

6.2 Sediment Trap



Description

A sediment trap is a temporary settling pond formed by construction of an embankment and/or excavated basin and having a simple outlet structure that is typically stabilized with geotextile and rip-rap. Sediment traps are constructed to detain sediment-laden runoff from small, disturbed areas for a sufficient period of time to allow the majority of the sediment to settle out. They are established early in the construction process using natural drainage patterns and favorable topography where possible to minimize grading.

Conditions Where Practice Applies

Sediment traps are used:

1. At the outlets of diversions, channels, slope drains, or other runoff conveyances that discharge sediment-laden water.
2. Below disturbed areas where the total contributing drainage area is **5 acres or less**. If the contributing drainage area is greater than 5 acres, the use of a Sediment Basin is recommended.
3. Where access can be maintained for removal and proper disposal of sediment.
4. In drainage swales or areas, where sediment control is needed upstream of a drainage pattern leading to a storm drain inlet.
5. Where the required life of the structure will be 18 months or less.

6. Where failure of the structure will not result in loss of life; or cause damage to buildings, roads, utilities, or other properties.

Note: Sediment traps, that have the entire capacity achieved through excavation, may have larger drainage areas without compromising the stability of the sediment trap.

Planning Considerations

Timing – Sediment traps shall be constructed as a first step in any land-disturbing activity, and shall be made functional before upslope land disturbance takes place. Sediment traps are temporary measures with a typical design life of 6 months to 18 months. One or more traps are often built early in the construction process to capture sediment, prior to construction of a larger structure (e.g., sediment basin or modified detention basin) is constructed. Sediment traps are to be functional during the entire construction process, both before and after new drainage systems are constructed.

Location – Sediment traps usually are placed near the edges of construction sites so to be out of the way of major construction activities.

Diverting Runoff – Temporary diversions at the perimeter of sites are used to direct runoff to sediment traps (see Temporary Diversion Specifications).

Storm-Sewer Diversions – Storm drains may be temporarily redirected through sediment traps during construction. After construction, the temporary pipes are removed and runoff is allowed to flow through the permanent storm drain as originally intended.

Utilities – Give special consideration to sediment trap location and possible interference with construction of proposed drainage ways, utilities and storm drains.

Trapping Efficiency – Improved sediment trapping efficiencies can be achieved by including both a “wet” storage volume and a drawdown or “dry” storage volume that enhances settling and prevents excessive sediment losses during large storm events. In order to maintain effectiveness, sediment must be periodically removed from the trap to maintain the required design volume. Frequent inspection and appropriate maintenance should be provided until the construction site is permanently protected against erosion.

Design Criteria

Capacity - The minimum total design volume for the sediment trap shall consist of two components, the dewatering zone and the sediment storage zone. These zones are shown schematically in Figure 6.2.1. The volume of the dewatering zone shall be calculated for the entire drainage area by the method shown below. The drainage area includes the entire area contributing runoff to the sediment basin, offsite as well as on. The sediment storage volume may be in the form of a permanent pool or wet storage to provide a stable-settling medium, while the dewatered volume shall be in the form of a draw down or dry storage of at least 67 cubic yards per acre which will provide extended settling time during less frequent, larger storm events.

a) Dewatering Zone Volume –

The volume of the dewatering zone shall be a minimum of 1800 cubic feet per acre of drainage (67 yd³/acre) or the minimum stated in the current NPDES construction general permit. The total volume of the dewatering zone shall be measured from the base of the stone outlet structure to the crest of the stone outlet structure.

b) Sediment Storage Zone Volume –

The volume of the sediment storage zone shall be calculated by one of the following methods. The sediment storage zone shall be measured below the elevation of the base of the stone outlet structure.

Method 1: The volume of the sediment storage zone shall be 1000 cu. ft. per disturbed acre within the watershed of the basin; OR

Method 2: The volume of the sediment storage zone shall be the volume necessary to store the sediment yield as calculated with RUSLE or a similar generally accepted erosion prediction model. While the sediment storage volume may extend to the expected time period of the construction project, the minimum estimated time between cleanouts shall be six months.

