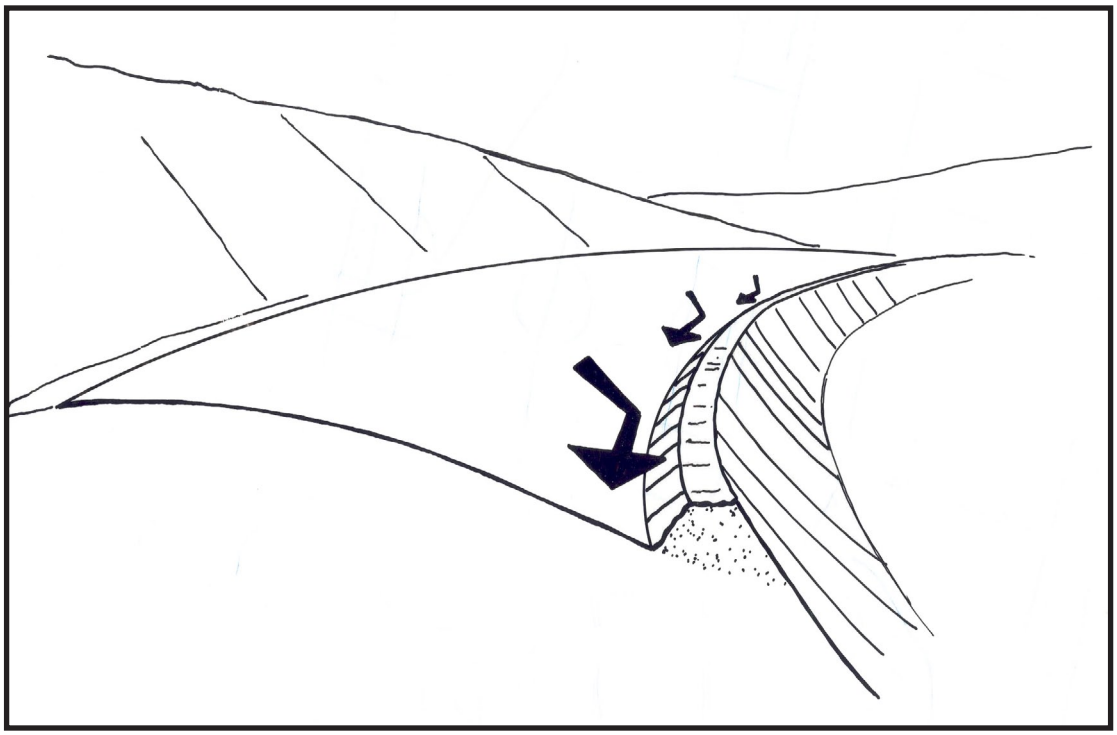
5.2 CONCENTRATED FLOW CONVEYANCE CONTROLS

Temporary concentrated flow conveyance controls consist of a system of installations or BMPs that are used alone or in combination to intercept, divert, convey, and discharge concentrated flows with a minimum of soil erosion, both on-site and downstream (offsite). Temporary concentrated flow conveyance controls may be required to direct run-on around or through the project in a non-erodible fashion. Temporary concentrated flow conveyance systems include the following BMPs:

5.2.1 Earth Dikes/Drainage Swales..... 68
5.2.2 Cut to Fill Slope Transitions..... 70
5.2.3 Erosion Protection at Structures.....72
5.2.4 Rock Outlet Protection..... 74
5.2.5 Slope Drains..... 76

Earth Dikes/Drainage Swales



5.2.1 Earth Dikes/Drainage Swales

Definition

Structures that intercept, divert, and convey surface runoff (generally sheet flow) to a desired location.

Purpose

- To divert runoff away from erodible surfaces.
- To divert runoff toward sediment trapping devices.

