United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

STREAMBANK AND SHORELINE PROTECTION

CODE 580

(Ft.)

INITIAL REVIEW – Comments and Responses
Drafted technical standard text (as sent for Initial Review) is in black and blue fonts. National minimum requirements are in black font; Wisconsin specific criteria is denoted with blue font.
Comments are in red, preceded by comment number (**C#**). To find a specific comment number, search for that number using "Ctrl + F" (Windows) or "Command + F" (Mac).
Responses to comments are in green italics.
Changes to standard text are in tracked changes.

DEFINITION

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

C9: Suggest adding language what the standard is protecting against.

RESPONSE: Thanks for your comment, the definition is part of the national standard language that we can't modify. Further detail is included in the standard Purpose below.

C38: Since the Wisconsin DNR seems to have special policies for flowage lakes, they should be listed here. [and in Purpose]

RESPONSE: Thanks for your comment. The NRCS standard is Federal, we can't insert state agency policy and/or standards into Code 580, but reference, if necessary.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Prevent the loss of land or damage to land uses or facilities adjacent to the banks of streams or constructed channels and shorelines of lakes, reservoirs, or estuaries. This includes the protection of known historical, archaeological, and traditional cultural properties.

  C1: "prevention of loss of land or damage to land". I'm concerned this opens a can of worms in the interpretation. On the ag side, NRCS is not promoting saving cropped fields by riprapping streams, yet as worded, it appears to give people permission to do that. Many I&E visits are because someone has a corn/bean field that at the top bank or within a few feet of it, and they want to stop the meandering to protect the field that's in a flood plain or immediately adjacent to a high bank. So, can the wording be changed to prevent it being used for saving ag crops, which is not a resource concern.

RESPONSE: National standard language cannot be changed. Loss of land was meant to be associated with excessive sediment and water quality degradation.

C10: Suggest adding language what the standard is preventing loss of land.

RESPONSE: Good comment, unfortunately we can't alter national language but will suggest it for the next national revision.

- Maintain the flow capacity of streams or channels.
- Reduce the offsite or downstream effects of sediment resulting from bank erosion.
- Improve or enhance the stream corridor or shoreline for fish and wildlife habitat, aesthetics, or recreation.

C11: Suggest adding some example methods of streambank and shoreline protection.

RESPONSE: Once this 580 standard is published, trainings will be scheduled around the state with staff that should address your comment. There are many different approaches and NRCS has numerous references on streambank and shoreline protection that are more detailed than the standard.

CONDITIONS WHERE PRACTICE APPLIES

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

C39: Does this Standard apply to beaches on lakes, streams, flowages, or reservoirs? Will beaching design still be an option for shoreline protection under this Standard?

RESPONSE: The team had no specific discussion on beaching. If the shoreline needs protection, beaches may be an option for stabilization when properly designed, but the technique would be outside the scope of this standard.

This standard does not apply to protection along open and unprotected shorelines of the Great Lakes.

C2: Does the Mississippi River need to be included?

RESPONSE: The technical criteria of this standard could apply to sections of the Mississippi River. WI NRCS program policy and priorities will preclude its use on rivers with watersheds exceeding 250,000 acres.

C12: Where does one go to find guidance for the Great Lakes?

RESPONSE: The Wisconsin DNR has some guidance for protection along the Great Lakes with permit info and design references. Army Corps of Engineers and National Oceanic and Atmospheric Administration (NOAA) coastal engineers may also be able to provide guidance.

C31: Definition of a streambank may vary county to county. Consider adding additional scenarios/thresholds because local zoning considers a watercourse to be a navigable stream typically at the 80 acre drainage area, and this standard would appear to apply to a more complex system (e.g. 582 std. applies with drainage area exceeding 1 sq mi).

RESPONSE: Thanks for your comments, the definition of navigable is state code. Although it may be interpreted differently across the state, the threshold of whether the stream is navigable doesn't impact the technical criteria for the design. However, it would impact the permitting requirement.

If a single site exceeds 500 feet, or the combination of existing and planned protection exceeds 1,000 feet in a ¼ mile reach (include both sides of the stream), complete the additional site assessment found under Open Channel (Code 582), Additional Criteria for Stream Restoration. Apply this practice as a component of stream restoration and address all identified channel impairments to the extent practicable.

C40: Does the statement "(includes both sides of the stream)" also mean that if work is done on both sides of the same segment of the stream it counts double when calculating the total length?

RESPONSE: Thanks for your comment, the reference to "both sides of the stream" refers to completed and/ or planned 580 on either side of the stream. Yes, both sides would count towards the total length.

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct this practice to comply with all Federal, State, and local laws, rules, and regulations. The landowner must obtain all necessary permissions from regulatory agencies, or document that no permits are required. The landowner and/or contractor is responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

The landowner is responsible for removing hazardous materials or point source pollution (e.g. *septic discharge)* within the work limits and attaining regulatory compliance prior to the construction of stream and shoreline protection.

