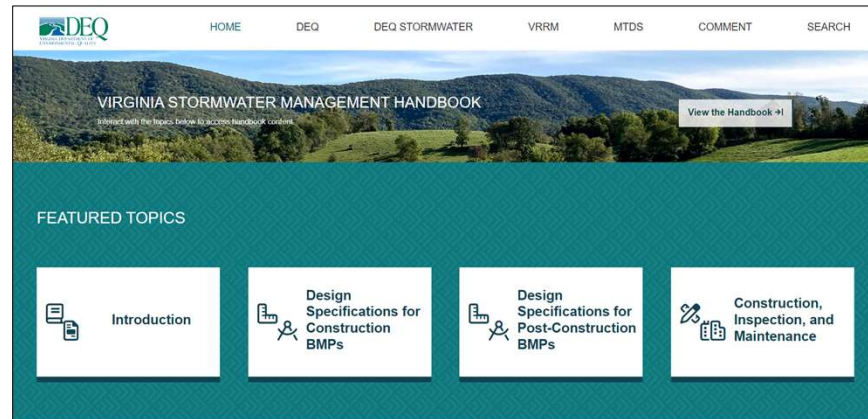


Module 3



Module 3



1

Module 3 Contents

- 3a. Design Specifications for Construction BMPs
- 3b. Erosion Control Measures – C-ECM
- 3c. Environmentally Sensitive Area Protection – C-ENV
- 3d. Perimeter Control Measures – C-PCM
- 3e. Sediment Control Measures – C-SSM
- 3f. Surface Stabilization Measures – C-SSM
- 3g. Native vs. Invasive Plant Species for ESC



2

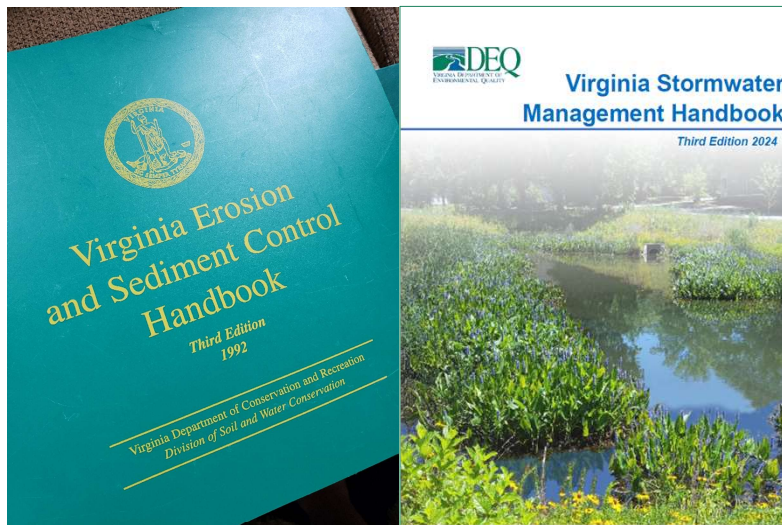
Module 3a.

