Module 7.

Erosion and Sediment Control Practices

Virginia Department of Environmental Quality

Technical Assistance

- Section 62.1-44.15:52. B. of the VESCL requires the Department to provide technical assistance and advice to, and conduct and supervise educational programs for VESCP authorities.

- One way the Department accomplishes this is with the Virginia Erosion and Sediment Control Handbook

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Virginia Erosion and Sediment Control Handbook (Table 3-1)

Chapter 1	Introduction
Chapter 2	Erosion and Sediment Control Principles, Practices and Cost
Appendix	Wall Chart (Unified Coding System)
Chapter 3	State Minimum Standards and Specifications
Chapter 4	Stormwater Runoff
Chapter 5	Engineering Calculations
Chapter 6	Preparing an Erosion and Sediment Control Plan
Appendices	6-A: Soils Information
	6-B: Soil Survey Information
	6-C: List of Soil Types
Chapter 7	Administrative Guidelines
Appendices	7-A: Sample Administrative Forms
	7-B: Enforcement Flow Chart
	7-C: Directory
Chapter 8	Virginia Erosion and Sediment Control Law and Regulations
Appendix	Glossary

Organization of ESCH Specifications

- Definition
- Purpose
- Condition Where Practice Applies
- Planning Considerations
- Design Criteria
- Construction Specifications
- Maintenance

Chapter 3

The Erosion and Sediment Control Specifications (for inspectors)

Turn to Chapter 3 in your handbook

3.01 (SAF) – Safety Fence (p. III-1)

Safety fence is not a ESC Practice; but is a protective barrier used for:

- **Delineation of project or property boundary**
- **Limiting access/Public safety/Traps, Basins**
- **Delineation of areas not to be disturbed or protected (i.e., for tree protection or areas used in the future for stormwater infiltration practices)**

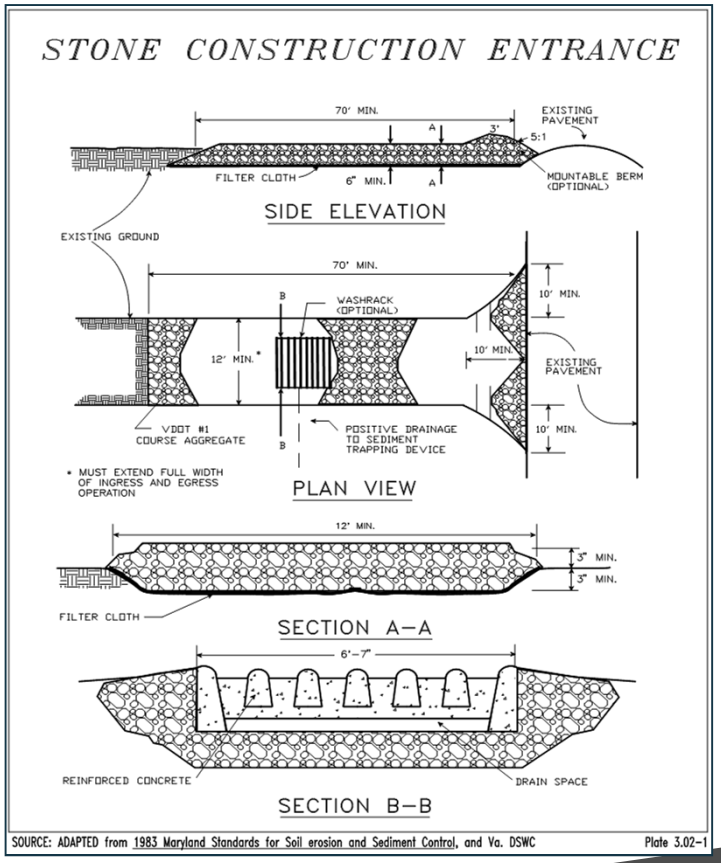
3.01 (SAF) – Safety Fence (p. III-2)

- **Plastic fence min. height is 5 feet**
- **Metal fence min. height is 6 feet**

Maintenance – repair and or replace as needed

3.02 (CE) – Construction Entrance (p. III-6)

- Prevents tracking of mud
- MS 4 &17 (Minimize tracking of mud/dirt into paved public roads)

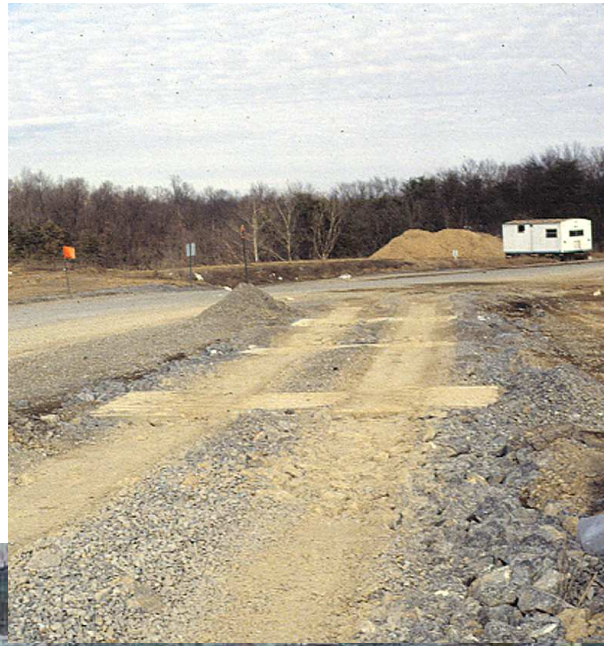


Design/Construction Specifications (p. III-7)

- 6” thick - 12’ wide & 70’ long
- Excavated 3”
- VDOT #1 aggregate (2-3” stone)
- Filter cloth under
- Wash water must be carried to an approved settling area (wash rack)

Maintenance per MS17

- **Mud shall be removed from paved areas at the end of the day.**
- **Cleaning of pavement shall be done by shoveling and sweeping**
- **Wash pavement ONLY after shoveling and sweeping**



Construction entrance problems

3.03 (CRS) – Construction Road Stabilization (p. III-11)

Design/Construction Specifications (p. III-12); MS 1

Installed per approved plan (14’ = 1 way; 20’ = 2 way)

- **Correct stone size (VDOT #1)**
- **Inspect for sediment accumulation on stone**

3.04 (STB)– Straw Bale Barrier (p. III-14)

Design/Construction Specifications (p.III-15)

- **MS-4**
- **Life span = less than 3 months**
- **Can only be used for sheet flow conditions (total drainage area ¼ acre per 100 feet)**
- **Installed on contour (no end runs)**
- **2 Stakes per bale**
- **Entrenched and backfilled**
- **Cleanout sediment (½ the barrier height) p.17**

Straw Bale Problems

3.05 (SF) – Silt Fence (p. III-19)

Design/Construction Specifications (p. III-20-21) MS 4

- **Should only be used for sheet flow conditions (total drainage area ¼ acre per 100 feet)**
- **However, if constructed across a ditch concentrated flow should be <1 cfs**
- **Should be installed on contour (no end runs)**

3.05 (SF) – Silt Fence (p. III-19)

Design/Construction Specifications (p. III-20-21)

- To be placed 5-7 feet beyond the base of a slope > 7%
- Height above ground

  Min=16”

  Max= 34”

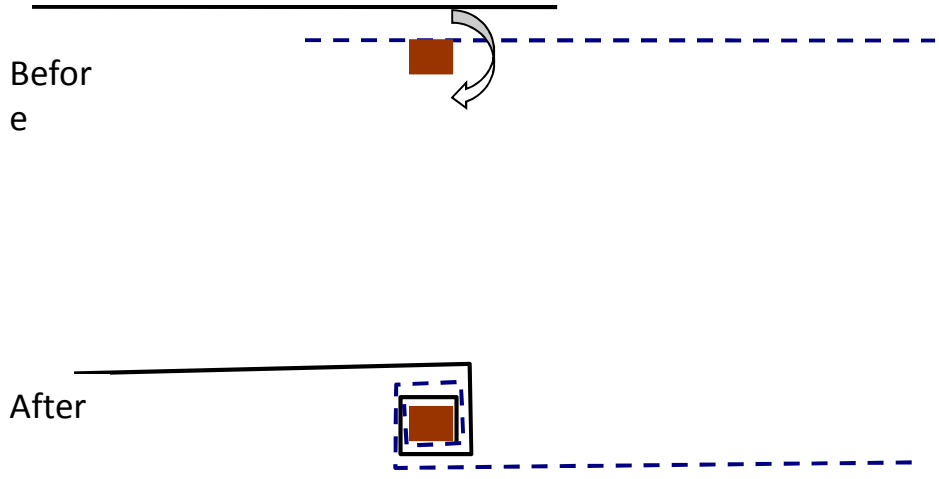
3.05 (SF) – Silt Fence (p. III-19)

Design/Construction Specifications (p. III-21-22)

- Stakes:
  - 5’ length
  - Oak – 2” dia. – max 6’ apart
  - Pine – 4” dia. – max 6’ apart
  - Steel post – weight of 1.33 pounds per foot

Joining two sections of silt fence

- In joints that overlap, min. of 6” of fabric around the stake (p. III-23)