Appropriate Applications

- At the base of fill slopes where runoff begins to concentrate.
- At the top of slopes to control rill and gully erosion.
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows.
- To divert runoff toward a stabilized watercourse or drainage structure.
- To divert sediment laden water to sediment trapping device.
- To divert storm water around construction staging areas.

Limitations

- Runoff must be diverted into existing or stabilized drainages or sediment basins.
- High runoff velocities may scour and erode dikes and swales. May be necessary to combine with other BMPs such as check dams, blankets, and sediment logs or riprap.
- Does not control erosion or remove sediment.

Standards and Specifications

- Must be sized correctly for expected flows.
- Swales shall be lined where high runoff velocities are expected.
- Dikes shall be stabilized by compaction or other means such as erosion control blankets or riprap.
- Provide stabilized outlets. Where runoff will carry sediment, divert flow into sediment traps.
- Where installed at construction traffic crossings, the top width may be wider and side slopes may be flatter.
- When possible, dikes and swales shall be installed early in the construction process.
- Shall not adversely impact adjacent properties and must conform to local floodplain management regulations.

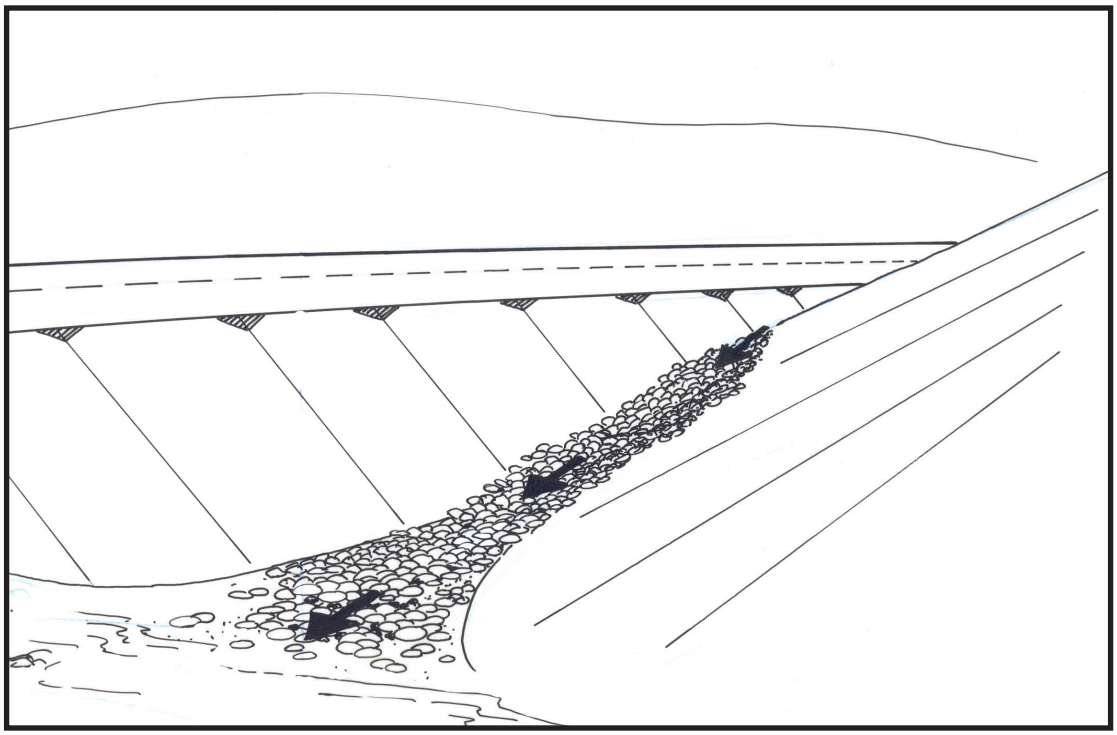
Inspections

- Follow inspection schedule required in CGP Part IV.H.
- Inspect for washouts and failure of associated BMPs.
- Check outlet stabilization for signs of erosion.