Sediment shall be removed when it has accumulated to the top of the sediment storage or wet storage zone. This elevation shall be signified by the top of a stake near the center of the trap.

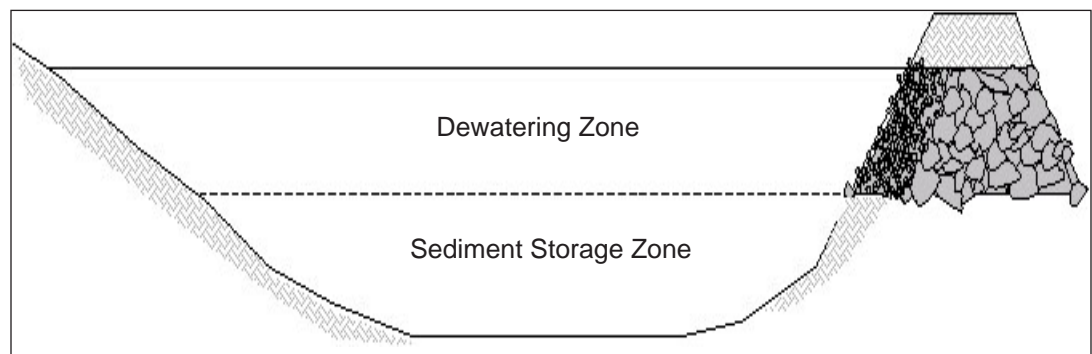


Figure 6.2.1 Capacity of a sediment trap is distributed between dewatering and sediment storage zones.

Embankment – Ensure that embankments for temporary sediment traps do not exceed 5 feet in height measured at the centerline from the original ground surface to the top of the embankment. Construct embankments with a minimum 4 foot top width and 2:1 (H:V) or flatter side slopes.

The design height of the embankment shall be increased by 5% to allow for settlement of the finished embankment. The original ground under the embankment shall be stripped of vegetation and scarified to a depth of 6 inches or more before placement of the fill material. Fill material should be made of clay, free of roots, large rocks, and organic material. Place fill in layers 6 inches thick and then compact using appropriate equipment. Fill material shall not be placed on frozen ground.

The completed embankment shall be seeded in accordance with temporary or permanent vegetation as found in this manual (Temporary Seeding or Permanent Seeding).

Excavation – Where sediment pools are formed or enlarged by excavation, keep side slopes at 2:1 (H: V) or flatter for safety. The maximum depth of excavation within the wet storage area (sediment storage zone) should be 4 feet to facilitate clean out and for site safety considerations.

Outlet Section – Construct the sediment trap outlet using a stone section of embankment located at the low point in the basin. The stone section serves two purposes: 1) the top section serves as a non-erosive spillway outlet for flood flow, and 2) the bottom section provides a means to de-watering the basin between runoff events. A combination of coarse aggregate and riprap shall be used to provide for filtering/detention as well as outlet stability.

Construct the outlet using well-graded stones with a d50 size larger than 6 inches (ODOT Type D). A 1 foot layer of AASHTO # 57 aggregate should be placed on the inside face to reduce drainage flow rate. Geotextile that meets the minimum requirements of ODOT Construction and Material Specification 712.09, Geotextile Fabric Type B, shall be placed at the stone-soil interface to act as a separation and to prevent piping. The geotextile shall be buried or keyed in at the upstream end a minimum of 6 inches. The crest of the stone outlet must be at least 1.5 feet below the top of the embankment to ensure that the flow will travel over the stone and not the embankment. The outlet shall be configured as noted in figure 2.