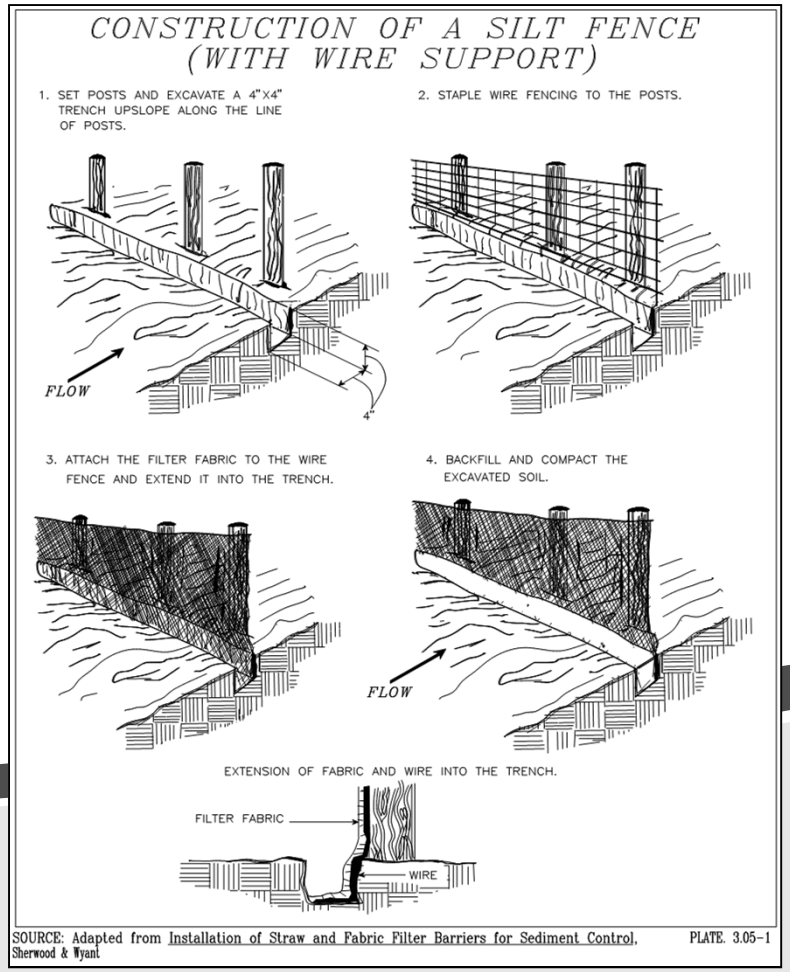


Joining of two rolls of silt fence by wrapping it around a stake.

3.05 (SF) – Silt Fence (p. III-19)

Design/Construction Specifications (p. III-23)

- **4" deep and 4" wide trench on upslope side ➔ 8" of fabric in trench**
- **Post shall be properly spaced**
- **Backfill trench and compact**
- **Fabric not to be stapled to trees**



3.05 (SF) – Silt Fence (p. III-26)

Maintenance

- Inspect after rainfall events
- Repair areas of end runs or undercutting
- Life span ~ 6 months
- Cleanout (½ barrier height)
- Remove when no longer needed (MS18)

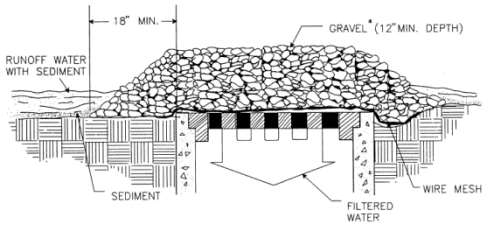
Silt Fence Problems

3.07 (IP) – Storm Drain Inlet Protection (P. III-31) MS-10

Types of drop inlet structures:

1. **Silt fence**
2. **Gravel and wire**
3. **Block and gravel**
4. **Others***

GRAVEL AND WIRE MESH DROP INLET SEDIMENT FILTER



3.07 (IP) Storm Drain Inlet Protection

Design/Construction Specifications (p. III-33)

- **Max. Drainage Area = 1 Acre**
- **Shall not create excessive ponding**
- **Filter fabric can be added**

3.07 (IP) Storm Drain Inlet Protection

Design/Construction Specifications (p. III-33-34)

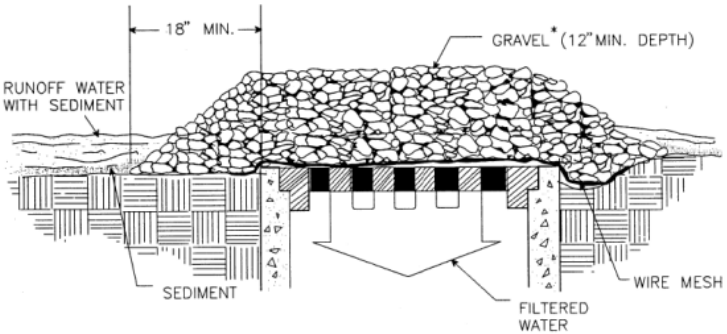
- **Silt Fence Drop inlet IP**
- **Use 2 X 4 stakes for vertical and horizontal**
- **Space 2 X 4's 3 feet apart**
- **Entrench fabric 12 inches around inlet (see detail p. III-35)**

3.07 (IP) Storm Drain Inlet Protection

Design/Construction Specifications (p. III-34)

- **Gravel & Wire Mesh Drop inlet IP**
- **Use ½" wire mesh over inlet**
- **Place stone over the wire**
- **Depth of stone shall be at least 12 inches**
- **Can also be used for curb inlets (p. 37)**

GRAVEL AND WIRE MESH DROP INLET SEDIMENT FILTER



3.07 (IP) Storm Drain Inlet Protection

Design/Construction Specifications (p. III-34)

- Block & Gravel Drop inlet IP
- Use 4”, 8” or 12” concrete block
- Shall be at least 12” high
- Use ½” wire mesh

3.07 (IP) – Storm Drain Inlet Protection (P. III-42)

Wooden weir & Block and gravel curb inlet protection

Inlet Protection Problems

More Inlet Protection Problems

Other Inlet Protection Devices

If these types of IP devices are used, what should the inspector make sure of?

3.08 (CIP) – Culvert Inlet Protection (p. III-46) MS-10

Silt fence culvert inlet protection

- **Must be constructed in a manner to facilitated clean out**
- **Provides protection from disturbed area above the culvert**
- **Types include:**
  - **Silt Fence**
  - **Sediment Trap**

3.08 (CIP) – Culvert Inlet Protection (p. III-47-48) MS-10

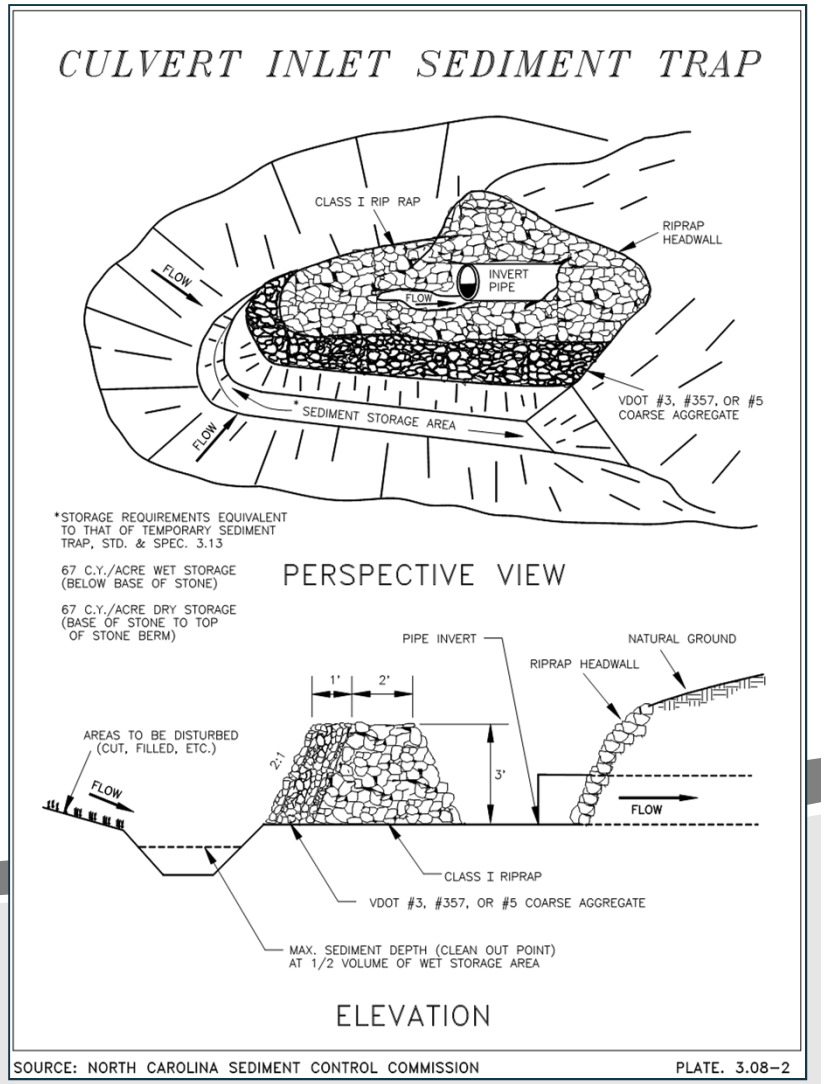
Silt fence culvert inlet protection

- **Expected useful life span is 3 months**
- **No more than 1 acre of drainage**
- **Minimum of 16” high**
- **Maximum of 34 inches**

