C. SHEET AND RILL SEDIMENTATION CONTROL (SR-SC)

C. SHEET AND RILL SEDIMENTATION CONTROL (SR-SC)

Sedimentation control is the last line of defense. If there is a possibility of erosion occurring on a construction site, a sedimentation control BMP should be installed. The primary function of sedimentation control is to decrease the velocity (power) of water for a long enough time to allow individual sediment particles to settle out. Some sedimentation control BMPs also filter sediment, in addition to settling them out.

Sedimentation control BMPs do not stop erosion from occurring, they prevent sediment from leaving the site. In addition, they are not effective at settling out fine textured soils (silts and clay). Sedimentation control BMPs should always be used in partnership with erosion control BMPs.

The type of sedimentation control BMP is dictated by the type of erosion that occurs. The BMPs in this section will provide sedimentation control for sheet and rill erosion. Distinguishing between raindrop erosion and sheet erosion is difficult so raindrop erosion is also included in this section.

The BMPs in this section will help to contain sediments generated by the processes of rainfall, sheet, and rill erosion. They are designed to work over a broad area and on the contour. The first three are designed to be placed along the contour, capture sheet flow, decrease the velocity (power), and allow sediment to settle out. The filter strip treats sheet and rill run off by infiltrating runoff water, and physically filtering sediment.

- Silt Fence
- Erosion Control Mix Berm
- Continuous Contained Berms
- Vegetated Filter strip

1. SILT FENCE

Definition and Purpose

Silt fence is a temporary sediment-retaining barrier of permeable geotextile fabric. Silt fence is designed to pond sediment laden water, reducing the flow velocity for a long enough period of time to promote settlement of sediment. Silt fence is not designed to filter fine sediment through the fabric

Appropriate Applications

- Downhill edge of disturbed slopes.
- Perimeter protection around soil stockpiles.

Limitations

- Not intended for areas receiving concentrated flows of water (i.e., ditches, downspouts, drainage swales, or streams).
- Can be difficult to properly install in shallow-to-ledge, stony, or forested ground.
- Silt fence does not filter fine soil particles, although it will filter particles larger than medium sized sand. It functions by ponding water and allowing sediment to settle out. If flow through time through ponded area is too short, silts and clays may pass through silt fence, uncontained.
- Must be removed and disposed of after disturbed site is stabilized.
- Shall be in a location where it can be accessed for maintenance.
- Geotextile fabric will degrade depending on amount of exposure to the sun. Functional life span of silt fence is approximately one field season.

Standards and Specifications

- Refer to Standard Detail Drawing.
- Silt fence shall be placed along a contour, to provide maximum storage capacity and limit flow parallel to the fence.
- Silt fence should have a relatively level area immediately up-gradient to provide an area for ponding.
- Maximum uphill drainage area should not exceed 100 feet in length as measured perpendicular to fence.
- Do not use below slopes that are subject to slumping.
- Refer to the MaineDOT Approved Product List – Geotextile for Materials Specification.

Application Procedures

- Bottom flap of silt fence shall be keyed into the ground a minimum 6” in depth. Alternatively, in areas where it is not practicable to key in the flap, it can be anchored with Aggregate for Crushed Stone Surface (Materials Specification 703.12), Erosion Control Mix, or other material approved by the Resident. Flap shall be anchored sufficiently to resist pull out.

- Anchor posts shall be spaced a maximum of 8 feet apart and driven approximately 18 inches into the ground.
- Joints between separate pieces of silt fence shall be spliced together by wrapping the two end posts together as shown in Standard Detail drawing.
- End sections of silt fence shall be curved uphill to a point that the base of last post is at or above the elevation of the top of the fence on the contoured length.

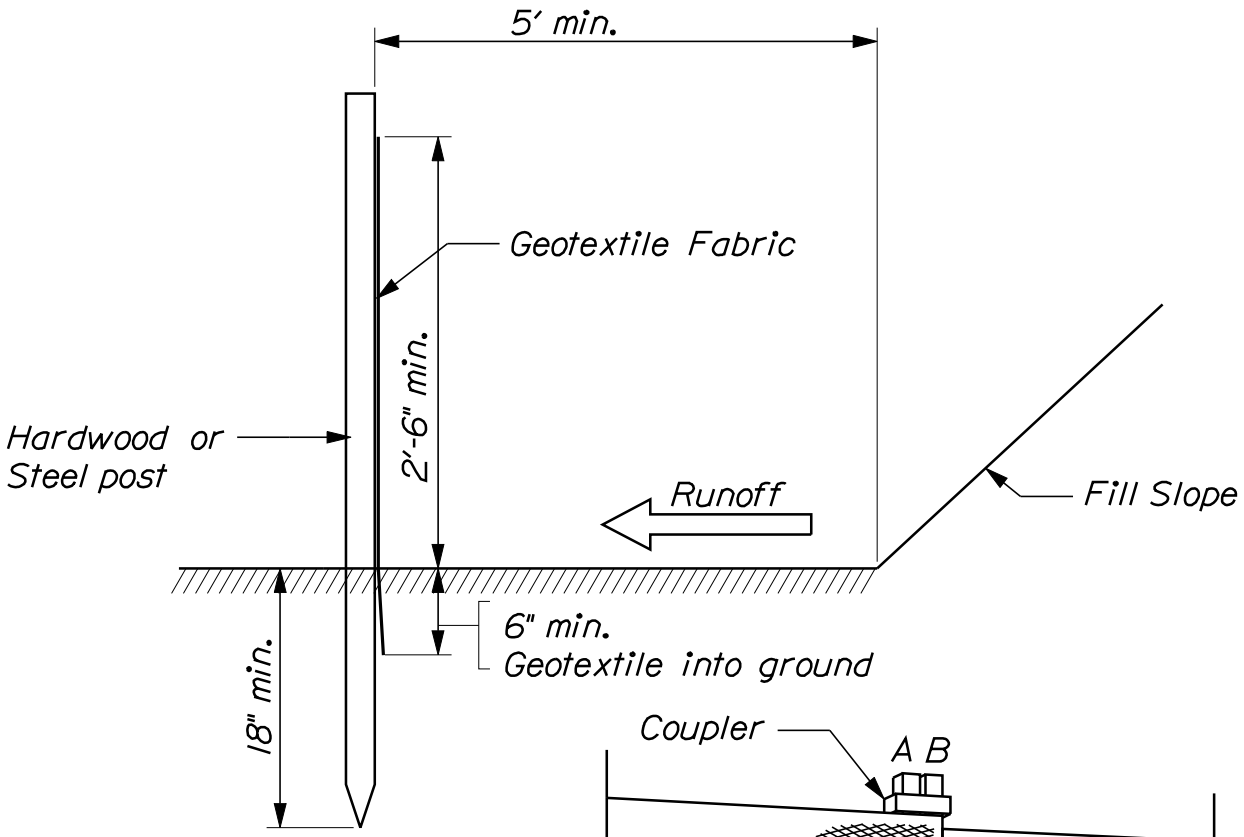
Maintenance and Inspection

Silt fence requires frequent inspection and maintenance. Inspections shall be conducted weekly and before, during, and after each storm event.

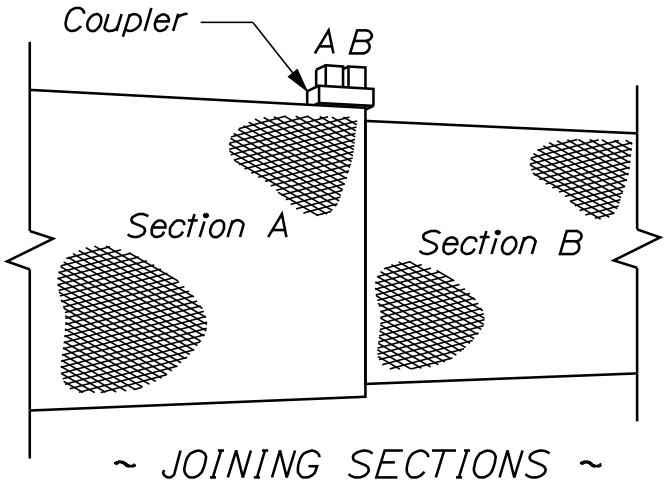
- Inspections should look for the following:
  - Failure under fence.
  - Slumping or torn sections of fence.
  - Breakage or movement of stakes.
  - Sections where significant amounts of sediment have accumulated.
- When sediment reaches half the height of a silt fence the sediment shall be removed immediately and disposed of in an approved location.
- Repairs to silt fence shall be made within 24 hours of the time they were first noted.
- Silt Fence shall be removed once permanent stabilization has been achieved on uphill disturbed areas. Disturbed ground resulting from removal shall be leveled and stabilized.

