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INDEX

INLET PROTECTION

6.50

EXCAVATED DROP INLET PROTECTION (Temporary)

Definition

An excavated area in the approach to a storm drain drop inlet or curb inlet.

Purpose

To trap sediment at the approach to the storm drainage systems. This practice allows use of permanent stormwater conveyance at an early stage of site development.

Conditions Where Practice Applies

Where storm drain drop inlets are to be made operational before permanent stabilization of the disturbed drainage area. This method of inlet protection is applicable where relatively heavy flows are expected, and overflow capability is needed (Figure 6.50a). Frequent maintenance is required and temporary flooding in the excavated area will occur. This practice can be used in combination with other temporary inlet protection devices such as Practice 6.51, *Hardware Cloth, and Gravel Inlet Protection* and Practice 6.52, *Block and Gravel Inlet Protection*.

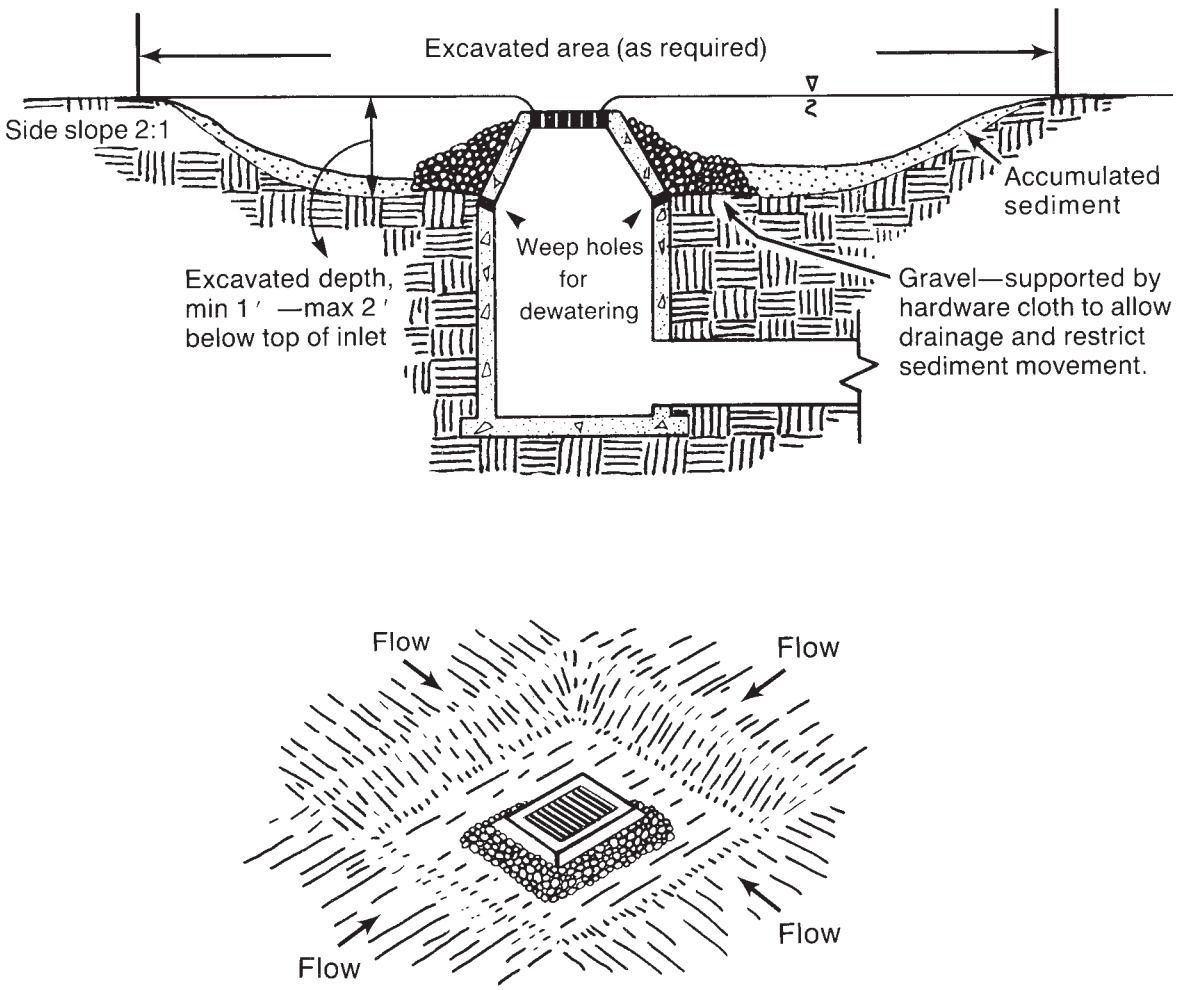


Figure 6.50a Excavated drop inlet protection.

Design Criteria

Limit the drainage area to 1 acre. Keep the minimum depth at 1 foot and the maximum depth of 2 feet as measured from the crest of the inlet structure.

