NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

STREAMBANK AND SHORELINE PROTECTION

(Ft.)

CODE 580

DEFINITION

Treatment(s) used to stabilize and protect banks of streams or constructed channels and shorelines of lakes, reservoirs, or estuaries.

PURPOSES

- To prevent the loss of land or damage to land uses or facilities adjacent to the banks of streams or constructed channels, shoreline of lakes, reservoirs, or estuaries including the protection of known historical, archeological, and traditional cultural properties
- To maintain the flow capacity of streams or channels
- Reduce the off-site or downstream effects of sediment resulting from bank erosion
- To improve or enhance the stream corridor for fish and wildlife habitat, aesthetics, or recreation

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to streambanks of natural or constructed channels and shorelines of lakes, reservoirs, or estuaries where they are susceptible to erosion. It does not apply to erosion problems on main ocean fronts, beaches, or similar areas of complexity.

CRITERIA

General Criteria Applicable to All Purposes

Laws, rules, regulations. This practice shall conform to all federal, state, local, and tribal laws, rules, and regulations. Laws, rules, and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.

The owner is responsible for securing necessary permits, complying with all laws and regulations, and meeting legal requirements applicable to the installation and operation and maintenance of this conservation practice and associated structures.

Treatments applied shall seek to avoid adverse effects to endangered, threatened, and candidate species and their habitats (whenever possible).

Also, treatments applied shall seek to avoid adverse effects to archaeological, historical, structural, and traditional cultural properties (whenever possible).

An assessment of unstable streambank or shoreline sites shall be conducted in sufficient detail to identify the causes contributing to the instability (such as livestock access, watershed alterations resulting in significant modifications of discharge or sediment production, in-channel modifications such as gravel mining, head cutting, water level fluctuations, boat-generated waves).

Proposed protective treatments to be applied shall be compatible with improvements being planned or installed by others.

Protective treatments shall be compatible with the bank or shoreline materials, water chemistry, channel or lake hydraulics, and slope characteristics above and below the waterline.

End sections of treatment areas shall be adequately anchored to existing treatments, terminated in stable areas, or be otherwise stabilized to prevent flanking of the treatment.

Protective treatments shall be installed that result in stable slopes. Design limitations of the bank or shoreline materials and type of measure installed shall determine steepest permissible slopes.

Designs will provide for protection of installed treatments from overbank flows resulting from upslope runoff and flood return flows.

Internal drainage for bank seepage shall be provided when needed. Geotextiles or properly designed filter bedding shall be incorporated with structural measures where there is the potential for migration of material from behind the measure.

If a sand-gravel filter is specified, the filter gradation shall be designed in accordance with Chapter 26 in National Engineering Handbook Part 633, *Soil Engineering*.

The geotextile will meet the requirements for a non-woven, Class II, geotextile. The requirements are a tensile strength greater than 120 pounds (American Society for Testing and Materials [ASTM] D 4632 [grab test]), a bursting strength of 210 psi (ASTM D 3786 [diaphragm test]), an elongation at failure greater than or equal to 50 percent (ASTM D 4632), a puncture force greater than 60 pounds (ASTM D 4833), an apparent opening size that is a maximum of a No. 40 sieve (ASTM D 4751), and a permittivity greater than 0.70 sec^{-1} (ASTM D 491).

Treatments shall be designed to account for any anticipated ice action, wave action, and fluctuating water levels.

All disturbed areas around protective treatments shall be protected from erosion. Disturbed areas that are not to be cultivated shall be protected as soon as practical after construction.

Vegetation shall be selected that is best suited for the site conditions and achieves the intended purpose(s).

In order to ensure plant community establishment and integrity, a vegetative management plan shall be prepared in accordance with Conservation Practice Standard (CPS) 342, Critical Area Planting.