Design Specifications for Construction BMPs



3

Where we were vs. where we are



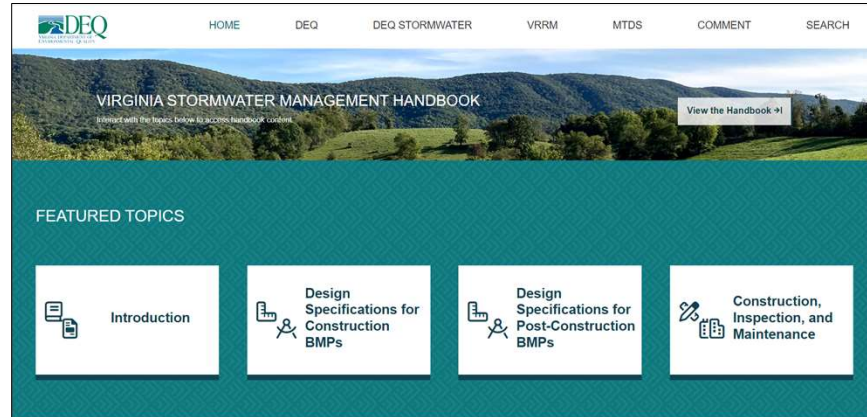
3a. | CONSTRUCTION BMPs



4

Virginia Stormwater Management Handbook

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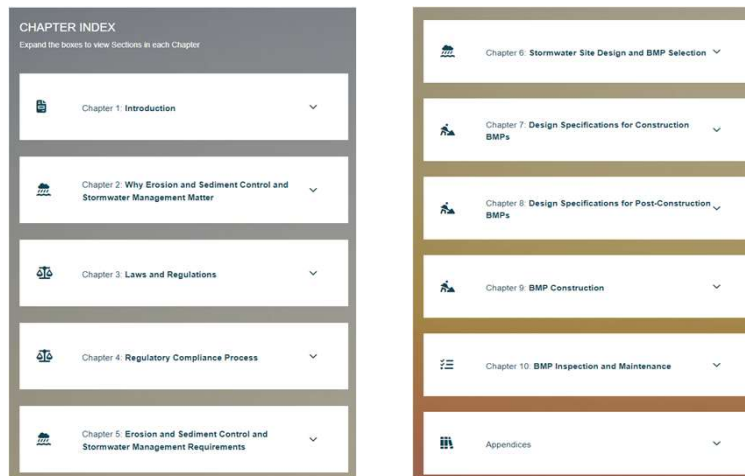


3a. | CONSTRUCTION BMPs



5

Virginia Stormwater Management Handbook



3a. | CONSTRUCTION BMPs



6

Virginia Stormwater Management Handbook

- The 2024 Virginia Stormwater Management Handbook (VESMHB) is an online technical guide for design, plan review and inspections
- Construction Best Management Practices (C-BMPs) are listed in Chapter 7
- C-BMPs can still be grouped as:
 - Structural controls
 - Vegetative controls
- C-BMPs are used to achieve the Minimum Standards

3a. | CONSTRUCTION BMPS



7

Organization of BMP Specifications

- 1.0 Definition
- 2.0 Purpose and Applicability
- 3.0 Planning and Considerations
- 4.0 Stormwater Performance Summary
- 5.0 Design Criteria
- 6.0 Construction Specifications
- 7.0 Operations and Maintenance Considerations
- 8.0 References
- Note: Some BMPs have additional sections

3a. | STRUCTURAL C-BMPS



8

Numbering and Nomenclature

First letter represents
the type of BMP

Number represents
the specific BMP

 **C-PCM-04** 

- Construction (C)
- Post-Construction (P)

3a. | CONSTRUCTION BMPS



9

Numbering and Nomenclature

C-PCM-04



Three letters represent the primary function of the BMP:

C-BMP

- Erosion Control Measures (ECM)
- Perimeter Control Measures (PCM)
- Surface Stabilization Measures (SSM)
- Sediment Control Measures (SCM)
- Environmentally Sensitive Area Protection (ENV)

P-BMP

- Basins (BAS)
- Filtration/Infiltration (FIL)
- Conveyance (CNV)
- Support Components (SUP)

3a. | CONSTRUCTION BMPS



10

Module 3b.

Erosion Control Measures – C-ECM



11

Erosion Control Measures – C-ECM

- Prevent sheet, rill, and gully erosion, reduce the overland flow velocities, shorten the length of flow, and divert and convey runoff safely through the site
- Sixteen BMPs are designated as C-ECMs
- Full details for each measure are found in the online Stormwater Management Handbook, Chapter 7

3b. | CONSTRUCTION BMPs – C-ECM



12

Erosion Control Measures – C-ECM

- Wattles and slope interruption devices
(C-ECM-01 – 03)



- Diversions and waterbars (C-ECM-04 – 08)



3b. | CONSTRUCTION BMPs – C-ECM



13

C-ECM-01 Slope protection



3b. | CONSTRUCTION BMPs – C-ECM



14

C-ECM-01 Slope Protection



3b. | CONSTRUCTION BMPs — C-ECM



15

The Diversion Family

Types of diversions

- Temporary - C-ECM-04
- Temporary Fill - C-ECM-05
- Temporary Right-of-Way C-ECM-06
- Diversions - C-ECM-07