Maintenance

- Repair as needed.
- Repair where damaged by construction equipment.
- If material is added to repair the dike it must be properly recompacted.
- Where flows are directed into sediment traps, maintain as described in Sediment Trap BMP.

Cut to Fill Slope Transitions



5.2.2 Cut to Fill Slope Transitions

Definition

Rock riprap placed in cut-to-fill slope transitions.

Purpose

- To reduce erosion at cut-to fill transitions.

Appropriate Applications

- Where concentrated surface flows must be conveyed from a cut ditch, down to the toe of the adjoining downstream fill slope.

Limitations

- Rock riprap transitions reduce erosion only when they have been sized and built properly.

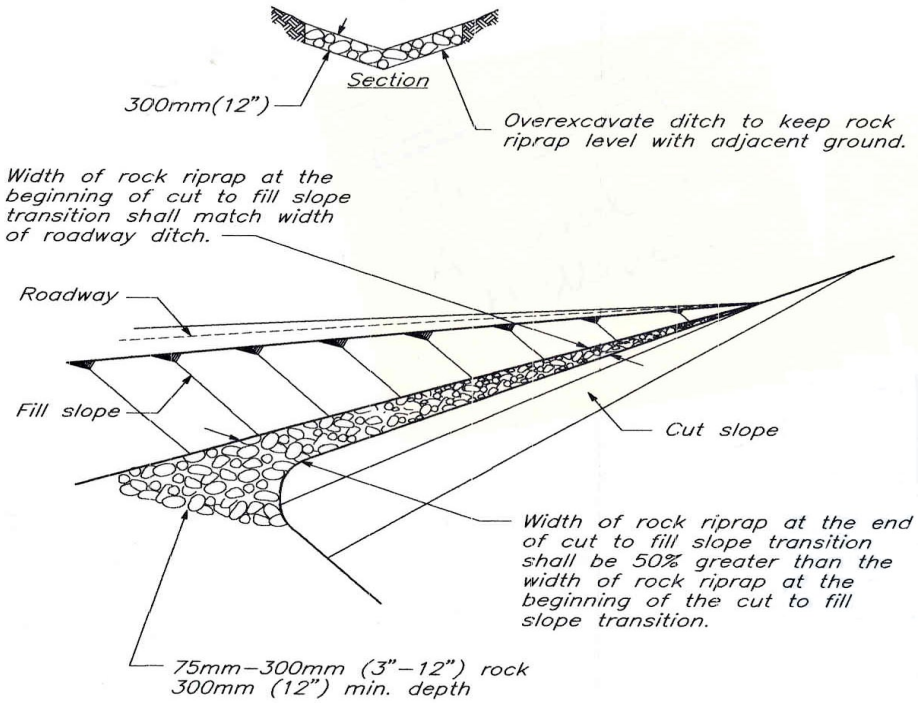
Standards and Specifications

- Width of riprap application at beginning of the cut-to-fill transition shall match width of roadside ditch.
- Width of rock riprap at end of cut-to-fill transition shall be 50% greater than the width of rock riprap at the beginning of the cut-to-fill transition.

- Cut-to-fill transition shall terminate at a planned or existing stabilized drainage.
- Rock shall be placed by hand or mechanical means to achieve complete coverage at the transition. Dumping of riprap may be necessary.
- Riprap shall be embedded into slopes.
- Riprap shall be placed to ensure that the center of the transition is lower than the edges and avoid runoff flow over unprotected soil.
- Size of rock used must be large enough to withstand expected design flow through the transition. Riprap greater than 6 inches shall be wire-tied if required by traffic recovery area.

Inspections and Maintenance

- Follow inspection schedule required in the CGP Part IV.H.
- Inspect for signs of slope erosion under and around the rock protection, check for erosion and displacement of rock at the outlet. Replace rock and repair as needed.