3.08 (CIP) – Culvert Inlet Protection (p. III-48) MS-10

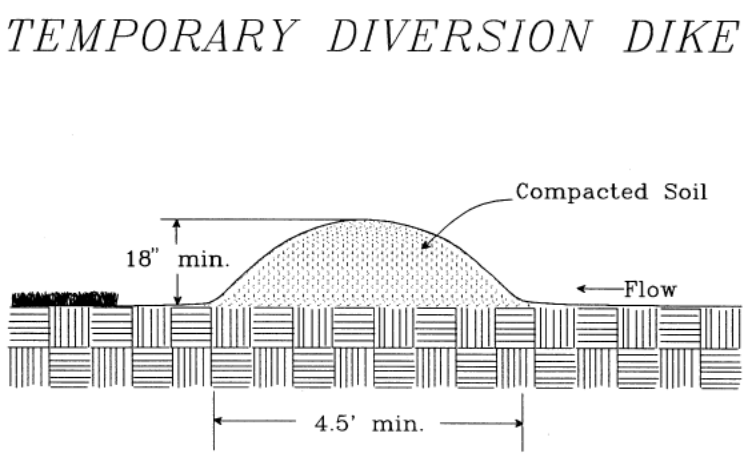
Culvert Inlet sediment trap

- **Constructed per approved plan and specifications**
- **Toe of riprap no closer than 24" from opening**
- **Proper cleanout/maintenance**



3.09 (DD) – Temporary Diversion Dike (p. III-52)

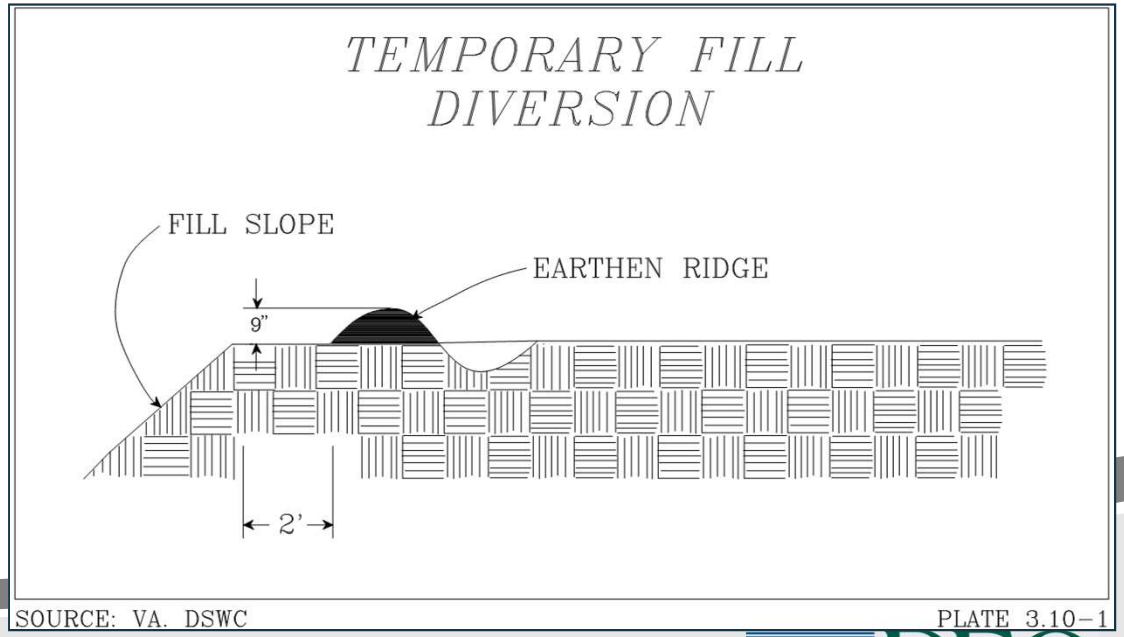
- **Temporary measure, usually to be installed as a first step measure (MS-4) and to be stabilized immediately (MS-5)**
- **Must have a positive grade, stable outfall or outlet**



SEP 30 2004

3.10 (FD) – Temporary Fill Diversion (p. III-56) MS-7 & 8

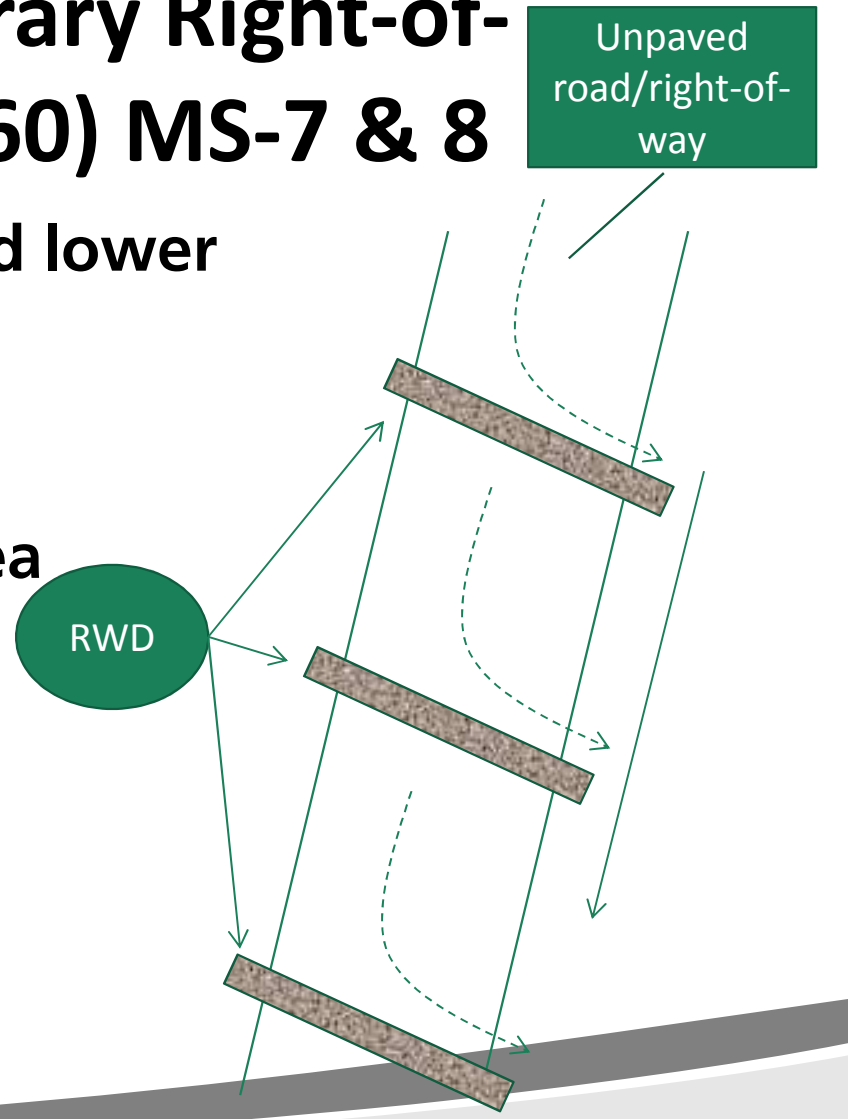
- Temporary structural measure, usually installed at the end of a working day on an active fill slope
- Needs positive grade to stable outfall
- Does <u>NOT</u> require stabilization = Maximum life 1 week
- Min. height = 9 inches



Incorrect construction of a Temporary Fill Diversion

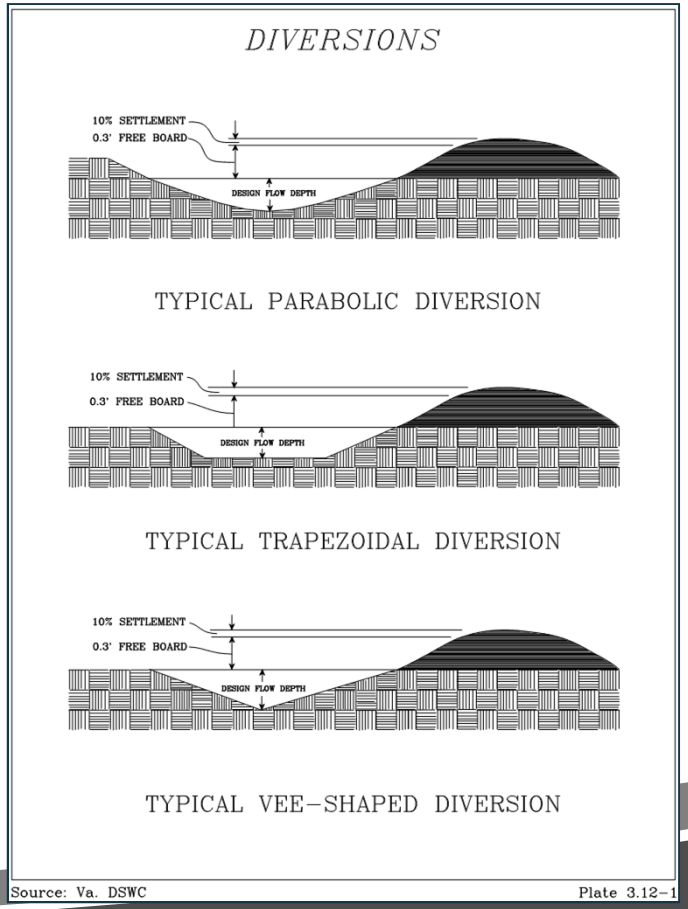
3.11 (RWD) – Temporary Right-of-Way Diversion (p. III-60) MS-7 & 8