Do not use construction demolition for streambank and shoreline protection, e.g. concrete, asphalt, blocks, bricks, etc.

C13: I wanted to make the creators of this document know that per WisDOT Standard Specification 606.2.1(3) - *The contractor may substitute waste concrete slabs for stone. Furnish sound concrete, free of protruding reinforcement, and conforming to the size requirements specified for stone.* When DOT works around waterways, if the nature of the waterway requires it, added Special Provisions would be needed to ensure that concrete slabs are not used.

RESPONSE: Utilization of concrete is not an option under this standard. The Wisconsin DNR typically will not permit waste concrete to be used on projects.

Assess unstable streambank or shoreline sites in enough detail to identify the causes contributing to the instability. The assessment should provide details necessary for design of the treatments and convey reasonable confidence that the treatments will perform adequately for the design life of the measure. If the failure mechanism for a streambank is a result of the degradation or removal of riparian vegetation, if possible, implement stream corridor restoration, along with bank treatment.

C3: I'm having a hard time understanding what this means, it appears to be a bit wordy?

RESPONSE: This is national standard language that cannot be edited. More detail on site assessments is included later in the standard. Additional information like the NRCS companion documents and training after the revised standard is published will also give clarity to the criteria.

Causes of instability include—

- Livestock access;
- Watershed alterations resulting in significant modifications of discharge or sediment production;

- In-channel modifications such as gravel mining;
- Head cutting;

C14: Is head-cutting defined somewhere?

RESPONSE: This is a summary list of potential causes of instability. This standard doesn't have a glossary section to add a definition and this a basic term in stream design.

- Water level fluctuations; and
- Boat-generated waves.

C15 // C41: Are there other examples of how streambanks get eroded (cropping very close, construction, redirecting flows, removing dense vegetation)? **//** The possible reasons for instability should also include human traffic, pedestrian and vehicular, and upland surface runoff.

RESPONSE: Thanks for your comment. There are many causes of instability but we tried to limit examples to include, but not limited to, some key areas in the above list. The user has the responsibility to determine the cause at their particular project.

Design streambank and shoreline treatments that are compatible with—

- Existing bank or shoreline materials;
- Planned improvements or improvements installed by others;
- Water chemistry;
- Channel or lake hydraulics; and
- Slope characteristics above and below the water line.

Avoid adverse effects on—

- Endangered, threatened, and candidate species and their habitats;
- Archaeological, historical, structural, and traditional cultural properties; and
- Existing wetland functions and values.

C16: Suggest adding something about downstream or upstream impacts.

RESPONSE: When protection exceeds 500/1,000 feet (see Conditions Where Practice Applies), this standard refers to CPS 582 which requires a detailed assessment of hydraulic and geomorphic impacts. Environmental evaluations should be completed in conjunction with this practice to address other environmental and social impacts.

Design treatments that result in stable slopes based on the bank or shoreline materials and the type of measure proposed. Account for anticipated ice action, wave action, and fluctuating water levels.

C4: Add shear stress?

RESPONSE: This is national language that is supplemented later on under the Additional Criteria for Streambanks, where the shear stress is emphasized.

Ensure that installations are protected from overbank flows from upslope runoff and flooding. Include internal drainage where bank seepage is a problem. Use geotextiles, designed filters, or bedding to prevent piping or erosion of material from behind the treatment. Anchor end sections into existing treatments or existing stable areas. Refer to NRCS NEH, Part 633, Chapter 26 for design of granular filters.

Geotextile, granular filters, or bedding is not required to prevent piping or erosion of material from behind rock riprap protection if all of the following conditions are met:

C42: The end of the sentence should be clarified. "…protection **if** all of the following conditions **are met**:"

RESPONSE: Good suggestion, change made.

- Minimum thickness of the rock riprap layer is three times the D_{50} stone size
- Seepage is not evident during the soils investigation
- Soil base is cohesive i.e. no substantial layers of fine sand or non-plastic silt
- Soil base is free of organics and very soft clays

Revegetate all areas disturbed during construction in accordance with NRCS Conservation Practice Standard (CPS) Critical Area Planting (Code 342). If climatic conditions preclude the use of vegetation, use NRCS CPS Mulching (Code 484) to install inorganic cover materials such as gravel. Protect the area from livestock and human traffic until the site is fully stabilized.

C43: "If climatic conditions preclude the use of vegetation" the word *climatic* should be deleted.

RESPONSE: Thanks for your comment, this is a good suggestion. Unfortunately, this is national language that cannot be edited. Vegetation requirements and applicability are addressed in the referenced standards.

Additional Criteria for Streambanks

In addition to the assessment requirements under General Criteria, include the following information in the design report. Refer to WI NRCS Supplements to NEH, Part 650, Chapter 16 for assessment tools.

