STANDARD AND SPECIFICATIONS FOR STRUCTURAL STREAMBANK PROTECTION

Definition

Stabilization of eroding streambanks by the use of designed structural measures, such as rock riprap, gabions, pre-cast concrete wall units and grid pavers.

Purpose

To protect exposed or eroded streambanks from the erosive forces of flowing water.

Condition Where Practice Applies

Generally applicable where flow velocities exceed 6 feet per second or where vegetative streambank protection is inappropriate. Necessary where excessive flows have created an erosive condition on a streambank.

Design Criteria

- Since each channel is unique, measures for structural streambank should be installed according to a design based on specific site conditions.
- Develop designs according to the following principles:
- Make protective measures compatible with other channel modifications planned or being carried out in the channel reaches.
- Use the design velocity of the peak discharge of the 10-year storm or bankfull discharge, whichever is less. Structural measures should be capable of withstanding greater flows without serious damage.
- Ensure that the channel bottom is stable or stabilized by structural means before installing any permanent bank protection.
- Streambank protection should begin at a stable location and end at a stable point along the bank.
- Changes in alignment should not be done without a complete analysis of effects on the rest of the stream system for both environmental and stability effects.
- Provisions should be made to maintain and improve fish and wildlife habitat. For example, restoring lost vegetation will provide valuable shade, food, and/or cover.
- Ensure that all requirements of state law and all permit requirements of local, state, and federal agencies are met.

Construction Specifications

Riprap – Riprap is the most commonly used material to structurally stabilize a streambank. While riprap will provide the structural stabilization necessary, the bank can be enhanced with vegetative material to slow the velocity of water, filter debris, and enhance habitat. See Biotechnical Measures for Erosion and Sediment Control, Section 4, for more information.

1. Bank slope – slopes shall be graded to 2:1 or flatter prior to placing bedding, filter fabric, or riprap.
2. Filter – filters should be placed between the base bank material and the riprap and meet the requirements of criteria listed in the Standards and Specifications for Riprap Slope Protection, page 5B.57.
3. Gradation – The gradation of the riprap is dependent on the velocity expected against the bank for the design conditions. See Table 5B.3 on page 5B.38. Once the velocity is known, gradation can be selected from the gradations below. The riprap should extend 2 feet below the channel bottom and be keyed into the bank both at the upstream end and downstream end of the proposed work or reach.

See Figure 5B.19 on page 5B.39 for details.

Gabions – Design and install gabions according to manufacturers recommendations. Since these are rectangular, rock-filled wire baskets, they are somewhat flexible in armoring channel bottoms and banks. They can withstand significantly higher velocities for the size stone they contain due to the basket structure. They also stack vertically to act as a retaining wall for constrained areas. (Figure 5B.20).

Gabions should not be used in streams that carry a bedload that can abrade the wire causing separation and failure.

Reinforced Concrete - May be used to armor eroding sections of streambank by constructing walls, bulk heads, or bank linings. Provide positive drainage behind these structures to relieve uplift pressures.

Grid Pavers – Modular concrete units with or without void areas can be used to stabilize streambanks. Units with void areas can allow the establishment of vegetation. These structures may be obtained in a variety of shapes (Figure 5B.20) or they may be formed and poured in place. Maintain design and installation in accordance with manufacturers instructions.

Revetment – Structural support or armoring to protect an embankment from erosion. Riprap and gabions are commonly used. Also used is a hollow fabric mattress with cells that receive a concrete mixture, (ie. Fabriform). Any revetment should be installed to a depth below the anticipated channel degradation and into the channel bed as necessary to provide stability.

Modular Pre-Cast Units – Interlocking modular precast units of different sizes, shapes, heights, and depths, have been developed for a wide variety of applications. These units serve in the same manner as gabions. They provide vertical support in tight areas as well as durability. Many types are available with textured surfaces. They also act as gravity retaining walls. They should be designed and installed in accordance with the manufacturers recommendations (Figure 5B.20).

All areas disturbed by construction should be stabilized as soon as the structural measures are complete.