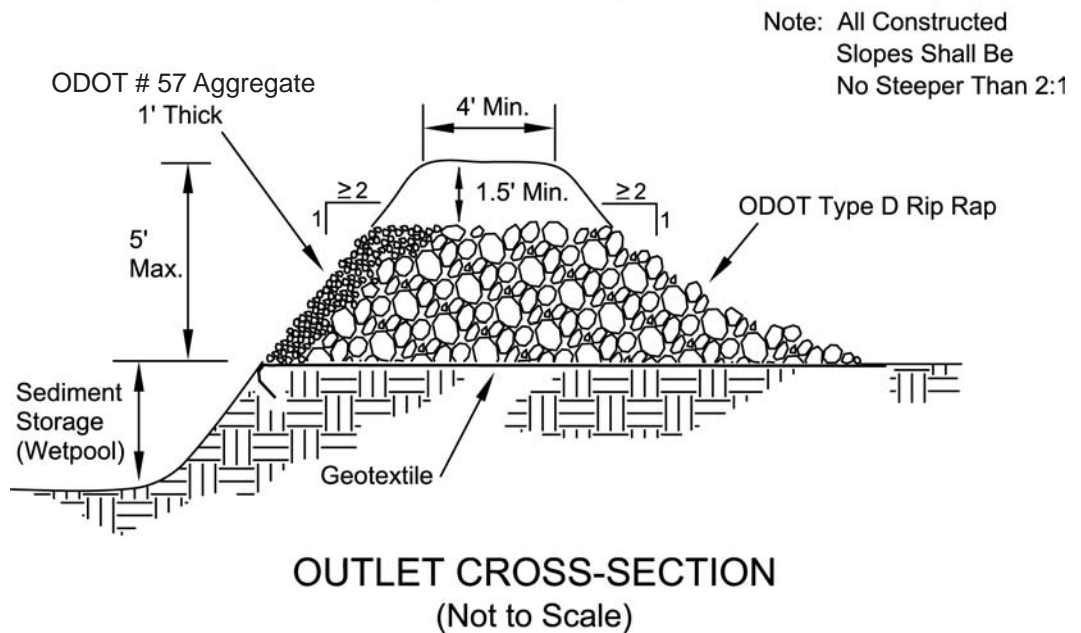


Figure 6.2.2 Outlet configuration

The spillway weir shall be at least 4 feet long and sized to pass the peak discharge of the 10-year, 24-hour storm without failure, overtopping of the basin or significant erosion. A maximum flow depth of 1 foot, a minimum freeboard of 0.5 foot, and maximum side slopes of 2:1 are required. See Table 6.2.1 for weir length associated with drainage area.

Table 6.2.1 Sediment Trap weir length.

Drainage Area (acres)	Weir Length (feet)
1	4.0
2	6.0
3	8.0
4	10.0
5	12.0

Note: alternatively use $Q_{\text{weir}} = CLH^{3/2}$
 Where C = Weir coefficient
 L = Weir Length (feet)
 H = Head of 1 foot

Direct spillway discharges to natural, stable areas. Locate outlets so that flow will not damage the embankment. Discharges must be conveyed to a natural waterway via a channel of adequate capacity and stability. Where the channel enters a natural waterway, the discharge shall be less than 1 ½ feet per second or otherwise less than the velocity that will initiate erosion or scour within the receiving waterway. When traps discharge to storm water facilities, the facility must have adequate capacity to receive the discharge from the sediment trap.

Where an emergency spillway is utilized, the primary rock spillway crest should be at least 1.5 feet below the settled top of the embankment with the emergency spillway crest being 0.5 foot below the top of the embankment.

The plans and specifications should show the following requirements:

1. Location of the sediment traps.
2. Size of sediment trap including width, length and depth.
3. Minimum cross section of embankment.
4. Typical cross section through the spillway with geotextile fabric details and rock placement.
5. Location of emergency spillway, if used.
6. Gradation and quality of rock.
7. Plans shall detail how excavated sediment is to be disposed of, such as placement on areas where it will be stabilized or removal to an approved off-site location.

All plans should include the installation and maintenance schedules with the responsible party identified.