- List the landowner's objectives for protection, available materials for bank treatments, existing and desired riparian land use, willingness to carry out maintenance activities, and special conditions.
- Determine the elevation of the bankfull flow (i.e. channel-forming discharge or ordinary high water mark). Bankfull flow fills a channel to an elevation where flow begins to spill onto the active floodplain. Bankfull flow can be identified by field indicators in alluvial channels that have adjusted to hydrologic conditions and sediment delivery. Over the long term, bankfull flow typically completes the most work in transporting sediment relative to the magnitude and frequency of other flows. Bankfull flow has a typical recurrence interval range of 1 to 3 years on an annualized frequency curve, with a predominance of values in the 1.2 to 1.8-year range, although exceptions may include urban areas, wetland streams, or settings influenced by colluvium or glacial features.

  C5: Good description, thank you

  RESPONSE: Thanks--the team wanted to clarify bankfull with this definition.

  C17: I think in this context, floodplain refers to the flatter area above the main stream channel where larger flows are conveyed and not the 100-year floodplain. The suggestion would be to make that distinction more clear. [Same comment for use of "floodplain" in bullet below this one.]

  RESPONSE: Thanks for the comment, you are correct that this isn't referring to the 100-year floodplain. The 100-year floodplain varies depending on stream channel and benches, etc. – there may be multiple benches which do the work at varying flows or even abandoned benches if altered or migrated.

- Determine the elevation of the highest active floodplain bench.
- Description of bank erosion severity using both methods below. Refer to the WI Field Office Technical Guide, Section III >Planning Tools >Engineering for erosion calculations.
  - Average annual rate of lateral migration (feet/year) measured at the apex of the channel

bend using historic aerial imagery over a period of 20 years. This method may be excluded, or the evaluation period abbreviated, if imagery is unavailable or obscured by canopy. In this case, use the estimated age of trees bordering each side of the channel.

C6: Will additional resources be made to determine what is severe, moderate, acceptable, etc.?

RESPONSE: We agree that estimating lateral migration can be difficult on sites and additional guidance is going to be needed for users of the standard to estimate this consistently. This design standard is just asking that the rates be documented because they corroborate the amount of shear stress used in revetment design. Other guidance will be need to determine program eligibility and what levels are important for different uses of the standard.

- Bank Erosion Potential Index (BEPI) at the apex of the channel bend

- Describe the channel evolutionary stage (i.e. down-cutting, widening, aggrading, or stable) and indications of future direction. Refer to NRCS NEH Part 654.0305(c).
- Describe the type and cause of streambank instability. Determine the type of bank failure such as a shallow slip failure, cantilever failure, or rotational shear failure. Describe causes of erosion such as concentrated flow around debris or sediment bars, seepage and soil piping, or high flow velocities along weak soil stratigraphy.

Perform a soils investigation along the planned improvement. Log the soil profile from the top of high bank to a depth of stable substratum using the Unified Soil Classification System. Identify the location and elevation of soil layers with seepage. Classify the bedload material.

C26: Soils investigations should not be required for every site. In many cases soil investigations from the top of high bank to the substratum elevation are not only cost prohibitive, but not feasible. This should be a site specific consideration using engineering judgement and not general criteria. There would be benefit to have more training on this topic.

RESPONSE: The team discussed the required intensity for soil borings and intentionally left it vague to allow some designer discretion. Every bend may be excessive to log on some sites, so soils should be logged to be representative of the site and account for changes in soils over the length of the project. Many of the projects can be investigated by using the existing exposed banks for the majority of the profile. This should not make projects cost prohibitive. A soils investigation does not necessarily imply a drill rig or backhoe. Not requiring any documentation of bank or foundation soils doesn't seem prudent. Additional training is a good suggestion.

C32: This soils investigation requirement appears that it would be burdensome to be required on every streambank site. Consider adding further clarification to thresholds for the limits of a soils investigation. Is it from top of ravine to bottom of stream? Are there additional analyses that could meet the above? We met with Army Corps a few years back and they recommended an in-situ "strength" test that would seem to provide more applicable.

RESPONSE: The team discussed the required intensity for soil borings and intentionally left it vague to allow some designer discretion. Every bend may be excessive to log on some sites, so soils should be logged to be representative of the site and account for changes in soils over the length of the project. The limits should be listed, from the top of bank to a depth of stable substratum.

Design streambank protection to be stable for all discharges from bankfull flow up to the 100-year flood or highest active floodplain bench. Estimate stream flows using the USGS Flood Frequency Characteristics of Wisconsin Streams or hydrologic models such as NRCS WinTR-20, WinTR-55, or USACOE HEC-HMS.

Use the shear stress method to design rock riprap, soil bioengineering, or other protection components.

Use a minimum safety factor of 1.2 for stability design. Refer to WI NRCS Website >Engineering > Spreadsheets > Streambank Protection, or NEH, Part 654, TS-14C for stone sizing criteria.

Extend inert bank protection to the elevation of bankfull flow or above. Limit structural treatment above the bankfull flow where vegetation establishment is adequate to stabilize the bank. Use a minimum slope of 1.5 horizontal to 1 vertical for rock riprap; 2:1 or flatter is recommended.