References

- MaineDOT Approved Product List: http://www.maine.gov/mdot/transportation-research/approved-products.php
- Materials Specification 703.12 - Aggregate for Crushed Stone Surface
- Materials Specification 717.04(d) – Erosion Control Mix



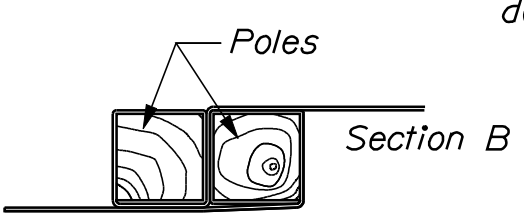
~ SIDE VIEW ~



Posts may be wired togther
when joining sections

~ JOINING SECTIONS ~

The coupler can be any accepetable
device used to tie the poles together



~ TOP VIEW ~

REF:
Best Management Practice for Erosion and Sedimentation Control -
Level Spreader

# SILT FENCE
# SEDIMENT BARRIER
802(04)

2. EROSION CONTROL MIX BERM

Definition and Purpose

Erosion control mix berm is a temporary sediment-retaining barrier consisting of a continuous berm made of erosion control mix. The erosion control mix berm is designed to pond sediment laden water, reducing the flow velocity for a long enough period of time to promote settlement of sediment. It is not designed to filter sediment through the structure although new research indicates that the berm will provide filtering of sediment.

Appropriate Applications

- Down hill edge of disturbed slopes.
- Perimeter protection around soil stockpiles.
- Often used on sites where silt fence is difficult to install (i.e., shallow ledge, or stony soils).

Limitations

- Not intended for areas receiving concentrated flows (i.e., ditches, downspouts, drainage swales or streams).
- Must be maintained.
- Must be in a location where it can be accessed for maintenance.

Standards and Specifications

- Erosion control mix berms shall be placed along a contour, to provide maximum storage capacity and limit flow parallel to the berm.
- Erosion control mix berms should have a relatively level area immediately up-gradient to provide an area for ponding. This area should be as wide as practicable.
- Maximum uphill drainage area should not exceed 100 feet as measured perpendicular to berm.
- For erosion control mix berm sizing see Figure 1.
- Side slopes of the berm shall be no steeper than 1:1.
- Berms shall consist of erosion control mix, meeting Materials Specification 717.04 (d). Alternative materials may be approved by the Resident on a case-by-case basis.

Application Procedures

- Cut tall grasses and woody vegetation from application area to prevent short circuiting of flow under berm.
- Material may be placed by hand, machinery, or pneumatic blower.
- End sections of erosion control mix berms shall be curved uphill to a point that the base of the end sections is at or above the elevation of the top of the berm along the contoured length.

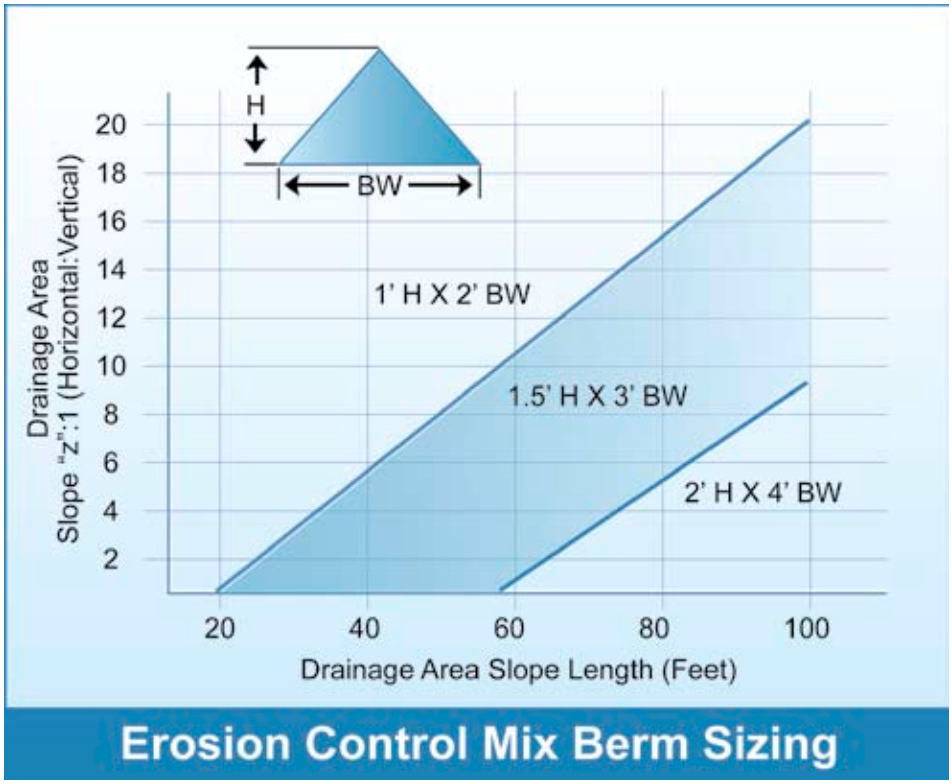


Figure 1

Maintenance and Inspection

- Erosion control mix berms require inspection weekly and before, during and after each storm event. Repairs shall be made immediately.
- Inspections should look for sections where water is running over, under, or through the erosion control mix berm and causing short circuiting of flow or erosion of the soil or the berm material.
- When sediments reach half the height of a barrier, the sediment shall be removed immediately and disposed of in an approved location.
- Temporary erosion control mix berms shall be removed or if approved by the Resident, broken up and spread over the ground once permanent stabilization has been achieved on upgradient disturbed areas. Final treatment (seeding) of this area will be as directed by the Resident.

References

- Materials Specification Section 717.04 – Mulch

3. CONTINUOUS CONTAINED BERM

Definition and Purpose

Continuous contained berms are manufactured temporary sediment-retaining barriers that are bound in a tubular roll. The continuous containment berm is designed to pond sediment laden water, reducing the flow velocity for a long enough period of time to promote settlement of sediment. Current products on the market include a geotextile mesh tubular sock filled with wood based material (similar to erosion control mix), and fiber rolls composed of straw, flax, or other similar material.

Appropriate Applications

- Install down slope of small disturbed areas.
- Use as perimeter protection around soil stockpiles.
- Install around drainage inlets and outlets.
- These products are most effective at directing flow and protecting outlets from flow on the road grade or from bridge decks where flow depths are low and the flexibility of the product can be used during the various stages of changing road grade.

Limitations

- Currently a compost filled geotextile sock produced by Filtrexx ® is accepted on a trial basis in Maine. Use of this or any other products must be approved by the Resident.
- In a standard application these products do not provide the same height of ponded water as silt fence or erosion control mix berm and therefore will not have the same settling capacity.
- If full contact with the ground is not achieved, there is a potential for short circuiting flow under the product that may cause erosion of the underlying soil.

Standards and Specifications

- Follow Manufacturer's Guidelines and Specifications.

Application Procedures

- Prepare existing ground surface as needed to achieve a smooth surface for maximum contact area.
- Install the berm along a contour, to promote continued sheet flow and provide maximum storage capacity. Barriers not placed along a contour will tend to concentrate runoff toward low spots, which are much more prone to failure.
- End sections of continuous containment berm shall be curved uphill to a point that the base of end section is at or above the elevation of the top of the berm along the contoured length.
- Continuous containment berm may be placed by hand or machinery; the sock may be filled by pneumatic blower onsite.

Maintenance and Inspection

Continuous containment berms require frequent inspection and maintenance. Inspections shall be conducted weekly as well as before, during, and after each storm event. The berms should be checked daily during extended periods of rain.

- Inspections should look for the following:
  - Sections where water is running over or under the continuous containment berm and causing short circuiting of flow.
  - Torn or degraded fabric.
  - Areas where vehicles have run over continuous containment berms.
- When sediments reach half the height of a continuous containment berm, the sediment shall be removed immediately and disposed of in an approved location.
- Repairs to continuous containment berm shall be made within 24 hours of the time they were first noted.
- Unless the continuous containment berm is composed of biodegradable material it should be removed once permanent stabilization has been achieved on the uphill disturbed area.

References

- Manufacturer's Guidelines and Specifications

4. VEGETATIVE FILTER STRIP

Definition and Purpose

A filter strip is a natural, undisturbed vegetated area that will remove sediment by reducing flow velocity, promoting infiltration, and allowing sedimentation to occur by physically trapping soil particles within the vegetation.

Filter strips are typically used for post construction permanent stormwater treatment but may be used below disturbed areas with short flow lengths such as road cross slope, shoulders, and inslopes.

For post construction permanent stormwater treatment, contact the Surface Water Quality Unit.

Appropriate Applications

- When disturbed areas are small, runoff is in sheet flow only, and concentrated flow does not occur until after flow through the filter. This application shall be approved by the Resident.