- Used to shorten slope length and lower velocity of runoff
- Min. height 18 inches
- Needs proper spacing (p.63)
- Needs to outfall to stabilized area
- Mountable by vehicles



3.12 (DV) – Diversions (p. III-65) MS-7 & 8

- Diversions are permanent and installed for a very specific reason
- Associated with a channel on the upslope side
- Need to be stabilized immediately after construction before making active (MS-5)
- Requires outlet protection

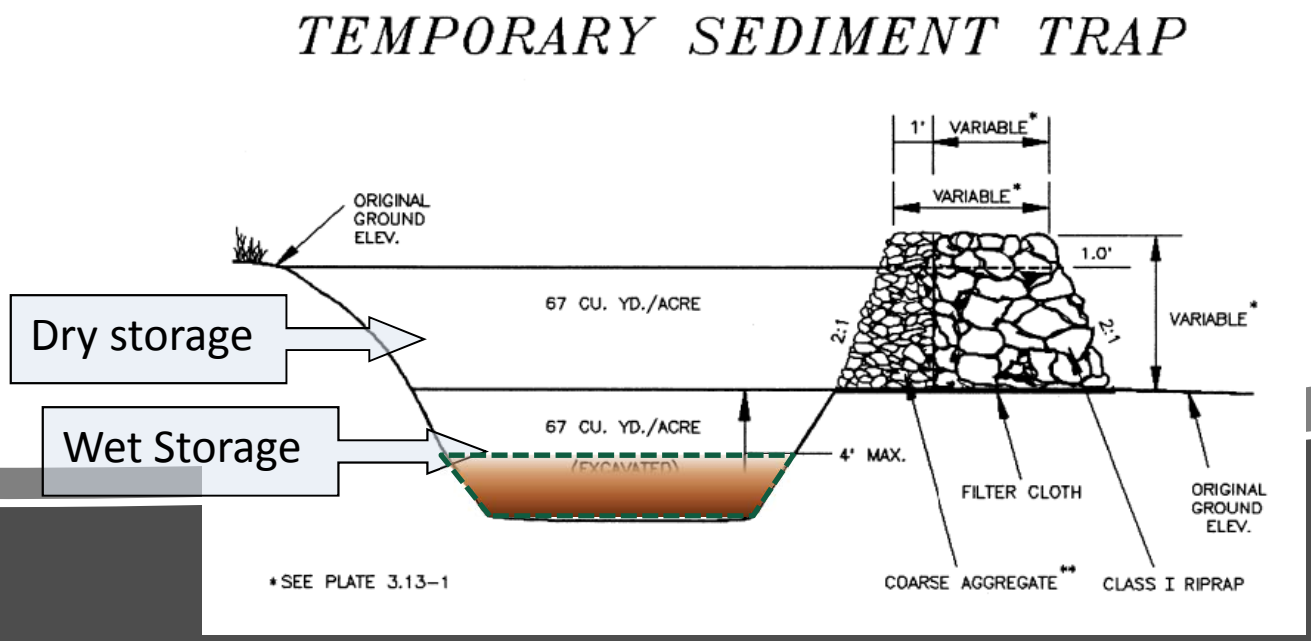


Diversion examples

3.13 (ST) – Temporary Sediment Trap (p. III-70)

MS-6 (a)

- **Must have a storage capacity of 134 cubic yards per acre of drainage area**
- **Storage volume = 50% dry; 50% wet**
- **Drainage areas less than 3 acres**



Sediment Trap Inspection Considerations

- Design/Construction Specifications (p. III-73)
- Side slopes no greater than 1:1 and maximum depth of wet storage is 4 feet
- Stone outlet:
  - Two sizes of stone-smaller size to provide filtering and the larger (rip-rap) to provide outlet stability
  - Filter cloth installed under the rock outlet
  - Outlet must be one foot lower than embankment

Sediment Trap Inspection Considerations

- Design/Construction Specifications (p. III-73-74)

- Embankment is constructed in 6” lifts using clean soil that has no roots, rock or other objectionable material
- MS-5 Requires seeding immediately after construction
- Maximum embankment height is 5 feet

Sediment Trap Inspection Considerations

- **Maintenance (p. III-75)**

- **Must be cleaned out when sediment reaches half of the wet storage volume**
- **Inspect at least once every two weeks and repair any damage immediately; and**
- **Make sure outlet rock is not clogged**

Sediment Trap Examples

Sediment Trap Inspection Problems

3.14 (SB) - Temporary Sediment Basin (p. III-77)

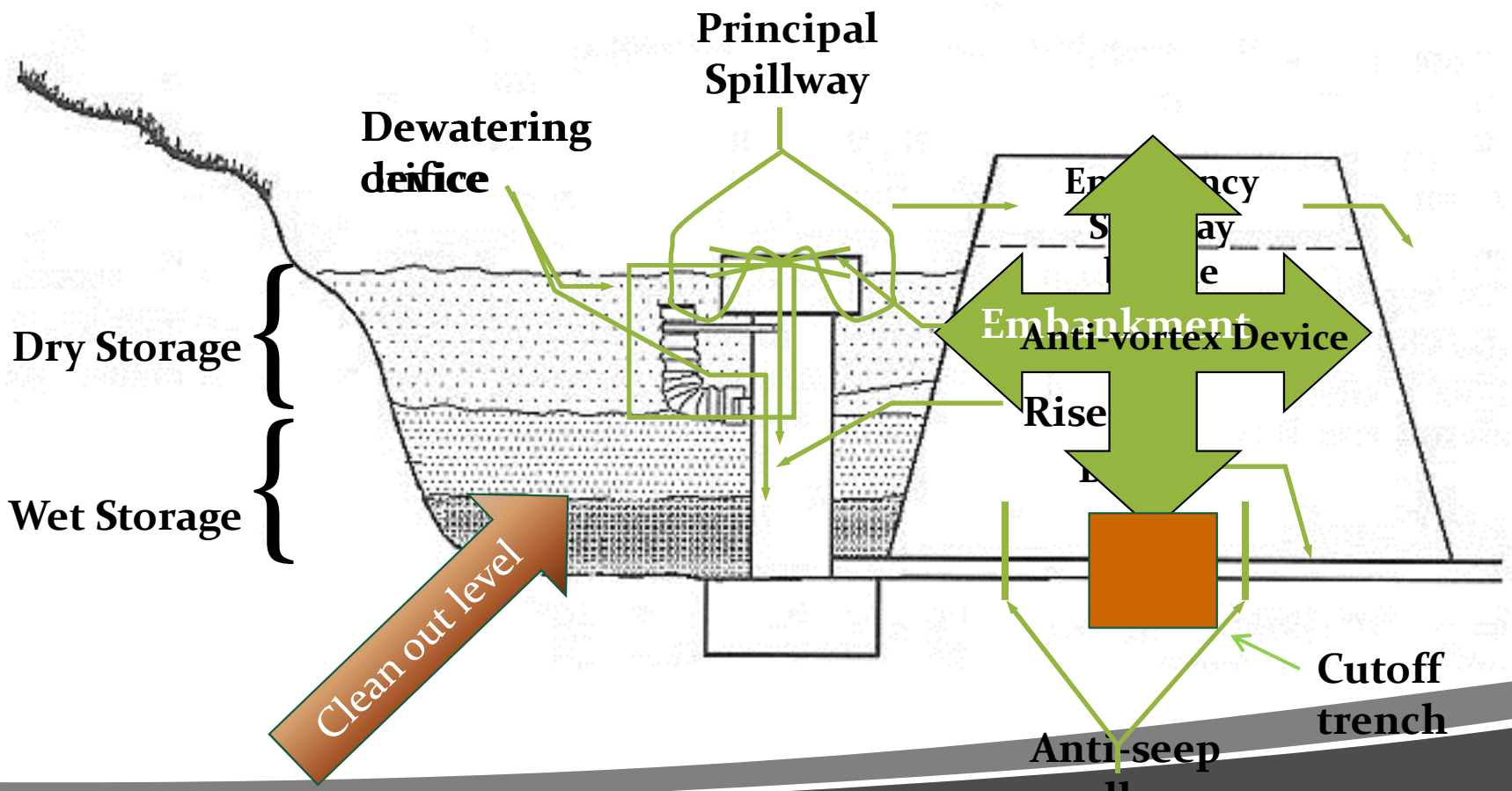
MS-6 (b)

- **Required for drainage areas ≥ 3 acres**
- **Shall have a capacity of 134 cubic yards per acre of drainage**

3.14 (SB) - Temporary Sediment Basin (p. III-77)

- Max. drainage area = 100 acres; min. = 3 acres;
- Outlets must pass 10 yr storm volume
- Must maintain permanent pool of water (67 cubic yds./ acre)

