NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

SURFACE DRAIN, MAIN OR LATERAL

(Ft.)
Code 608

DEFINITION

An open drainage ditch for moving the excess water collected by a field ditch or subsurface drain to a safe outlet.

PURPOSE

This practice is applied for one or more of the following purposes:

- To convey excess surface or shallow subsurface water from a field ditch to a safe outlet.
- To convey excess subsurface water from a subsurface drain to a safe outlet.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to ditches that receive and convey drainage water from surface and/or subsurface drains.

This standard does not apply to collection of water from the surface or subsurface of the field. Use Florida NRCS conservation practice standard (CPS) Code 607, Surface Drain, Field Ditch, or Subsurface Drain, Code 606 for that function.

CRITERIA

General Criteria Applicable to All Purposes

Evaluate and avoid or minimize impact to cultural resources, wetlands and Federal and state protected species to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

Compliance with all applicable Federal, State and local regulations and ordinances is required.

If wetlands are present then complete an appropriate wetland determination per established procedures.

Drainage requirements. Locate and design mains and laterals to serve as integral parts of a surface and/or subsurface drainage system that meets the conservation and land use needs.

Capacity. Size the ditch capacity to provide for the removal of excess water, based on climatic and soil conditions and the needs of crops. Base the design capacity of the ditch on the watershed area; the topographic, soil, and land use information; and use of the appropriate drainage curves or coefficients contained in the NRCS National Engineering Handbook (NEH) Part 650, Chapter 14, Water Management (Drainage), Appendix FL 14G.

In irrigated areas, the capacity analysis will include the effect of irrigation water deliveries, irrigation canal or ditch losses, soil stratification and permeability, deep percolation losses, field irrigation losses, subsurface drain discharge, and quantity of surface water to be carried by the drainage ditch.

Whether the outlet is by gravity flow or by pumping, design the outlet to be sufficient for the quantity and quality of water conveyed.

Protect the structural integrity and flow capacity of existing structures such as bridges or culverts within the system.

All lands to be drained shall be suitable for agriculture, after installation of required drainage and other conservation practices.

Base the design and installation on adequate surveys and investigations.

Hydraulic Grade Line. Determine the hydraulic grade line for drainage ditch design from control points, including elevations of significant low areas served by the ditch and hydraulic grade lines of any tributary ditches and the outlet. Set the hydraulic grade line of the ditch low enough to provide positive drainage into the ditch during the design flow event, plus calculated freeboard, or a minimum of 0.5 feet below the fields that will receive normal drainage.

Account for the effects of hydraulic losses caused by culverts, bridges, or other obstructions in the channel section in the design. Design culverts and bridges with sufficient hydraulic capacity and depth to satisfy drainage needs and to minimize obstruction to flow.

Depth. Design the drainage ditch deep enough to allow for normal siltation. For a ditch that serves as an outlet for subsurface drains, design for a normal water surface at or below the invert of the outlet end of the drain. The normal water surface is the elevation of the usual base flow during the growing season. Where site conditions allow, design the flow line elevation of the main or lateral to be at least 1 foot lower than the invert elevations of subsurface drains or field ditches that outlet into the main or lateral.

Cross Section. Design the ditch cross section to meet the combined requirements of capacity, limiting velocity, depth, side slopes, bottom width, and, if needed, allowances for initial sedimentation, all below the design hydraulic grade line. Design side slopes based on site conditions to be stable and meet maintenance requirements.

Where a low-flow or two-stage channel is planned, use the design process in NRCS NEH, Part 654.1005.

Use the NRCS NEH Part 650, Chapter 14, Water Management (Drainage), Appendix FL 14G or other local information to determine side slope limits for specific soils and/or geologic materials. If such information is not available, set the design side slopes in the main or lateral no steeper than those recommended for ordinary conditions in NRCS NEH, Part 650, Engineering Field Handbook, Chapter 14, Section 650.1412 (d). Account for side-slope stability during rapid drawdown conditions in the design.

Velocity. Ensure stability of the ditch bottom and side slopes. Base the maximum permissible design velocity, or maximum permissible stress, on site conditions. Avoid potential for excessive sedimentation accounting for the soils and sediment delivery amount for the particular location. Without site specific information, the minimum design velocity is 1.4 feet per second.

The velocity for newly constructed channels with drainage areas in excess of 1 square mile must meet the stability requirements specified for Florida NRCS CPS Open Channel, Code 582.

Use Manning's equation to determine the design velocity. Select Manning's n value based on channel hydraulic radius, channel alignment, an aged channel condition, and probable vegetative growth expected under normal maintenance. Unless special site studies are available to justify other values, use the appropriate Manning's n factor in NRCS NEH, Part 650, Engineering Field Handbook, Chapter 14, Section 650.1412 (d), or in the NRCS NEH Part 650, Chapter 14, Water Management (Drainage), Appendix FL 14G, to determine the required design capacity.