Diversions require:

- Grade/Positive flow
- Most require immediate stabilization
- Outlet protection

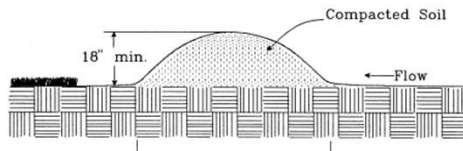


3b. | CONSTRUCTION BMPs — C-ECM



16

C-ECM-04 Temporary Diversion 5.0 Design Criteria



- Maximum drainage area = 5 acres
- Minimum compacted height 18"
- Minimum width 4.5'
- Must have positive grade to a stabilized outlet

3b. | CONSTRUCTION BMPs — C-ECM



17

Erosion Control Measures – C-ECM

- Channels, sub-surface drains, and flumes
(C-ECM-09 – 11)



- Slope drains (C-ECM-12)



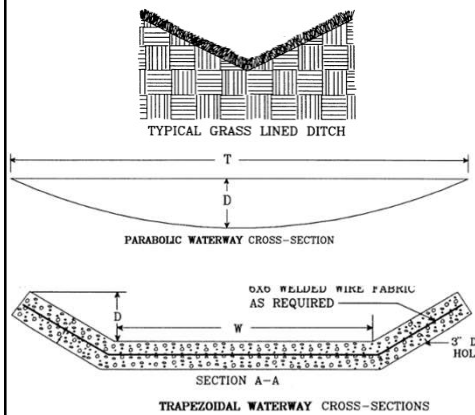
3b. | CONSTRUCTION BMPs — C-ECM



18

C-ECM-11 Stormwater Channel

5.0 Design criteria



- Vee-shaped
 - Small quantities of water in a limited-space area
- Parabolic
 - Larger quantities of water with more available space
- Trapezoidal
 - Larger quantities of water to move at high velocities

3b. | CONSTRUCTION BMPs — C-ECM



19

5.0 Design Criteria - Channel Planning

- The outlet condition for all channels must be considered, inspected, and monitored
- Energy dissipation is required
- 10-year storm (MS-19 man-made channel)



3b. | CONSTRUCTION BMPs — C-ECM



20

Landscape Design – Dry Creek Beds

Drainage channels reworked as a dry creek bed must be design for the stone lining and the 10-year channel flow – MS-19.



3b. | CONSTRUCTION BMPs – C-ECM



21

Stormwater Conveyance Channel (VDOT)



3b. | CONSTRUCTION BMPs – C-ECM



22

Erosion Control Measures – C-ECM

- Riprap (C-ECM-13)



- Temporary level spreaders, outlet protection, and transition mat (C-ECM-14-16)



3b. | CONSTRUCTION BMPs – C-ECM



23

C-ECM-13 Riprap 5.0 Design Criteria



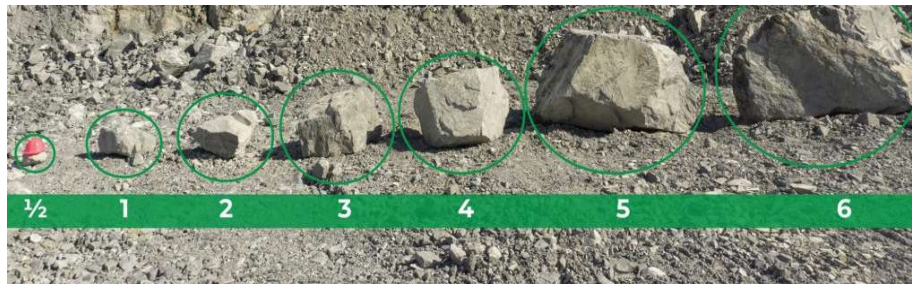
- Filter fabric or approved underlayment
- Correct stone size
- Laid to full thickness in one operation

3b. | CONSTRUCTION BMPs – C-ECM



24

Riprap sized – Compared to a construction helmet (Far left)



3b. | CONSTRUCTION BMPs – C-ECM



25

Outlet Protection Examples



3b. | CONSTRUCTION BMPs – C-ECM



26

Outlet Protection Examples



3b. | CONSTRUCTION BMPs — C-ECM



27

Module 3c.