3.14 (SB) - Temporary Sediment Basin



Sediment Basin Construction Specifications (p. III-88-89)

- <u>Embankment</u>
  - Cross sections (width height, slope) must be in accordance with the approved plan
  - Fill material shall be approved and shall achieve a compaction of 95%
  - Must be placed and compacted in 6 inch layers or lifts

Sediment Basin Construction Specifications (p. III-88-89)

- <u>Principle Spillway</u>
  - Fill material shall be placed in 4 inch layers or lifts and compacted carefully
  - A minimum of 2 feet of material needs to be over the barrel before equipment can traverse
  - The minimum diameter is 15 inches and shall be a minimum of 1 foot below the crest of the emergency spillway

Sediment Basin Construction Design/Construction Specifications (p. III-81-82)

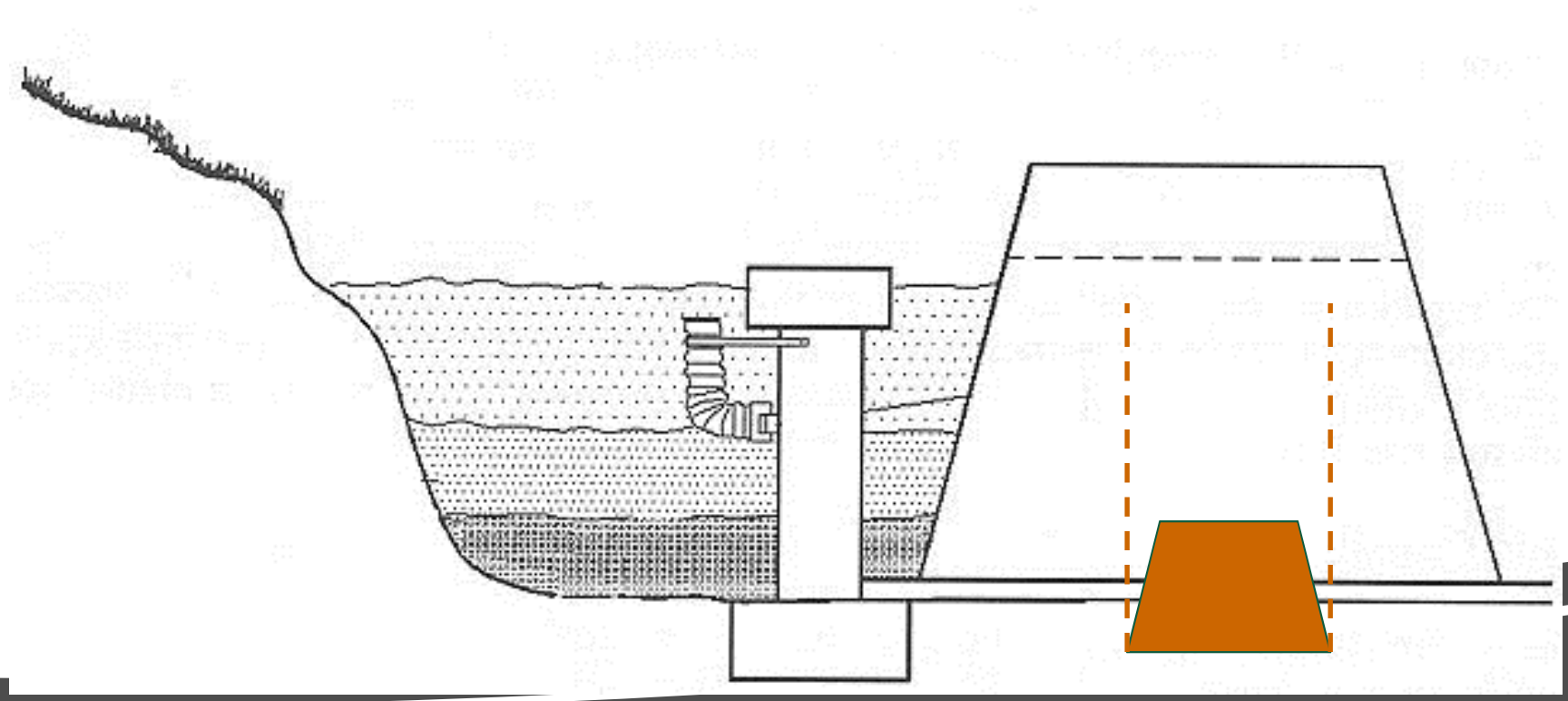
- Anti-vortex device and trash rack shall be attached to the top of the principle spillway
- De-watering device shall be attached to riser
- The base of the riser shall be anchored by either concrete or steel plate (see approved plan for details)
- The barrel shall have a watertight connection to the riser and shall have outlet protection

Sediment Basin Construction Design/Construction Specifications (p. III-84)

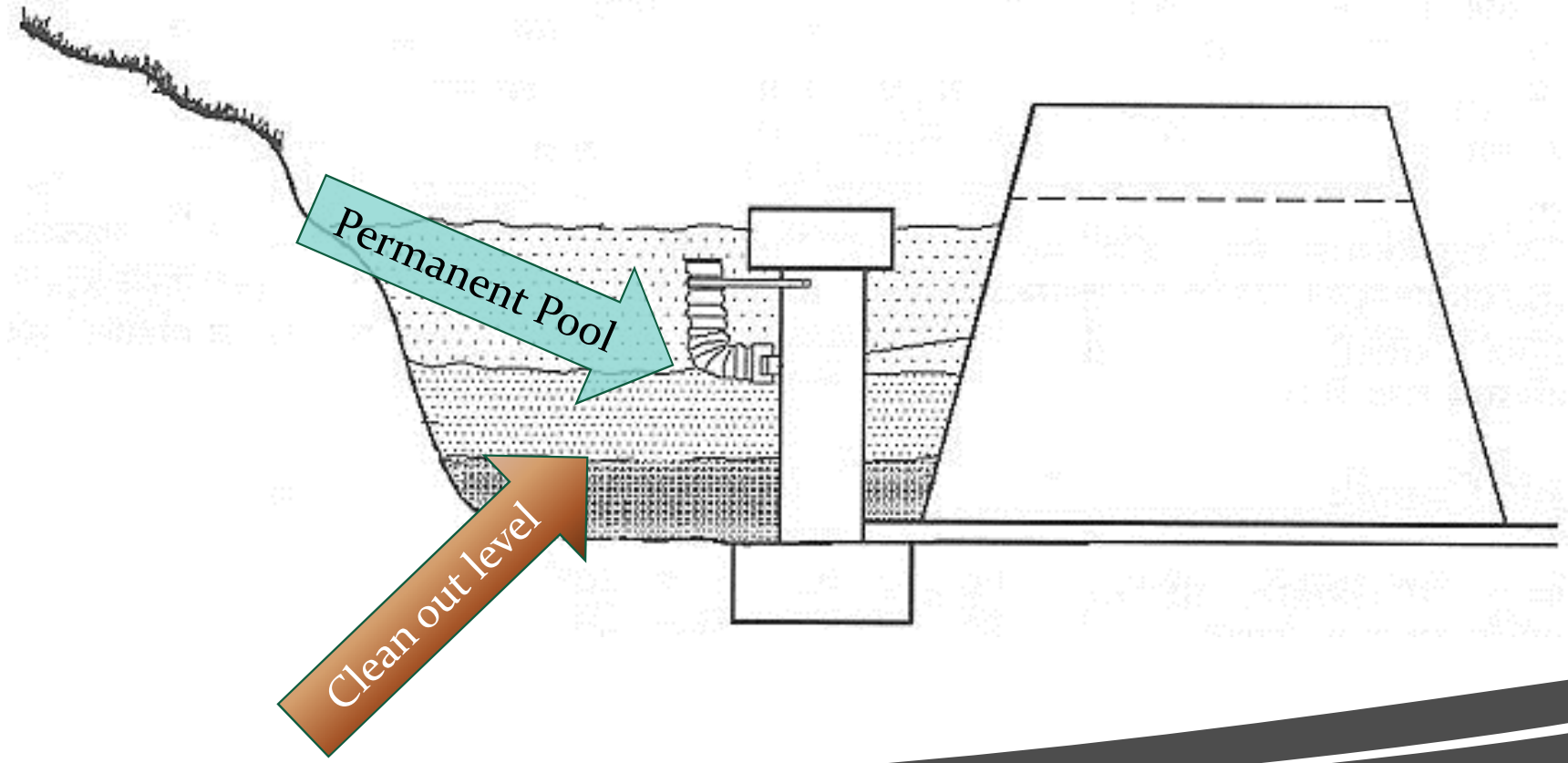
- Anti-seep collars to control seepage may or may not be required. See approved plan
- If so, compaction around these are critical (95%)
- The embankment and sides of the basin shall be stabilized immediately per MS 5

Sediment Basin Construction Specifications (p. III-88)

