

NATURAL RESOURCES CONSERVATION SERVICE
DOCUMENTATION REQUIREMENTS FOR
SURFACE DRAIN, MAIN OR LATERAL

CODE 608

Planning and Investigation

Areas requiring drainage to allow or increase production of crops may be subject to the wetland compliance provisions of the [National Food Security Act Manual \(NFSAM\)](#) and the National Environmental Policy Act (NEPA) provisions in [General Manual Title 190, Section 410.26](#). A certified wetland determination should be completed in the area where the drainage is planned as part of the conservation planning process. If no wetlands exist in the planned construction area and no wetlands will be affected by the installation of the drainage system, then this should be recorded in the conservation assistance notes. If wetlands do exist, then proper mitigation measures must be followed before installing the drainage system. The agency expert providing the wetland determination can assist with the mitigation requirements for the planned practice.

Surveys

The extent of surveys and investigation required will vary depending on the size and complexity of the area to be drained. Large, relatively flat areas will require a topographic survey to determine the layout and grading of surface drains. This survey can be accomplished using a total station and data collector, global positioning system (GPS) and data collector, or a grid survey. Record and plot the survey data according to the guidance in [Chapter 1 in National Engineering Handbook Part 650 \(NEH 650\)](#), [Engineering Field Handbook](#).

[Appendix D in National Engineering Handbook Part 645 \(NEH 645\)](#), [Construction Inspection](#), provides guidance for taking and recording field survey notes for design, layout, and checkout.

Individual differences in note keeping are allowed, but the information shown in [Appendix D in NEH 645](#) shall be the minimum requirements needed for adequate note keeping. Information collected and recorded electronically shall be plotted as needed to provide the basis for quantity calculations or other design documentation. A copy of the electronic data should be kept in the electronic design folders or as part of the project case file, whichever is more applicable to the project.

For areas where the location of the ditch or ditches is known, a profile of the ditch centerline and cross sections at regular intervals will be adequate for design. Record survey data on [Form NRCS-ENG-28 and Form NRCS-ENG-29, Loose Leaf Field Sheet](#), or [Forms KS-ENG-37 and KS-ENG-37a, Field Notes](#) (or equivalent). Profile shots should be taken along the planned centerline of the ditch at every 100-foot station or closer if needed to show significant changes in land slope. Profile shots may be spaced every 200 feet if the ground is uniformly level. Cross sections should be surveyed at frequent enough intervals to provide an accurate measurement of yardage. The maximum spacing between surveyed cross sections should be 200 feet. Stationing should start at the outlet end and proceed up the drain.

At least 1 bench mark shall be established and recorded in the field notes. All surveys shall meet the accuracy standards for rough surveys in [Table 1-1 in NEH 650](#).

Design Criteria

Design in accordance with the criteria listed in [Conservation Practice Standard 608, Surface Drain, Main or Lateral](#), and [Chapter 14 in NEH 650](#).

For drainage areas of less than 100 acres, the bottom width of the ditch should be a minimum of 6 feet. For drainage areas of greater than 100 acres, use the Cypress Creek equation from [Chapter 14 in NEH 650](#). This equation is:

$$Q = CM^{0.83}$$

Where: Q = Flow in cubic feet per second (cfs)
for which the drain is to be
designed

C = Appropriate drainage curves

M = Drainage area in square miles

Use the applicable drainage curves shown in [Table 14-1 in NEH 650](#) for regions shown in [Figure 14-4 in NEH 650](#). The capacity of the ditch should be equal to or greater than the required capacity from the general equation.

Allowable velocities for bare earth channels are shown in [Table 14-3 in NEH 650](#) for various types of soil textures. The velocity in the ditch should be calculated using Manning's equation. The roughness coefficient "n" value can be estimated using [Table 14-4 in NEH 650](#).

The ditch side slopes should be designed to match the field conditions. Side slopes of 2 horizontal to 1 vertical (2:1) may be used when the ditch will not be crossed with farm machinery. Side slopes of 4:1 or flatter may be used where the ditch is crossed by field machinery but the field is farmed parallel to the ditch. Use 8:1 or flatter slopes where the ditch is farmed across or drainage enters the ditch.

Compute the excavated yardage using the average end area method or computer drafting software. End areas can be calculated using a variety of methods including hand calculation, plotting and measuring using a planimeter, or using a computer spreadsheet. [Form KS-ENG-4c, Earthwork Computation Sheet - Cut](#), and the [Earthwork Volume](#) spreadsheet can be used to determine excavated quantities from the design or construction surveys. The planned amount of excavation should be given for each ditch as well as the location for spoil placement.

Design and Plans

Develop the design in accordance with the above Design Criteria section. The drawings and specifications should be developed in accordance with [CPS 608](#), and [Chapter 14 in NEH 650](#). The number of drawings required will

be based on the complexity of the drainage system. At a minimum, the drawings should include a plan sheet showing the location of all drainage ditches and other features, profiles of the channel grade where the channels tie into other structures, typical cross sections, and adequate information on any structural items required.

Layout

Layout for construction of drainage ditches should consist of marking the centerline and cut slope toe locations with stakes or flags. Mark the cut from ground surface to the planned bottom grade on either the centerline or cut slope stakes. Reference hubs or offset stakes may be set at a distance from the cut slope toe to be out of the way during construction but close enough to be used for checking of grades during construction and at final checkout. The cut to the grade at centerline of the channel from the top of the reference hub or offset stake should be shown in the notes and marked on the stakes. Cuts should be recorded to the nearest 0.1 foot.

Checkout

Checkout will consist of checking the grade, cross section, and length of constructed ditches. Record the standard engineering notes on [Form NRCS-ENG-28 and Form NRCS-ENG-29](#), or [Forms KS-ENG-37 and KS-ENG-37a](#), (or equivalent).

The grade should be checked in the center of the ditch bottom at each station. At least 2 cross sections will be taken for each ditch, preferably near each end. The distance between cross sections will not exceed 400 feet. The measured length of each ditch will be noted in the survey notes and on the design plans.