Environmental Sensitive Area Protection
C-ENV



28

Environmental Sensitive Area Protection C-ENV

- Used in environmentally sensitive areas such as stream corridors, wetlands, and floodplains, as well as crossings or work within these areas
- Projects in ESAs typically require additional permitting through DEQ's Virginia Water Permitting, Army Corp. of Engineers, VMRC, or local wetland's boards.
- Fifteen BMPs are designated as C-ENVs and briefly detailed in your PG. Highly specialized and detailed in the 2024 VSWHB.

3c. | CONSTRUCTION BMPs — C-ENV



29

Environmental Sensitive Area Protection C-ENV

- Structural streambank stabilization (C-ENV-01-02)



- Waterway and wetland crossings (C-ENV-03-06)



3c. | CONSTRUCTION BMPs — C-ECM



30

C-ENV-03 Temporary Vehicular Stream Crossing



1.0 Definition - May include bridges, round or oval pipes, or pipe arches

- Non-erodible materials
- Sufficient to carry the load
- Keeps construction traffic from damaging channel or banks of stream
- Bridges must be anchored - Upstream is preferred

3c. | CONSTRUCTION BMPs — C-ECM



31

Environmental Sensitive Area Protection C-ENV

- Gabions (C-ENV-07)



- Pump around diversion (C-ENV-08)



- Overnight channel protection (C-ENV-09)

3c. | CONSTRUCTION BMPs — E-ENV



32

C-ENV-10 Trenchless Silt Fence



Trenchless silt fence is used to intercept and detain small amounts of sediment from disturbed areas during construction to prevent sediment from leaving the site where typical silt fence (trenched) would adversely impact the surrounding woody vegetation to be preserved.

3c. | CONSTRUCTION BMPs — C-ENV



33

Environmental Sensitive Area Protection C-ENV

- Wetland specific BMPs (C-ENV-11-13)
- Modified turbidity curtains (C-ENV-14)
- Seeding, Mulching, and Soil Stabilization (Wetlands/Streams) (C-ENV-15)



3c. | CONSTRUCTION BMPs — C-ENV



34

Module 3d.

Perimeter Control Measures C-PCM



35

Perimeter Control Measures C-PCM

- Intercept sheet flow from slopes and remove sediment and other contaminants through ponding, settling, and physical filtration, effectively preventing contaminants from leaving the site and entering surface waters
- Five BMPs are designated as C-PCMs
- Full details for each measure are found in the online Stormwater Management Handbook, Chapter 7

3d. | CONSTRUCTION BMPs — C-PCM



36

Perimeter Control Measures C-PCM

- Safety Fencing (C-PCM-01)



- Straw and brush barriers (C-PCM-02)



3d. | CONSTRUCTION BMPs — C-PCM



37

C-PCM-01 Safety Fence



3d. | CONSTRUCTION BMPs — C-PCM



38

Perimeter Control Measures C-PCM

- Silt fence, wire reinforced and super silt fence (C-PCM-03)



- Compost filter sock (C-PCM-04)



3d. | CONSTRUCTION BMPs — C-PCM



39

C-PCM-03 Silt Fence 2.0 Purpose and Applicability



- Temporary sediment barrier
- Intercepts and detains small amounts of sediment
- Decreases the velocity of sheet flows and low-to-moderate level channel flows

3d. | CONSTRUCTION BMPs — C-PCM



40

Wire Reinforced Silt Fence

6.0 Construction Specifications



- Often used at job site perimeter.
- Stakes may be placed up to 10' apart
- Check plans carefully – the detail in the HB make it very easy to miss wire reinforced silt fence being called for

3d. | CONSTRUCTION BMPS – C-PCM



41

Super Silt Fence

6.0 Construction Specifications



Super Silt Fence:

- Install 2.5-inch-diameter galvanized or aluminum poles
- Maximum spacing = 10'
- Poles must extend at least 24" below the ground surface and 33" above ground