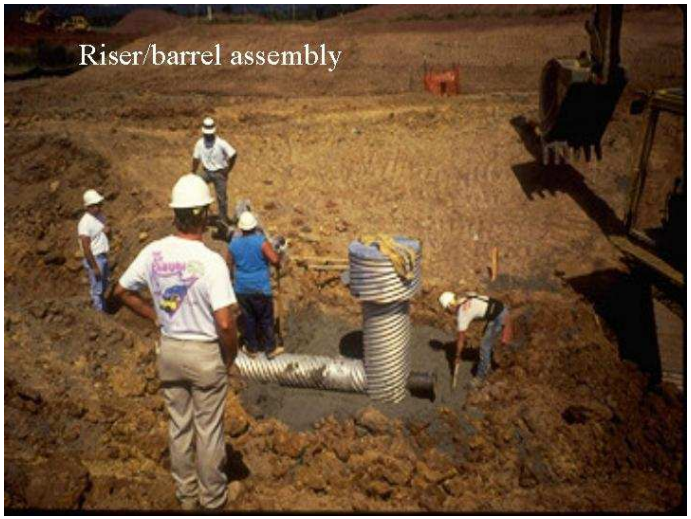
- The <u>cutoff trench</u> must be installed properly



Sediment Basin Maintenance (p. III-90)



Sediment Basin Examples



3.15 (TSD) – Temporary Slope Drain (p. III-116)

- Used in conjunction with a diversion dike
- MS-8

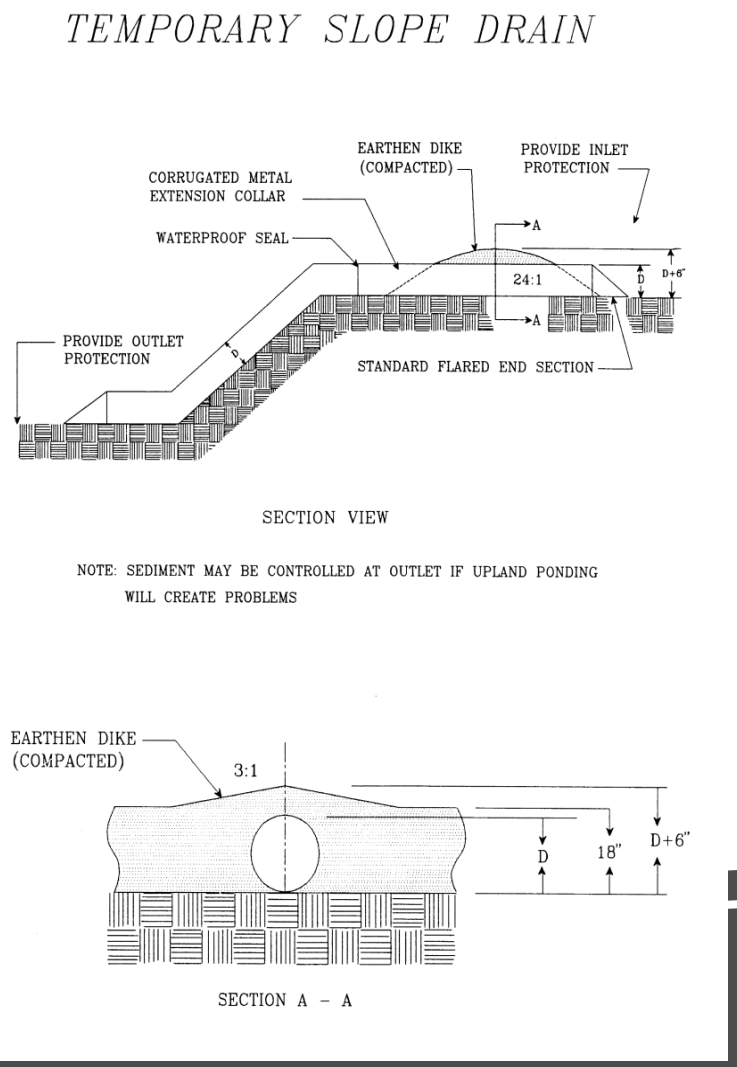
Temporary Slope Drain Design/Construction Specifications (p. III-117-118)

- Maximum Drainage area is 5 acres
- Need to be sized according to table 3.15-A
- Inlet shall be a standard flared end section and have inlet protection
- Entrance of the drain is located at a low point
- The dike at the inlet of the drain must be properly compacted

Temporary Slope Drain Design/Construction Specifications (p. III-118-119)

- Entrance of the drain has a slope of ½ inch per foot
- Make sure slope drain has been properly anchored down the slope with water tight fittings
- Make sure proper outlet protection is installed

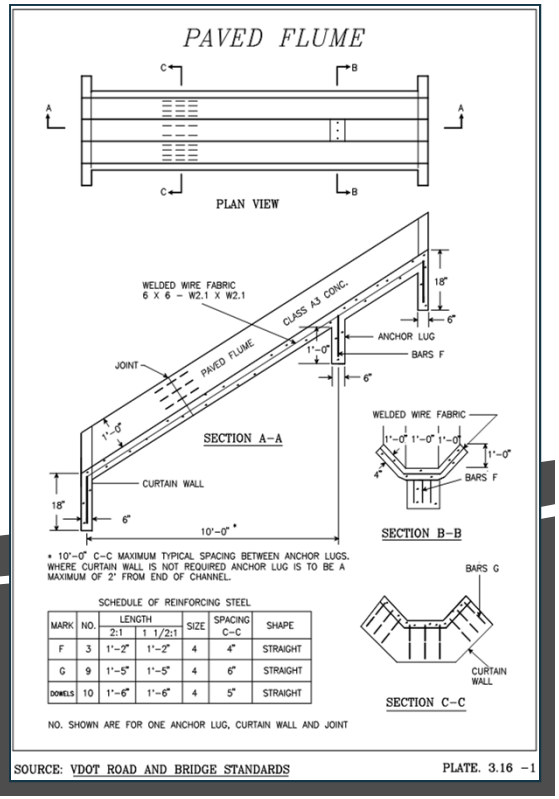
Incorrect Temporary Slope Drain examples



3.16 (PF) – Paved Flume (p. III-123)

Is a permanent paved/concrete channel constructed on a slope MS-8, 10 or 11

- **Cross section (p.-125)**
  - **Maximum slope ratio is 1.5:1**
  - **Must have curtain walls top and bottom**
  - **See detail p. 127**
  - **Must have anchor lugs per specification**



3.16 (PF) – Paved Flume (p. III-123)

•Cross section (p.-125)

- Expansion joints are required every 90 feet
- Outlet protection & energy dissipater
- Must handle 10 yr. peak storm

3.17 (SCC) – Stormwater Conveyance Channels (p. III-130) MS-5, 19

Three different types:

Grass, Rip-Rap, Concrete

Three different shapes:

V-Shape, Parabolic and Trapezoidal

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Stormwater Conveyance Channel Inspection Items

- In rip rap or concrete lined channels, the finished cross-section and elevation of the stone or concrete is ≤ elevation of the diversion or tributary at the point of intersection.

Stormwater Conveyance Channel Inspection Items

- For rip rap channels, was filter cloth installed underneath?
- For concrete channels were expansion joints installed every 90 feet?

Stormwater Conveyance Channel Inspection Items

- Grass lined channels must be stabilized before made operational
- All channels need: outlet protection and to discharge into an adequate channel

Stormwater Conveyance Channel Inspection Items

- Erosion in a grass lined channel may occur because of excessive velocity
- Channels should be inspected frequently for erosion & under scour
- See table on page III-135

Examples of Stormwater Conveyance Channels

3.18 (OP) – Outlet Protection (p. III-154)

Used to dissipate energy of runoff discharged from channels, pipes, conveyances and prevent erosion in the receiving channel (MS-11) .

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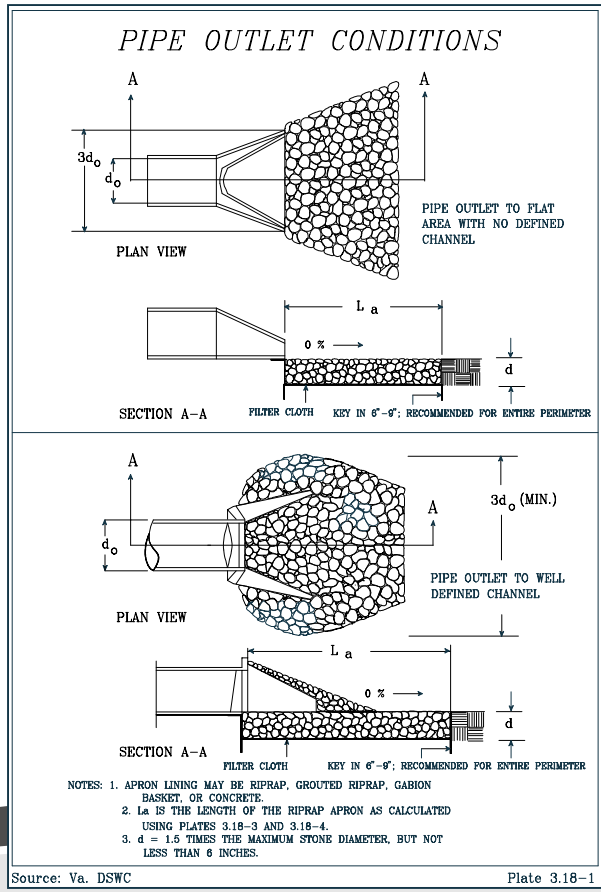
3.18 (OP) – Outlet Protection (p. III-155)

