets Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a lined waterway, a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, a sediment basin, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed and established before diversion construction to insure establishment of vegetative cover in the outlet channel.

The release rate of an under ground outlet, when combined with storage, shall be such that the design storm runoff will not overtop the diversion ridge. The underground outlet shall meet the requirements for Underground Outlet (620) and/or for Subsurface Drains (606). Conduits must be buried deep enough to prevent damage from tillage equipment. Compaction effort is required where the conduit passes under the diversion ridge.

The design depth of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

State water laws shall be adhered to in the diversion and disposal of drainage water.

Vegetation Disturbed areas that are not to be cultivated shall be seeded as soon as practicable after construction. Topsoiling may be necessary to facilitate revegetation. Critical Area Planting (342) standards and specifications will be followed for seedbed preparation, fertilization, and mulching.

Lining If the soils or climatic conditions preclude the use of vegetation for erosion protection, non-vegetative linings such as gravel, rock riprap, cellular block, or other approved manufactured lining systems may be used.

CONSIDERATIONS

A diversion in a cultivated field should be aligned and spaced from other structures or practices to permit use of modern farming equipment. The side slope lengths should sized to fit equipment widths when cropped.

At non-cropland sites, consider planting native vegetation in areas disturbed due to construction.

Maximize wetland functions and values with the diversion design. Minimize adverse effects to existing functions and values. Diversion of upland water to prevent entry into a wetland may convert a wetland by changing the hydrology. Any construction activities should minimize disturbance to wildlife habitat. Opportunities should be explored to restore and improve wildlife habitat, including habitat for threatened, endangered, and other species of concern.

On landforms where archeological sites are likely to occur, use techniques to maximize identification of such sites prior to planning, design, and construction.

PLANS AND SPECIFICATIONS

Plans and specification for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be prepared for use by the client. The plan shall include specific instructions for maintaining diversion capacity, storage, ridge height, and outlets.

The minimum requirements to be addressed in the operation and maintenance plan are:

1. Provide periodic inspections, especially immediately following significant storms.
2. Promptly repair or replace damaged components of the diversion as necessary.
3. Maintain diversion capacity, ridge height, and outlet elevations especially if high sediment yielding areas are in the drainage area above the diversion. Establish necessary clean-out requirements.
4. Each inlet for underground outlets must be kept clean and sediment buildup redistributed so that the inlet is at the lowest point. Inlets damaged by farm machinery must be replaced or repaired immediately.
5. Redistribute sediment as necessary to maintain the capacity of the diversion.

6. Vegetation shall be maintained and trees and brush controlled by hand, chemical and/or mechanical means. The ridge shall be kept free of weeds, shrubs, trees, and burrowing animals.

7. Keep machinery away from steep sloped ridges. Keep equipment operators informed of all potential hazards.

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SCOPE

The work shall consist of all excavating, filling, shaping, and seeding necessary for the construction of the diversion(s) as shown on the plans. Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized and held within legal limits.

The completed job shall present a workmanlike appearance and shall conform to the lines, grades and elevations shown on the drawings or as staked in the field.

All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used.

SITE PREPARATION

All trees, brush, stumps, rubbish and other unsuitable material shall be removed from the site. Disposal method and site(s) will be shown on the plans.

Construction methods that enhance wildlife habitat shall be used where practical. Trees, stumps, and brush removed from the construction area may be piled for wildlife habitat when approved by the landowner.

EARTH FILL

After the site preparation has been completed, all gullies, ditches within the diversion channel and supporting ridge, which are below the design grade will be filled. Unless otherwise specified, all fill material will be obtained from within the diversion cross section and shall be free from brush, roots, sod, frozen soil, and rocks in excess of 6 inches. Fill will be placed in approximately uniform layers of not more than 9 inches in thickness, and each layer will be compacted by routing the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by not less than one tread track of the equipment. The fill material shall have adequate moisture so that when kneaded in the hand, it will form a ball that does not readily separate. Fill material that is too dry shall have water added or work shall be stopped until moisture conditions are satisfactory.

EXCAVATION

The diversion channel will be excavated to the dimensions shown on the plans. Unless otherwise specified, all excavated material will be used for earth fill to construct the supporting ridge of the diversion. When topsoiling is specified the diversion channel will be excavated 4 inches below the design dimensions. Excess excavated material will be disposed of on the downhill side of the supporting ridge and spread in such a manner that it will not adversely affect tillage operations.

TOPSOIL

When specified on the plan, topsoil from the construction area will be preserved by stockpiling. After all excavation is complete, topsoil shall be uniformly spread over the diversion channel and supporting ridge to a uniform depth of at least 4 inches.

VEGETATIVE TREATMENT

A seedbed shall be prepared by loosening the soil to a depth of 2 to 4 inches and smoothed as required to meet the design cross section. Unsuitable material that will interfere with seeding and maintenance shall be removed and disposed of. Stabilizing crop, seed, fertilizer, lime, mulch, and other requirements will be of the type and rates specified on the plans.

UNDERGROUND CONDUITS

If underground conduits are located under diversion ridges, mechanical compaction or installation and backfill of conduit trenches shall be made in advance to allow adequate settlement. The materials used for the inlet and conduit shall be suitable for the purpose intended and must meet the requirements of Subsurface Drains (606).