Install warning signs, barricades, perimeter fence and other measures around sediment traps as necessary to protect workers, children, equipment, etc.

Operation and Maintenance

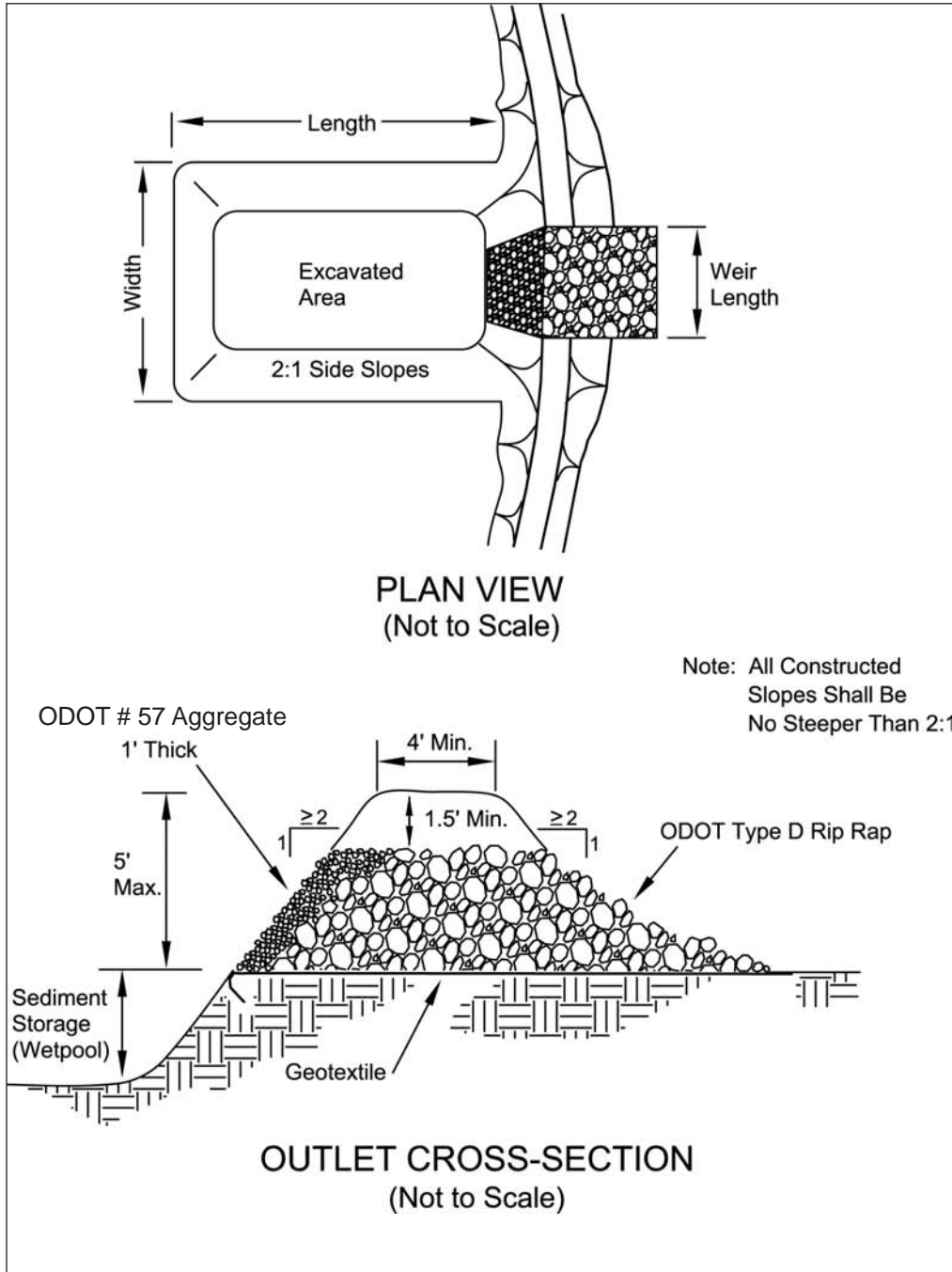
1. The capacity and function of the sediment trap shall be maintained by inspecting on a weekly basis and after each runoff event, and by performing the necessary activities shown below.
2. Establish vegetative cover and fertilize as necessary to maintain a vigorous cover around the sediment trap.
3. Inspect the pool area, embankment and spillway area for burrowing rodents, slope failure, seepage, excess settlement, and displaced stone. The area should be inspected for structural soundness and repaired as needed.
4. Regularly inspect water discharged from trap for excess suspended sediments. Identify and perform necessary repairs to improve water quality. Excessive suspended sediments may require design modifications or treatment with flocculants.
5. Remove woody vegetated growth on the embankment and spillway areas.
6. Remove trash and debris that accumulate in the pond and have potential to block spillways.
7. Dewatering outlets shall be regularly checked to ensure that performance is maintained. Filter stone choked with sediment shall be removed and replaced to restore its flow capacity.
8. Remove sediment and restore the sediment trap to its original dimensions when sediment has accumulated to the top of the sediment storage or wet storage zone. This elevation shall be signified by the top of a stake near the center of the trap. Removing sediment by hand may be necessary adjacent to the outlet section of the embankment to prevent equipment damage. Place the removed sediment and stabilize with vegetation in a designated area where it will not easily erode again. Restore trap to its original dimensions and replace stone as needed on the outlet.
9. After the entire construction project is completed, temporary sediment traps should be dewatered and regraded so as to conform to the contours of the area. All temporary structures should be removed and the area seeded, mulched and stabilized as necessary.