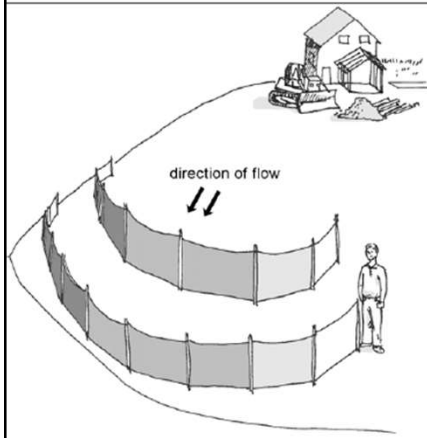
3d. | CONSTRUCTION BMPS – C-PCM



42

Silt Fence- Installation

6.0 Construction Specifications



EPA and the new HB guidance shows use of J-Hooks at the end of silt fence runs to prevent end runs.

Illustration from Clark Co. Washington State, Minnesota Stormwater manual

3d. | CONSTRUCTION BMPs — C-PCM



43

Silt Fence- Installation

But do J-Hooks work?



3d. | CONSTRUCTION BMPs — C-PCM



44

Another Silt Fence Problem



3d. | CONSTRUCTION BMPs — C-PCM



45

C-PCM-05 Compost Filter Sock



1.0 Definition - Also called a filter log, is a temporary sediment control practice consisting of a biodegradable or photodegradable mesh tube filled with a coarse compost media to filter sediment and other pollutants associated with construction and prevent their migration offsite.

- Place parallel to the contour with ends extending 8' at a 45° angle
- Replace per manufacturer's frequency recommendations

3d. | CONSTRUCTION BMPs — C-PCM



46

Module 3e.

Sediment Control Measures C-SCM



47

Sediment Control Measures C-SCM

- Prevent sediment transport by surface flows from leaving the site by providing practices to capture or filter sediment
- Thirteen BMPs are designated as C-SCMs and briefly detailed in your PG
- Full details for each measure are found in the online Stormwater Management Handbook, Chapter 7

3e. | CONSTRUCTION BMPs — C-SCM



48

Sediment Control Measures C-SCM

- Dust control (C-SCM-01)



- Site entry and traffic route controls (C-SCM-02-03)



3e. | CONSTRUCTION BMPs — C-SCM



49

C-SCM-01 Dust Control



Reduction of movement of dust on the ground surface and in the air during land disturbance, demolition, and construction

Methods

- Vegetative Cover
- Mulch
- Tillage
- Irrigation
- Sprays

3e. | CONSTRUCTION BMPs — C-SCM



50

C-SCM-02 Construction Entrance



Stabilized stone pad with filter fabric liner located where vehicles enter and leave a construction site

- Reduce amount of mud tracked onto public road or other paved surface
- It's not a driveway! It should be rough!

3e. | CONSTRUCTION BMPs — C-SCM



51

CE Maintenance per MS-17



- 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

3e. | CONSTRUCTION BMPs — C-SCM



52

CE – Worker Safety



If the site exits onto a busy highway, a wheel wash station or extension of the CE should be considered.

ALSO! Get these guys some safety vest!

3e. | CONSTRUCTION BMPs – C-SCM



53

Sediment Control Measures C-SCM

- Inlet protections (C-SCM-04-05)



- Wood chip filter berms (C-SCM-06)

- Rock check dams & rock filter outlets (C-SCM-07-08)



3e. | CONSTRUCTION BMPs – C-SCM



54

C-SCM-05 Inlet Protection Problems



3e. | CONSTRUCTION BMPs — C-SCM



55

C-SCM-05 Buddies, Eels, and others



Section 3.0 Planning and Considerations

Pre-manufactured proprietary devices are compatible with most types of inlets and typically consist of either fabric tubes with aggregate or other filter material or fabric sacks placed underneath an inlet grate to trap sediment.

3e. | CONSTRUCTION BMPs — C-SCM



56

C-SCM-08 Rock Filter Outlet

1.0 Definition - A rock filter outlet is a berm constructed of riprap and stone aggregate where unanticipated concentrated flow to a perimeter control (e.g., silt fence or straw bale barrier) has **caused the perimeter control to fail**.