Classify stream segments requiring protection according to a system deemed appropriate by the State. Evaluate incised segments or segments that contain the 5-year return period (20 percent probability) or greater flows for further degradation or aggradation.

C7: When you say "evaluate" can you give a definition or description?

RESPONSE: This is national standard language that cannot be edited.

C44: What is the current system deemed appropriate by the State and why isn't just stated here in the standard? Since these standards are updated periodically any changes to the appropriate standard can be updated at the time of revision. The way it is now, I don't know how to find out which system is the appropriate system.

RESPONSE: This is national standard language that cannot be edited.

Do not realign the channel without an assessment of upstream and downstream fluvial geomorphology that evaluates the impacts of the proposed alignment. Determine the current and future discharge- sediment regime using an assessment of the watershed upstream of the proposed channel alignment.

C18: Suggest adding "…and agency approval."

RESPONSE: This is national standard language that cannot be edited.

C45: The first sentence should be reworded for clarity. Channel realignment should be avoided. If realignment is necessary, an assessment of the upstream and of the downstream geomorphology must be completed.

RESPONSE: This is national standard language that cannot be edited.

C46: This section should also reference CPS 584.

RESPONSE: Bed stabilization may not be necessary depending on the alignment change. The channel realignment doesn't necessarily mean a shortened channel length. CPS 582 may be appropriate as well.

Do not install bank protection treatment in channel systems undergoing rapid and extensive changes in bottom grade and/or alignment unless designing the treatments to control or accommodate the changes. Refer to Channel Bed Stabilization (Code 584). Construct bank treatment to a depth at or below the anticipated lowest depth of streambed scour.

Refer to NRCS NEH, Part 654, TS-14B, or USACE EM 1110-2-1601, Chapter 3, Section IV for scour calculations. At minimum, key thetreatment at least two feet below the streambed or into stable substratum. Investigate the thalweg for at least 150 feet downstream to anticipate advancing headcuts or knickpoints.

C19: Is revetment the only treatment method?

RESPONSE: The term "revetment" was changed to "treatment" for consistency and clarity.

C47: Where did the 150 feet come from? The distance should be tied to the stream size or slope not just a set number of feet.

RESPONSE: 150 feet is cited as a minimum. It is correct that depending on stream size or slope, more may be necessary. The intent was to make sure some investigation was being completed.

Start and end the treatment at a stable anchorage point, such as a crossover or well-vegetated bank. Protect the upstream and downstream end of a revetment from flanking by bank erosion. Consider the potential for lateral channel migration in determining the appropriate keyway depth. Key the ends of articulated concrete mats or gabion-type revetment at least 4 feet into the bank. Key the ends of a rock riprap revetment at least 2 times the blanket thickness into the bank--- a minimum length of 4 feet on each end.

Stabilize toe erosion by treatments that redirect the stream flow away from the toe or by structural treatments that armor the toe. Where toe protection alone is inadequate to stabilize the bank, shape the upper bank to a stable slope and establish vegetation, or stabilize with structural or soil bioengineering treatments.

Shape the vegetated portion of banks to a minimum slope of 3 horizontal to 1 vertical or flatter. A minimum 2:1 slope is acceptable for short reaches where physical structures, roadways, utilities, or property lines restrict space.

C8: For sandy sites, may need 4:1 or flatter.

RESPONSE: This criteria in CPS 580 is consistent with CPS 342 Critical Area Planting and also provides flexibility in small areas as needed. Note, the CPS 342 section on Bank and Channel Slopes indicates "A combination of vegetative and structural measures may be necessary on slopes steeper than 3:1 to ensure adequate stability." There are situations where flatter may be necessary. The language did appear prescriptive and will be changed to a "minimum" slope of 3:1.

C33: Consider adding 4:1 slopes if mowing is anticipated for managing woody vegetation.

RESPONSE: Thanks for the comment, this is a good consideration but not necessarily design criteria.

To the extent possible, retain or replace habitat-forming elements that provide cover, food, pools, and water turbulence. This includes stumps, fallen trees, debris, and sediment bars. Only remove these stream habitat elements when they cause unacceptable bank erosion, flow restriction, or damage to structures.

Design treatments to remain functional and stable for the design flow and sustainable for higher flow conditions. Evaluate the effects of changes to flow levels compared with the preinstallation flow levels, for low and high flow conditions. Ensure treatments do not limit stream flow access to the floodplain. Do not design treatments that result in negative offsite impacts such as increased channel or bank erosion downstream.

Evaluate the impact of flow-changing techniques (e.g. stream barbs) on the opposite bank. If the opposite bank is under different ownership, consult with the landowner about potential impacts. Refer to NRCS NEH, Part 650, TS-14H for flow-changing techniques.

C20: Are stream barbs defined somewhere?

RESPONSE: There is not a glossary section to this standard. Stream barbs are fairly commonly used and are mentioned as an example here. Standard drawings are available.

Critical Sites. The following sites present a high risk of failure and require further analysis of the potential failure modes to ensure a stable design.