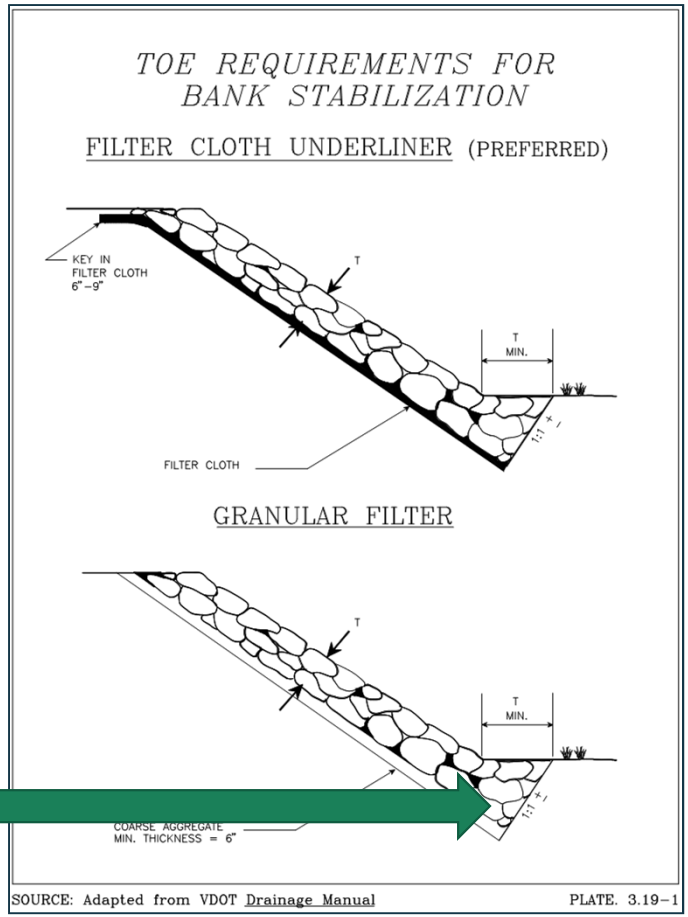
- Installed at 0% grade
- First excavate to depth shown on the approved plan or details
- Install filter fabric
- Place rock to correct depth, length and width
- Smooth transition with natural channel
- If in a well defined channel, side slope no greater than 2:1



Maybe?

3.19 (RR) – Riprap (p. III-166) MS-7, 11 & 19

- Make sure filter fabric underlying (except slopes > 1.5:1)
- Check the stone size to make sure it is correct
- Should be laid to full thickness in one operation
- Make sure the toe was installed



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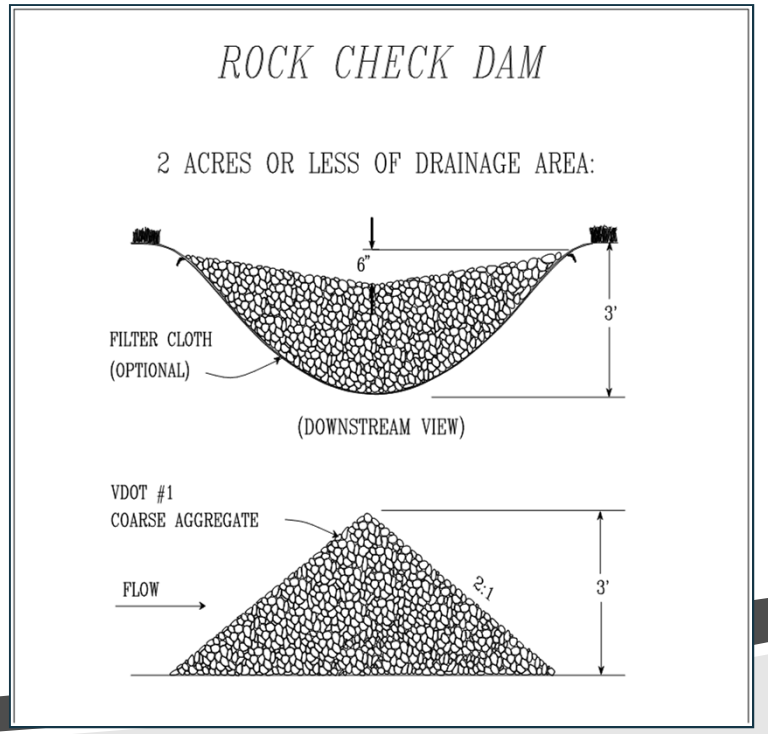
3.20 (CD) – Rock Check Dams (p. III-185)

- Verify correct stone size was used
- Two stone sizes depending on drainage area
- Verify stone was laid correctly and center of the dam is 6 inches lower than edges



3.20 (CD) – Rock Check Dams (p. III-185) Design/Construction Specifications (p. III-186-188)

- Used to reduce velocity in a ditch or swale
- Max. height is 3 feet.
- Remove accumulated sediment when it exceeds half the height of the dam

3.23 (SSS) – Structural Streambank Stabilization (p. III-210) MS-15

- Often part of a stream restoration project or erosion abatement
- Can be done with rip rap, gabions or other non-erodible materials
- Limit the disturbed area while stabilization excavation is being performed
- What other MS would apply?

3.24 (SC) – Temporary Vehicular Stream Crossing (p. III-218-219) MS-13

- Temporary crossings should be constructed of non-erodible materials
- The type will depend on drainage area
- Bridges must be anchored

3.24 (SC) – Temporary Vehicular Stream Crossing (p. III-219) MS-13

- **Make sure sediment trapping measures have been installed along the access road leading to the stream crossing (div. dikes, silt fence, const road stabilization)**

3.24 (SC) – Temporary Vehicular Stream Crossing (p. III-219) MS-13

- Culvert crossing p.221
- Filter cloth placed on bed & back before pipe placement

- Proper stone size and stabilization over the pipes are critical

3.25 (USC) – Utility Stream Crossing (p. III-227-237) MS-12, 13, 14

- Type A, B, or C (velocity dependent)
- Must be operational and stabile before construction activity begins
- Inspect at the end of each day for construction material stability
- See page 230 for example

3.26 (DS) – Dewatering Structure (p. III-238) MS-16 (C)

- The type used must sized correctly and not overfilled
- Storage capacity (ft.^{3}) should = 16 x pump discharge capacity (GPM)

3.26 (DS) – Dewatering Structure (p. III-238) MS-16 (C)

- Ensure proper settlement of the structure is adhered to before cleaning out the sediment (p. 243)
- Clean-out at 1/3 the capacity

3.27 (TC) – Turbidity Curtain (p. III-246) MS-12, 14

- Used to provide sediment protection when working along the edge in water
- See page 254 for installation methods

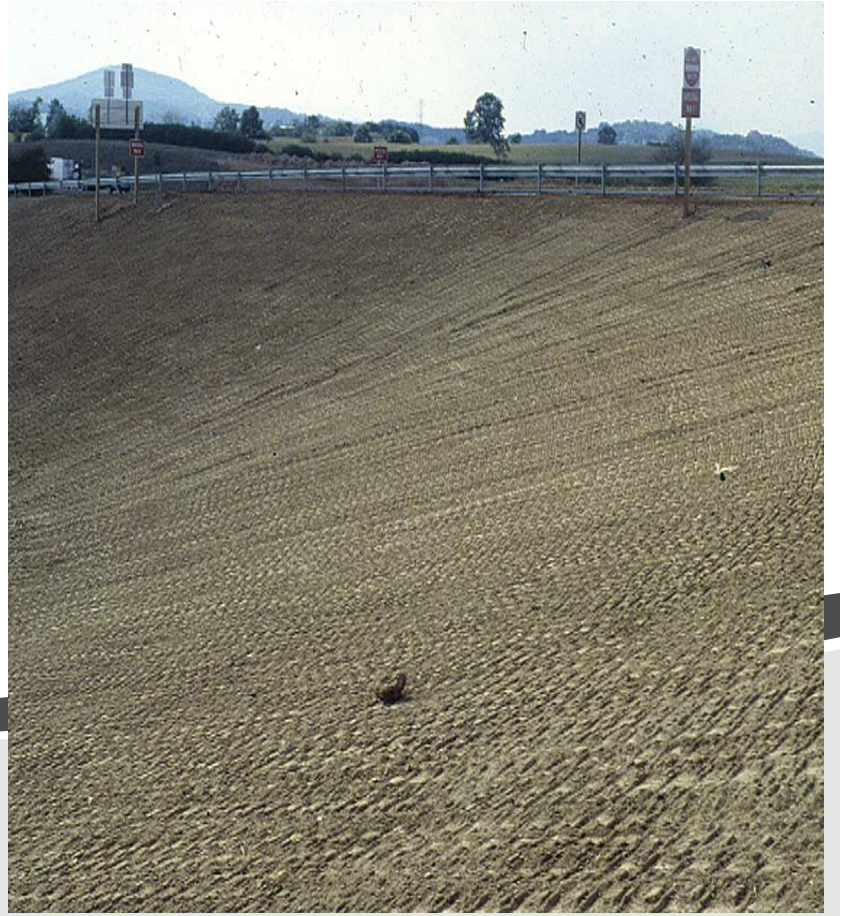
3.28 (SD) – Subsurface Drain (p. III-256), MS 9

- May be used in areas of high water tables and on water seeps on a slope face
- There are several ways and materials choices to use

3.29 (SR) – Surface Roughening (p. III-273); MS 1

Purpose: To slow down water and increase infiltration down; thus, reducing erosion

- **Make sure groves, cleat tracks or other roughing are oriented horizontally (not vertically)**



Slope roughening examples

Area should be seeded & mulched per MS?

