

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

SURFACE DRAINAGE, FIELD DITCH

(ft)

CODE 607

DEFINITION

A graded ditch for collecting excess water in a field.

PURPOSES

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

- To drain surface depressions.
- Collect or intercept excess surface water, such as sheet flow, from natural and graded land surfaces or channel flow from furrows.
- Convey excess water to an outlet.
- Collect or intercept excess subsurface water and carry it to an outlet.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to drainage field ditches installed to collect and convey water from a field. It does not apply to Surface Drainage, Main or Lateral (608) or to Grassed Waterways or Outlets (412).

Applicable sites are flat or nearly flat and:

1. Have soils that are slowly permeable (low permeability) or that are shallow over barriers, such as rock or clay, which hold or prevent ready percolation of water to a deep stratum.
2. Have surface depressions or barriers that trap rainfall.
3. Have insufficient land slope for ready movement of runoff across the surface.

4. Receive excess runoff or seepage from uplands.
5. Require the removal of excess irrigation water.
6. Require control of the water table.
7. Have adequate outlets available for disposal of drainage water by gravity flow or pumping.

CRITERIA

General criteria applicable to all purposes

Drainage field ditches shall be planned as integral parts of a drainage system for the field served and shall collect and intercept water and carry it to an outlet with continuity and without ponding.

Investigations

An adequate investigation shall be made of all sites.

Location

Ditches shall be established recognizing topography and property boundaries, in straight or nearly straight courses. Random alignment may be used to follow depressions and isolated wet areas of irregular or undulating topography. Excessive cuts and the creation of small irregular fields shall be avoided.

On extensive areas of uniform topography, collection or interception ditches shall be installed as required for effective drainage.

Design

The size, depth, side slopes, and cross section area shall:

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1. Be adequate to provide the required drainage for the site.
 2. Permit free entry of water from adjacent land surfaces without causing excessive erosion.
 3. Provide effective disposal or reuse of excess irrigation water (if applicable).
 4. Conduct flow without causing excessive erosion.
 5. Provide stable side slopes based on soil characteristics.
 6. Permit crossing by field equipment if feasible. Culverts or other facilities can be used where needed.
1. Permit construction and maintenance with available equipment.

Capacity

For design capacity, the value of Manning's "n" shall be selected according to the materials in which the ditch is constructed, the alignment and hydraulic radius, and additional retardance because of vegetation.

Improved irrigation water management to decrease the rate and volume of surface runoff on surface irrigated land shall also be considered.

Velocities

Field ditches shall be designed to develop velocities that are non-erosive for the soil materials through which they pass.

Local information on velocity limits, as approved by the NRCS State Conservation Engineer shall be used if available. If such information is not available, maximum design velocity shall not exceed those shown in Table 1.

Surface drainage field ditches shall be designed with enough capacity to carry the required flows at velocities that will be developed under the maximum probable retardance conditions.

A Manning's "n" no greater than 0.025 shall be used for checking designs to see that velocities do not exceed permissible values.

Stability

Characteristics of a stable ditch are:

1. The surface drainage field ditch neither aggrades nor degrades beyond tolerable limits.
2. The ditch banks do not erode to the extent that the ditch cross section is changed appreciably.

Flow related stability analysis is not required if velocity is 2 ft/s or less.

For newly constructed ditches in fine-grained soils and sands, Manning's "n" values shall be determined according to procedures in Chapter 6 of National Engineering Technical Release TR-25, and shall not exceed 0.025.

Related structures

Erosion, water control structures, culverts, diversions, or other related structures needed to supplement the surface drainage field ditch shall be designed and installed to meet NRCS standards for the particular structure and type of construction.

CONSIDERATIONS

Water Quantity

1. Effects on water budget components, especially relationships between runoff and infiltration.
1. The effect of changes in the water table on the rooting depth for anticipated land uses.

Water Quality

1. Downstream effects of erosion and yields of sediment and sediment-attached substances.
2. Effects on the salinity of the soil in the drained field.
3. Effects on the loading of dissolved substances downstream.
4. Potential changes in downstream water temperature.
5. Effects on wetlands or other water-related wildlife habitat.

6. Effects on the visual quality of downstream watercourses.

PLANS SPECIFICATIONS

Plans and specifications for constructing drainage field ditches shall be in keeping with this standard and shall describe the requirements for properly installing the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An Operation and Maintenance plan must be prepared for use by the landowner or operator responsible for irrigation field ditches operation and maintenance. The plan should provide specific instructions for operating and maintaining the irrigation field ditches to insure it functions properly. Minimum requirements to be addressed in the Operation and Maintenance Plan are:

1. Prompt repair or replacement of damaged components is necessary
2. Remove debris and foreign material from drainage ditches and other components that hinders system operation
3. Maintain good vegetative cover on all slopes and watercourses.

List items specific to the project on the Operation and Maintenance Worksheet.

REFERENCES

USDA NRCS, National Engineering Field Handbook, Chapter 14.

USDA NRCS, Standard Drawings Handbook - Washington.

USDA NRCS, National Engineering Technical Release, Design of Open Channels, TR-25, October 1977.

Table 1 - Permissible Surface Drainage Field Ditch Velocities

	<u>Velocity after aging of ditches carrying:</u>		
	Clear water, no detritus	Water transporting colloidal silts	Water transporting non-colloidal silts, sands, gravels, or rock fragments
Original material excavated for field ditch	<u>ft/sec</u>	<u>ft/sec</u>	<u>ft/sec</u>
Fine sand (non colloidal)	1.50	2.50	1.50
Sandy loam (non-colloidal)	1.75	2.50	2.00
Silt loam (non-colloidal)	2.00	3.00	2.00
Alluvial silts when non-colloidal	2.00	3.50	2.00
Ordinary firm loam	2.50	3.50	2.25
Volcanic ash	2.50	3.50	2.00
Fine gravel	2.50	5.00	3.75
Stiff clay (very colloidal)	3.75	5.00	3.00
Graded loam to cobbles when non-colloidal	3.75	5.00	5.00
Alluvial silts when colloidal	3.75	5.00	3.00
Graded, silt to cobbles, when colloidal	4.00	5.50	5.00
Coarse gravel (non-colloidal)	4.00	6.00	6.50
Cobbles and shingles	5.00	5.50	6.50
Shales and hardpans	6.00	6.00	5.00