Berms and spoil banks. Locate adjacent berms at a safe distance from the drain and shape berm-side slopes as required to:

- provide access for maintenance equipment; eliminate the need for moving spoil banks in the future;
- provide for work areas and facilitate spoil bank spreading; prevent excavated material from washing or rolling back into ditches; and
- lessen sloughing of ditch banks caused by heavy loads near the edge of the ditch banks.

Spread spoil material as soon as practical in accordance with NRCS CPS, Spoil Spreading, Code 572.

Where spoil material is placed along the ditch rather than spread over adjacent fields, ensure that the spoil banks have stable side slopes. Make provision to convey water flows through the spoil bank and into the ditch without causing serious erosion. Maximum berm height is 3 feet above original ground. Minimum berm width is shown in Table 1.

Table 1 - Minimum berm width as a function of ditch depth

Ditch depth (ft)	Minimum berm width (ft)
<6	8
6–8	10
>8	15

Related structures and ditch protection. Protect drainage mains and laterals against erosion where surface water or shallow ditches enter deeper ditches. Use suitable measures such as chutes, drop structures, pipe drops, grassed waterways, critical area planting, filter strips, or specially graded channel entrances to minimize side inlet erosion. Use grade control structures, bank protection, or other suitable

measures if necessary to reduce velocities and control erosion. Grade control structures must meet the criteria in Florida NRCS CPS Code 410, Grade Stabilization Structure.

Protect structures from washout by flows exceeding design capacity.

Design each structure for an open -ditch system according to NRCS conservation practice standards for the kind of structure and type of construction used.

Provide a travel way if needed for movement and operation of equipment required for maintenance of the channel.

Channel vegetation. Establish vegetation according to Florida NRCS CPS Critical Area Planting, Code 342. If natural revegetation will adequately control erosion, provide documentation regarding the time for establishment of protection and needed efforts to control invasive species.

CONSIDERATIONS

When planning this practice consider—

- The use of a low-flow or two -stage channel design.
- Impacts of sedimentation downstream.
- Possible damages above or below the point of discharge that might involve legal actions or other offsite impacts.
- Potential impacts on wetlands.
- Impacts on cultural resources.
- Use of riparian buffers, filter strips, and fencing.
- Potential water quality effects of soluble pollutants and sediment-attached pollutants.
- Impacts to wildlife.
- Impacts of invasive species movement and establishment through the drainage network.
- Sizing and locating crossings to accommodate farming equipment.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for constructing the drainage main or lateral in keeping with this standard and describing the requirements for constructing the practice to achieve its intended purpose.

The owner or operator is responsible for securing all required permits or approvals and for performing in accordance with such laws and regulations. The landowner and/or contractor is responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

Plans and specification shall include, but not limited to—

- Site plan layout.
- Typical cross-sections of the main and/or lateral.
- Grade of drains.
- Spacing of drains.
- Location of drains.
- Detail of appurtenance structures including location, dimensions and elevations.
- Vegetative requirements, if applicable.

- Outlet protection if needed.
- Location of utilities and notification requirements.

OPERATION AND MAINTENANCE

Provide a site-specific operation and maintenance (O&M) plan to the landowner or operator before the practice is installed.

Include guidance in the O&M plan for the routine maintenance and operational needs of the drainage main or lateral. Include guidance on periodic inspections and post-storm inspections to detect and minimize damage to the drain. The minimum requirements to be addressed in the O&M plan are:

- Maintain cross section and gradient by controlling channel erosion and sloughing.
- Immediately remove silt deposits, obstructions, or blockage of the drainage system.
- Control the growth of vegetative materials by the use of herbicides and/or mowing. Avoid direct drainage water contact with herbicides.
- Remove all foreign debris that hinders system operation.
- Install and maintain fences to control livestock access when adjacent fields are used for pasture.
- Immediately repair any vandalism, vehicular, or livestock damage.
- Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity. (If threatened species are involved, follow policy on endangered or threatened species.)

REFERENCES

USDA NRCS National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, Water Management (Drainage).
USDA NRCS National Engineering Handbook, Part 654, Stream Restoration Design, Chapter 10, Two-Stage Channel Design.
Florida NRCS Conservation Practice Standards:
Critical Area Planting, Code 342
Grade Stabilization Structure, Code 410
Open Channel, Code 582
Spoil Spreading, Code 572
Surface Drainage, Field Ditch, Code 607
General Manual
Title 420-Part 401
Title 450-Part 401
Title 190-Parts 410.22 and 410.26
National Cultural Resources Handbook
National Environmental Compliance Handbook
National Food Security Act Manual
National Planning Procedures Handbook
Florida Supplements to Parts 600.1 and 600.6