Maintain side slopes around the excavation no steeper than 2:1

Keep the minimum volume of excavated area around the drop inlet at approximately 1800 ft^3/acre disturbed.

Shape the basin to fit site conditions, with the longest dimension oriented toward the longest inflow area to provide maximum trap efficiency.

Install provisions for draining the temporary pool to improve trapping efficiency for small storms and to avoid problems from standing water after heavy rains.

Construction Specifications

1. Clear the area of all debris that might hinder excavation and disposal of spoil.

2. Grade the approach to the inlet uniformly.

3. Protect weep holes by gravel.

4. When the contributing drainage area has been permanently stabilized, seal weep holes, fill the basin with stable soil to final grading elevations, compact it properly, and stabilize.

Maintenance

Inspect, clean, and properly maintain the excavated basin after every storm until the contributing drainage area has been permanently stabilized. To provide satisfactory basin efficiency, remove sediment when the volume of the basin has been reduced by one-half. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize it appropriately.

References

Inlet Protection

6.51, Hardware, Cloth, and Gravel Inlet Protection
6.52, Block and Gravel Inlet Protection (Temporary)

6.51

HARDWARE CLOTH & GRAVEL INLET PROTECTION

Definition

A temporary measure of wire-mesh hardware cloth around steel posts supporting washed stone placed around the opening of a drop inlet.

Purpose

To prevent sediment from entering yard inlets, grated storm drains or drop inlets during construction. This practice allows early use of the storm drain system.

Conditions Where Practice Applies

To be placed around a catch basin or a drop inlet and where the flow is light to moderate. If heavy flow is anticipated, use the rock doughnut inlet protection method (Practice 6.54, *Rock Doughnut Inlet Protection)*. It is also used where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. This method of inlet protection is effective where the inlet is expected to drain shallow sheet flow. The immediate land area around the inlet should be relatively flat (less than 1 percent) and located so that accumulated sediment can be easily removed.

This practice must not be used near the edge of fill material and must not divert water over cut or fill slopes.

Design Criteria

Ensure that drainage areas do not exceed 1 acre per inlet.

For securing the wire mesh hardware cloth barriers, use steel T posts. The posts need to be 1.25 lb/linear ft steel with a minimum length of 5 feet. Make sure the posts have projections to facilitate fastening the hardware cloth. Securely drive each stake into the ground to a minimum depth of 2 feet. The maximum spacing for the posts is 4 feet.

The wire mesh should be at least a 19-gauge hardware cloth with a ¼ inch mesh opening. The total height should be a minimum of 2 feet. Providing a flap of hardware cloth on the ground projecting away from the inlet can aid in removal of the stone at the project's completion. The sediment control stone, with a height of 16 inches, should have a outside slope of 2:1.

The top elevation of the structure must be at least 12 inches lower than the ground elevation downslope from the inlet. It is important that all storm flows pass over the structure into the storm drain and not bypass the structure. Temporary dikes below the structure may be necessary to prevent bypass flow. Soil excavated when constructing the sediment pool may be used for this purpose (Figure 6.51a).

