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

General Criteria Applicable to all Purposes

This practice shall be applied in accordance with all applicable local, state, and federal laws and regulations.

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. Avoid impounding additional surface water or diverting linear flow within the channel. If the stream crossing will adversely impact the adjacent area due to a net rise in flood stage, landowners and affected public entities should be consulted.

Crossings shall be installed perpendicular to the direction of stream flow.

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 and Trails**.** Where high rates of erosion from adjacent roads or trails that slope toward 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. "Livestock only" crossings shall be no less than 6 feet wide. Width shall be measured from the upstream edge to the downstream edge 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 4 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 of adequate quality 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 the peak flow from a 10-year frequency, 24-hour duration storm.

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 to be vegetated shall be planted as soon as practical after construction. When necessary, use NRCS Conservation Practice Standard 342, Critical Area Planting where vegetation is unlikely to become established by natural regeneration, or acceleration of the recovery of disturbed vegetation is desired.

Criteria for Culvert and Bridge Crossings

Design of bridges shall be done under the direct supervision of an engineer. The design must support the expected loading, but not less than 100 pounds per square foot of floor area. The bridge must be durable and stable during peak flows from the 25-year frequency, 24-hour duration storm.

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 safely pass the bankfull flow or the peak runoff from the 2-year, 24-hour peak discharge, whichever is less. Crossing structures and streambanks shall be protected from damages and erosion due to out-of-bank flows. Additional culverts may be placed at various elevations to maintain terrace or floodplain hydraulics.

Culverts shall extend the full width of the crossing, including side slopes. At least one culvert pipe shall be placed at or below grade of the existing stream bottom.

Refer to the Fish Passage – Culvert Design Procedure (396DP) for culvert crossings required to address normal passage of fish and other aquatic species.

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

The cross-sectional area of the crossing, perpendicular to the flow, 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 necessary to promote concentration of low and/or base flows.

All ford-type crossings shall be designed to remain stable during peak flows from the 10-year frequency, 24-hour duration storm.

To protect against undercutting, cutoff walls shall be provided to a depth of 3 feet at the upstream edge of all ford-type stream crossings . Cutoff walls to a depth of 2 feet shall be provided at the downstream edge of all rock aggregate ford-type crossings and should be considered on all ford-type crossings to protect against undercutting.

The finished top surface of the ford type stream crossing in the bottom of the

watercourse shall not be higher than the original stream bottom at the upstream 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. The crossing shall not impede movement of aquatic species.

A concentration zone shall be provided in the middle of the crossing to maintain adequate flows for movement of aquatic species during low-flow periods.

Ford-type crossings shall be designed to resist damages due to settlement, piping, undercutting, frost heave, ice, flooding, and other site hazards and loads.

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

Concrete Ford Crossings.

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

Concrete shall have a minimum compressive strength of 3,500 psi at 28 days. Concrete ford crossings shall have a 5-inch minimum thickness of concrete reinforced with a minimum of 6-inch by 6-inch, 6 gauge welded wire fabric. Unless the foundation is otherwise acceptable, the concrete slab shall be placed on a minimum 4-inch thick rock base.

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.

Refer to Nebraska NRCS standard drawings for concrete ford-type crossings for detailed installation information.

Geocell, Gabion, **and/or Rock Ford Crossings**

Rock ford crossings with geotextile may be used in most situations and 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 crossing and shall extend across the bottom of the stream. The geotextile shall extend up the banks to at least to the 10-year, 24-hour peak discharge elevation.

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.

Refer to Nebraska NRCS standard drawings for rock aggregate or gabion ford-type crossings for detailed installation information.

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.

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.

Outlet protection should be considered when discharge velocities and energies at the outlets of bridges, culverts, conduits, or channels are likely to be erosive.

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.

Refer to the Statement of Work for Stream Crossing (578) for additional information.

OPERATION AND MAINTENANCE

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

The stream crossing, appurtenances, and associated fence should be inspected after each major storm event, with repairs made as needed to identify repair and maintenance needs, including the following items.

- Periodic grading or re-shaping to maintain grades and dimensions
- Periodic addition of surfacing materials, where used
- Re-seeding of areas with damaged or destroyed vegetation
- Repair or replacement of damaged fences or gates
- Removal and management of manure deposits for livestock crossings

REFERENCES

Clarkin, K., G. Keller, T. Warhol, S. Hixon, 2006. Low-Water Crossings: Geomorphic, Biological, and Engineering Design Considerations. USDA, Forest Service, National Technology and Development Program.

NRCS Conservation Practice Standard, Access Road, Code 560

NRCS Conservation Practice Standard, Critical Area Planting, Code 342

NRCS Conservation Practice Standard, Fence, Code 382

NRCS Conservation Practice Standard, Fish Passage – Culvert Design Procedures, Code 396DP

NRCS Conservation Practice Standard, Stream Channel Stabilization, Code 584

NRCS Statement of Work for Stream Crossing (578)

American Concrete Institute website