Limitations

- Use of a filter strip may be limited by extent of right-of-way.
- Filter strip areas must be in established vegetated areas. Newly vegetated areas are not permitted.
- Runoff must enter the filter as sheet flow. Rill or concentrated flow is not allowed.
- Filter effectiveness will vary depending upon slope, underlying soils, the type and density of the vegetation, and the amount of flow into the filter.
- Wetlands are not acceptable as filter strips.

Standards and Specifications

- The filter strip area shall be undisturbed. No construction activities shall be allowed within the filter strip area.
- The contributing disturbed area shall be a maximum of 25 feet with no more than 10 feet being greater than 5:1 (inslopes).
- The filter strip shall have a slope of less than 33% (3:1). The optimum gradient within the filter strip is 1 to 2% (100:1 to 50:1).
- The filter strip area must be an established vegetated area of either grass or woody vegetation and must be healthy and have a vigorous growth habit.
- Grass filter strips must be meadow or field. Maintained lawns are not recommended and must be approved by the Resident.
- Wooded and shrub filter strips must have a cover of duff, leaf litter, and roots that completely cover the ground surface.
- From the top of the filter strip on the contour, the slope lengths should not converge i.e. the shape of the contour line should be constant or diverge.
- Refer to Table 1 for recommended filter strip lengths.

Slope %	Slope Ratio	Minimum Filter Length (feet)
1	100:1	25
2	50:1	30
5	20:1	35
10	10:1	45
14	7:1	55
20	5:1	65
25	4:1	75
33	3:1	85

Table1 Minimum Filter Strip Length

Application Procedures

- Filter strip locations shall be clearly identified in the field before construction begins.
- Take appropriate measures to ensure that runoff is entering the filter strip as sheet flow.

Maintenance and Inspections

- The filter strip should be inspected weekly as well as before, during, and after storm events during construction to check for channelized flow and/or erosion and sediment deposits.
- After construction the filter strip should be inspected periodically to ensure that it is functioning correctly.

D. CONCENTRATED FLOW EROSION CONTROL (CF-EC)

D. CONCENTRATED FLOW EROSION CONTROL (CF-EC)

Gully erosion begins when runoff concentrates with enough depth and velocity to cut into the soil to a depth of one foot or more. On transportation projects gully erosion usually occurs within constructed channels or where a large volume of water is concentrated and allowed to flow over unprotected soil. The BMPs in this section will address these types of situations by:

- Protecting the channel lining from high velocities.
- Protecting the inlet and outlet slopes around culverts, and underdrain outlets from scour.
- Decreasing the erosive power by slowing the velocity of water as it exits high velocity concentrated flow structures: (culverts, downspouts or ditches).
- Decreasing the erosive power by decreasing the volume (depth) of water flowing in a channel.

The BMPs in this section include:

- Channel Linings
- Temporary Channel Lining - Plastic Sheeting
- Riprap Downspout
- Temporary Slope Drain
- Energy Dissipators
- Culverts - Inlet/Outlet Protection

1. CHANNEL LININGS

Definition and Purpose

Channel linings are armoring techniques that protect permanent concentrated flow channels from erosion. There are two basic types of channel lining; vegetated (grass) or stone-lined. Other treatments may be used on a case-by-case basis.

Appropriate Applications

- Grass is adequate when flow velocities and depths of flow are low enough to not cause erosion of the channel.
- Stone should be used when grass is not adequate to protect the channel from erosion or where there are adverse growing conditions such as poor quality or saturated soils.
- Although their primary function is stormwater conveyance, a grass-lined channel on a grade at or below 1% also provides limited filtering of sediment and pollutants, which may be of benefit to downstream water bodies.

Limitations

- This standard is not to be used for stream channel linings or stream bank protection.
- Road sand and/or salt can smother grass or create conditions that inhibit growth.
- Stone-lined channels are generally more expensive than grass-lined channels.
- Stone-lined channels may not be preferred from an aesthetic or environmental perspective. Alternatives such as the use of turf reinforced matting may be used. Consult a design engineer or the SWQU.

Standards and Specifications

- Channel linings shall be designed to withstand, as a minimum, the flow from a 10-year, 24-hour storm event. For channels with grades 0-6% grass is usually adequate for long term protection.
    - During construction and until grass cover has fully established it must be protected from flowing water by installing Erosion Control Blanket.
    - Refer to Standard Detail Drawing.
    - Install within one week of completed grading. In sensitive watersheds daily application of temporary mulching may be required prior to installation of erosion control blanket.
    - Spacing of anchors shall be placed at a maximum spacing of 3 feet on center or as required by the manufacturer, whichever is closer.
    - Seed according to design, either Method 1 or Method 2 as specified in Standard Specification 618 – Seeding. Method 3 is unacceptable for channels.
- For channels with grades less than 6% but with long duration flows that make grass establishment and maintenance difficult, (low lying areas with a high water table, continuously flowing underdrains or springs) stone lining may be needed - consult a design engineer or the SWQU.

- For channels with grades over 6% install stone in the bottom to a minimum width of one third the top width.
    - Refer to Highway Design Guide Volume 1, Chapter 12, Drainage Design for channel design.
    - Stone gradation for most road ditches shall be in accordance with Materials Specification 703.29 – Stone Ditch Protection.
    - Geotextile installed under the stone shall comply with Standard Specification 620 - Geotextiles.
- Other treatments such as turf reinforced matting or articulating concrete blocks may be used with the approval of the Resident.

Application Procedures

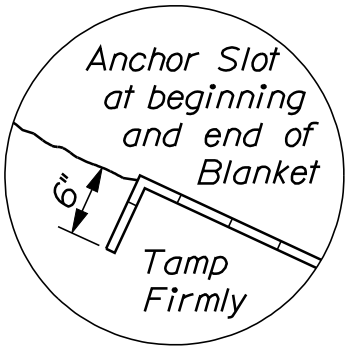
- If water is present in the channel, divert runoff from the channel while it is under construction.
- Construct the channel in sections, beginning at the outlet.
    - Stabilize the channel outlet per plans and cross-sections (i.e. level spreader, ditch turn-out, riprap apron, etc.).
    - Excavate to the required lines and grades for the channel.
    - Install the appropriate channel lining.
        - For grass-lined channels, fine grade the channel; if design calls for it apply loam. Apply seed and fertilizer according to Seeding Specification. Before the end of the day, install the erosion control blanket in the channel bottom and mulch the remainder; see **Hay and Straw Mulch or Hydraulic Mulches**.
        - For stone-lined channels, install geotextile and then the stone.

Maintenance and Inspections

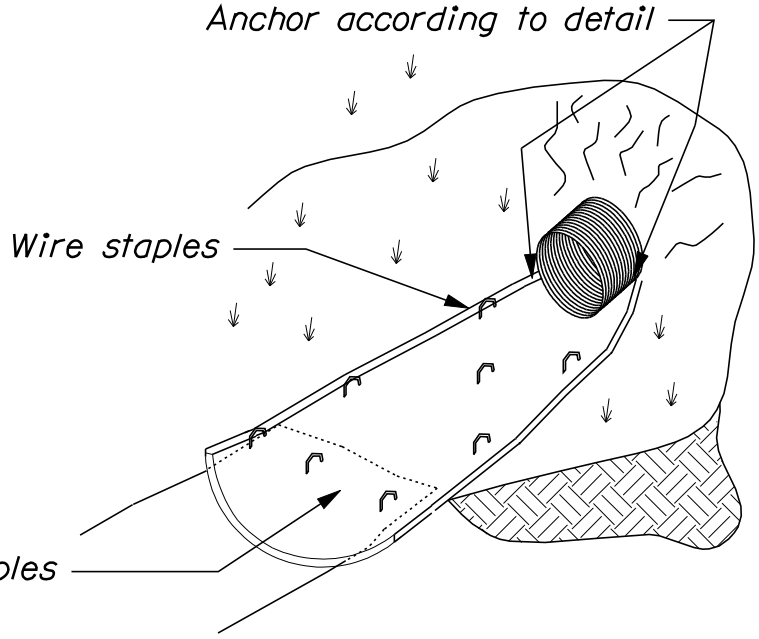
- The Contractor should inspect grass-lined channels weekly and prior to, during, and after storm events to check for erosion. Any failures shall be repaired immediately by regrading, reapplying seed, and covering with erosion control blanket and/or mulch. The contractor shall maintain erosion control blankets and mulch until new grass covers at least 90% of the soil surface. Grass is not considered established until ground cover is mature enough to withstand the erosive forces of channel flow.
- The Contractor should inspect stone-lined channels weekly to check for movement of the stone and/or erosion. Repairs shall be made immediately.