Vegetative Erosion Controls

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3.30 (TS) – Topsoiling (p. III-279)

Topsoiling consists of 3 processes:

1. Stripping

2. Stockpiling

3. Spreading

MS 2 – stockpiling
MS 3 – Permanent seeding

Topsoil

- Original soil
- Soil (micro)organisms
- Good growing medium
- Nutrients
- High water holding capacity
- Low bulk density
- Organic matter

Topsoil

- Stock piling (takes up space)
- Requires more time to strip, stock pile and reapply
- Increased exposure time of denuded areas
- Weed seeds

Topsoil Stripping and Stockpiling Specifications (p. III-281-282)

- Make sure perimeter controls are in place prior to stripping
- Avoiding stripping of soil when it is frozen or wet
- Limit areas to be stripped to those designated for construction

Topsoil Stripping and Stockpiling

- Stockpiles must be stabilized in accordance with MS2
- Stockpiles off-site must be inspected as well

Topsoil Stockpiles

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Topsoil Spreading (p. 282)

- Ensure subsoil is loosened to provide a good bond between the subsoil and the topsoil
- Verify topsoil is spread to a minimum depth of 2" on 3:1 or steeper slopes and 4" on flatter slopes

- Ensure good contact between the subsoil and topsoil
- Note table 3.30-A for quantity

3.(31) TS – Temporary Seeding (p. III-284)

Used for:

- **Compliance with MS-1**
- **Compliance with MS-5**
- **As a nurse crop to bridge to an optimal time for permanent seeding**

Temporary Seeding

- Determine if denuded areas will remain dormant for longer than 14 days (MS-1)
- Make sure the area is mulched after seeding
- Make sure the seed used is appropriate for the time of year (see table 3.31-B p. 287 & 3.31-C p. 288)

Permanent Seeding (3.32)

Used for:

- **Compliance with MS-1 and MS-3 (final stabilization)**

Need:

- **Good growing medium/soil**
- **Good plant material**

Soil and Plant Material Requirements

- Verify the soil is at least 12 inches deep (to bedrock or impermeable layer)
- Check the approved plan for appropriate type of plants for your area
- Check to see if the soil has been tested by a soils laboratory and recommendations for the soil pH and nutrient content have been made

Soil and Plant Material Requirements

- Make sure the soil does not contain large amounts of rocks, woody materials, or construction debris
- Only, certified seed should be used

Soil and Plant Material Requirements

- See pages 296-301 for plant information and uses
- Pages 302-305 provide recommendations for seed mixture

Final inspection for Permanent Seeding

Is the area mulched after seeding? (3.35)

Is permanent stabilization achieved? (MS-3)

3.33 (SO) – Sodding (p. III-332)

Positive

- Immediate results/erosion, dust, mud control
- Can be established almost year-round
- No weeds
- Area can be used quickly after sodding
- Less prone to failure

Negative

- Limited species selection and diversity
- Expensive
- Difficult to sod inaccessible places
- Warm soil in summer may reduce establishment of cool season grasses
- Watering requirements for establishment

Inspecting Sodding Operations

- Site Preparation
- Installation
- Maintenance

Sod Installation Considerations

- Soil was slightly irrigated if sodding occurs during very dry weather
- Sod is installed within 36 hours of harvesting
- Sod is unrolled to provide soil contact

Installation of Sod (p.336)

- Sod is laid in staggered rows
- Sod is tightly butted against each other
- Sod installed on steep slopes is anchored

Installation in Waterways (p. 340)

- Sod strips in waterways should be laid perpendicular to the flow
- Butt ends tightly
- Peg or staple after rolling

3.34 (BE)/(ZE) – Bermuda and Zoysia grass (p. III-343) MS-3

- Plant specimens should be planted between May 1 and July 15 (full coverage in 8 to 12 weeks)
- Suited for sunny locations (both grass species are intolerant to shade)

3.35 (MU) – Mulching (p. III-349)

- Protect the soil from raindrop impacts, thus reducing erosion
- Provide a favorable microclimate for seed germination and plant establishment

#1 choice of mulch is straw – applied at 2 tons/acre

Fiber mulch – applied at 500-750 lbs/acre over straw mulch

Other organic mulches: Table 3.35-A

3.36 (B/M) – Blankets & Matting (p. III-356)

- Treatment 1 (VDOT EC-2) is a (bio) degradable blanket

- Treatment 2 mats (VDOT EC-3) are non-degradable plastic structures

Installation

Stabilization Blanket/Matting Inspections

- Need to be installed according to the approved plan, specifications in the VESCH and/or manufacturer recommendations
- Installation on a relatively smooth soil with no clods, rock, or rills
- Ensure there is proper contact between the mat and the soil by laying them loosely on the soil (note: stretching the blankets and mats will lift the materials and reduce soil contact)

Stabilization Blanket/Matting Inspections

- Confirm if check slots are required and if so verify if they are installed properly
- Confirm proper orientation (overlap)in accordance with the VESCH
- Ensure manufacturer's specifications on stapling or staking are followed
- Inspect for undermining and undercutting until permanently vegetated and stabilized

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3.37 (VEG) – Trees, Shrubs, Vines & Ground Covers (p. III-369)

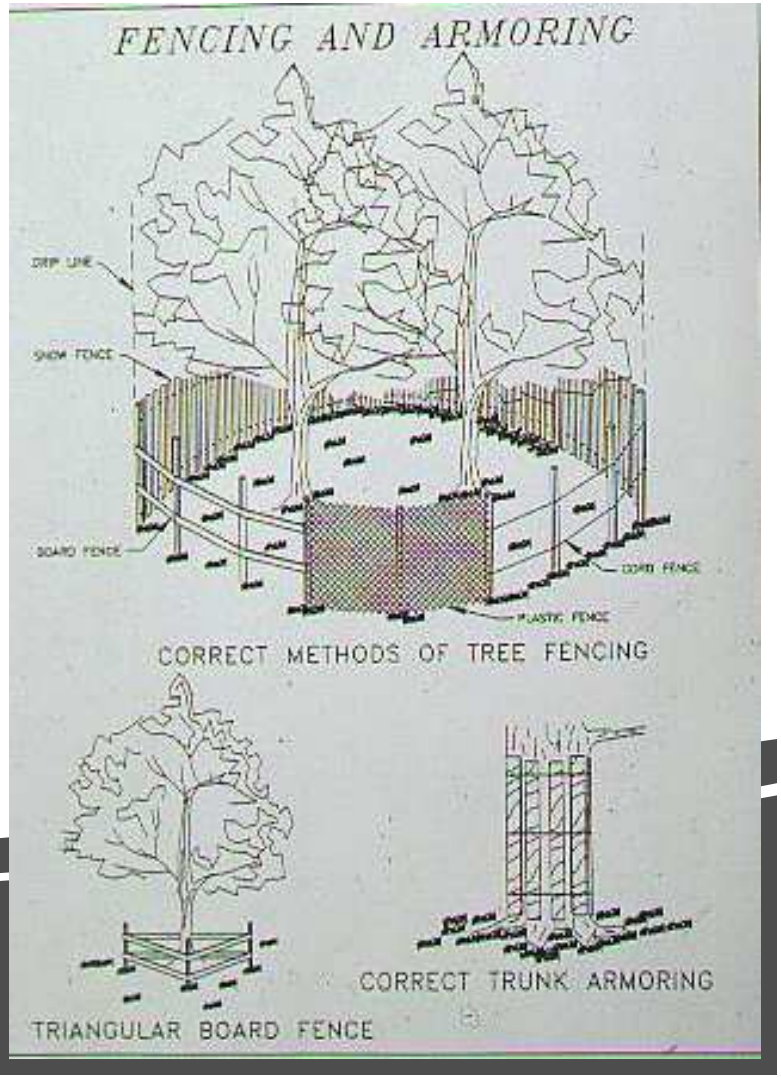
Inspection items for establishing tree or woody vegetation include:

- **Ensure that good, vigorous plant material is being used**
- **Ensure the plants are properly planted, watered, and mulched**

3.38 (TP) – Tree Preservation & Protection (p. III-393)

Inspection items for tree preservation and protection include:

- **Make sure protection is installed at the drip line to minimize root damage from equipment**
- **Check the tree protection area for potential infringements (such as vehicle parking, storage and other damage)**
- **Make sure the fencing and armoring is not damaged**



Tree Protection and Preservation

3.39 (DC) – Dust Control (p. III-414)

Dust Control Measures:

- ***Vegetative cover*** **- areas of no construction traffic**
- ***Mulch*** **- Fast & effective; not in traffic areas - use binders to tack**
- ***Tillage*** **- Emergency measure to bring clods to surface**
- ***Irrigation*** **- Keep surface wet**
- ***Spray on adhesives*** **- Organics - derivatives of pine tar and vegetable gum**

End of Module 7

Virginia Department of Environmental Quality