CUT TO FILL SLOPE TRANSITION
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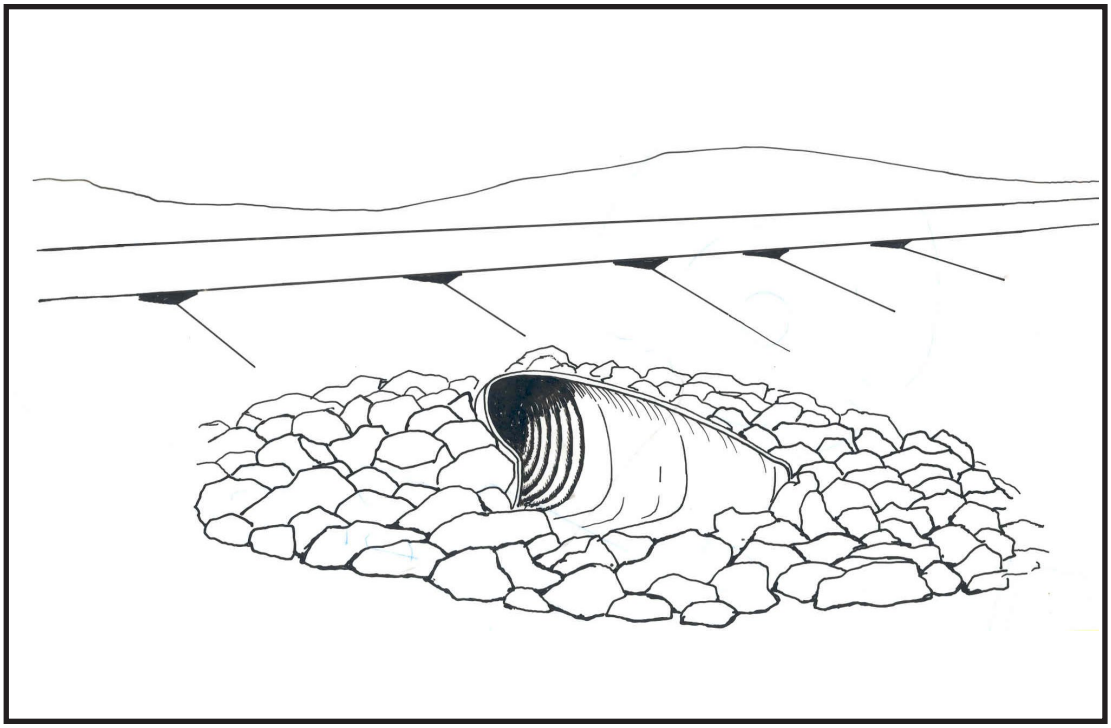
Erosion Protection at Structures



5.2.3 Erosion Protection at Structures

Definition

Rock riprap place along soil interface of concrete and metal structures

Purpose

- To reduce or eliminate the potential for undercutting at structures.

Appropriate Applications

- Place at any structure that abuts a soil surface and where concentration and/or velocity of storm water is great enough to cause erosive flows.

Limitations

- None

Planning Considerations

- Rock interface protection is effective when the rock is sized and placed properly.

Standards and Specifications

- Design and size as specified in the contract documents or as directed by the Engineer.