References

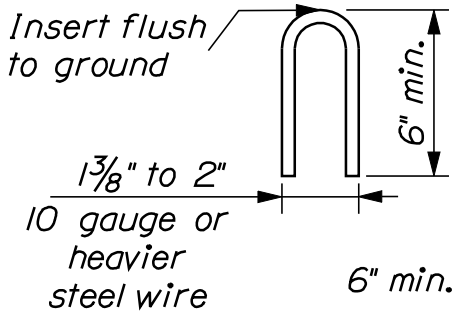
- Standard Specification 613 – Erosion Control Blankets
- Standard Specification 610 – Stone Fill, Riprap, Stone Blanket, and Stone Ditch Protection
- Materials Specification 717.061 – Erosion Control Blanket
- Materials Specification 703.29 – Stone Ditch Protection
- Maine Highway Design Guide, May 2002



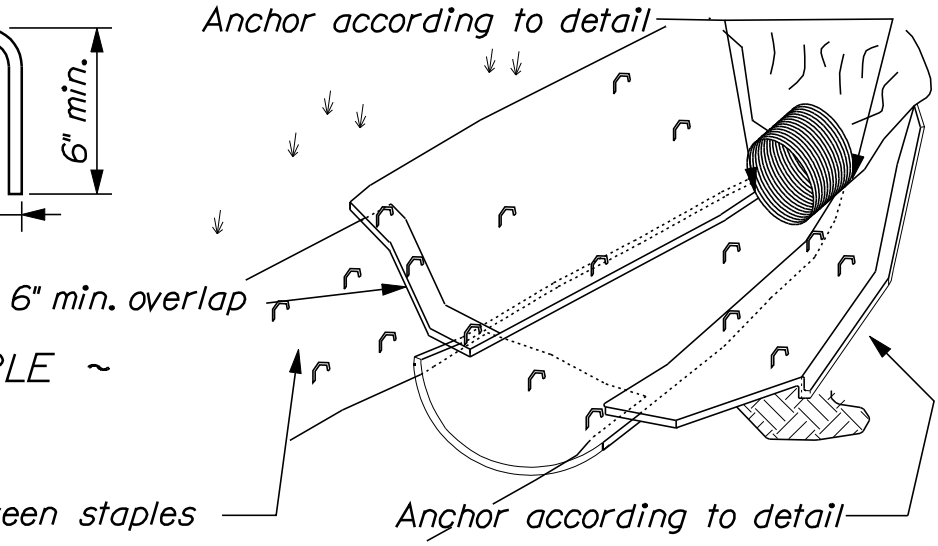
~ ANCHOR DETAIL ~



~ UNCOVERED CHANNEL SIDE SLOPES ~



~ WIRE STAPLE ~



~ COVERED CHANNEL SIDE SLOPES ~

NOTES:

1. Width may vary depending on design flows, channel side slopes, and type of material chosen.
2. Follow Manufacturer's recommendations for anchoring blanket ends, overlaps, and staple spacing. Dimensions shown for these activities are to be used as a minimum.
3. Staples may be as provided or biodegradable staples according to the Qualified Products List*
4. See Section 717.0611 of the MaineDOT Standard Specifications or MaineDOT Qualified Products List*

*http://www.maine.gov/mdot/transportation-research/qpl.php

EROSION CONTROL BLANKET
DITCH APPLICATIONS

802(02)

2. TEMPORARY CHANNEL LINING - PLASTIC SHEETING

Definition and Purpose

Temporary channel lining - plastic sheeting is a method of armoring a concentrated flow channel that has been constructed and will be removed before final project completion or, in emergency situations a permanent channel lining has not been installed and the channel is exposed to concentrated flow.

Appropriate Applications

- A temporary hillside diversion lining.
- For temporary stream diversion channel see **Temporary Stream Diversion (IN WATER)**.
- Any other constructed channel that will temporarily carry concentrated flows and has not been protected by other means.

Limitations

- Plastic sheeting is difficult to install during high wind.
- If not properly anchored, plastic sheeting and geotextile fabrics are susceptible to wind and if dislodged can be a severe safety hazard, especially to the traveling public.
- Plastic sheeting is easily vandalized, cut, or torn.

Standards and Specifications

- Channel cross section may be formed by excavating, or by placing a berm of earthen fill, gravel, sandbags or other material that will resist lateral movement during anticipated high flows in the channel.
- Plastic sheeting shall be polyethylene sheeting and shall have a minimum thickness of 4 mils. Other materials such as woven or non-woven geotextile may be used with the approval of the Resident.
- Material shall be wide enough to extend over top edge of channel with enough slack to provide adequate anchoring.
- Anchoring - The edges of plastic sheeting should be toed into the soil or anchored with non-erodible ballast i.e., crushed stone, sand-bags, or other suitable materials. Anchoring should be continuous throughout the channel length.
- If more than one roll of sheeting is used in the channel, the upstream roll shall overlap the downstream roll by a minimum of 2 feet and the seam shall be adequately anchored.

Application Procedures

- Shape channel area where sheeting will be applied, to provide a relatively smooth surface. Remove any projections that could puncture or tear sheeting during deployment.
- Unroll plastic sheeting in channel section and apply anchoring to all edges and seams.

Maintenance and Inspection

- The Contractor should inspect plastic sheeting weekly and before, during, and after storm events for stability and indication of flow bypass. Place additional anchors, as necessary.

3. RIPRAP DOWNSPOUT

Definition and Purpose

A riprap downspout is a permanent armored channel that conveys concentrated runoff down a steep slope to a stable outlet area without causing erosion. Downspouts typically involve high velocity water flow and therefore require significant armoring to prevent scouring.

Appropriate Applications

- To convey concentrated flow road runoff down a steep inslope. Typically at the end of a curbed section of road, at bridge abutments, or at a sags (low point) in a road.
- To convey surface water runoff down a backslope. Sources include seeps, spring runoff, and water from hillside diversions.
- Not to be used for diverting stream channels.

Limitations

- High velocity flow can be unstable flow. Any in-channel obstructions can cause water to jump out of bank. Channel cross section must remain smooth. Obstructions can be ice build-up, debris, or a misplaced rock.
- For high velocity flow, the riprap downspout must be installed with an energy dissipator at the outlet to prevent scour.
- Depending on the road grade, high velocity flows may bypass downspout inlet. Conveying water into the downspout may require reshaping of the road grade or installing a structural diverter.

Standards and Specifications

- Refer to Standard Detail Drawing.
- If the drainage area is greater than 0.5 acres of road section, 1.5 acres of lawn (light development), or 3 acres of forest (undeveloped) then the downspout design shall be approved by an engineer.
- The downspout shall discharge to a stabilized area capable of handling flows without eroding; see **Energy Dissipator**.
- The downspout shape shall be trapezoidal or parabolic in cross-section.
- For road grade runoff, the inlet of the downspout shall be depressed to direct water into it.
- Riprap shall be underlain with non-woven geotextile according to Materials Specification 722.03 - Erosion Control Geotextile.
- Riprap shall be according to Materials Specification 703.26 - Plain and Hand Laid Riprap,
- The downspout shall be installed perpendicular to the slope and the maximum slope shall be no more than 2:1 unless designed by an engineer.

Application Procedures

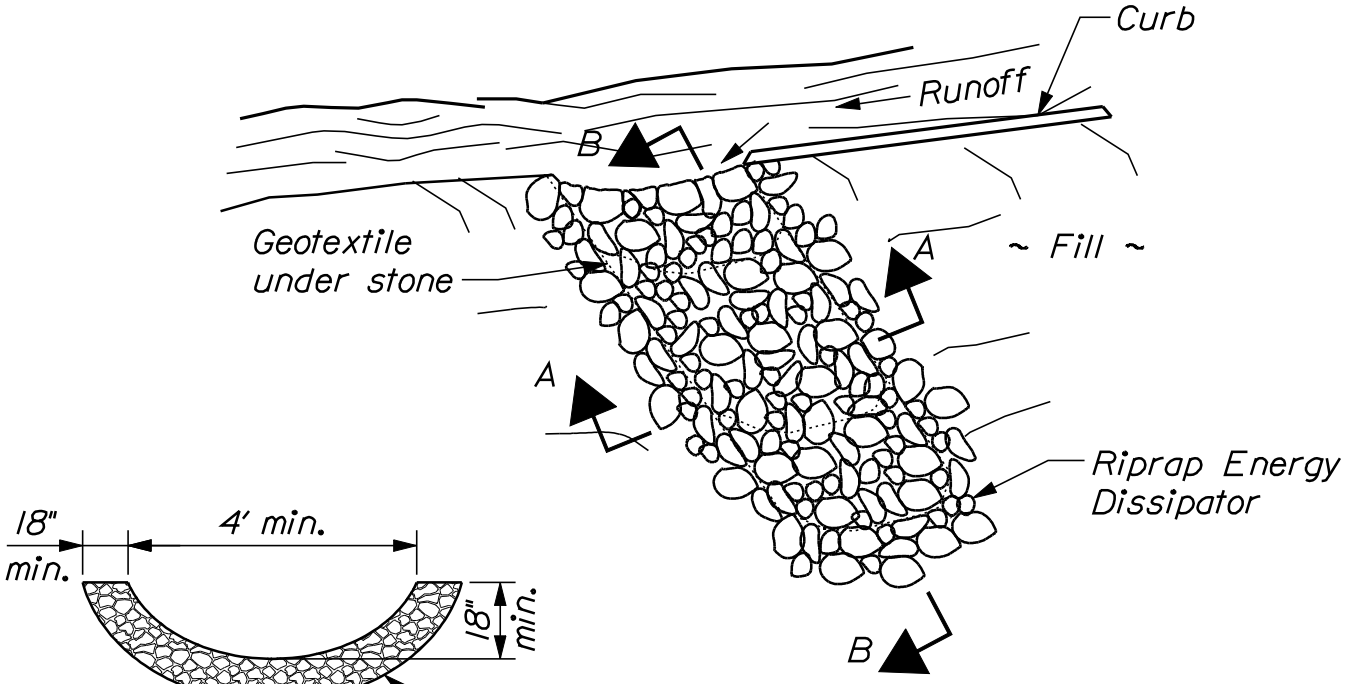
- Install the downspout during dry conditions.
- Make sure the inlet is depressed and stabilized to direct water into the downspout.
- Install an energy dissipator at the outlet.