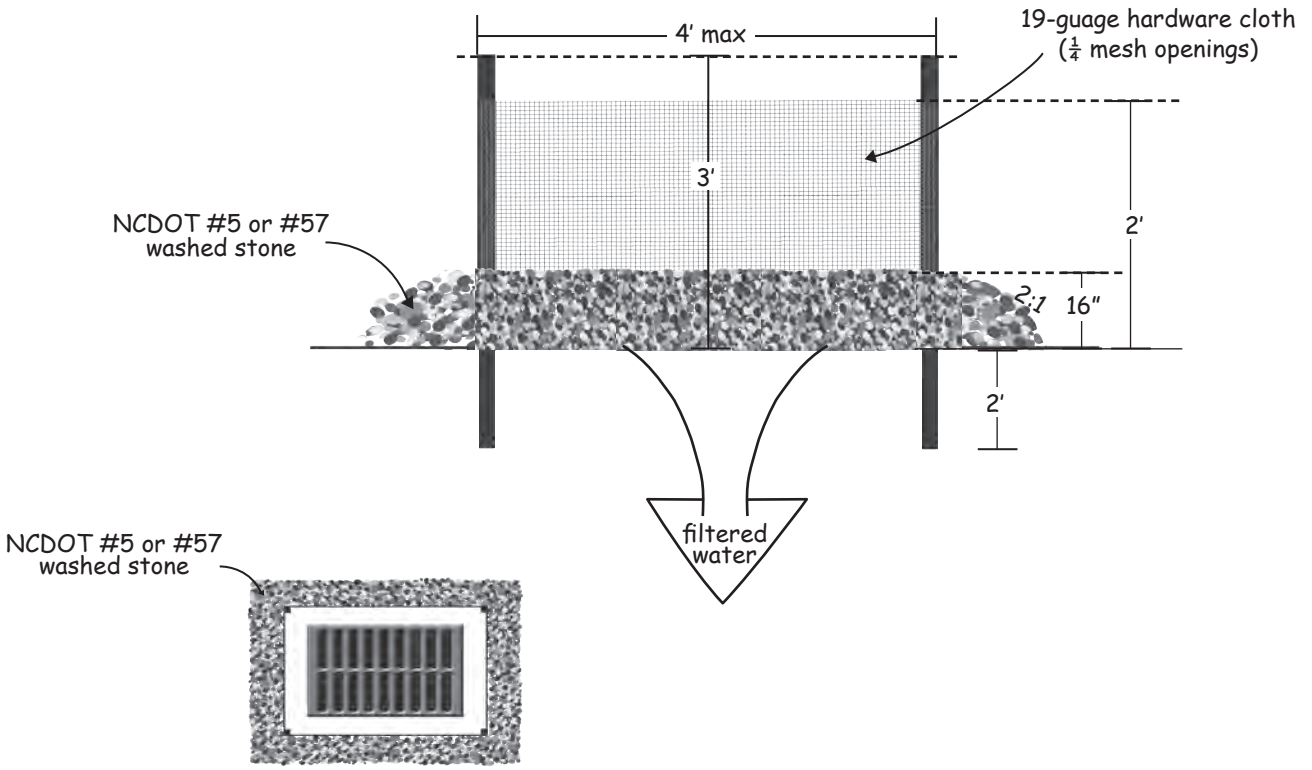


Figure 6.51a Hardware cloth and gravel inlet protection

Construction Specifications

1. Uniformly grade a shallow depression approaching the inlet.

2. Drive 5-foot steel posts 2 feet into the ground surrounding the inlet. Space posts evenly around the perimeter of the inlet, a maximum of 4 feet apart.

3. Surround the posts with wire mesh hardware cloth. Secure the wire mesh to the steel posts at the top, middle, and bottom. Placing a 2-foot flap of the wire mesh under the gravel for anchoring is recommended.

4. Place clean gravel (NC DOT #5 or #57 stone) on a 2:1 slope with a height of 16 inches around the wire, and smooth to an even grade.

5. Once the contributing drainage area has been stabilized, remove accumulated sediment, and establish final grading elevations.

6. Compact the area properly and stabilized it with groundcover.

Maintenance

Inspect inlets at least weekly and after each significant (½ inch or greater) rainfall event. Clear the mesh wire of any debris or other objects to provide adequate flow for subsequent rains. Take care not to damage or undercut the wire mesh during sediment removal. Replace stone as needed.

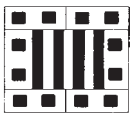
References

Inlet Protection
6.52, Block and Gravel Inlet Protection
6.54, Rock Doughnut Inlet Protection

North Carolina Department of Transportation
Standard Specifications for Roads and Structures

6.52

BLOCK AND GRAVEL INLET PROTECTION (Temporary)



Definition

A sediment control barrier formed around a storm drain inlet by the use of standard concrete block and gravel.

Purpose

To help prevent sediment from entering storm drains before stabilizing the contributing watershed. This practice allows early use of the storm drain system.

Conditions Where Practice Applies

Where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. This method of inlet protection applies to both drop inlets and curb inlets where heavy flows are expected, and an overflow capacity is necessary to prevent excessive ponding around the structure. Shallow temporary flooding after rainfall should be expected, however.

This practice must not be used near the edge of fill material, and must not divert water away from the storm drain.

Design Criteria

Keep the drainage area no greater than 1 acre unless site conditions allow for frequent removal and adequate disposal of accumulated sediment.

Keep the height of the barrier at least 12 inches and no greater than 24 inches. Do not use mortar. Limit the height to prevent excess ponding and bypass flow.

Recess the first course of blocks at least 2 inches below the crest opening of the storm drain for lateral support. Support subsequent courses laterally if needed by placing a 2 x 4-inch wood stud through the block openings that are perpendicular to the block course needing support. Lay some blocks on their side in the bottom row for dewatering the pool (Figure 6.52a).

Place gravel just below the top of the blocks on slopes of 2:1 or flatter. Place hardware cloth or comparable wire mesh with 1/2-inch openings over all block openings to hold gravel in place.

The top elevation of the structure must be at least 6 inches lower than the ground elevation downslope from the inlet. It is important that all storm flows pass over the structure and into the storm drain and not past the structure. Temporary diking below the structure may be necessary to prevent bypass flow. Material may be excavated from inside the sediment pool for this purpose.

