

Fish Habitat Restoration Methods Concept Specification

Rock Riprap

Purpose:

- To provide stream bank erosion control in serious to extreme conditions.
- To provide additional fish habitat.

Conditions Where Applicable:

- Instream location and sizing must be approved by an Adopt-A-Stream Biologist.
- Where high water, ice, or groundwater seepage has caused excessive erosion damage to stream banks and stream bends. Angular rocks of a selected size range are placed in a "knitted" fashion or fitted snugly on the bank to achieve maximum strength and durability.
- This technique is useful in areas where water velocities do not exceed 4 m/s (12.4 ft/s) at flood stage and/or where submergence lasts continuously for more than a few days.
- Many eroding banks will naturally recover if ice scouring is eliminated by instream restoration techniques. If this will happen at the site it is preferred to undertaking other bank stabilization methods.

Habitats Created:

- Reduced siltation of habitats.

Advantages:

- Rock tolerates some lateral seepage.
- The rock's rough surface tends to reduce water velocities thus dissipating the stream's erosion energy force and minimizing the erosion problem.
- The riprap barrier is flexible and adjusts to minor shifts and movement of the bank.
- Immediate protection is provided.
- It improves instream cover habitat for juvenile and adult fish.
- In the long term it acquires a natural appearance, especially after being planted or colonized with vegetation.
- Easy to apply and repairs are generally made quickly but seldom required.

Disadvantages:

- Access to site for heavy machinery may be difficult.
- Installation costs can be high for large-scale projects. Installation usually requires a backhoe or excavator for grading and placing of larger material.
- If the rock bank is not long enough and is not "placed" in properly at the upstream

and downstream ends or the toe of the bank, the erosion problem can be shifted upstream or downstream. If not properly "placed" into the streambed, the structure can be undermined and failure expected.

- In the short term riprap often looks unnatural until colonized by plants.
- Provides a "hardened" bank and limits growth of vegetation.
- It may interfere with the natural, lateral movement of the stream.

Design Criteria:

- Rock should be placed on a well-graded slope no steeper than 2:1. The grade of the slope is determined by the site's soil conditions.
- The type of rock used depends on local availability (quarried stone including shot rock). Angular material is the best but round rock can be effectively used on very small sites. Do not use shales and other "soft" rocks as they can break up with the ice.
- The rock size is a function of several variables but mainly stream flow velocity. Rock size is determined by qualified person during the design stage. Water velocities greater than 3.5 m/s (10.9 ft/s) require a more extensive design.
- Riprap is applied at a thickness of at least 1.5 times the maximum stone size and not less than 30 cm (12 in) thick.
- Failure of the structure can result from improper grading, rock size, length of structure, installation methods, and failing to "tie" the structure into the bank at a critical location. Critical locations include the bank toe and upstream and downstream ends of the structure. An experienced person is a great asset in avoiding these problems.
- Extend riprap to above of the bank full level. This is variable depending on the river.
- The largest rocks are fitted (keyed) into the bank toe and upstream and downstream ends. The ends of the project must taper into the bank. On larger sites fitting the rock into the bank toe may require the use of a backhoe to either push the rock into a soft substrate or dig into a hard substrate to fit rock beneath the stream bed.
- Any displaced rock should be repaired immediately.
- Design for peak flow period.
- Construct during low flow period.
- The ability of riprap to withstand the erosive forces depends on the inter-relation of a number of variables. As conditions vary considerably from watershed to watershed and site to site, this technique should not be attempted without the prior approval and assistance from a qualified person.

Implementation Steps:

- These are only suggested steps and may be modified.
- Do machine work from the bank on from instream
- Prepare the site.
- Clear area of debris.

- Grade banks to the recommended slope.
- Dig out the toe trench.
- Install any seepage drains required.
- Place the riprap.
- Riprap can be placed by hand or by machine. Riprap should be placed to its full thickness in one operation.
- Blend or "feather" the ends of the riprap section into the upstream and downstream banks.
- A vegetative cover should be established on any areas that were graded but not covered with riprap.

References:

DFO Gulf Region Culvert Guidelines.

Ministry of Natural Resources of Ontario entitled the "Community Fisheries Involvement Program: Field Manual".

Federal Interagency Stream Restoration Working Group (FISRWG). 1998. Stream Corridor Restoration: Principles, Processes and Practices.

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