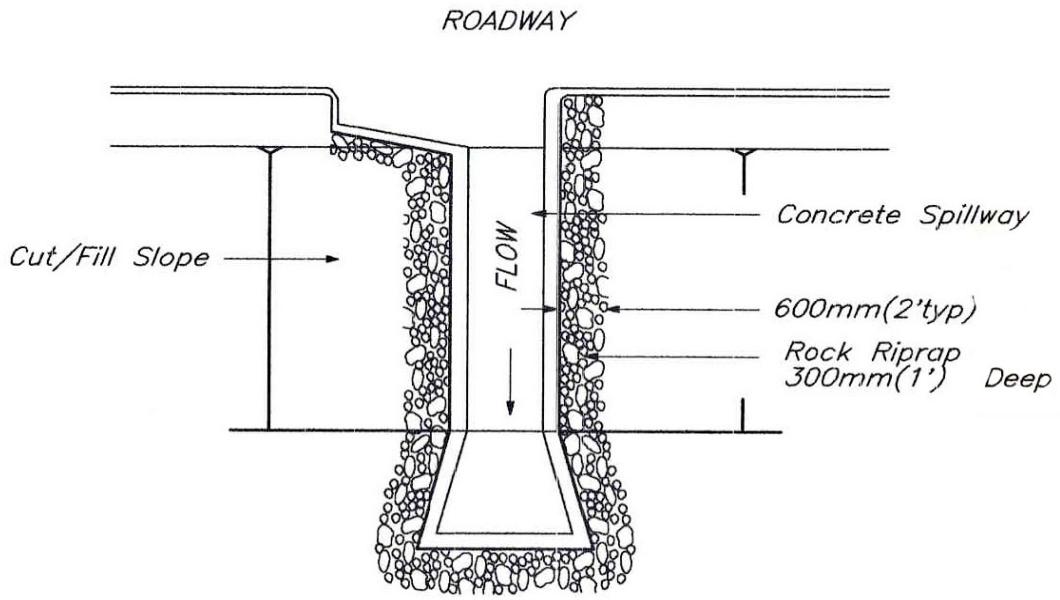
- Use sound, durable, and angular rock for best results.

Inspections

- Follow inspection schedule required in the CGP Part IV.H.
- Inspect for signs of erosion and undercutting around the structure.

Maintenance

- Replace rock and repair erosion damage as needed.



PLAN

SIZE WIDTH AND DEPTH OF ROCK RIPRAP
SHALL BE SIZED PER SITE CONDTIONS

SPILLWAY EROSION PROTECTION

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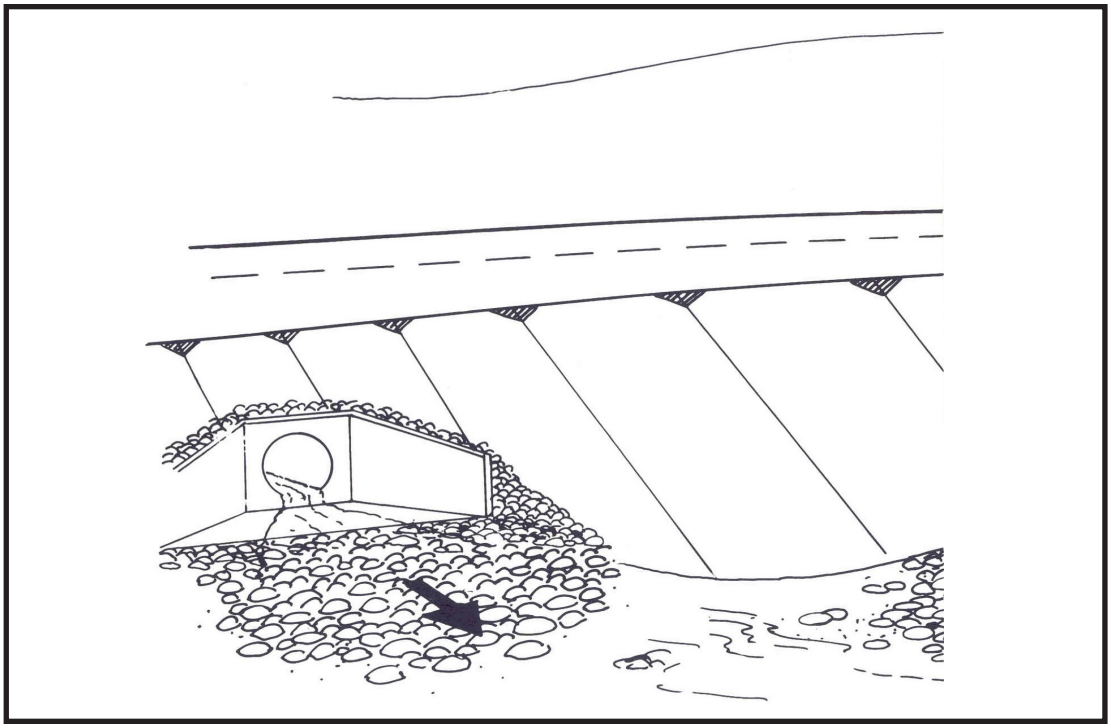
Rock Outlet Protection



