NATURAL RESOURCES CONSERVATION SERVICE

DOCUMENTATION REQUIREMENTS FOR

UNDERGROUND OUTLET

CODE 620

General

Design and layout will be in accordance with the criteria listed in Chapter 3 in National Engineering Handbook Part 650 (NEH 650), *Engineering Field Handbook*, and the Kansas Supplement to Chapter 3 in NEH 650; Chapter 8 in NEH 650, and the Kansas Supplement to Chapter 8 in NEH 650; and Conservation Practice Standard 620, Underground Outlet. If an underground outlet is to be a component of another practice (terrace, diversion, water and sediment control basin, etc.), it shall also satisfy the applicable criteria of the other practice standard.

Layout

A profile survey of the underground outlet shall be made and recorded 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.

The survey shall contain the following information:

- Elevation and description of the bench mark. (The bench mark is usually located near the outlet.)
- Station and elevation of the outlet and the riser.
- Elevation of the natural ground above the outlet.
- Station and elevation of significant breaks in the slope between the riser and/or the outlet.

It is recommended that the distance between rod readings not exceed 200 feet.

Design

The design of an underground outlet should be completed using the Terrace (Storage) spreadsheet that includes Form KS-ENG-19, Underground Outlet-620; Engineering Field Tools–Terrace Design Tool; or equivalent. This spreadsheet may also be used for the outlet design of underground outlet diversions and water and sediment control basins.

To use the Terrace (Storage) spreadsheet and to complete Form KS-ENG-19 and the design sheets, refer to the instructions in the spreadsheet and the following guidance:

- Based on the design runoff and duration of flooding, the spreadsheet calculates the minimum storage volume and the minimum release rate according to factors in the Kansas Supplement to Chapter 8 in NEH 650.
- Riser design

  --Riser capacity must equal or exceed the minimum release rate.

  --Riser design must consider potential plugging of perforations by debris and trash. Normally half of the holes are assumed to be plugged.

  --The following minimum dimensions are recommended: 1-inch diameter holes, 40 holes per foot, 3-foot long perforated section on the riser.
- Orifice design

  --Orifice capacity must equal or exceed the minimum release rate.

  --The orifice head is the distance from the channel elevation to the orifice plus 0.7 times the water depth at the riser.

  --It is recommended that orifices be designed in increments no smaller than 0.25 inch.

  --It is recommended that orifices be designed no smaller than 3 inches to minimize plugging problems.

- Main conduit design

  --The main conduit capacity must equal or exceed the accumulated flow.

  --The accumulated flow is the sum of the flow from the main conduit above the design point plus the flow from the orifice at the design point.

  --Check the conduit for conformance to minimum and maximum fill-over-pipe criteria.

  --The main conduit should generally be designed in non-pressure flow.

  --The conduit below the lowest riser may be designed in pressure flow in the following circumstances (with no orifice in the riser)—both of which may be modeled in the Terrace (Storage) spreadsheet:

  a. When using a vertical ("bubble-up") riser outlet.

  b. To reduce the required main conduit size in the lowest reach by showing that the weight of the water can increase discharge in some conditions. The conditions when pressure flow can give an advantage are where the main conduit is short, the accumulated flow is large, the water depth in the terrace channel is high, and the main conduit grade is less than 1%.

Field Sheets and Plans

Use Form KS-ENG-19 in the Terrace (Storage) spreadsheet, to record the following design information:

- The location map, the name of the owner and/or operator, legal description, county, and identification.
- Sign the "Designed by," "Checked by," "Approved by," and "Layout by" blocks and enter the respective dates.
- Complete the Table of Quantities by indicating all components and materials that are required to complete the job.
- List the design dimensions of the main conduits, risers, and orifices in the blocks below the Table of Quantities.
- On page 2, record the Bench Mark (BM) Elevation and Location.
- Show the stations, elevations, cuts, distances, and slopes for the risers, conduits, and outlet.

Complete additional drawings as required to convey all pertinent details of the underground outlet design.

Checkout

Perform a profile survey on the underground outlet line.

- Record rod readings on page 2 of Form KS-ENG-19 in the Terrace (Storage) spreadsheet in the Checkout section.
- Take rod readings of the following.

  --Channel elevation at each riser location.

  --Flow line elevation of the main conduit at each riser location.

  --Outlet elevation.

  --Bench mark elevation.

  --Other pertinent points.

Measure the installed lengths of the main conduit by using a fiberglass tape, by chaining, or by using a handheld Global Positioning System (GPS).

Check and document the type of riser and the main conduit materials installed by recording markings on the pipe, etc.

Record installed quantities in the appropriate column of the Table of Quantities on page 1 of Form KS-ENG-19.

Check the following details to ensure the job conforms to the design:

- Riser–The diameter, perforated length, size and number of holes per foot, and support posts and removable cap (if required).
- Orifice location and diameter.
- Outlet protection and rodent guards.
- As-built main conduit reach slopes.
- As-built minimum and maximum heights of fill over the main conduit.