C27: The Critical Site criteria below is too broad and will encompass too many sites that are not in fact critical. Consider fine tuning the bullets below to better hone in on true critical sites.

RESPONSE: Critical sites characterize situations where projects have failed when rock sizing procedure for subcritical flow were applied. The standard suggests the need for additional analysis on these sites, but does not require it.

- Water surface slope > 0.8 percent

C59: Where does the energy grade line of >0.8 percent come from? This seems low and would capture a lot of streams in the SW area that I wouldn't consider critical and needing a water surface profile analysis.

RESPONSE: We could simply call out supercritical flow, rather than estimate a water surface slope that would produce supercritical flow. However, many technicians would not recognize the term or the condition which invalidates most rock sizing procedures that assume subcritical flow. This slope, although somewhat arbitrary, was based on collective experience of those on the SOC team and review of previously failed sites. A range of 0.8% to 1.0% was discussed. This again would warrant additional evaluation but not necessarily a hydraulic model.

- Sites < 200 feet downstream from a bridge or culvert crossing.

C28 // C60: Why 200 feet? Individual bridges and culverts very so much that I think there needs to be site specific analysis to determine the distance of concern downstream. Not a one size fits all distance. // Sites < 200 feet downstream from a bridge or culvert crossing – Perhaps we should provide guidance on the size of the stream/watershed that would put this into a critical site?

RESPONSE: Thanks for the comment. 200' seemed appropriate to the team for streams sizes likely to demonstrate significant bank erosion at the outlet end of bridges and culverts. The designer needs to identify where nonuniform supercritical flow ends and uniform, subcritical flow begins in order to identify the proper design procedures. Not knowing where that transition takes place creates a problem.

C34: Concern with the use of the word "culvert" without a specific minimum size. Perhaps the comment we made [Comment C31] would clarify that small watersheds don't apply to this standard.

RESPONSE: Where culvert and bridge flow is creating a bank erosion problem, it is likely supercritical flow. The hydraulic jump or undulating turbulence can drift downstream and invalidate the subcritical flow conditions typically assumed in rock sizing procedures.

C35: Consider adding an alternative to just "<200 feet downstream" based on applying a safety factor to the 2:1 expansion distance from a structure to alleviate this being the only criteria that requires the below analysis.

RESPONSE: The 2:1 expansion distance would not necessarily contain the turbulence and secondary currents associated with vertical contractions in the crossing.

- Entrenched channels (floodprone width to bankfull width ratio <1.4) and headwater channels with colluvium cobbles and boulders. These conditions are indicative of Rosgen stream types (A, F, G, and D) at crossover sections immediately upstream and downstream of the channel bend.

C29: I work in NE Wisconsin and many of the stream systems score <1.4 and would be considered entrenched. However these systems do not have flow conditions that would be described as nonuniform, rapid, or supercritical. Again I think site specific analysis is needed. I recommend removing this bullet all together.

RESPONSE: Language was added to indicate entrenched flows have high shear stress, where increased safety factors and deeper keyways would be prudent. The specific analysis may take more time than the additional analysis suggested in the standard.

C36: Concern with the amount of entrenched channels we have in our region at relatively small watersheds and that being "entrenched" would make them all critical sites. Perhaps the comment we made [Comment C31] would clarify that small watersheds don't apply to this standard.

RESPONSE: Entrenched channels are typically unstable, where flood flows will attempt to the flank or undermine streambank protection.

- Banks with a building or infrastructure located less than two times the bank height from the edge. Conduct a geotechnical investigation and evaluate the effects of surcharge load, seepage, and safety factors in a slope stability model. Investigation typically includes logging and sampling to the depth of a uniform, firm foundation for toe protection. It may also include soil testing: sieve analysis and Atterberg limits for Unified Soil Classification; in-place density and shear strength for slope stability. Refer to NRCS NEH, Part 631, Chapters 2 and 5 for Group B structures.

C21: The distance calculation [first line of final bullet point] is unclear.

RESPONSE: The language will be clarified.

Flow at these sites is associated with high shear stress. The flow is often classified as nonuniform, rapid, or supercritical. Consider a water surface profile model to evaluate a full range of flows to determine the location and magnitude of sudden changes in water surface elevation (i.e. hydraulic jumps); and to determine energy slope and shear stress for bank treatments and scour depth calculations.

C30 // C61: This [water surface profile model] seems extreme. Is there a step down or something less involved than running a HEC-RAS model. I'm concerned that too few people will be able to do this. // I don't think we should require a water surface profile for all critical sites. Something like "Additional analysis will be done to determine if a water surface profile model is needed. If a water surface profile is completed, evaluate a full range of flows…..".

RESPONSE: The language was changed to consider a water surface profile model. Other than making very uncertain and conservative assumptions in Manning's equation, there are really no comprehensive ways to accurately estimate the energy slope and depth at critical sites without a water surface profile model. FHWA HEC-23 & 14 and USACE EM 1110-2-1601, 3.7(e) were referenced as empirical tools to estimate rock sizing on steep slopes and around bridges and culverts. However, these tools would still produce uncertain results without an accurate energy slope and depth from a water surface profile model.