Additional Criteria for Streambanks

The stream shall be classified according to either the Schumm channel evolution model or the Rosgen stream channel classification system (see Chapter 7 in National Engineering Handbook Part 653 [NEH 653], Stream Corridor Restoration: Principles, Processes, and Practices and the Kansas Supplement to NEH 653, Chapter 7). Segments that are incised or that contain the 5-year return period (20 percent probability) or greater flows shall be evaluated for further degradation or aggradation.

A site assessment shall be performed to determine if the causes of instability are local (such as poor soils, high water table in banks, alignment, or obstructions deflecting flows into bank) or systemic in nature (such as aggradation due to increased sediment from the watershed, increased runoff due to urban development in the watershed, or degradation due to channel modifications). The assessment will be to the extent and detail necessary to provide (1) a basis for design of the bank treatments and (2) that the treatments will perform adequately for the design life of the measure with reasonable confidence.

The streambed and bank stability shall be evaluated to determine if the toe (the lower edge of the bank) requires protection.

Changes in channel alignment shall not be made without an assessment of both upstream and downstream fluvial geomorphology that evaluates the effects of the proposed alignment. The current and future discharge-sediment regime shall be based on an assessment of the watershed above the proposed channel alignment. The checklist, “Measurable Attributes for Describing Conditions in the Stream Corridor,” in Chapter 4 in NEH 653 shall be used to document the current and future condition of the stream and watershed.

The channel grade of the streambed shall be stable, based on a field assessment (such as Stream Visual Assessment Protocol), before any permanent type of bank protection can be considered feasible.

Bank protection treatment shall not be installed in channel systems undergoing rapid and extensive changes in bottom grade and/or alignment unless the treatments are designed to control or accommodate the changes. Bank treatment shall be constructed to a depth at or below the anticipated lowest depth of streambed scour.

When the failure mechanism is a result of the degradation or removal of riparian vegetation, stream corridor restoration shall be implemented where feasible (see the Additional Criteria for Stream Corridor Improvement section) as well as treating the banks.

Toe erosion shall be stabilized by treatments that redirect the stream flow away from the toe or by structural treatments that armor the toe. Refer to Chapter 16 in National Engineering Handbook Part 650 (NEH 650), *Engineering Field Handbook*, for guidance.

When toe protection alone is inadequate to stabilize the bank, the upper bank shall be shaped to a stable slope and vegetated or stabilized with structural or soil-bioengineering treatments.

Channel clearing to remove stumps, fallen trees, debris, and sediment bars shall only be performed when they are causing or could cause unacceptable bank erosion, flow restriction, or damage to structures. Habitat-forming elements that provide cover, food, pools, and water turbulence shall be retained or replaced to the extent possible.

Treatments shall be functional and stable for the design flow and sustainable for higher flow conditions.

Treatments shall not induce an increase in natural erosion.

Treatments shall not limit stream flow access to the flood plain.

Where flooding is a concern, the effects of protective treatments shall not increase flow levels above those that existed prior to installation.

Additional Criteria for Shorelines

All revetments, bulkheads, or groins are to be no higher than 3 feet (1 meter) above mean high tide or mean high water in non-tidal areas.

Structural shoreline protective treatments shall be keyed to a depth to prevent scour during low water.

For the design of structural treatments, the site characteristics below the waterline shall be evaluated for a minimum of 50 feet (15 meters) horizontal distance from the shoreline measured at the design water surface.

The height of the protection shall be based on the design water surface plus the computed wave height and freeboard. The design water surface in tidal areas shall be mean high tide.

When vegetation is selected as the protective treatment, a temporary breakwater shall be used during establishment when wave action would damage the vegetation.

Additional Criteria for Stream Corridor Improvement

Stream corridor vegetative components shall be established as necessary for ecosystem functioning and stability. The appropriate composition of vegetative components is a key element in preventing excess long-term channel migration in re-established stream corridors. The establishment of vegetation on channel banks and associated areas shall also be in accordance with CPS 342.