5.2.4 Rock Outlet Protection

Definition

Rock riprap or grouted riprap placed at outlets ends of culverts, conduits, or channels.

Purpose

- To prevent scour and reduce velocity of exiting storm water flows.

Appropriate Applications

- Where discharge velocities and energies at the outlets of culverts, pipes or channels are sufficient to erode the downstream channel.
- At discharge outlets that carry continuous flows of water.
- At points where lined conveyances discharge to unlined conveyances.

Limitations

- Loose rock may be washed away during high flows.
- Freeze/thaw cycles may break up grouted riprap.

Standards and Specifications

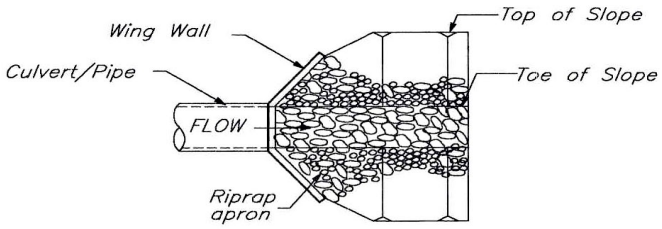
- Grouted or wire-tied rock riprap can minimize maintenance requirements.
- Rock must be sized and placed properly to be effective. Refer to ADOT Drainage Manual.
- A sediment trap below the outlet is recommended if runoff is sediment-laden.
- Use sound, durable and angular rock for best results.

Inspections

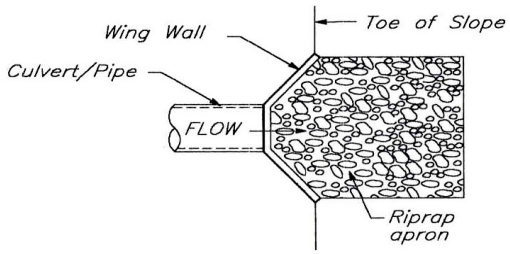
- Follow inspection schedule required in the CGP Part IV.H.
- Inspect for displacement of riprap or damage to underlying fabric, and signs of scour beneath the riprap or around the outlet.

Maintenance

- Replace rock and repair apron and slopes as needed.



WELL DEFINED CHANNEL PIPE OUTLET



UN–DEFINED CHANNEL PIPE OUTLET

NOTES:

1. Area, depth, and size of riprap are based on culvert or pipe size and hydraulic flow calculations.

2. Pipes and culverts should also include erosion protection around the inlet and outlet structures (see BMP No. 6A Erosion Protection at Structures.