Maintenance and Inspections

- During project construction, inspect the downspout weekly and before, during, and after storm events. Make any needed repairs within 24 hours. Inspect periodically to check for erosion at the outlet area and stability of the channel itself. Remove any debris blocking or diverting flow in the downspout.

References

- Standard Specification 610 – Stone Fill, Riprap, Stone Blanket, and Stone Ditch Protection
- Standard Specification 620 – Geotextiles
- Materials Specification 703.26 – Plain and Hand Laid Riprap
- Materials Specification 722.03 – Erosion Control Geotextile



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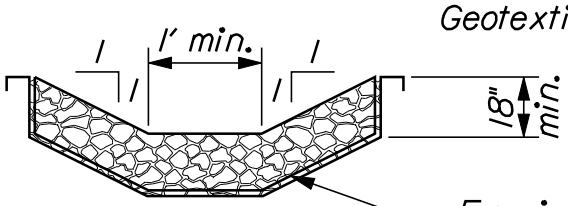
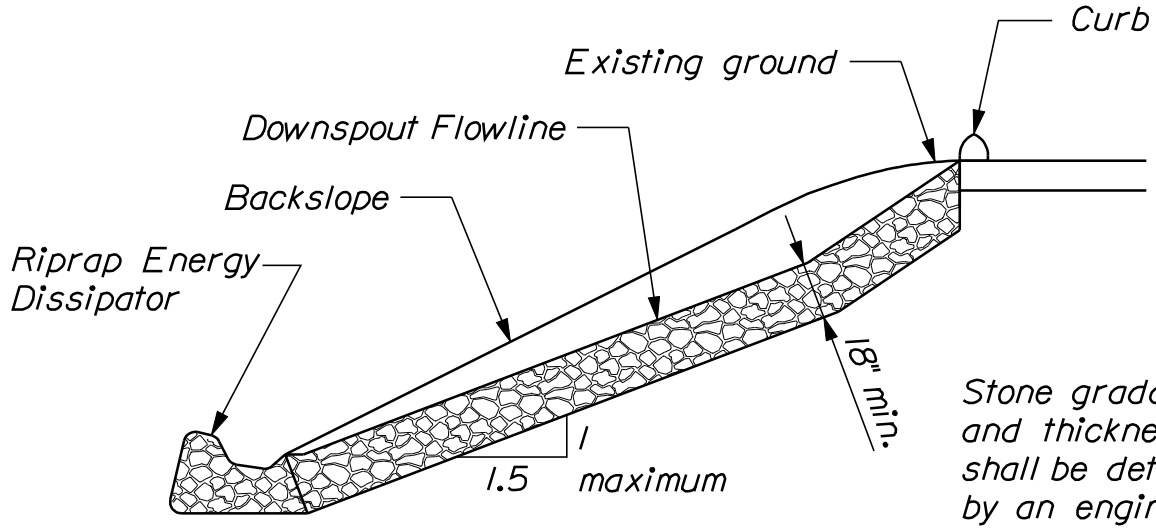


~SECTION A-A~

1.5:1 maximum Slope
2:1 or Flatter is prefered



Stone gradation and thickness shall be determined by an engineer.

~SECTION B-B~

REF: Best Management Practices for Erosion and Sedimentation Control - Temporary Slope Drains

RIPRAP DOWNSPOUT

802(05)

4. TEMPORARY SLOPE DRAIN

Definition and Purpose

Temporary slope drains are flexible structures that convey concentrated flow down a cut or fill slope without causing erosion. Slope drains are considered a temporary practice that should be used as an interim measure during construction. For a permanent practice see **Riprap Downspout**.

Slope drains typically involve high-energy (fast) water and therefore require significant armoring at the inlet and outlet. The temporary slope drains described here are constructed of plastic sheeting, geotextile fabric, corrugated pipe, or HDPE pipe. Other lining materials shall be approved by the Resident.

Appropriate Applications

- Installed on inslopes or backslopes when under construction or newly stabilized slopes that are vulnerable to erosion.
- Used to temporarily convey runoff until permanent BMPs are installed and stabilized.

Limitations

- High velocity flow in channel must be installed with an energy dissipator at the outlet to prevent scour.
- If the water runoff carries sediments from the watershed then a Concentrated Flow–Sediment Control (CF-SC) BMP must also be installed.

Standards and Specifications

- Refer to Standard Detail Drawing.
- Temporary slope drains shall discharge to a stabilized area capable of dissipating energy without eroding; see **Energy Dissipator**.
- Direct surface runoff to the temporary slope drain with a hillside diversion above backslopes or a detour berm made of sandbags or a continuous contained berm; see **Continuous Contained Berm (SR-SC)**. Other diversion methods shall be approved by the Resident on a case-by-case basis.
- For road grade runoff, the inlet of the temporary slope drain shall be depressed to direct water into it.
- Flexible pipe drains shall be anchored securely to the ground.
- Temporary slope drains shall have the minimum sizes specified in the Standard Detail Drawing.
- Install slope drains perpendicular to the slope at a maximum slope of 2:1.

- Watershed shall not exceed the following areas:

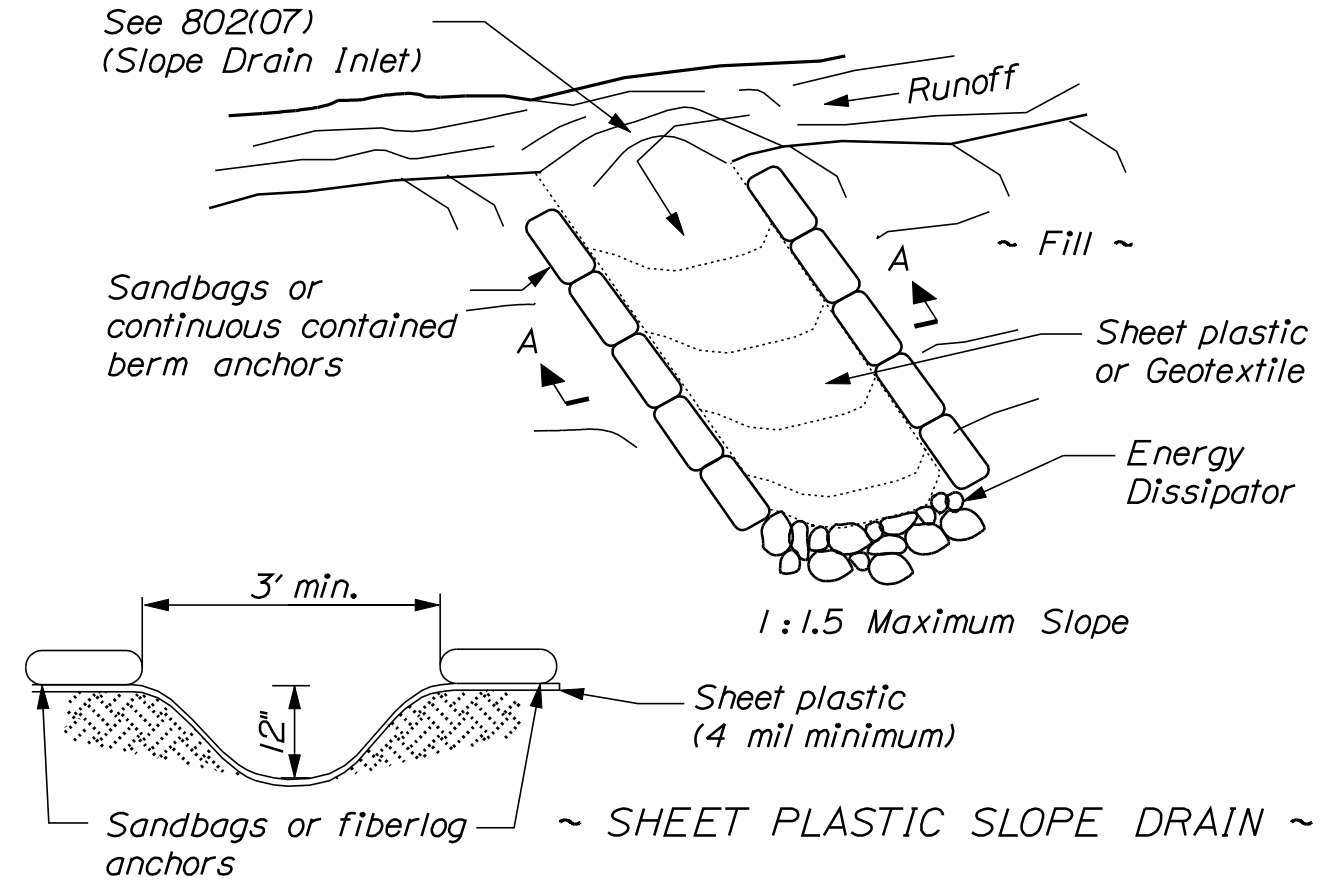
Maximum Allowable Drainage Area (ac)			
Temporary Slope Drain	Forest (undeveloped)	Lawn (light development)	Impervious (road surface or parking lots)
12 inch Pipe	1.0	0.4	0.2
18 inch Pipe	1.2	0.5	0.2
3 foot Plastic Sheet	2.8	1.2	0.5