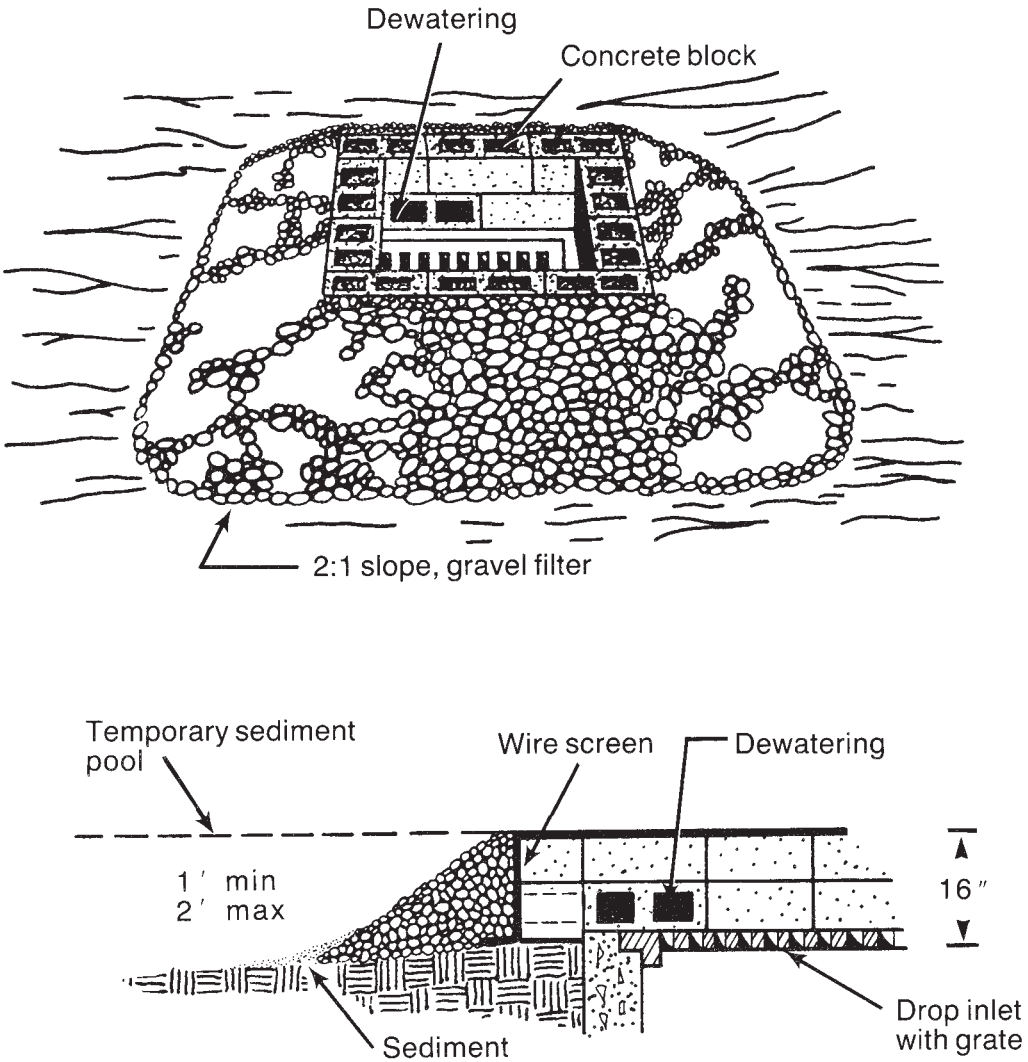


Figure 6.52a Block and gravel drop inlet protection.

Construction Specifications

1. Lay one block on each side of the structure on its side in the bottom row to allow pool drainage. The foundation should be excavated at least 2 inches below the crest of the storm drain. Place the bottom row of blocks against the edge of the storm drain for lateral support and to avoid washouts when overflow occurs. If needed, give lateral support to subsequent rows by placing 2 x 4 wood studs through block openings.

2. Carefully fit hardware cloth or comparable wire mesh with ½-inch openings over all block openings to hold gravel in place.

3. Use clean gravel, ¾- to ½-inch in diameter, placed 2 inches below the top of the block on a 2:1 slope or flatter and smooth it to an even grade. DOT #57 washed stone is recommended.

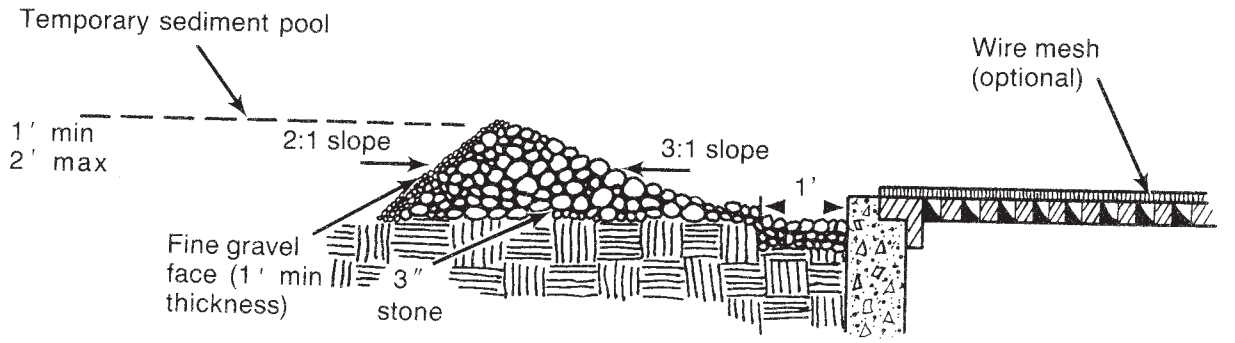


Figure 6.52b Gravel drop inlet protection (gravel donut).