Treatments shall be designed to achieve habitat and population objectives for fish and wildlife species or communities of concern as determined by a site-specific assessment or management plan. Objectives shall be based on the survival and reproductive needs of populations and communities. These include habitat diversity, habitat linkages, daily and seasonal habitat ranges, limiting factors, and native plant communities. The type, amount, and distribution of vegetation shall be based on the requirements of the fish and wildlife species or communities of concern (to the extent possible).

Treatments shall be designed to meet aesthetic objectives as determined by a site-specific assessment or management plan. Aesthetic objectives shall be based on human needs (including visual quality, noise control, and microclimate control). Construction materials, grading practices, and other site development elements shall be selected and designed to be compatible with adjacent land uses.

Treatments shall be designed to achieve recreation objectives as determined by a site-specific assessment or management plan. Safety requirements shall be based on the type of human use and recreation objectives.

CONSIDERATIONS

When designing protective treatments, consider the changes that may occur in the watershed hydrology and sedimentation over the design life of the treatments.

Consider using debris removed from the channel or streambank in the treatment design when it is compatible with the intended purpose.

Use construction materials, grading practices, vegetation, and other site development elements that minimize visual impacts and maintain or complement existing landscape uses such as pedestrian paths, climate controls, and buffers. Avoid excessive disturbance and compaction of the site during installation.

Use vegetative species that are native and/or compatible with local ecosystems. Avoid introduced or exotic species that could become nuisances. Consider species that have multiple values such as those suited for biomass, nuts, fruit, browsing, nesting, aesthetics, and tolerance to locally used herbicides. Avoid species that may be alternate hosts to disease or undesirable pests. Species diversity should be considered to avoid loss of function due to species-specific pests. Species on noxious plant lists should not be used.

Select plant materials that provide habitat requirements for desirable wildlife and pollinators. The addition of native forbs and legumes to grass mixes will increase the value of plantings for both wildlife and pollinators.

Try to use treatments that promote beneficial sediment deposition and the filtering of sediment, sediment-attached, and dissolved substances.

Consider maintaining or improving the habitat value for fish and wildlife by including treatments that provide aquatic habitat in the treatment design and that may lower or moderate water temperature and improve water quality.

Stabilize side channel inlets and outlets and outlets of tributary streams from erosion if possible.

Incorporate aquatic habitat when selecting the type of toe stabilization.

Try to maximize adjacent wetland functions and values with the project design and minimize adverse effects to existing wetland functions and values.

Exclude livestock during establishment of vegetative treatments when practical, and appropriate grazing practices should be applied after establishment to maintain plant community integrity. Wildlife may also need to be controlled during establishment of vegetative treatments. Temporary and local population control methods should be used with caution and within state and local regulations.

When appropriate, establish a buffer strip and/or diversion at the top of the bank or shoreline protection zone to help maintain and protect installed treatments; improve their function; filter out sediments, nutrients, and pollutants from runoff; and provide additional wildlife habitat.

Incorporate conservation and stabilization of archeological, historical, structural, and traditional cultural properties when applicable.

Consider safety hazards to boaters, swimmers, or people using the shoreline or streambank when designing treatments.

Protective treatments should be self-sustaining or require minimum maintenance.

PLANS AND SPECIFICATIONS

Plans and specifications for streambank and shoreline protection shall be prepared for specific field sites and based on this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Plans shall include treatments to minimize erosion and sediment production during construction and provisions necessary to comply with conditions of any environmental agreements, biological opinions, or other terms of applicable permits.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be prepared for use by the owner or others responsible for operating and maintaining the system. The plan shall provide specific instructions for operating and maintaining the system to ensure that it functions properly. It shall also provide for periodic inspections and prompt repair or replacement of damaged components or erosion.

REFERENCES

NRCS, National Engineering Handbook, Part 650, *Engineering Field Handbook*, Chapter 16, Streambank and Shoreline Protection

NRCS, National Engineering Handbook, Part 653, *Stream Corridor Restoration: Principles, Processes, and Practices*

NRCS, National Engineering Handbook, Part 654, *Stream Restoration Design*