NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

STREAM CROSSING

(No.)

CODE 578

DEFINITION

A stabilized area or structure constructed across a stream to provide a travel way for people, livestock, equipment, or vehicles.

PURPOSE

- Improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream.
- Reduce streambank and streambed erosion.
- Provide crossing for access to another land unit.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where an intermittent or perennial watercourse exists and a ford, bridge, or culvert type crossing is desired for livestock, people, and /or equipment.

CRITERIA

All Federal, State and local requirements shall be addressed in the design.

All stream crossing conservation practices are required to apply for and receive U. S. Army Corps of Engineers permits (404), Tennessee Valley Authority permits (26a – if located within the Tennessee River drainage area), and any permits that may be required by local units of government. The Stream Crossing conservation practice is exempt from Tennessee Department of Environment and Conservation permits (ARAP) as long as the requirements in this Conservation Practice Standard are met. All conditions listed within the permits shall be followed during the installation of the practice.

Location. Stream crossings shall be located in areas where the streambed is stable or where grade control can be provided to create a stable condition. Avoid sites where channel grade or alignment changes abruptly, excessive seepage or instability is evident, overfalls exist, or large tributaries enter the stream. Wetland areas shall be avoided if at all possible.

Locate crossings, where possible, out of shady riparian areas to discourage cattle loafing time in the stream.

Stream crossings shall provide a way for normal passage of water, fish and other aquatic animals within the channel during all seasons of the year.

Access Roads. Where high rates of erosion of the adjacent roadways that slope towards the crossing threaten to deliver an excessive amount of sediment to the drainage, install measures to minimize erosion of the roadside ditch, road surface, and/or cut slopes. Where the stream crossing is installed as part of a roadway, the crossing shall be in accordance with NRCS Conservation Practice Standard, 560, Access Road.

Width. The stream crossing shall provide an adequate travel-way width for the intended use. A multi-use stream crossing shall have a travel-way no less than 10 feet wide and no more than 20 feet wide. "Livestock only" crossings shall be no less than 6 feet wide. Width shall be measured from the upstream end to the downstream end of the stream crossing and shall not include the side slopes.

Side Slopes. All cuts and fills for the stream crossing shall have side slopes that are stable for the soil involved. Side slopes of earth cuts or fills shall be no steeper than 2 horizontal to 1 vertical. Rock cuts or fills shall be no steeper than 1.5 horizontal to 1 vertical.

Stream Approaches. Approaches to the stream crossing shall blend with existing site conditions where possible, and shall not be steeper than 5 horizontal to 1 vertical. Unless the foundation geology is otherwise acceptable, the approaches shall be stable, have a gradual ascent or descent grade, and be underlain with suitable material, as necessary, to withstand repeated and long term use. The minimum width of the approaches shall be equal to the width of the crossing surface.

Surface runoff shall be diverted around the approaches to prevent erosion of the approaches. Roadside ditches shall be directed into a diversion or away from the crossing surface.

Rock. All rock shall be chosen to withstand exposure to air, water, freezing and thawing. When rock is used, it shall be sufficiently large and dense so that it is not mobilized by design flood flows.

Fencing. Areas adjacent to the stream crossing shall be permanently fenced or otherwise excluded as needed to manage livestock access to the crossing.

Cross-stream fencing at fords shall be accomplished with breakaway wire, swinging floodgates, hanging electrified chain or other devices to allow the passage of floodwater debris during high flows.

All fencing shall be designed and constructed in accordance with NRCS Conservation Practice Standard 382, Fence.

Vegetation. All areas disturbed during construction shall be vegetated as soon as practical after construction in accordance with NRCS Conservation Practice Standard 342, Critical Area Planting.

Criteria for Culvert and Bridge Crossings

Design of culverts and bridges shall be consistent with sound engineering principles and shall be adequate for the use, type of road, or class of vehicle. Culverts and bridges shall have sufficient capacity to convey the design flow without appreciably altering the stream flow characteristics.

