USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

DIVERSION

CODE 362
(Reported by Ft.)

DEFINITION

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

PURPOSES

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

1. 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;
2. Divert water away from farmsteads, agricultural waste systems, and other improvements;
3. Collect or direct water for water-spreading or water-harvesting systems;
4. Increase or decrease the drainage area above ponds;
5. Protect terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above;
6. Intercept surface and shallow subsurface flow;
7. Reduce runoff damages from upland runoff;
8. Reduce erosion and runoff on urban or developing areas and at construction or mining sites;
9. Divert water away from active gullies or critically eroding areas;
10. 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.

CONSIDERATIONS

Consider the impacts of construction on water quality and quantity such as:

Water Quantity

1. Effects on the components of the water budget, especially on volumes and rates of runoff.

Water Quality

1. Effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances carried by runoff;
2. Short-term and construction-related effects on downstream water resources.

Construction should be scheduled so that completion occurs during periods suitable for the establishment of vegetation. Avoid locating diversions in wooded or other areas where establishment and maintenance of adequate vegetative cover will be difficult.

For additional protection of high value property such as buildings, consider higher frequency design storms.

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

Consider establishing filter strips on each side of the diversion to improve water quality and

adding a vegetative buffer to the sides of the waterway for wildlife habitat.

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

CRITERIA

General Criteria

Diversions shall not be substituted for terraces on land requiring terracing for erosion control.

Permanent diversions shall not be used below high sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channel are installed with or before the diversions.

The design for capacity and stability may be calculated by Manning's equation by taking into consideration the degrees of retardance of various vegetal covers as well as the principle that the retardance to flow varies with the product of the velocity and the hydraulic radius. Designs will normally be based on retardance "D" for stability and permissible velocity and retardance "C" for capacity (top width and depth). Any deviation will be in accordance with Table 9-1, Engineering Field Handbook. Design procedures are outlined in detail in Chapter 9, Diversions, Engineering Field Handbook.

Capacity

The diversion practice shall comply with all federal, state, and local laws, rules or regulations governing diversions. The landowner is responsible for securing required permits.

Diversions protecting agricultural land and those that are part of a pollution abatement system must have the capacity to carry the peak runoff from a 10-year, 24-hour duration storm as a minimum.

Diversions designed to protect waste management systems, urban areas, buildings and roads, and those designed to function in connection with other structures shall have enough capacity to carry the peak runoff expected from a storm frequency consistent with the hazard involved but not less than a 25-year, 24-hour duration storm.

Diversions as temporary measures with a life span of less than two years shall be designed in accordance with 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control.

Diversions that are needed, as part of a plan to divert a stream shall meet the temporary stream diversion criteria contained in the Maryland Guidelines to Waterway Construction.

The design depth of the diversion shall be the channel storm flow depth plus 0.3 feet of freeboard.

Cross Section

The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes.

The ridge height shall include a minimum of 10 percent for settlement. The ridge shall have a minimum top width of 4 feet at the design elevation. The minimum cross section shall meet the specified dimensions. The top of the constructed ridge shall not be lower at any point than the design elevation plus the specified overfill for settlement.

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

Grade and Velocity

Maximum channel velocities for permanently vegetated channels shall not exceed those recommended in Table 9-1 of the NRCS Engineering Field Handbook (EFH) Part 650, Chapter 9.

The allowable velocity for the particular soil type and vegetal cover will determine the maximum grade for a given diversion cross-section, except that the velocity shall not exceed 6 feet per second. Velocities may be increased but may not exceed 8 feet per second with use of a permanent geotextile lining. Design and installation of geotextile shall follow manufacturer's

recommendations. Sufficient grade will be established or supplemental subsurface drains provided for removal of seep water between intervals of surface runoff.

Location

Outlet conditions, topography, land use, cultural operations, soil type and length of slope shall determine diversion location. Diversions should be parallel or have the best alignment possible. In a cultivated field they must be aligned to permit use of modern farming equipment. In determining diversion location, consideration shall be given to the effects caused by changing natural watercourses and putting additional flow into a watercourse.

When diversions are used to intercept subsurface flow or seepage, they shall be located using information from soil borings locating the water bearing material and the slowly permeable layer. The diversions shall be cut at least three (3) inches into the slowly permeable layer.

Outlet

Each diversion must have an adequate, stable outlet. The outlet may be a grassed, stone center or lined waterway; a vegetated or paved area; a grade stabilization structure; a storm sewer; a stable watercourse; an underground outlet; a sediment basin, or a combination of these practices.

The outlet, in all cases, must be stable for the design storm, and convey runoff to a point it will not cause damage. Vegetative outlets must be established prior to diversion construction if needed to ensure establishment of protective vegetative covers in the outlet channel.

Underground outlets in combination with temporary flood storage must have sufficient capacity to handle the design storm volume and provide the freeboard required. Underground outlets shall meet the requirements of the Maryland conservation practice standard, for Underground Outlet, code 620.

Protection and Sedimentation

If the movement of sediment into the channel during the planned life of a diversion is a significant problem, then, one or more of the following measures shall be used, as appropriate:

Land treatment measures shall be used to stabilize the source of sediment, or,

Structural measures shall be installed to trap the sediment.

A filter strip of close growing grass shall be installed and maintained immediately above the diversion channel. The filter strip shall meet the requirements of Maryland conservation practice standard, Filter Strip, code 393.