Common Problems/Concerns

Utilizing sediment traps on large drainage areas (greater than 5 acres) where Sediment Basins (see page 2 of this chapter) are appropriate will increase sediment discharged during construction.

Failure to removed trapped sediment will reduce the effectiveness of this practice in capturing sediment.

Specifications
for
Sediment Trap



Specifications
for
Sediment Traps

1. Work shall consist of the installation, maintenance and removal of all sediment traps at the locations designated on the drawings.
2. Sediment traps shall be constructed to the dimensions specified on the drawings and operational prior to upslope land disturbance.
3. The area beneath the embankment shall be cleared, grubbed and stripped of vegetation to a minimum depth of six (6) inches. The pool shall be cleared as needed to facilitate sediment cleanout.
4. Fill used for the embankment shall be evaluated to assure its suitability and it must be free of roots or other woody vegetation, large rocks, organics or other objectionable materials. Fill material shall be placed in six (6) inch lifts and shall be compacted by traversing with a sheepsfoot or other approved compaction equipment. Fill height shall be increased five (5) percent to allow for structure/foundation settlement. Construction shall not be permitted if either the earthfill or compaction surface is frozen.
5. The maximum height of embankment shall be five (5) feet. All cut and fill slopes shall be 2:1 (H:V) or flatter.
6. A minimum storage volume below the crest of the outlet of 67 yd³. for every acre of contributing drainage area shall be achieved at each location noted on the drawings with additional sediment storage volume provided below this elevation.
7. Temporary seeding shall be established and maintained over the useful life of the practice.
8. The outlet for the sediment trap structure shall be constructed to the dimensions shown on the drawings.
9. The outlet shall be constructed using the materials specified on the drawings. Where geotextile is used, all overlaps shall be a minimum of two (2) feet or as specified by the manufacturer, whichever is greater. All overlaps shall be made with the upper most layer placed last. Geotextile shall be keyed in at least 6" on the upstream side of the outlet.
10. Warning signs and safety fence shall be placed around the traps and maintained over the life of the practice.
11. After all sediment-producing areas have been permanently stabilized, the structure and all associated sediment shall be removed. Stable earth materials shall be placed in the sediment trap area and compacted. The area shall be graded to blend in with adjoining land surfaces and have positive drainage. The area shall be immediately seeded.