Application Procedures

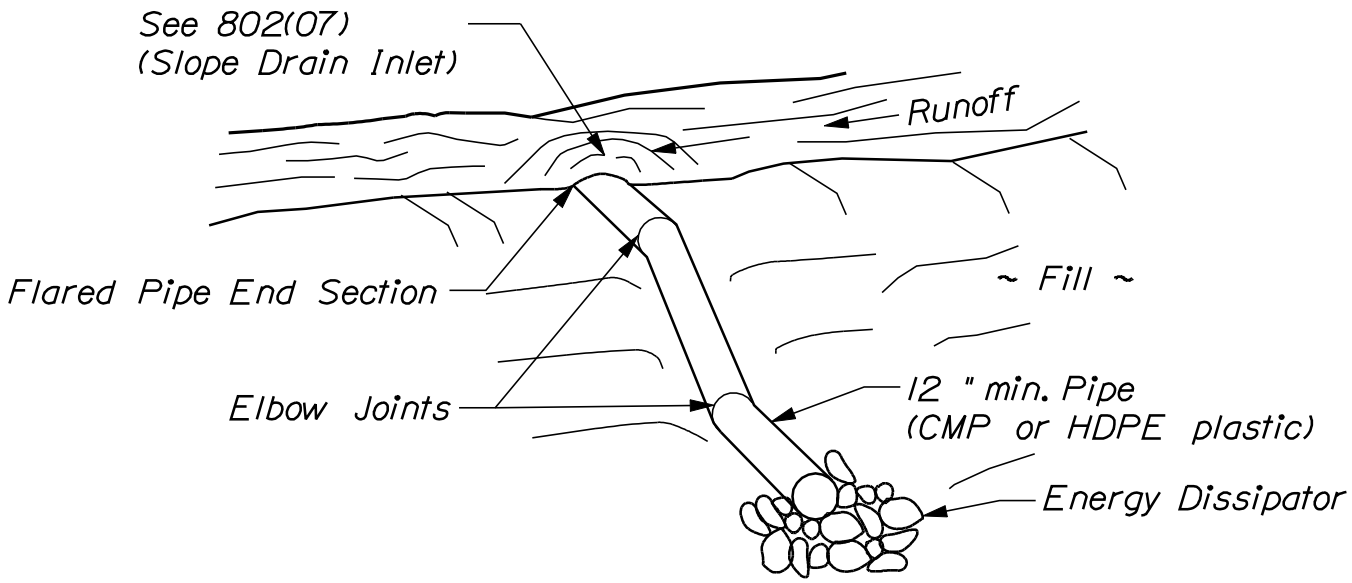
- Install the temporary slope drain during dry conditions. The inlet shall be entrenched to prevent water flowing underneath the drain.
- Immediately install inlet and outlet protection.
- Install detour berm at inlet to direct surface runoff into the temporary slope drain.
- Make all pipe connections watertight.
- When temporary slope drain is removed, stabilize any remaining disturbed areas.

Maintenance and Inspections

- Inspect weekly as well as before, during, and after storm events. Ensure that runoff is not bypassing the structure. Check for erosion at the inlet and outlet areas. Also check for debris clogging the drain. Make any needed repairs immediately.



~ SHEET PLASTIC SLOPE DRAIN ~

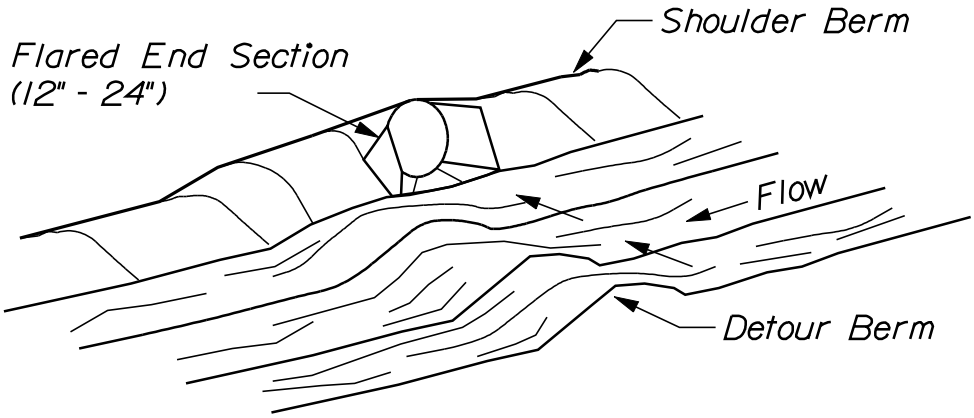


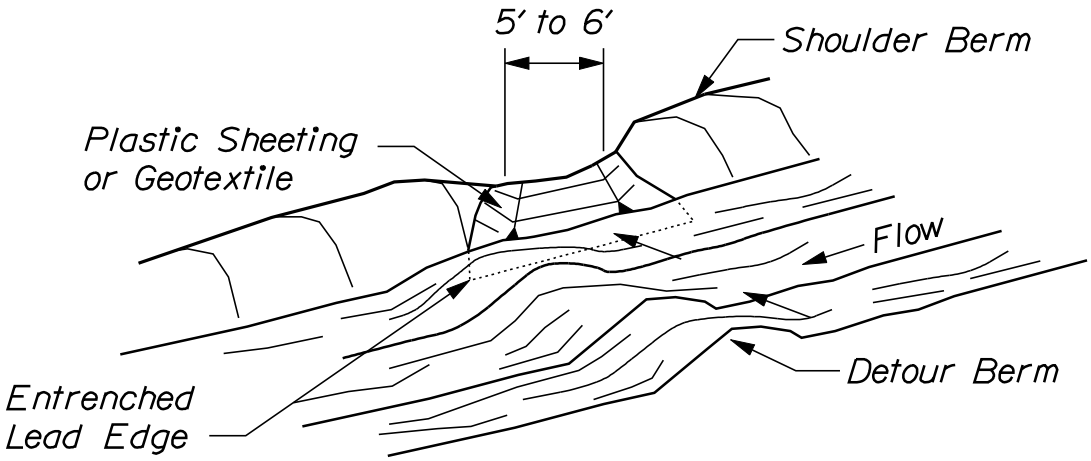
~ PIPE SLOPE DRAIN ~

REF: Best Mngmt. Practices for Erosion and Sedimentation Control - Temporary Slope Drains