ROCK OUTLET PROTECTION

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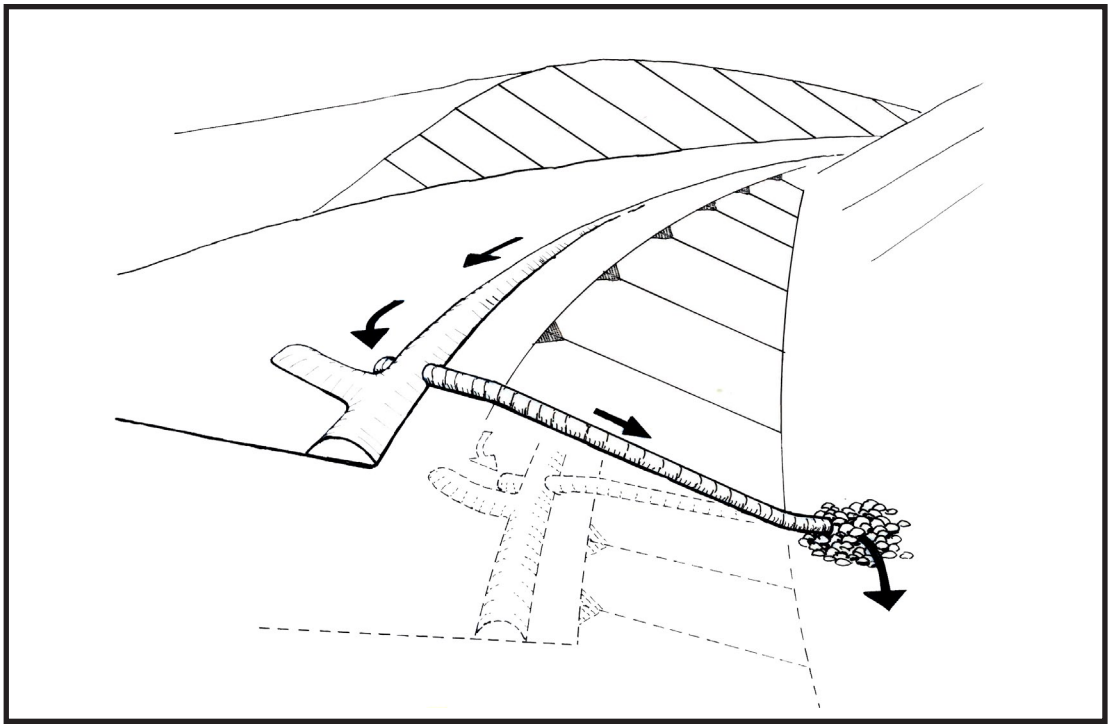
Slope Drains



5.2.5 Slope Drains

Definition

A temporary drain used to intercept and convey runoff into a stabilized drainage.

Purpose

- To prevent soil erosion.

Appropriate Applications

- Installed where slopes may be eroded by surface runoff.
- Typically used in conjunction with top of slope diversion berms, dikes or swales or temporary embankment curbs.
- Where final road grades are completed but remain unpaved.
- May be used as emergency spillway for sediment basin.

Limitations

- Volume of runoff to be conveyed must not exceed capacity of structure.
- Larger areas require a paved spillway, rock lined channel or additional pipes.
- May become clogged or overcharged during large storms forcing water around pipe.
- Failure causes extreme slope erosion.

Standards and Specifications

Design and Layout

- Size of area to be drained must be taken into consideration. Typically, no more than 5 acres shall be drained by one pipe. For larger areas, use a rock-lined channel or a series of pipes.
- Direct runoff into stabilized drainages.
- Inlet installation is critical because it is a common point of failure. Consider use of erosion control blanket at inlets.
- Outfall must be protected by riprap. For that reason, installation is typically limited to maximum grades of 2:1(v:h). Installation on steeper slopes is difficult.
- Consider flared end section for high volume discharges.
- Slope drains can be placed on the surface of slopes or installed below grade.
- Recommended materials for pipes are PVC, ABS or comparable.
- If a pipe slope drain is conveying sediment-laden water all flows shall be directed into a sediment-trapping device.

