Diversion (Ft.) 362

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 stripcropping systems.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where surface runoff water control and/or 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

Diversions shall be planned, designed, and constructed to comply with all federal, state, local, and tribal laws, rules, or regulations.

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.

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. The design storm shall not be less than that required in specified regulations. Freeboard shall be not less than 0.3 feet.

Design depth is the channel storm flow depth plus freeboard.

Cross Section. The channel may be parabolic, V-shaped, or trapezoidal.

The diversion shall be designed to have stable side slopes not to be steeper than 2H:1V. Side slopes shall also be designed to accommodate the equipment anticipated to be used for maintenance and tillage/harvesting that will cross the diversion.

The ridge shall have a minimum top width of 4 feet at the design depth *with the following exception: The ridge top width may be 3 feet at design depth for diversions with less than 10 acres of drainage area above cropland, pastureland, or woodland.*

The fill height shall include a settlement factor of not less than five percent.

Topsoil if needed for vegetative establishment.

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

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

Stability and Capacity. Channel grades may be uniform or variable. Channel velocity shall be non-erosive for the soil and planned vegetation or lining.

Design velocities shall be from 1.5 to 4.5 feet/sec. or those obtained by using the procedures, "n" values, and recommendations in the NRCS Engineering Field Handbook (EFH), Part 650, Chapter 9; whichever is less. Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels may be used in place of NRCS EFH, Chapter 9. Maximum velocities shall be determined using a retardance of "D" or less. See Michigan Supplement Tables 9-1.1 and 9-1.2 in NRCS EFH, Part 650, Chapter 9.

When a retardance class method is used to determine capacity by the equation

Q =AV,

and the velocity (V) is calculated by using Manning's equation, the highest expected value of "n" shall be used.

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

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 with or before the diversions. 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 ensure establishment of vegetative cover in the outlet channel.

The release rate of an underground outlet, when combined with storage, shall be such that the design storm runoff will not overtop the diversion ridge.

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. *Diversions shall be vegetated according to NRCS Conservation Practice Standard Critical Area Planting (342). Species selected shall be suited to the site conditions and intended uses. Selected species will have the capacity to achieve adequate density, height, and vigor within an appropriate time frame to stabilize the diversion.*

Disturbed areas that are not to be cultivated shall be seeded as soon as practicable after construction.

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used. Refer to FOTG Section II, Invasive Plant Species for plant materials identified as invasive species.

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.

Liners shall be designed in accordance with NRCS Conservation Practice Standard Lined Waterway or Outlet (468).

CONSIDERATIONS

Consider the potential effects of installation and operation on cultural, historical, archeological, or scientific resources at or near the site need to be considered in planning.

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 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 wetland functions and values. Diversion of

upland water to prevent entry into a wetland may convert a wetland by changing the hydrology.

Consider planning construction activities to 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 ameliorating the condition or, if not feasible consider stock piling the topsoil, over-cutting the diversion and replace the topsoil over the cut area to facilitate vegetative establishment.

Use supplemental irrigation as necessary to promote establishment of vegetation.

Provide livestock and vehicular crossings as necessary to prevent damage to the diversion and its vegetation.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Support data documentation requirements are as follows:

- Inventory and evaluation records
  - CONS-6 notes or special report
- Survey notes, where applicable
  - Design survey
  - Construction layout survey
  - Construction check survey
- Design records
  - Physical data, functional requirements, and site constraints, where applicable
  - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
  - Location map
  - "Designed by" and "Checked by" names or initials
  - Approval signature
  - Job class designation
  - Initials from preconstruction conference
  - As-built notes
- Construction inspection records
  - CONS-6 notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.

REFERENCES

USDA, ARS. 1987. Stability design of grass-lined open channels. Agriculture Handbook 667.

USDA, NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chap. 9, Diversions