C37: [water surface profile model] unsteady? Or can we get the answers from a steady model?

RESPONSE: Revetment designs need the shear stress applied by the water. The determination of shear stress requires an accurate energy slope. Accurate energy slopes at critical sites come from a water surface profile model, i.e. HEC-RAS. Without a HEC-RAS model, the energy slope and flow depth are uncertain and so is the rock size.

C62: Modify the JAA levels or add a category for "critical sites" so only qualified people do the additional analysis.

RESPONSE: Good suggestion.

This hydraulic analysis may result in heavier revetment components, uniform rock gradations, flatter side slopes, or deeper keyways. Refer to USACE HEC-RAS software for flow modeling. Refer to rock sizing methods for hydraulically steep slopes or USACE EM 1110-2-1601, 3.7(e), bridge scour, FHWA HEC-23, and culverts FHWA HEC-14, Chapter 10. Refer to Open Channel (582) when site stability is caused by sediment and bedload transport issues; and Channel Bed Stabilization (584) when the site instability is caused by channel bed aggradation or degradation.

C63: HecRas does not do a good job of calculating useful shear stress values for a channel and that further analysis outside of HecRas is needed. This is a training thing, not a CPS thing.

RESPONSE: This is true, but we would only use the HEC-RAS shear stress values for sediment transport calculations in alluvial channel design. HEC-RAS does a great job of computing the energy slope and flow depth which are used in revetment design procedures.

Conduct a geotechnical investigation and develop a slope stability model to determine the factor of safety for slope stability when a home or building is located near the streambank. This distance will vary depending on type of structure, bank slope, soil type, and presence of seepage but will generally be horizontally within two to three times the height of the bank from the toe of the slope. Refer to NRCS NEH Part 631, Chapters 2 and 5 for Group B structures for geologic investigation guidance. Investigations typically include logging and sampling to a depth below the thalweg, and soil tests to determine Unified Soil Classification, in-place density, and shear strength.

Additional Criteria for Shorelines

For the design of structural treatments, evaluate the site characteristics below the waterline for a minimum of 50 feet horizontally from the shoreline measured at the design water surface. Base the height of the protection on the design water surface plus the computed wave height and freeboard. Use mean high tide as the design water surface in tidal areas. Limit revetments, bulkheads, or groins to no higher than 3 feet above mean high tide, or mean high water in nontidal areas. Key-in structural shoreline protective treatments to a depth that prevents scour during low water.

C48: There is guidance as to what should be in the evaluation of the site characteristics within the first 50 feet off the shore. It is not clear why the distance is 50 and there are lots of things that could be found in that area but much of it is not relevant to any design for shoreline protection. There is no requirement to determine the fetch, mean water depth along the fetch or that the maximum wind velocity needs to be determined so that the wave height can be calculated.

RESPONSE: Thanks for the comment, the main intent of evaluation of this 50 feet is to determine the grade of the lakeshore bottom to identify potential areas of concern and to make sure the toe of any protection will be stable.

C49: Where would one find the high tide levels for Wisconsin lakes? On flowage lakes there is usually two high water levels and two low water levels. Water is lowered in the winter when there is little or no wave action and the water is raised in the summer months. Should there be some guidance as to what levels to use?

RESPONSE: The tide levels are not appropriate for Wisconsin lakes as sites would be in non-tidal areas. Some lakes may have a staff gauge that could be used to determine minimum or maximums. Otherwise physical evidence and landowner or lake district knowledge of water level management may be used to determine this. If there is a seasonal fluctuation, both the maximum normal water level and minimum normal water levels need to be considered in the design.

When using vegetation as the protective treatment, include a temporary breakwater during establishment when wave run-up could damage the vegetation.

In addition to the assessment requirements under General Criteria, include the following information in the design report.

- Landowner's objectives for protection, available materials for shoreline treatments, existing and desired riparian land uses, willingness to carry out maintenance activities, and special conditions.
- Elevation of the ordinary high water mark (OHWM) and range of lake level fluctuations.
- Height of watercraft waves and frequency of watercraft activity.
- Severity of shoreline erosion using average annual rate (feet per year) of shoreline recession with

measurements from historic aerial imagery over a period of 20 years. This method may be excluded, or the evaluation period abbreviated, if imagery is unavailable or obscured by canopy. Refer to NRCS Field Office Technical Guide, Section III >Planning Tools >Engineering for erosion calculations.

C50: Sometimes there are remnants of past shoreline protection structures that could be used to determine the extent of previous erosion. These are usually within the first 50 from shore.

RESPONSE: Thanks for the comments, there are many different types of items that could be used to document recession including the past protection as mentioned along with outfall pipes that may be exposed. Any of these could be used to help document the recession rates.