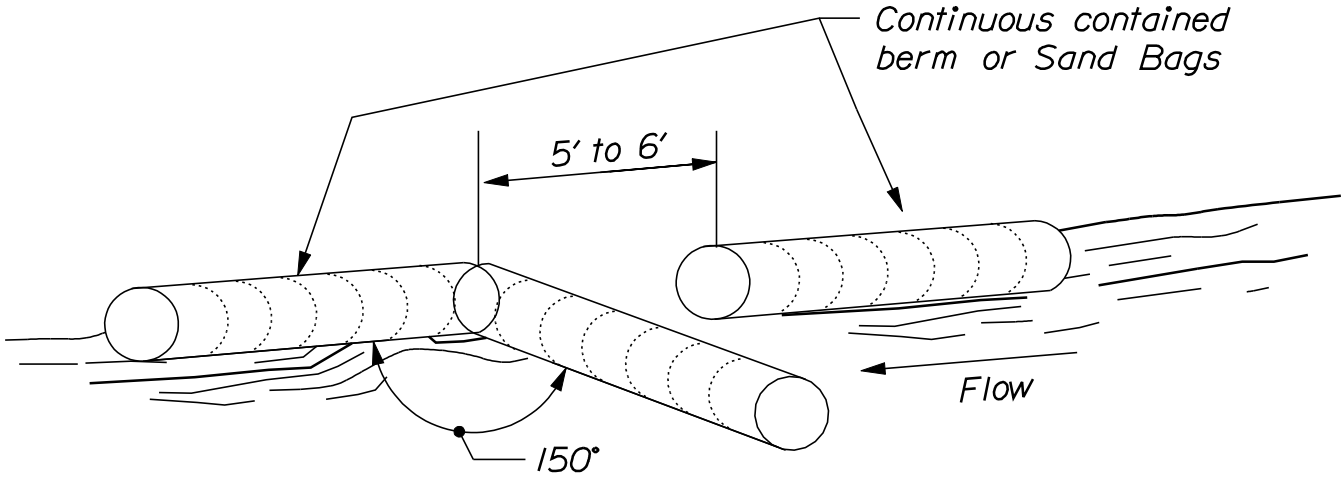
TEMPORARY SLOPE DRAINS

802(06)





~ SLOPE DRAIN INLETS ~



REF: Best Mngmt. Practices for Erosion and Sedimentation Control - Temporary Slope Drains

TEMPORARY SLOPE DRAIN INLETS

802(07)

5. ENERGY DISSIPATORS

Definition and Purpose

Energy dissipators consist of riprap armoring at flow transition areas (high energy to low energy) to dissipate energy and prevent scouring of the downstream channel. They are typically specified at pipe outlets and/or swale transitions from steeper to flatter grades.

Energy dissipators are generally considered permanent structures but they may also be implemented as a temporary structure for temporary water diversion systems.

Appropriate Applications

- Where high velocity channelized flow outlets to a channel that may be subject to scour erosion. Examples include:
  - pipe outlets.
  - riprap downspouts.
  - temporary slope drains.
  - underdrain outlets.

Limitations

- Common usage of this specification is not intended for flows exceeding 50 cfs; it is generally for pipe diameters 36 inches or less. Flows exceeding 50 cfs must be designed by an engineer.
- Not to be used in a natural stream channel unless specifically approved by the SWQU staff; see **In-Water Work** section. If fish passage is a concern, refer to MaineDOT Waterway and Wildlife Crossing Policy and Design Guide.
- These devices are not intended to provide sedimentation control. Sediment is often observed in these structures but is typically re-suspended and washed downstream by the next significant storm event.

Standards and Specifications

- There are two primary types of energy dissipators addressed in this manual: a riprap apron and a riprap plunge pool. Other methods proposed by the contractor must be individually approved by the Resident.
- Determining which type of energy dissipator depends on amount of flow, grade, and type of downstream channel. Typically aprons are used for lower flow conditions at the outlets of smaller pipes such as driveway culverts and underdrain outlets. Plunge pools are better at dissipating higher energies and transitioning the flow to better conform to existing downstream channel conditions.
- Refer to Standard Detail Drawing for dimensions.

- **Riprap Apron**

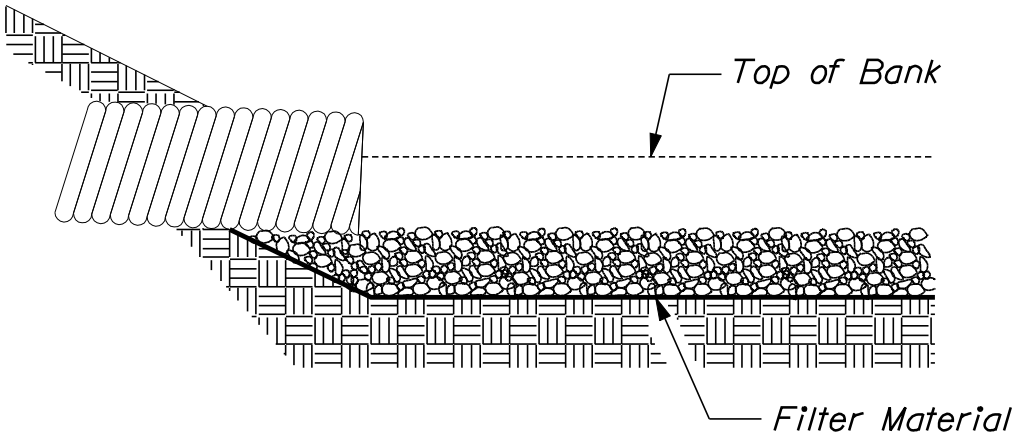
    - Riprap shall be underlain with non-woven geotextile according to Materials Specification 722.03 - Erosion Control Geotextile.
    - Riprap shall be according to Materials Specification 703.29 - Stone Ditch Protection.
    - For application with culverts, riprap shall extend at least six inches under the culvert invert.
    - Apron surface shall be rough, with many of the larger stones projecting into flow area.
    - Length = 4.5 x Diameter for pipes or 4.5 x top width of incoming flow channel.
    - Width = 3 x Diameter for pipes or 3 x top width of incoming flow channel.
    - The apron shall be installed at a 0% grade. If site conditions limit the ability to install at this grade, consider the use of a plunge pool.
    - The apron shall be shaped so that the centerline invert is slightly lower than the edges to prevent flow from splitting around the apron and eroding the earth beside the apron.

- **Plunge Pool**

    - Riprap shall be underlain with non-woven geotextile according to Materials Specification 722.03 - Erosion Control Geotextile.
    - Riprap shall be according to Materials Specification 703.26 - Plain and Hand Laid Riprap.
    - For application with culverts, riprap shall extend at least six inches under the culvert invert.
    - Rule of Thumb for sizing plunge pools for culverts 36” in diameter (900 mm) or less:
    - Depth = 1 x Diameter.
    - Width = 2 x Diameter.
    - Length = 4 x Diameter.
    - Side slopes of the pool should be 2:1 and shall be no steeper than 1.5:1
    - Stone shall be installed to provide a smooth transition into receiving channel.
    - Outlet - The outlet end of the pool should be the same cross sectional dimensions as the downstream channel. Armoring should extend at least two feet beyond the outlet of the plunge pool.

Application Procedures

- Construction shall take place in the dry.
- Divert flowing water as necessary; see **In-Water Work**.
- Energy dissipators shall be installed within 24 hours of culvert or drainage structure installation.



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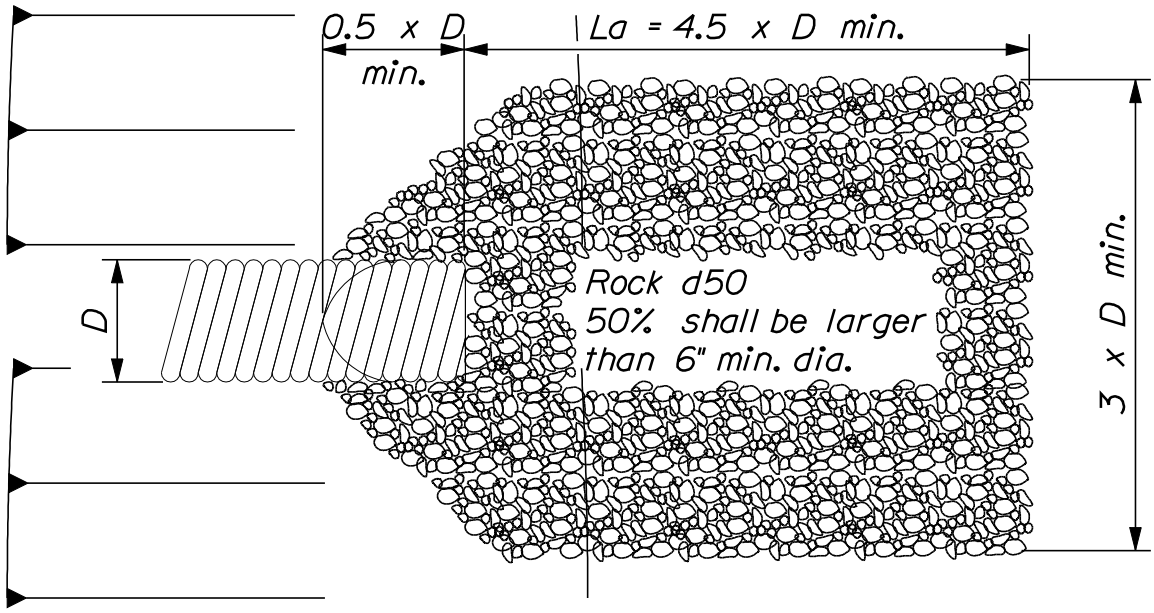


