MAP CODE
OUTLT

OUTLET PROTECTION

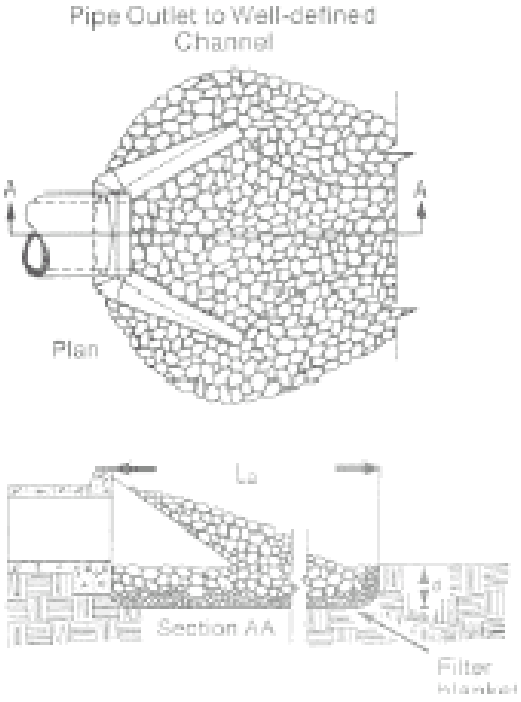
USE Erosion
Sediment

What

- A rock lined apron and flow area at the outlet of a pipe or culvert, paved flume, lined waterway or other flow system.

Purpose

- Prevents scour and erosion at water conveyance outlets.
- Minimizes the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.



Notes

1. L_a is the length of the riprap apron.
2. d=1.5 times the maximum stone diameter but not less than 6".
3. In a well-defined channel, extend the apron up the channel banks to an elevation of 6' above the maximum tailwater depth or to the top of the bank, whichever is less.
4. A filter blanket or filter fabric should be installed between the riprap and soil foundation.

Source: USDA-NRCS, 2001

Where

YES: Outlet protection is required at the outlets of all ponds, stormwater systems, pipes, culverts, ditches and anywhere runoff is conveyed to a natural or manmade drainage feature such as a stream wetland, lake or ditch.

Materials Equipment & Costs

Riprap, filter fabric.
Equipment to move materials.
$ Low.

Plans & Spec's

- Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.
- The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.
- Construct the apron with no overfall at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.
- Immediately after construction, stabilize all disturbed areas with hydroseeding or any other proven method.

Installation

- Use the 10 year peak runoff or the design discharge of the water conveyance structure (whichever is greater) to size the outlet production.
- With low flows, vegetation, including sod, can be effective.
- If the water discharges directly into a well-defined channel, extend the apron across the channel bottom and up the channel banks to an elevation of 15 centimetres.

Maintenance

- Inspect riprap outlet structures after heavy rains to see if any erosion has taken place around or below the riprap, or if stones have been dislodged.
- Add rock as needed to maintain the intended function.
- Immediately make all needed repairs to prevent further damage.

Sources

Austin, L. (2001): **Construction Stormwater Pollution Prevention;** Stormwater Management Manual for Western Washington, Volume II. *Washington State Department of Ecology*, page 129, Publication 9912, URL <http://www.ecy.wa.gov/biblio/9912.html>, June 2001.

United States Department of Agriculture, (1994): **Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater, Best Management Practice Standards.**