- Location, type, and quantity of existing shoreline protection adjacent to the site. Describe the effectiveness or success of those treatments.

C51: This section should be a consideration and not a requirement. On many lakes there could be many different landowners in the ¼ mile setback. Without a boat or trespassing, it could be difficult to evaluate any existing shoreline protection and it may not be useful information if the shore conditions or the fetch are different for those sites.

RESPONSE: Thanks for the comment, your concerns are noted. The language was changed to reference adjacent sites.

- History of ice action which may include interviews or evidence of ice sheet thickness and push up elevations.

C52: Ice heaves and damage to vegetation or property are much better indicators of ice damage than interviews.

RESPONSE: Thanks for the comment, the bullet does contain the information you referenced. Interviews are not as reliable, but may provide additional information like frequency of ice problems.

- Lake designations: Areas of Special Natural Resource Interest (ASNRI), Outstanding Resource Waters (ORW), Exceptional Resource Waters (ERW), size and type of water body.
- Type and density of riparian vegetation and invasive species.

Perform a soils investigation along the planned reach of protection. Log the soil profile from the top of high bank to a depth of stable substratum. Use the Unified Soil Classification System. Identify the location, elevation, and soil layer(s) of observed seepage. Classify the littoral material.

Conduct a geotechnical investigation and develop a slope stability model to determine the factor of safety for slope stability when a home or building is located near the shoreline escarpment. This distance will vary depending on type of structure, bank slope, soil type, and presence of seepage but will generally be horizontally within two to three times the height of the bank from the toe of the slope. Refer to NRCS NEH, Part 631, Chapters 2 and 5 for Group B structures for geologic investigation guidance. Investigations typically include logging and sampling to a depth below the lake bottom, and soil tests to determine Unified Soil Classification, in-place density, and shear strength.

C53: This required investigation seems excessive. NEH Part 631, Chapter 2 indicates that the investigation is for structures such as earthen dams and not a lake cottage. Many of Wisconsin's lakes are in the glaciated parts of the state. Is there an exemption for the compaction of glacial till like there is for CPS 313? The top of bank on some lakes are 25 feet high and a single-story house 70 feet horizontally from the OHWM should not be in danger of causing a slope failure.

Part 631, Chapter 2 requires a preliminary study of documents and other remote sensing methods to determine in a detailed study is needed. The proposed standard requires the development of slope stability model whether a detailed investigation is warranted or not.

RESPONSE: Thanks for the comment. NEH Part 631 covers all investigation. It may not be specific to shoreline escarpments but it's the best we have for now. The standard language was adjusted to clarify sites where geotechnical investigations are warranted. The designer needs to seek out the proper specialist to examine the factor of safety for slope stability when homes and buildings are at risk.

Provide lakeshore protection to the highest elevation of the following:

- OHWM plus the storm wave height as specified in Wisconsin NR 328
- Height of watercraft generated waves
- Height of seep lines in the bank if not controlled by some other fashion

C54: The maximum height of structural protection is determined to be OHWM + the Design wave height with the current requirements so that we can get a general permit from the DNR. The height of "protection" is the OHWM + Run up + Set up. OHWM + Run up + Set up [2nd bullet] will always be higher than OHWM + design wave height [1st bullet].

RESPONSE: Agreed. Second bullet removed.

Use a minimum slope of 1:5 horizontal to 1 vertical for rock riprap; 2:1 or flatter is recommended.

C55: Some revetments are vertical by design and there are many vegetative slopes as steep as 1.5:1 installed on lakes. With use of turf reinforcement and erosion control mats, the vegetative installations are stable. DOT has guidance for vegetating steep slopes.

RESPONSE: Agreed. Language changed to 1.5:1 for rock riprap.

C56: It is not clear to me as to why we will allow the O&M plan to install riprap that is not properly grade, undersized, and without hardness testing on lakeshores. Ice will pick up any size rock in the right conditions. On flowage lakes the ice has move the larger rock out away from the shore and left the smaller rock. If we replace them with rock from the smaller end of the original rock gradation, the riprap will not withstand the wave action the next summer. Ice action has been controlled through the use of flatter slopes on Lake Winnebago and with larger rocks at the toe of the riprap where the flatter slopes are not practical. Beaching protection in the current Wisconsin Supplement to 580 works well or areas where ice heaving is a problem.

RESPONSE: Agreed. Language removed.

Additional Criteria for Stream Corridor Improvement

Establish stream corridor vegetative components as necessary for ecosystem function and stability. The appropriate composition of vegetative components is a key element in preventing excess long-term channel migration in reestablished stream corridors. Establish vegetation on channel banks and associated areas according to NRCS CPS Critical Area Planting (Code 342).

C57: Is there a minimum width for a stream corridor? Can a pasture be considered to be a stream corridor?

RESPONSE: There is no minimum width.

C58: Some counties have Shoreland Ordinances that are more restrictive than CPS 342. Since this is in the standard and the counties need to meet the standard and their own ordinance, they may have to decide which side of the conflict to be on.