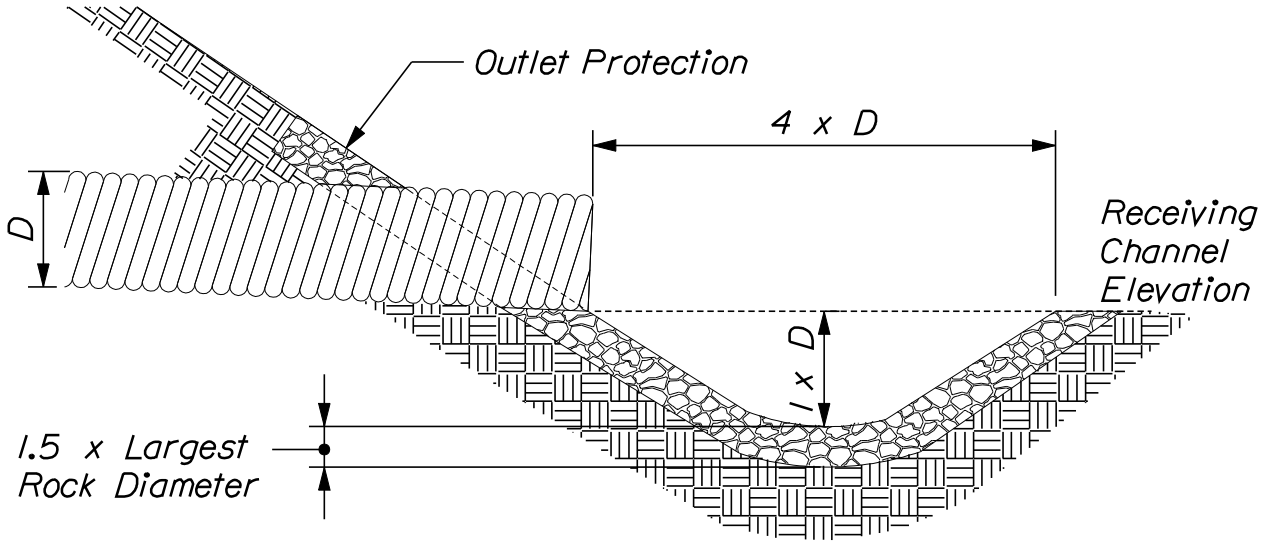
~ PLAN ~

NOTES:

1. 'La' = Length of apron. Distance 'La' shall be of sufficient length to dissipate energy.
2. Apron shall be set at a zero grade and aligned straight.
3. Filter material shall be filter fabric or 6" thick minimum graded gravel layer.
4. REF: Best Management Practice for Erosion and Sediment Control - Energy Dissipator Riprap Apron

ENERGY DISSIPATOR - RIPRAP APRON

802(08)



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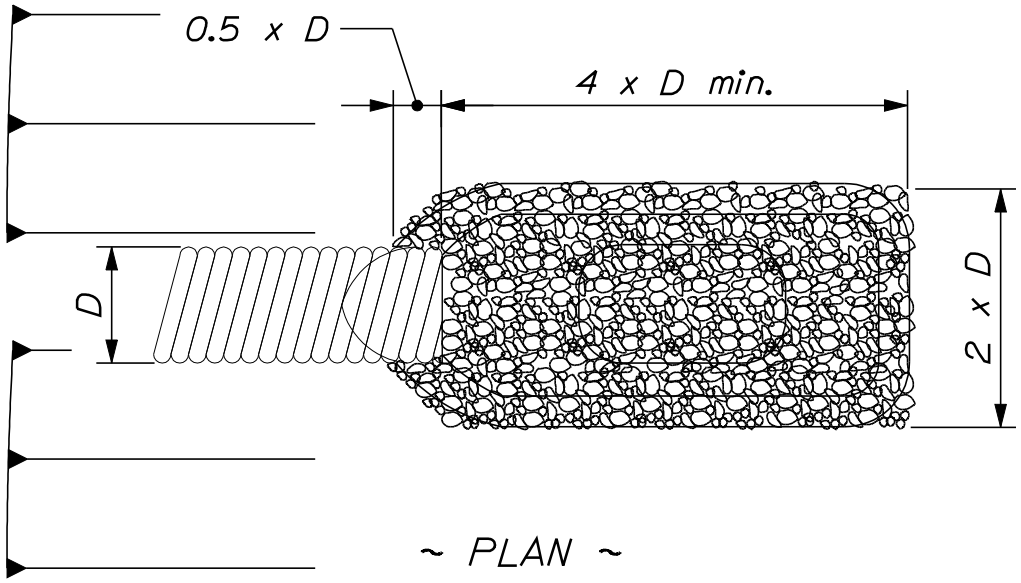

~ PLAN ~

NOTES:

1. Riprap shall be underlain by gravel bedding or non-woven geotextile.
2. REF: Best Management Practices for Erosion and Sediment Control - Energy Dissipator

ENERGY DISSIPATOR - PLUNGE POOL

802(09)

Maintenance and Inspections

- The contractor should inspect weekly and before, during, and after storm events during construction for damage, due to scour. Repair immediately. Thereafter, inspect periodically for damage and repair as necessary.
- Inspect apron for displacement of the riprap.
- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying geotextile fabric immediately.
- Temporary devices shall be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of project construction.

References

- Standard Specification 610 – Stone Fill, Riprap, Stone Blanket, and Stone Ditch Protection
- Materials Specification 703.26 – Plain and Hand Laid Riprap
- Standard Specification 620 – Geotextiles
- Materials Specification 722.03 – Erosion Control Geotextile
- Federal Highway Administrations Report No. FHWA/RD-82/011 Scour at Culvert Outlets in Mixed Bed Materials. September 1982
- HEC 14 Hydraulic Design of Energy Dissipators for Culverts and Channels September 1983
- MaineDOT Waterway and Wildlife Crossing Policy and Design Guide

6. CULVERTS - INLET AND OUTLET PROTECTION

Definition and Purpose

Inlet/outlet protection consists of protective armor placed on the slope around the inlet and outlet of a culvert or drainage pipe to prevent erosion by scouring or slumping of steepened banks. This specification addresses riprap structures but other options include concrete headwalls, gabions, manufactured structures, or reinforced vegetative covers.

This practice does not include stabilization on the channel bottom at the pipe outlet. For channel bottom stabilization:

- If the channel is classified as a stream, refer to the MaineDOT Waterway and Wildlife Crossing Policy and Design Guide along with references cited at the end of this specification.
- If the channel is not a stream refer to **Energy Dissipators**.

This is a permanent BMP, but may be used during construction to protect temporary pipes.

Appropriate Applications

- At pipe inlets and outlets where flow transition in and out of pipes are likely to pond and cause scour around pipe inlets.
- At pipe inlets and outlets where headwalls are greater than 2:1 and/or under water for long durations and prone to slumping.

Limitations

- This specification is intended for small streams, drainages, and driveway culverts (typically less than 3 feet in diameter). For large stream culverts it is the responsibility of the design engineer to determine proper stabilization.
- Riprap headwalls may have a negative impact on stream habitat. Whenever possible, riprap quantities should be limited and vegetative treatments should be considered.

Standards and Specifications

- Protective armoring shall extend beyond the structure on all sides no less than one-half pipe diameter, or one-half the maximum dimension of a non-circular pipe.
- Rock size:
    - for most stream applications Plain and Hand Laid Riprap (Materials Specification 703.26) should be used.
    - Stone Ditch Protection (Materials Specification 703.29) may be used for cross and driveway culverts

- Grass may be appropriate inlet/outlet protection for driveway pipes and other small pipes (18 inches and less) that receive minimal flow provided the slope is a 2:1 grade or less. An Erosion Control Blanket shall be installed as temporary mulch until vegetation is established.
- Riprap shall be underlain by gravel bedding or a non-woven geotextile to prevent erosion of the underlying soil; see Standard Specification 620 - Geotextiles.
- Riprap should not be placed on slopes greater than 1.5:1. Consult with an engineer for structural measures, such as gabions or concrete headwalls, for slopes greater than 1.5:1.
- In streams, inlet and outlet protection shall be installed within 24 hours of pipe or culvert installation.

Application Procedures

- Divert any standing or flowing water before any excavation; see **In-Water Work**.

Maintenance and Inspections

- The contractor should inspect the inlet/outlet protection weekly as well as before, during and after storm events for damage due to scour or slumping. Repairs shall be made immediately. Thereafter, inspect periodically for damage and repair as necessary.

References

- Standard Specification 613 – Erosion Control Blankets
- Standard Specification 610 – Stone Fill, Riprap, Stone Blanket, and Stone Ditch Protection
- Materials Specification 703.29 – Stone Ditch Protection
- Maine Highway Design Guide, May 2002
- Hydraulic Design Series Number 5, Publication No. FHWA-NHI-01-020 September 2001
- Hydraulic Engineering Circular No. 15 (HEC #15), Publication No. FHWA-IP-87-7, April 1988
- MaineDOT Waterway and Wildlife Crossing Policy and Design Guide