4. If only stone and gravel are used, keep the slope toward the inlet no steeper than 3:1. Leave a minimum 1-foot wide level stone area between the structure and around the inlet to prevent gravel from entering inlet. On the slope toward the inlet, use stone 3 inches in diameter or larger. On the slope away from the inlet use ½ - ¾-inch gravel (NCDOT #57 washed stone) at a minimum thickness of 1 foot.

Maintenance

Inspect the barrier at least weekly and after each significant (½ inch or greater) rainfall and make repairs as needed.

Remove sediment as necessary to provide adequate storage volume for subsequent rains.

When the contributing drainage area has been adequately stabilized, remove all materials and any unstable soil, and either salvage or dispose of it properly. Bring the disturbed area to proper grade, then smooth and compact it. Appropriately stabilize all bare areas around the inlet.

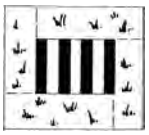
References

Inlet Protection
6.50, Excavated Drop Inlet Protection (Temporary)
6.51, Hardware Cloth, and Gravel Inlet Protection (Temporary)

North Carolina Department of Transportation
Standard Specifications for Roads and Structures

6.53

SOD DROP INLET PROTECTION



Definition

A permanent grass sod filter area around a storm drain drop inlet in a stabilized, well-vegetated area.

Purpose

To limit sediment from entering storm drainage systems as a permanent protection measure.

Conditions Where Practice Applies

Where the drainage area of the drop inlet has been permanently seeded and mulched, and the immediate surrounding area is to remain in dense vegetation. This practice is well suited for lawns adjacent to large buildings.

Design Criteria

Keep velocity of design flow over the sod area at all points less than 5 ft/sec.

Place sod to form a turf mat completely covering the soil surface for a minimum distance of 4 feet from each side of the drop inlet where runoff will enter.

Maintain the slope of the sodded area no greater than 4:1.

Keep the drainage area no greater than 2 acres; maintain this area undisturbed or stabilize it.

Construction Specifications

1. Bring the area to be sodded to final grade elevation with top soil. Add fertilizer and lime, and install sod according to Practice 6.12, *Sodding*.

2. Lay all sod strips perpendicular to the direction of flows.

3. Keep the width of the sod at least 4 ft in the direction of flows.

4. Stagger sod strips so that adjacent strip ends are not aligned.

Maintenance

During the first 4 weeks, water sod as often as necessary to maintain moist soil to a minimum depth of 2 inches.

Maintain grass height at least 2 inches with no more than one-third the shoot height (grass leaf) removed in any mowing.

Apply fertilizer as necessary to maintain the desired growth and sod density. Add lime as needed to maintain the proper pH.

References

Surface Stabilization
6.12, Sodding

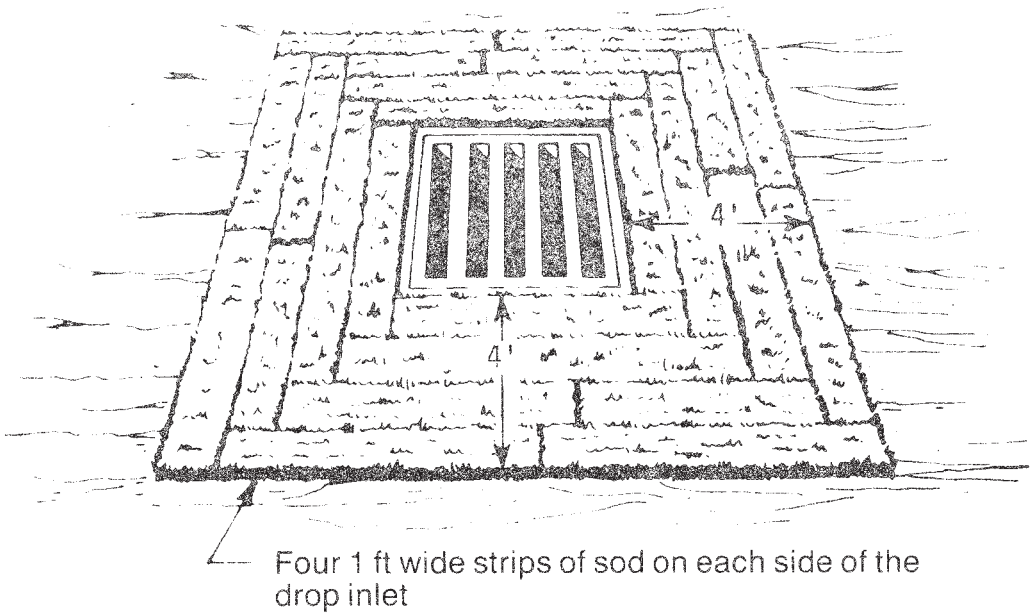
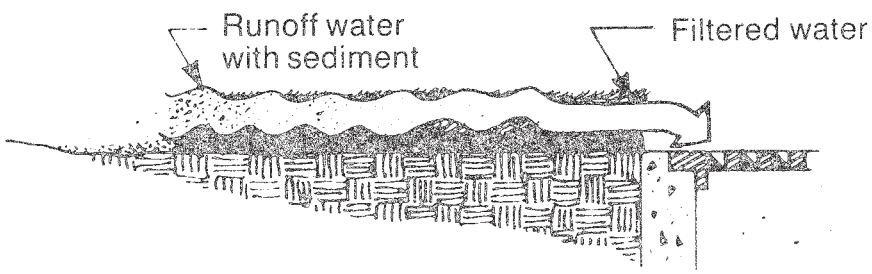