RESPONSE: The NRCS standard is Federal; county policy and/or ordinances aren't incorporated into Code 580.

Design treatments 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. Establish objectives on the survival and reproductive needs of populations and communities, including habitat diversity, habitat linkages, daily and seasonal habitat ranges, limiting factors, and native plant communities. Develop the requirements for the type, amount, and distribution of vegetation using the requirements of the fish and wildlife species or communities of concern.

Design treatments to meet aesthetic objectives as determined by a site-specific assessment or management plan. Establish aesthetic objectives based on human needs, including visual quality, noise control, and microclimate control. Use construction materials, grading practices, and other site development elements compatible with adjacent land uses.

CONSIDERATIONS

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

When designing bank treatments, consider changes that may occur in the watershed hydrology, landuse, and sedimentation due to climate change. The magnitude and duration of rainfall and streamflow events may have increased from historical averages. Use local forecasts of climate change in the design if available.

Incorporate debris removed from the channel or streambank into the treatment design when it is compatible with the intended purpose to improve benefits for fish, wildlife, and aquatic systems.

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, buffers, etc. Avoid excessive disturbance and compaction of the site during installation.

C22: What is meant by “climate controls” in this context?

RESPONSE: That is a good question. This is national language that cannot be edited but it is a consideration, not a required criteria.

Use vegetative species that are native and/or compatible with local ecosystems. Avoid introduced species that could become nuisances. Consider species that have multiple values such as those suited for biomass, nuts, fruit, browse, nesting, aesthetics, and tolerance to locally used herbicides. Avoid species that may be alternate hosts to disease or undesirable pests. Consider species diversity to avoid loss of function due to species-specific pests.

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. Consider and refer to NRCS CPS Wetland Wildlife Habitat Management (Code 644).

Use treatments that promote beneficial sediment deposition and the filtering of sediment and sediment-attached and dissolved substances.

Maintain or improve fish and wildlife habitat 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.

Maximize adjacent wetland functions and values with the project design to the extent practicable.

To maintain plant community integrity, exclude livestock during establishment of vegetative treatments and apply appropriate grazing practices after establishment.

Control wildlife during establishment of vegetative treatments. Use temporary and local population control methods with caution and within applicable regulations.

When appropriate, consider establishing 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.

Consider the perennial vegetation requirement (35' min.) under the Wisconsin NR 115.05(1)(c)2 "Minimum zoning standards for shorelands," in the operation & maintenance plan.

C23: Is the 35' standard in all Shoreline Zoning Codes?

RESPONSE: All county shoreland zoning codes were not reviewed and some may be different, however the 35' is in the model ordinance language and comes from state statute NR 115.05(1)(c)2. This was reworded to reference the state statue rather than zoning codes for a more appropriate reference.

To the extent possible, excavate a floodplain bench to reduce the entrenchment ratio and stress on streambank protection measures.

C24: I think in this context, floodplain refers to the flatter area above the main stream channel where larger flows are conveyed and not the 100-year floodplain. The suggestion would be to make that distinction more clear.

RESPONSE: This statement is not referring to the 100-year floodplain and not sure how it could be clarified.

Consider safety hazards to boaters, swimmers, or people using the shoreline or streambank when designing treatments. Place warning signs as necessary.

Consider installing self-sustaining or minimal maintenance treatments.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. Include provisions 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. At a minimum, include—

- A plan view of the layout of the streambank and shoreline protection.
- Typical profiles and cross sections of the streambank and shoreline protection.
- If the planned treatment exceeds 300 feet, show a profile view along the channel improvement reach. Include the thalweg, top of high bank, bankfull elevation, vertical extent (top and bottom) of treatment and other planned structures. Include soil logs and seepage locations.
- Structural drawings adequate to describe the construction requirements.
- Requirements for vegetative establishment and mulching, as needed.
- Safety features.
- Site-specific construction and material requirements, e.g. rock and bedding/filter gradations.
- Work limits --- extent of protection, ingress and egress locations for construction equipment, parking areas, borrow and spoil locations, areas of habitat requiring protection or avoidance (e.g. wetlands, regulated floodplains, riparian and upland areas, instream habitat), property

lines, and buried/overhead utilities.

- Pollution control, e.g. staged construction, floating silt curtains, silt fences, erosion control wattles and logs.

C25: Suggest substituting "Sediment and Erosion Control…" for "pollution [control…]."

RESPONSE: Pollution control is a generic term used by regulatory agencies to cover everything that may impact water quality including oil, grease, and fuel discharge from equipment doing the work. The relevant Wisconsin Construction Specification 5 is titled Construction Site Pollution Control, which is where this terminology comes from.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator. At a minimum, include—

- Instructions for operating and maintaining the system to ensure it functions properly.
- Periodic inspections and prompt repair or replacement of damaged components.
- Periodic inspections and prompt repair of erosion.
- Instructions for maintaining healthy vegetation, when required.
- Instructions for controlling undesirable vegetation.

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