Vegetation

Disturbed areas that are not to be farmed shall be established to cover as soon as practicable after construction. Seedbed preparation, liming, fertilizing, seeding and mulching shall be in accordance with the Maryland conservation practice standard, for Critical Area Planting, code 342

Lining

If the soils or climate conditions preclude the use of vegetation and protection is needed, non-vegetative linings, such as gravel, small rock riprap, cellular block, or special materials shall be used in accordance with Maryland conservation practice standard, for Lined Waterway or Outlet, code 468.

SPECIFICATIONS

Plans and specifications for installing diversions shall be in keeping with this standard and according to the construction specifications.

The base area for the diversion shall be prepared so that a good bond is obtained between the foundation and the embankment. Sod and topsoil shall be removed from the base area of the diversion and stockpiled. All gullies, dead furrows, and other depressions shall be filled.

The entire diversion cross section, including cut slope, channel, top and backslope, shall be smoothed and finished in such a manner that normal farm equipment can operate on it to prepare a seed bed.

Topsoil shall be stockpiled and spread over excavations and other areas to facilitate revegetation.

OPERATION AND MAINTENANCE

A maintenance program shall be established to maintain the diversion capacity, vegetative cover, and outlet stability. Vegetation damaged by machinery, herbicides, or erosion must be repaired promptly.

A written operation and maintenance plan shall be provided to and reviewed with the landowner. The plan shall include the following items and others as appropriate:

1. Inspect for damage at least once a year and after major storms for damage. Fill in and seed any bare or washed areas following original seeding specifications;
2. If diversions are not fertilized at the same time that the surrounding cropland is fertilized, a maintenance application should be made. Apply-one half the amount of fertilizer used during vegetation establishment as needed to maintain a vigorous sod;
3. Minimize damage to vegetation by excluding livestock or by only allowing controlled grazing;
4. Remove sediment deposits to maintain capacity;
5. Mow or periodically graze vegetation to encourage dense vigorous growth and to maintain capacity. Control noxious weeds as required by state law;
6. Do not use as a field road;
7. Avoid spraying with herbicides during crop applications and herbicide runoff into the diversion;
8. To enhance wildlife values, avoid mowing the diversion during the peak nesting season (April 15 to August 15);
9. Diversion ridges can be hazardous for farming operations or mowing. Care must be exercised when operating on slopes of the diversion to avoid equipment upset.

SUPPORTING DATA AND DOCUMENTATION

Field Data and Survey Notes

Record on survey note paper, SCS-ENG-28 & 29, the following minimum data:

1. Plan view sketch of system layout;
2. Field slope;
3. Grade of each design reach;
4. Length of each reach and total length;
5. Type and location of outlet, special protection if needed;
6. Cross-section (minimum or one per reach);
7. Profile and cross-section of outlet and, special protection if needed.

Design Data

Record on appropriate engineering paper. For guidance on the preparation of engineering plans see Chapter 5 of the EFH, Part 650. The following is a list of the minimum required design data:

1. Locate practice on farm plan map in case file;
2. Plan view including, location map, all system components, profile of diversion, cross section of each design reach, material and construction specifications;
3. Determine soil type, and any special restrictions. Provide all soil loss calculations;
4. Determine peak runoff from the contributing drainage area for the required design storm in accordance with Chapter 2, Engineering Field Handbook, Part 650 or by other approved method;
5. Design for each reach in accordance with Chapter 9, EFH, Part 650, or other source;
6. Show job class on plan;
7. Quantities estimate;
8. Details of outlet protection or other structural components needed;
9. Planting plan. This must meet the criteria, specifications, and documentation requirements of the Maryland conservation practice standard for Critical Area Planting, code 342. Show on plan.

Construction Check Data/ As-Built

Record on survey notepaper, SCS-ENG-28, or other appropriate engineering paper. Survey data will be plotted on plans in red. The following is a list of minimum data needed for As-builts:

1. Documentation of site visits on CPA-6. The documentation shall include the date, who performed the inspection, specifies as to what was inspected, all alternatives discussed, and decisions made and by whom;
2. Check notes recorded during or after completion of construction showing profile of ridge at 100-foot intervals, grade, cross section of constructed reaches and outlets including length, width and depth;
3. Calculate acreage;
4. Statement on seeding and fencing (when required);
5. Final quantities and documentation for quantity changes, and materials certification;
6. Sign and date check notes and plans by someone with appropriate approval authority. Include statement that practice meets or exceeds plans and NRCS practice standards.

REFERENCES

1. USDA, Natural Resources Conservation Service, Maryland Field Office Technical Guide, Section IV, Standards and Specifications.
2. USDA Natural Resources Conservation Service, *National Engineering Handbook*, Part 650 Chapters 2, and 9.
3. USDA, Natural Resources Conservation Service, *National Engineering Handbook, Part 633*, Gradation Design of Sand and Gravel Filters, Chapter 26.
4. USDA Natural Resources Conservation Service, *National Handbook of Conservation Practices*.
5. USDA, Agricultural Research service, *Stability Design of Grass-lined Open Channels*, Agriculture Handbook No.667, 1987.
6. Maryland Department of Transportation, State Highway Administration, *Standard Specifications for Construction and Materials*, Baltimore, Maryland, October 1993.
7. Maryland Department of Environment, 1994 Maryland Standard and Specifications for Soil Erosion and Sediment Control.