Figure 6.53a Sod strips protect inlet area from erosion (source: Va SWCC).

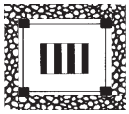


Specific Application

This method of inlet protection is applicable only at the time of permanent seeding, to protect the inlet from sediment and mulch materials until permanent vegetation has become established.

Figure 6.53b Sod drop inlet sediment filter (source: Va SWCC)

6.54



ROCK DOUGHNUT INLET PROTECTION (Temporary)

Definition

A doughnut shaped rock dam that prevents sediment from getting into a drop inlet. The rock dam has a built-in sediment storage area around the outside perimeter of the structure.

Purpose

To prevent sediment from entering a storm drain.

Conditions Where Practice Applies

To be used at drop inlets with large drainage areas or at drop inlets that receive high velocity water flows, possibly from many directions. Sediment is captured in an excavated depression surrounding the inlet. When drainage area exceeds 1 acre, additional measures are necessary. This practice must not divert water away from the storm drain.

Design Criteria

Place measure at least 30 feet away from vehicular traffic. This inlet protection can be modified to protect one side of the inlet if only one side receives flow.

Stone—A minimum 1-foot wide level area set 4 inches below the drop inlet crest will add protection against the entrance of material. Structural stone should be Class B riprap with 2:1 side slope, and a minimum crest width of 18 inches. The height of the stone should be from 2 to 3.5 feet. The outside face of the riprap should be covered in a 12-inch thick layer of #5 or #57 washed stone. Wire mesh with 2-inch openings may be placed over the drain grating but must be inspected frequently to avoid blockage by trash.

The top elevation of the stone structure must be at least 12 inches lower than the ground elevation downslope from the inlet. **It is important that all stormwater flow over the structure into the storm drain, and not past the structure.** Temporary diking below the structure may be necessary to prevent bypass flow. Material may be excavated from inside the sediment pool for this purpose (Practice 6.52, *Block and Gravel Inlet Protection*).

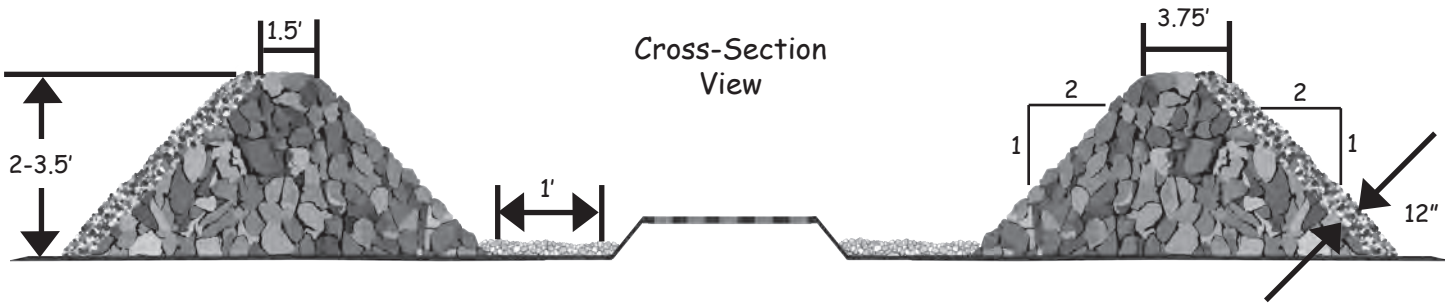
Construction Specifications

1. Clear the area of all debris that might hinder excavation and disposal of spoil.

2. Grade shallow depression uniformly towards the inlet with side slopes no greater than 2:1. Grade a 1-foot wide level area set 4 inches below the area adjacent to the inlet.

