CONSERVATION PRACTICE STANDARD

DIVERSION

Code 362

(Ft.)

DEFINITION

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

PURPOSE

This practice may be applied 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 waste systems, and other improvements.
- Collect or direct water for storage, water-spreading, or water-harvesting systems.
- 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 strip cropping systems.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where surface runoff water control and management are needed, and 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, will be designed for a minimum capacity for the peak discharge from the 2-year frequency, 24-hour-duration storm.

Diversions that protect agricultural land and those that are part of a pollution abatement system must have a minimum capacity for the peak discharge from a 10-year frequency, 24-hour-duration storm.

Diversions designed to protect areas such as urban areas, buildings, roads, and animal waste management systems require 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.

Design temporary diversions with less than a 2 year life span in accordance with the current version of the Maryland Standards and Specifications for Soil Erosion and Sediment Control.
Design depth is the channel storm-flow depth plus freeboard. Freeboard minimum depth is 0.3 ft.

**Cross Section**
The channel may be parabolic, V-shaped, or trapezoidal. The diversion side slopes are based on stability and access requirements for maintenance.

The minimum top width of the supporting ridge is 4 feet except for diversions with less than 10 acres of drainage area above cropland, pastureland, or woodland, where the minimum top width of the supporting ridge may be 3 feet.

The top of the constructed ridge at any point must not be lower than the design depth plus a minimum of 10% for settlement.

The diversion design depth at a culvert crossing must equal the headwater depth for the culvert design storm plus freeboard.

Prepare the base area of the diversion to create a good bond between the foundation and the embankment. Remove sod and topsoil from the base area and stockpile to spread on the constructed diversion. Excavate all dead furrows, gullies, and other depressions on no steeper than 1:1 slopes and fill appropriately.

**Channel Stability and Capacity**
Channel grades may be uniform or variable. Determine minimum depth and width requirements for channel stability by using the procedures in the National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 9, Diversions; or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels (Sept. 1987); or other equivalent methods. The ARS handbook can be found on the USDA National Agricultural Library Digital Collections Web site.

When a retardance class method is used to determine capacity \(Q\) of the diversion by the relationship

\[Q = VA,\]

and, the velocity \(V\) is calculated by using Manning's Equation; use the highest expected value of Manning's "n", which represents the flow retardance due to the height, density and type of vegetation.

If a permanent geotextile lining is used for stability, velocities may not exceed 8 ft/sec. Follow the manufacturer’s recommendations for design and installation of the geotextile lining.

Utilize surface type inlets and subsurface drains to control permanent, intermittent, or trickle flow of water usually caused by springs or uncontrolled upstream drainage areas that lasts for more than 72 hours after a storm event.

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

If movement of sediment into the channel is a problem, include extra capacity for sediment accumulation in the design and instructions for periodic removal 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, 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. Install vegetative outlets before diversion construction to insure establishment of stable vegetative cover in the outlet channel.

When using an Underground Outlet, Maryland conservation practice standard MD-620, the diversion ridge must contain the design storm runoff combined with an underground outlet release rate to protect from overtopping. To prevent the diversion from overtopping, the designed outflow capacity of the outlet(s) must be achieved at, or below, the design depth of the diversion at their junction.

**Vegetative Establishment**
Vegetate diversions according to Maryland Conservation Practice Standard (CPS) for Critical Area Planting, MD-342. Select species suited to the site conditions and intended uses. Use plant species that exhibit the capacity to achieve adequate density, height, and vigor within an appropriate time frame to stabilize the diversion. Establish vegetation as soon as conditions permit.

Prepare, smooth and finish the entire diversion cross section in such a manner that farm equipment can appropriately prepare a seed bed.

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

Design diversion channel liners in accordance with Maryland CSP Lined Waterway or Outlet MD-468.

**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 be sized to fit equipment widths when cropped.

At noncropland sites, consider planting native vegetation in areas disturbed due to the diversion construction.

Diversion of upland water to prevent entry into a wetland may convert a wetland by changing the hydrology. In analyzing downslope impacts, minimize adverse effects to existing wetland functions and values. Similarly consider how to maximize wetland functions and values with the diversion design.

Provide construction inspection to ensure that the top of the constructed ridge at any point meets the design depth plus the specified overfill for settlement.

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.

For vegetated diversions, avoid areas where unsuitable subsurface, subsoil, substratum material that limits plant growth such as salts, acidity, root restrictions, etc., may be exposed during implementation of the practice. Where these areas cannot be avoided, seek recommendations from a soil scientist for improving the condition or, if not feasible, consider stock piling the topsoil, over excavating the diversion and replace the topsoil over the excavated area to facilitate vegetative establishment.

Construction should be scheduled so that completion occurs during periods suitable for establishment of vegetation. Avoid locating diversions in wooded areas or other areas where establishment and maintenance of vegetation would be difficult.
For additional protection of high value properties, such as buildings, consider designing for a higher frequency storm.

Provide for livestock and vehicular crossings as necessary to prevent damage to vegetation.

Consider filter strips or vegetative buffers on each side of the diversion to improve water quality and/or wildlife habitat.

Consider the potential for uncovering or redistributing toxic materials or minimally productive soils that might cause undesirable effects on plants, animals, or water.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for diversions that describe the requirements for applying the practice according to this standard. As a minimum, the plans and specifications must include—

- A plan view of the layout of the diversion including known utilities and Maryland Miss Utility one call system requirements.
- Typical cross sections of the diversion(s).
- Profile(s) of the diversion(s) that include both the channel bottom and supporting ridge top.
- Disposal requirements for excess soil material.
- Vegetative establishment requirements.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for use by the client. Include specific instructions for maintaining diversion capacity, storage of runoff water, ridge height, and outlets in the plan.

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

- Provide annual inspections and immediately following significant storm events.
- Promptly repair or replace damaged components of the diversion.
- Maintain diversion capacity, ridge height, and outlet elevations especially if high sediment-yielding regions are in the drainage area above the diversion. Establish necessary clean-out requirements.
- Each inlet for underground outlets must be kept clean and sediment buildup redistributed so that the inlet is at the lowest point. Replace or repair Inlets damaged by farm machinery immediately.
- Redistribute sediment as necessary to maintain the capacity of the diversion.
- Maintain vegetation and trees and control brush by hand, chemical, and mechanical means. Maintenance of vegetation will be scheduled outside of the primary nesting season for grassland birds.
- Control pests that will interfere with the timely establishment of vegetation.
- Keep machinery away from steep-sloped ridges. Keep equipment operators informed of all potential hazards.
- Minimize damage to vegetation by excluding livestock or by only allowing controlled grazing.
- Provide a fertilizer recommendations. Minimally apply ½ of the fertilizer used during seeding preparation annually to maintain a vigorous sod.
- Provide a mowing schedule and control noxious weeds as required by state law. Avoid mowing during nesting seasons, April 15th to August 15th.
- Do not use as a field road.
- Avoid spraying herbicides during crop applications and avoid herbicide runoff by applying at appropriate times only.
- Diversion ridges can be hazardous for farming operations or mowing. Care must be exercised when operating on diversion slopes to avoid equipment upset.

REFERENCES

USDA, NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chapters 2 & 9,

USDA, Natural Resources Conservation Service, Maryland Field Office Technical Guide, Section IV, Standards and Specifications.


USDA Natural Resources Conservation Service, National Handbook of Conservation Practices.

Maryland Department of Transportation, State Highway Administration, Standard Specifications for Construction and Materials, Baltimore, Maryland, 2008.