

RIPRAP

Riprap is a layer of various-sized rocks used to protect a streambank from erosion.



Figure 20. Riprap along the bend of a stream with vegetation between the rocks

Advantages and Disadvantages

- Riprap is effective because the rock can adjust to the contours of the streambank and vegetation can grow among the rocks to provide habitat for wildlife in and above the stream.
- Riprap is easy to install and repair, has a natural appearance, and does not harm the environment.
- Riprap works well with a combination of soil bioengineering techniques used up the slope.

Materials

- Class D or E revetment stone, preferably broken limestone, dolomite, or quartzite, available from most quarries (see the Riprap section on page 9). Rough, angular surfaces and variety of sizes will allow the rock to fit together tightly to form a dense barrier.

Preparation

- Determine the stream's velocity by dropping a wood chip into the stream and counting the number of seconds it takes for the chip to travel 50 feet. Divide 50

by the number of seconds to get the stream's velocity in feet per second. Table 2 describes the sizes for riprap based on the speed at which water flows when the stream is at high-flow conditions.

Table 2. Recommended sizes for riprap

Velocity of stream during high flow	Size range (diameter across longest part of rock)
Slow (2-4 ft/sec)	3" - 6"; average 4"
Moderate (4-6 ft/sec)	4" - 12"; average 8"
* Fast (6-12 ft/sec)	5" - 18"; average 14"

*This velocity is the most common cause of streambank erosion in Iowa.

- Use a rock size that the velocity of the stream will not be able to move when the stream is at high-flow conditions.
- The rock used for riprap on fast-flowing streams should weigh between 50 and 150 lbs, with most of the stones weighing at least 90 pounds.
- Smaller rocks should be included in the mixture to fill in the spaces between the larger rocks.
- Broken concrete can be used if the pieces vary in size (well-graded) and the steel reinforcement rods have been removed.
- Broken asphalt should not be used, because of its toxicity to riparian wildlife and low density.
- Rubble from the demolition of buildings should not be used if it contains wood, wallboard, plaster, etc.
- Junk such as washing machines, cars, tires, and refrigerators should never be used. In many cases, junk littering a streambank aggravates the erosion problem.
- Before installing riprap, the bank should be reshaped to a maximum slope of 2 feet horizontal to 1 foot vertical (2H:1V) or flatter.

Installation

- A geotextile fabric can be used after the slope has been graded to stabilize the soil.
- Place a 6-inch layer of gravel or crushed stone, and then firmly place the riprap. If a properly chosen filter/engineering fabric is used, gravel or crushed rock does not need to be used.
- The rock should be inspected to ensure a variation of rock size throughout the slope, and the largest, heaviest rocks should be placed along the bottom of the bank. The rocks should form a layer 12 to 18 inches thick.
- The rock should generally cover the bank from the bottom of the stream to the level of a 2-year or 5-year storm. The remainder of the eroding bank should be reshaped and planted with trees, shrubs, and grasses, as described in the previous sections of this document entitled Seeding of Streambank and Live Stakes.
- If streambed scouring is anticipated, extend the riprap into a trench across the streambed so that if the current makes the channel deeper, the riprap barrier will not be undermined. Use this approach only where streambed degradation is

present. This process may require a series of such stream crossings in the same area to reduce the stream velocity through the area of potential bank erosion.

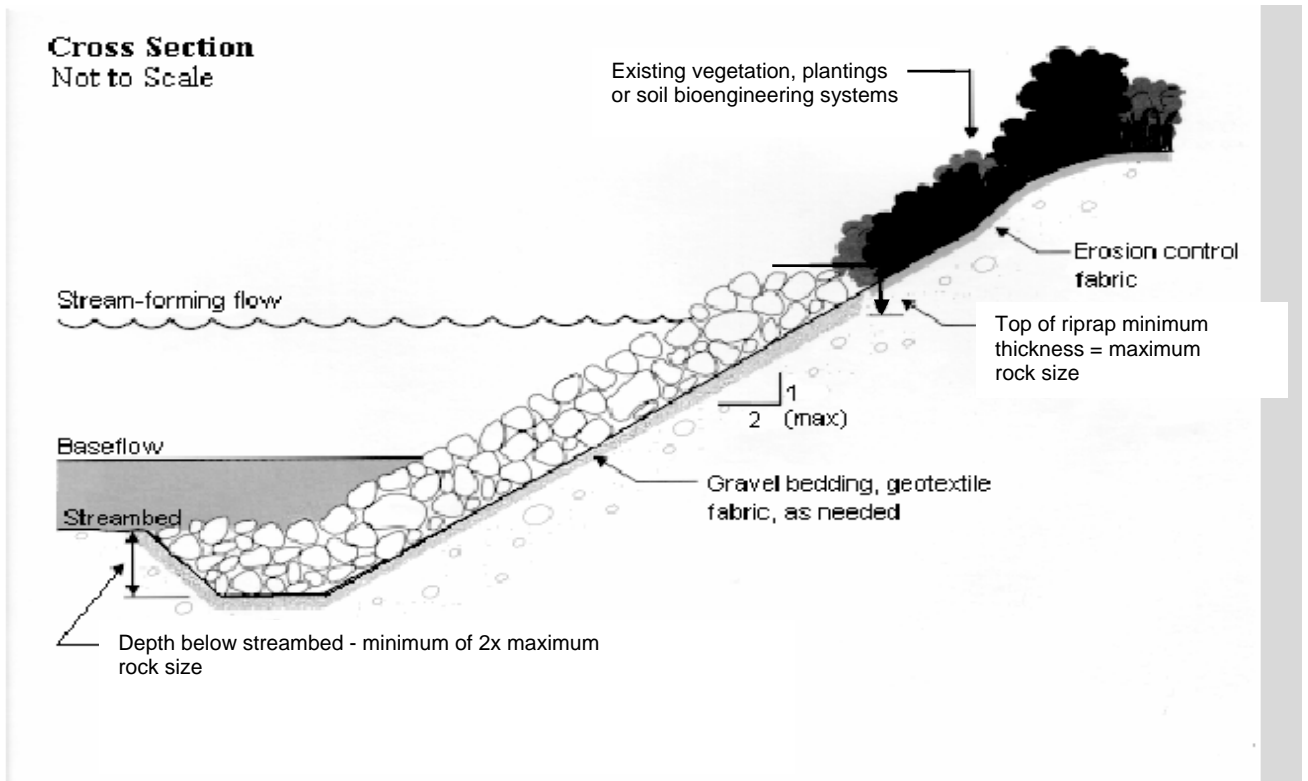


Figure 21. Cross-sectional view of riprap placement on the graded slope of a streambank