3. Install the Class B or Class I riprap in a circle around the inlet. The minimum crest width of the riprap should be 18 inches, with a minimum bottom width of 7.5 feet. The minimum height of the stone is 2 feet.

4. The outside face of the riprap is then lined with 12 inches of NC DOT #5 or #57 washed stone.



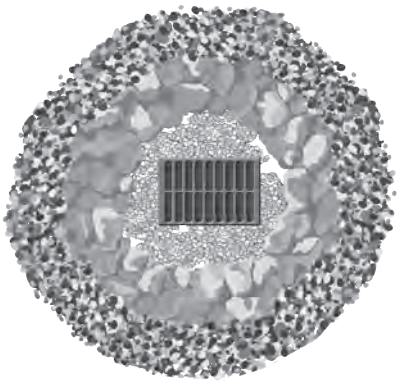


Figure 6.54a Rock doughnut inlet protection plan view and cross-section view.

Maintenance

Inspect rock doughnut inlet protection at least weekly and after each significant (½ inch or greater) rainfall event and repair immediately.

To provide satisfactory inlet protection efficiency, remove sediment from the sediment pool area when the volume is decreased by half. This will help provide adequate storage volume for the next rain. Stabilize excavated material appropriately.

Take care not to damage or undercut the structure during sediment removal. Remove debris from the inlet and replace stone as needed. If the inlet was covered with wire mesh the mesh should be cleaned of debris.

When the contributing drainage area has been adequately stabilized, remove all materials and dispose of sediment properly. Bring the disturbed area to the grade of the drop inlet. Smooth and compact it as needed.

Appropriately stabilize all bare areas around the inlet with ground cover.

References

Inlet protection
6.52, Block and Gravel Inlet Protection (Temporary)

North Carolina Department of Transportation
Erosion & Sedimentation Guidelines for Division Maintenance Operation, 1993.

6.55

ROCK PIPE INLET PROTECTION

Definition

A horseshoe shaped rock dam structure at a pipe inlet with a sediment storage area around the outside perimeter of the structure.

Purpose

To prevent sediment from entering, accumulating in and being transferred by a culvert or storm drainage system prior to stabilization of the disturbed drainage area. This practice allows early use of the storm drainage system.

Conditions Where Practice Applies

Rock pipe inlet protection may be used at pipes with a maximum diameter of 36 inches. This inlet protection may be used to supplement additional sediment traps or basins at the pipe outlet, or used in combination with an excavated sediment storage area to serve as a temporary sediment trap. Pipe inlet protection should be provided to protect the storm drainage system and downstream areas from sedimentation until permanent stabilization of the disturbed drainage area.

Do not install this measure in an intermittent or perennial stream.

Planning Considerations

When construction on a project reaches a stage where culverts and other storm drainage structures are installed and many areas are brought to the desired grade, there is a need to protect the points where runoff can leave the site through culverts or storm drains. Similar to drop and curb inlets, culverts receiving runoff from disturbed areas can convey large amounts of sediment to lakes or streams. Even if the pipe discharges into a sediment trap or basin, the pipe or pipe system itself may clog with sediment.

Design Criteria

When used in combination with an excavated sediment storage area to serve as a temporary sediment trap, the design criteria for temporary sediment traps must be satisfied. The maximum drainage area should be 5 acres, and 3600 cubic feet of sediment storage per acre of disturbed drainage area should be provided.

The minimum stone height should be 2 feet, with side slopes no steeper than 2:1. The stone “horseshoe” around the pipe inlet should be constructed of Class B or Class I riprap, with a minimum crest width of 3 feet. The outside face of the riprap should be coved with a 12-inch thick layer of #5 or #57 washed stone.

In preparing plans for rock pipe inlet protection, it is important to protect the embankment over the pipe from overtopping. The top of the stone should be a minimum of 1 foot below the top of the fill over the pipe. The stone should tie into the fill on both sides of the pipe. The inside toe of the stone should be no closer than 2 feet from the culvert opening to allow passage of high flows.

The sediment storage area should be excavated upstream of the rock pipe inlet protection, with a minimum depth of 18 inches below grade.