Culverts shall be sized to handle at least the bankfull flow or the peak runoff from the 2-year, 24-hour peak discharge, whichever is less. Crossings shall be adequately protected so that out-of-bank flows safely bypass without structure or streambank damage, or erosion of the crossing fill. The minimum depth of compacted fill over the culvert shall be equal to one-half the diameter, or 12 inches, whichever is greater. Additional culverts may be used at various elevations to maintain terrace or floodplain hydraulics.

The length of the culvert shall be adequate to extend the full width of the crossing, including side slopes. At least one culvert pipe shall be placed on or below grade with the existing stream bottom.

Acceptable culvert materials include concrete, corrugated metal, corrugated plastic, new or used high quality steel and other materials approved by the engineer.

Acceptable bridge materials include concrete, steel, and wood.

Criteria for Ford Crossings

When ford crossings are used, the cross-sectional area of the crossing shall not be less than the natural channel cross-sectional area. A portion of the crossing shall be depressed at or below the average stream bottom elevation when needed to keep base flows or low flows concentrated.

Cutoff walls shall be provided at the upstream and downstream edges of ford-type stream crossings when needed to protect against undercutting.

When NRCS Conservation Practice Standard 584, Stream Channel Stabilization is not used to stabilize the ford type crossing, the finished top surface of the ford type stream crossing in the bottom of the watercourse shall be no higher than the original stream bottom at the downstream edge of the ford crossing. If the downstream edge of the ford crossing is above the original stream bottom, the ford crossing shall be stabilized in accordance with NRCS Conservation Practice Standard 584, Stream Channel Stabilization.

Where rock is used for ford-type stream crossings for livestock, use a hoof contact zone or alternative surfacing method over the base course of rock. This zone could include

crushed limestone, rock screenings, crusher run, or similar materials, and shall cover the entire rock surface. Generally, 4 inches of hoof contact zone is necessary.

Concrete Fords

Concrete ford crossings shall be used only where the foundation of the stream crossing is determined to have adequate bearing strength.

Concrete shall have a minimum compressive strength of 3,000 psi at 28 days. Concrete ford crossings shall have a minimum thickness of placed concrete of 5 inches with minimum reinforcement of 6-inch by 6-inch, 6 gauge welded wire fabric, or other steel reinforcement configurations with equivalent or higher strength. Fiber mesh shall not be considered acceptable as concrete reinforcement. The concrete slab shall be poured on a minimum 4-inch thick rock base, unless the foundation is otherwise acceptable.

Precast concrete panels may be used in lieu of cast-in-place concrete slabs. Precast concrete units shall comply with ACI 525 or 533, or as otherwise acceptable for local conditions.

When heavy equipment loads are anticipated, the concrete slab shall be designed using an appropriate procedure as described in American Concrete Institute, ACI 360, Design of Slabs on Grade.

Geocell and/or Rock Ford Crossings

Rock ford crossings with geotextile shall be used when the site has a soft or unstable subgrade. Ford crossings made of stabilizing material such as rock riprap are often used in steep areas subject to flash flooding, where normal flow is shallow or intermittent.

The bed of the channel shall be excavated to the necessary depth and width and covered with geotextile material. The geotextile material shall be installed on the excavated surface of the ford and shall extend across the bottom of the stream and at least up to the 10-year, 24-hour peak discharge elevation, or to top of streambank elevation, whichever is lower.

The geotextile material shall be covered with at least 6 inches of crushed rock. If using geocells, the cells shall be at least 6 inches deep. All geosynthetic material shall be suitably durable and shall be installed in accordance with the manufacturer's recommendations, including the use of staples, clips and anchor pins.

At minimum, all rock ford stream crossings shall be designed to remain stable during the 10-year, 24-hour peak discharge.

CONSIDERATIONS

Avoid or minimize stream crossings, when possible, through evaluation of alternative trail or travel-way locations.

Ford crossings have the least detrimental impact on water quality when crossing is infrequent. Ford crossings are adapted for crossing wide, shallow watercourses with firm streambeds.

Evaluate the design approach slopes while considering equipment that may be utilizing the stream crossing. Vehicles or equipment that are used to pull various length trailers through the crossing have trouble transitioning from a 5:1 approach slope to a flat channel bed slope. Consider using flatter approach slopes for these instances.