Maintenance

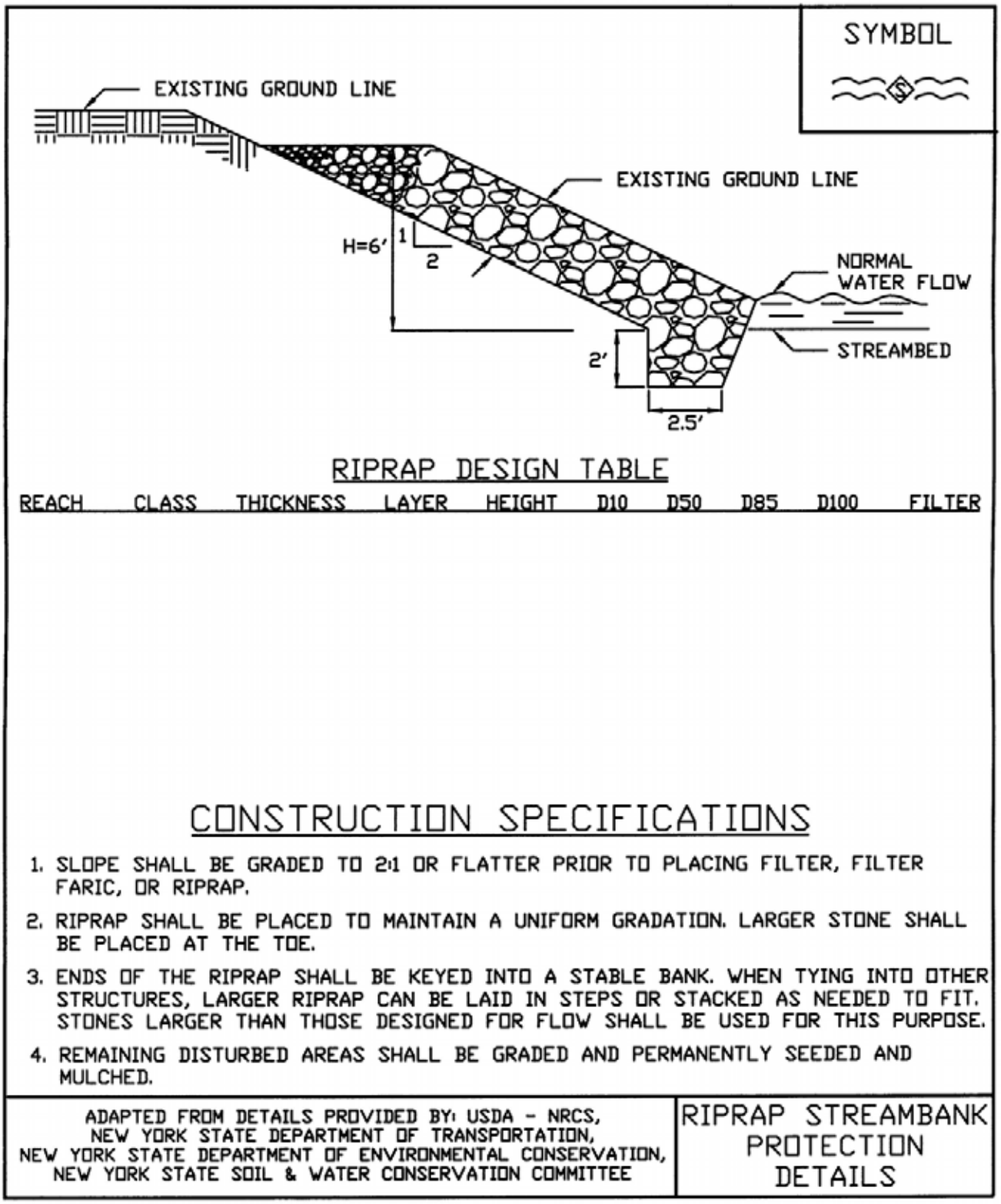
Check stabilized streambank sections after every high-water event, and make any needed repairs immediately to prevent any further damage or unraveling of the existing work.

Table 5B.3—Riprap Gradations

Class	Layer Thickness (in.)	Max Velocity (ft./s.)	Wave Height (ft.)		PERCENT FINER BY WEIGHT											
					D_{10}			D_{50}			D_{85}			D_{100}		
					Wt. (lbs.)	d_o (in.)	d□ (in.)	Wt. (lbs.)	d_o (in.)	d□ (in.)	Wt. (lbs.)	d_o (in.)	d□ (in.)	Wt. (lbs.)	d_o (in.)	d□ (in.)
I	18	8.5	-		5	5	4	50	10	8	100	13	10	150	15	12
II	18	10	-		17	7	6	170	15	12	340	19	15	500	22	18
III	24	12	2		46	10	8	460	21	17	920	26	21	1400	30	24
IV	36	14	3		150	15	12	1500	30	25	3000	39	32	4500	47	36
V	48	17	4.8		370	20	16	3700	42	34	7400	53	43	11,000	60	49

d_o = gravel material d□ = angular rock riprap
Wt = weight in pounds

Figure 5B.19
Riprap Streambank Protection



RIPRAP DESIGN TABLE

REACH	CLASS	THICKNESS	LAYER	HEIGHT	D10	D50	D85	D100	FILTER

CONSTRUCTION SPECIFICATIONS

1. SLOPE SHALL BE GRADED TO 2:1 OR FLATTER PRIOR TO PLACING FILTER, FILTER FARIC, OR RIPRAP.
2. RIPRAP SHALL BE PLACED TO MAINTAIN A UNIFORM GRADATION. LARGER STONE SHALL BE PLACED AT THE TOE.
3. ENDS OF THE RIPRAP SHALL BE KEYED INTO A STABLE BANK. WHEN TYING INTO OTHER STRUCTURES, LARGER RIPRAP CAN BE LAID IN STEPS OR STACKED AS NEEDED TO FIT. STONES LARGER THAN THOSE DESIGNED FOR FLOW SHALL BE USED FOR THIS PURPOSE.
4. REMAINING DISTURBED AREAS SHALL BE GRADED AND PERMANENTLY SEEDED AND MULCHED.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS,
NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

RIPRAP STREAMBANK PROTECTION DETAILS

Figure 5B.20
Structural Streambank Protection Methods