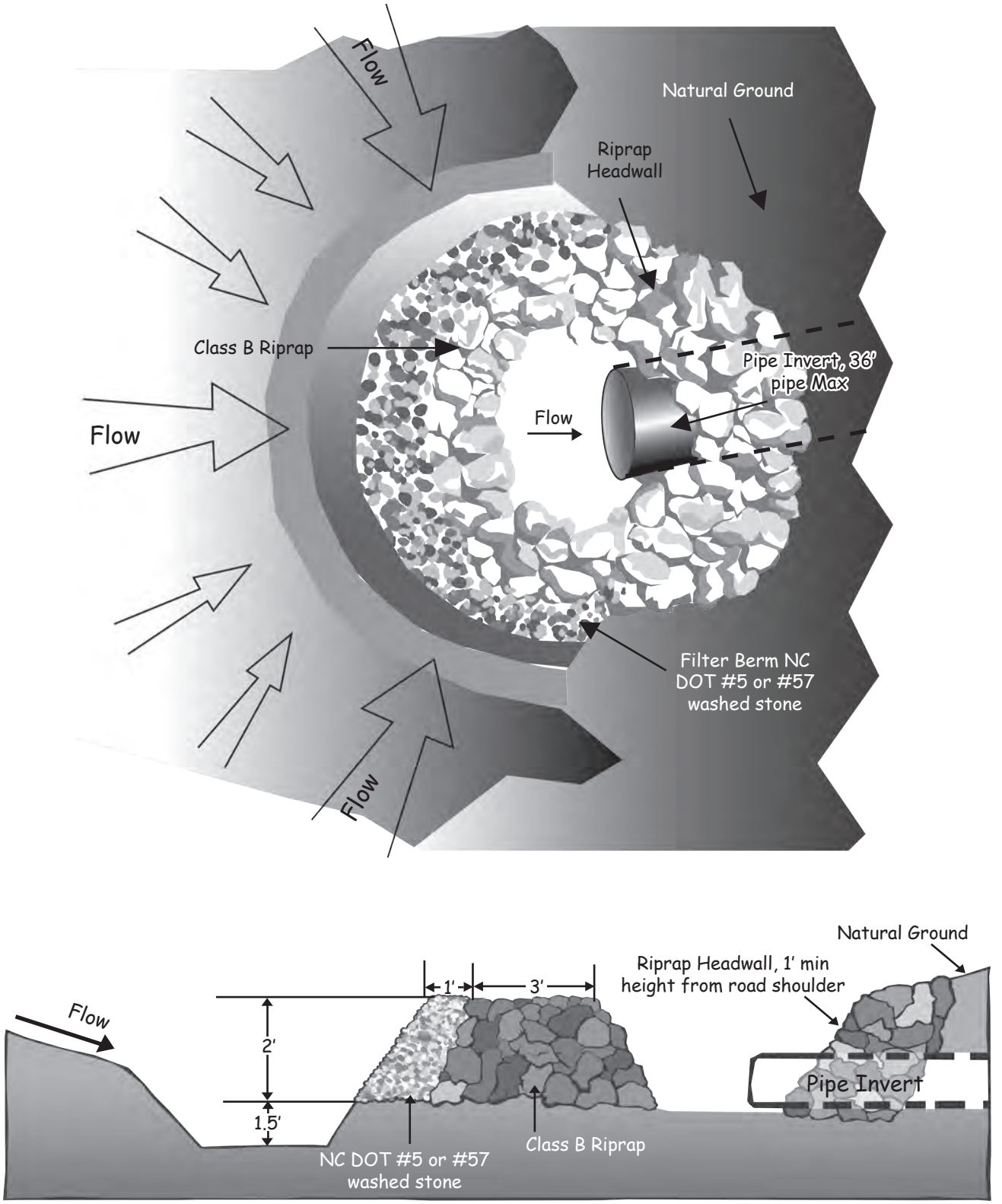


Figure 6.55a Rock pipe inlet protection plan view and cross-section view

Construction Specifications

1. Clear the area of all debris that might hinder excavation and disposal of spoil.

2. Install the Class B or Class I riprap in a semi-circle around the pipe inlet. The stone should be built up higher on each end where it ties into the embankment. The minimum crest width of the riprap should be 3 feet, with a minimum bottom width of 11 feet. The minimum height should be 2 feet, but also 1 foot lower than the shoulder of the embankment or diversions.

3. A 1 foot thick layer of NC DOT #5 or #57 stone should be placed on the outside slope of the riprap.

4. The sediment storage area should be excavated around the outside of the stone horseshoe 18 inches below natural grade.

5. When the contributing drainage area has been stabilized, fill depression and establish final grading elevations, compact area properly, and stabilize with ground cover.

Maintenance

Inspect rock pipe inlet protection at least weekly and after each significant (½ inch or greater) rainfall event and repair immediately. Remove sediment and restore the sediment storage area to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Place the sediment that is removed in the designated disposal area and replace the contaminated part of the gravel facing.

Check the structure for damage. Any riprap displaced from the stone horseshoe must be replaced immediately.

After all the sediment-producing areas have been permanently stabilized, remove the structure and all the unstable sediment. Smooth the area to blend with the adjoining areas and provide permanent ground cover (*Surface Stabilization*).

References

Inlet protection
6.52, Block and Gravel Inlet Protection (Temporary)

Sediment Trap and Barriers
6.60, Temporary Sediment Trap

Surface Stabilization
6.15, Riprap

North Carolina Department of Transportation
Erosion & Sedimentation Guidelines for Division Maintenance Operation, 1993.

Virginia Erosion and Sediment Control Handbook. 1992. STD & SPEC 3.08, Culvert Inlet Protection. pages III-46 - III-51 (Culvert Inlets Sediment Trap).