In ford type crossings, evaluate the potential for channel bed materials to mobilize in larger storm events. Consider leaving the channel bed portion of the crossing in a natural state and only constructing the approaches when it is a high probability that the armored center portion of the crossing will be mobilized with the other bed materials on a regular basis.

In ford type crossings, consider recessing the toe of the approaches back into the original streambank 1 foot or more to reduce potential scour at constructed toe of the approach ramps.

In ford type crossings where the approach ramps intersect with a bedrock streambed, consider the addition of a concrete curb that is secured to the bedrock with rebar drilled into the bedrock. The concrete curb can provide a stable toe for the approach slopes, and will help reduce the loss of surface materials from the approach slopes.

Stream crossings should be located where adverse environmental impacts will be minimized and considering the following:

- Effects on up-stream and down-stream flow conditions that could result in increases in erosion, deposition, or flooding.
- Short term and construction-related effects on water quality.
- Effects on fish passage and wildlife habitats.
- Effects on cultural resources.
- Overall effect on erosion and sedimentation that will be caused by the installation of the crossing and any necessary stream diversion.

Where stream crossings are used, evaluate the need for safety measures such as guardrails at culvert or bridge crossing, or water depth signage at ford crossings.

PLANS AND SPECIFICATIONS

Plans and specifications for stream crossings shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

1. Drawings.
2. Material and Construction Specifications.
3. Width of Crossing.
4. Total Length of Crossing.
5. Grade or percent of slope of the approach ramps.
6. Type and dimensions of geotextile fabric.
7. Dimensions of the trench and the method of securing the ends of the geotextile.
8. Gradation, type, and quantity of gravel or other surfacing materials.
9. Location and extent of fencing required.
10. Location and quantities of seeding required to vegetate disturbed areas.
11. Method of surface water diversion during construction (If needed).
12. Other pertinent design data and approval signature.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed and implemented for the life of the practice.

- Inspect the crossing regularly, especially after heavy rains. Stream crossings will need periodic maintenance throughout the lifespan. Damaged areas will be filled, compacted, and re-graded immediately. Remove debris or blockages. Repair and/or restore flow capacity as needed.
- Maintain the crossing surface in good condition, which includes periodic grading and the addition of stone or other surface material when necessary. Prevent surface ponding by localized grading or addition of stone to remove depressions. Fill low areas in travel treads and re-grade, as needed, to maintain road cross section. Road base rock may be required to stabilize the foundation.
- The top surface of the stone may be eroded away during flooding. This stone must be replaced to ensure a safe and stable travel surface for the livestock.
- Maintain all concrete work, rock riprap, grouted rock, flagstone, or precast stone. Replace to original grades with similar materials as necessary.
- Culvert-type crossings impose a restriction to stream flow, and can receive excessive damage from floods, requiring regular maintenance to preserve their integrity. Risk can be minimized by crowning the backfill over the culvert pipes above top of bank elevations, leaving a low space on one or both abutments to serve as an emergency spillway during out of bank flow. Check the wearing surface for ruts, replacing the displaced fill with gravel. Check for erosion of earthfill slopes, upstream and downstream, especially if the crossing has been over topped. Rock riprap stone can be added to help hold the fill slopes, and

may be grouted with high slump concrete to anchor the armor. Check for abnormal settlement around pipes. Water passing outside of the culverts can erode the fill material. Replace missing fill with large stone prior to replacing the wearing surface. Remove debris blocking pipe inlets, and check for scour at the pipe outlets in the channel. Fill eroded channel bottom with rock riprap stone.

- The fencing component should be checked after every high flow event as well as on a regular basis. Any fencing that has been damaged due to high flows should be repaired immediately. Care should have been taken during installation to minimize the damage caused to the corridor fencing (parallel to the stream) by the cross-fencing (perpendicular to the stream). Replace or repair any fencing as necessary during the lifespan of the practice.
- If the crossing is also used as a watering location, the landowner should check the site during periods of low flow to ensure the livestock have an adequate source of water.
- Maintain road ditch and drainage facility capacities. Maintain vegetated areas in adequate cover. Re-seed and mow as needed.
- Immediately repair any vandalism, vehicular, or livestock damage to earthfills, side slopes, spillways, outlets or other appurtenances.