Installation

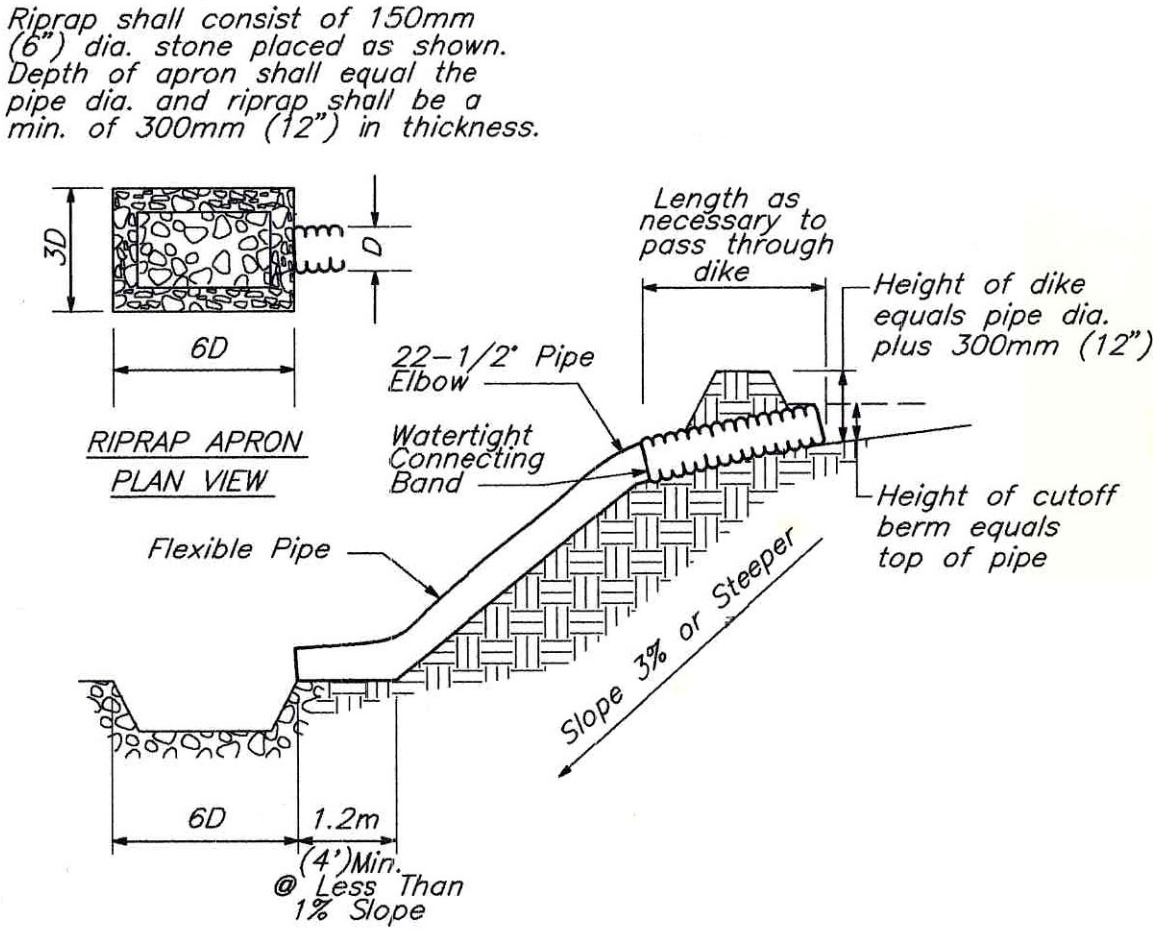
- Install as directed in contract documents. Drains shall be perpendicular to slope contours.
- All slope drain pipe sections shall be securely fastened together with a watertight seal and shall be securely anchored into the soil.
- Follow requirements for diversion dikes/swales to construct diversions used to direct runoff into a slope drain. Compact soil around and under inlet, outlet, and along length of pipe.
- The area below the outlet must be stabilized with a riprap apron. Refer to Erosion Protection and Structures Detail E-2.

Inspections

- Follow inspection schedule required in Construction General Permit Part IV.H.
- Inspect for structural integrity, blockage, and stability at the inlet and outlet.
- Inspect for downstream scour; remedy as required.

Maintenance

- Reinforce inlet with compacted soil or sandbags if problems occur.
- If outlet flow is directed to a sediment-trapping device, sediment should removed as specified in for that device.



FLEXIBLE PIPE SLOPE DRAIN

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