

RIPRAP FOR STREAMBANK PROTECTION

Produced by
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WHAT IS IT?

Riprap is a heavy stone facing (armor) on a shorebank used to protect it and the adjacent upland against wave scour. Riprap depends on the soil beneath it for support and should be built only on stable shores or bank slopes.

ENVIRONMENTAL CONSIDERATIONS

Stabilizing streambanks with shrub and tree vegetation provides excellent habitat for fish and wildlife species. Maine's fisheries rely on a combination of shading and leaf drop by the plants. Shading protects fish species from "thermal pollution" -- when the water heats up too much for fish to thrive. Leaf litter provides the first link in the food chain -- a food source for the insects that young fish feed on. Avoid at all costs using riprap if vegetation can solve your erosion problem. If riprap is unavoidable, use a combination of riprap and plantings to provide the vegetative cover needed.

WHAT IS RIPRAP COMPOSED OF?

Riprap is composed of three sections: the armor or stone layer, the filter layer, and the toe protection.

Typical armor is composed of rough, angular rock. The second component, the underlying filter layer, supports the stone against settlement, allows groundwater to drain through the structure, and prevents the solid beneath from being washed through the armor layer by waves or groundwater seepage. The toe protection prevents settlement or removal of the lower edge of the riprap.

In certain cases overtopping of the top of the riprap slope may be a factor which needs to be considered. The top of the slope can be protected by including a stone overtopping apron in the design.

STONE SIZE

To assure that a riprap shoreline will remain stable; you must specify the size of the stone to be used. Stone size is commonly expressed in terms of a D50 value. D50 values are generally expressed in inches, and can be thought of as the average stone size in a rock mix. For example, if the D50 of a rock mix is 12 inches, 50% of the stones will pass through a sieve with 12-inch openings. The remaining rocks will be larger. Their largest

stone in the mix should be no larger than 1.5 times the D50 (18 inches). The thickness of the riprap layer should be 2.25 times the D50, or 27 inches.

To determine the correct stone size for a streambank stabilization project, you must first determine the water velocity of the stream during a spring storm event.

DETERMINING WATER VELOCITIES

Water velocities need to be evaluated during spring runoff when water will be moving at its peak speed. Extreme caution needs to be used when working next to streams! Take every possible safety precaution to protect yourself and your assistant from drowning!

Plan to survey your stream during the heavy spring runoff season. You will need a tape measure; several floating objects (small sticks work well) and a watch, which counts seconds. One person should be stationed at a point upstream armed with the sticks. The second person stands 100 feet downstream from them with the watch. Throw the stick into the stream and time how long it takes the stick to travel the 100 feet between the two people. Repeat once or twice.

To convert this measurement into feet per second, you divide 100 feet by the number of seconds you counted. This equals the number of feet per second the water travels.

RIPRAP SIZING CHART

FEET PER SECOND	ROCK D50 (INCHES)	ROCK WEIGHT (POUNDS)
5	4	3
6	6	10
7	8	24
8	10	47
9	12	81
10	15	158
11	18	273
12	20	375
13	24	650
14	27	925
15	30	1268
16	35	2013

RIPRAP SIZING

Use the previous chart to determine the stone size (in terms of D500 you will need for your riprap. Be sure that you get a rock mixture which includes smaller stone sizes to be sure the small voids in the rock mix are filled.

LARGEST STONE = 1.5 X D50

THICKNESS OF RIPRAP LAYER = 2.25 X D50

LIMITATIONS OF RIPRAP

Riprap protects only the land immediately behind it and not adjacent areas. Near the riprap, erosion may be accelerated by wave reflection from the structure.

Riprap by itself does not provide a good habitat for fish. Using a combination of riprap with trees and woody shrubs planted between will provide wave protection as well as the vegetative cover required by spawning and young fish.

FILTER LAYER

Filter layers of either special filter **cloth** (also called geotextile) or 6 inches of well-graded gravel should be provided to prevent loss of slope material through voids in the armor. A well-graded gravel will contain a mix of stone sizes ranging from fine sands through 3 inch stones - no stone should exceed 6 inches. When using filter cloth, an intermediate layer of sand between the riprap layer and the fabric helps to distribute the load and prevent rupture of the filter cloth.

SLOPE

Prior to riprap construction, the existing ground should be graded to an appropriate slope, preferably no steeper than 1.5 horizontal to 1 vertical (1.5 to 1). The DEP calls for the slope to be no flatter than 2 horizontal to 1 vertical (2 to 1). Clean, well-graded fill material should be added as needed to achieve a uniform grade. The fill should be free of large stones (larger than 6 inches) and firmly compacted before construction proceeds.

CONSTRUCTION CONSIDERATIONS

Site Accessibility

Determine if the project can be built using only hand tools and portable power equipment or if heavy equipment is also necessary. If heavy equipment is required, you must locate a good access to the site. Be careful to keep movement of heavy machinery to a minimum in these sensitive areas. Expect to have to replant some vegetation after the project is completed

Choosing a Contractor

Identify a reputable firm in your area. Ask for a list of their similar projects. Contact the owners to arrange for personal inspection of the work and ask questions to help you assess if the contractor's past performance equals their claims.

Erosion Control Measures

Plan to install your riprap when the water level is the lowest, usually during the late summer. Before any work is begun, a barrier of silt fencing should be installed on the downslope side of construction. Be sure the fencing is installed properly! If there is any evidence of siltation reaching the stream, you can be fined by the DEP! If the silt fencing needs to be installed in the water, rather than embedding the fencing 6 inches, place a row of sandbags at the base of the fencing to hold it down. Be sure the construction is performed quickly and efficiently - delays during construction can lead to a major impact to the stream.

The way in which the riprap is installed makes a big difference. Be sure the contractor does not have heavy equipment in the stream. Ideally, machinery should be parked on a

flat area at the top of the slope and construction should be done by reaching out over the slope. This will help prevent damage to the top of the slope.

Construction should start at the base and work upwards. If the job takes several days, the face of each section should be stabilized with stone and bare soil above the work area should be mulched before leaving for the day.

Once the riprap is installed, any mud and dirty water between the construction area and the fencing should be pumped out and disposed of in a wooded area away from the stream. Be sure any areas of bare soil have been reseeded and mulched. The silt fencing can be removed when a good cover of vegetation is present.

Inspecting the Work

Close inspection of the contractor's work is required. Keep a photographic record beginning with existing conditions and proceeding through completion of construction. If possible, check lines, grades, slopes and elevations of structures to assure compliance with your plans. Materials should be examined for adequate conformity with specifications. After construction, maintain a photographic record throughout the life of the structure.