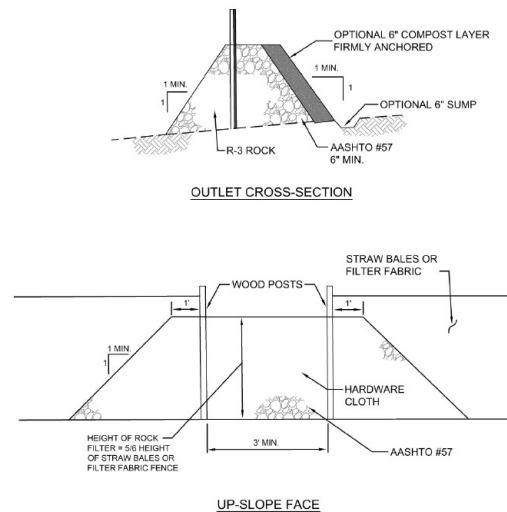


3e. | CONSTRUCTION BMPs — C-SCM



57

C-SCM-08 Rock Filter Outlet



3e. | CONSTRUCTION BMPs — C-SCM



58

Sediment Control Measures C-SCM

- Turbidity curtains (C-SCM-09)



- Dewatering structures – multiple types (C-SCM-10)



3e. | CONSTRUCTION BMPs — C-SCM



59

C-SCM-10 Dewatering Structures



- Dewatering bags must:
 - Adequate for the GPM of the pump
 - Removed and disposed of after use
- Effluent released to a well-vegetated area (at least 75'), through silt fence, or other ESC measure

3e. | CONSTRUCTION BMPs — C-SCM



60

Sediment Control Measures C-SCM

- Temporary sediment traps and basins (C-SCM-11-12)



- Concrete washout pit – multiple types (C-SCM-13)



3e. | CONSTRUCTION BMPs — C-SCM



61

C-SCM-11 Temporary Sediment Trap



- Temporary ponding basin for runoff from drainage areas less than 3 acres
- Sediment settles out in pond
- Constructed and made functional before upslope land disturbance takes place (MS-4)

3e. | CONSTRUCTION BMPs — C-SCM



62

Sediment Trap Example



3e. | CONSTRUCTION BMPS — C-SCM



63

Sediment Trap Problem



3e. | CONSTRUCTION BMPS — C-SCM

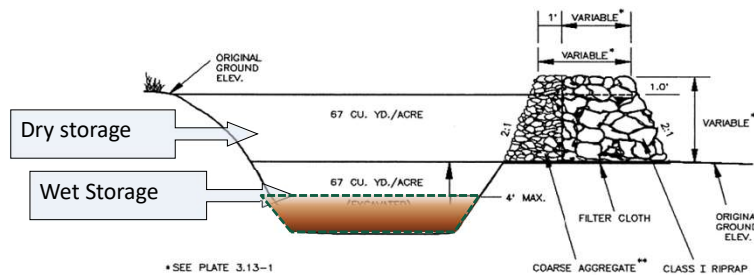


64

Maintenance (p. III – 75)

- Must be cleaned out when sediment reaches half of the wet storage volume
- Make sure outlet rock is not clogged

TEMPORARY SEDIMENT TRAP



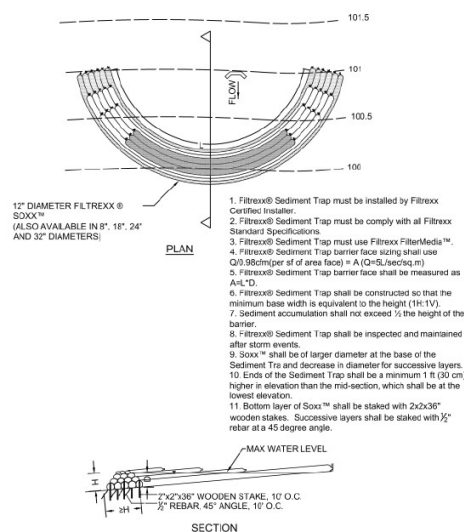
3e. | CONSTRUCTION BMPs – C-SCM



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6.0 New Sediment Trap Designs

Compost Filter Sock Sediment Trap



3e. | CONSTRUCTION BMPs – C-SCM



66

6.0 New Sediment Trap Designs

Compost Filter Sock Sediment Trap



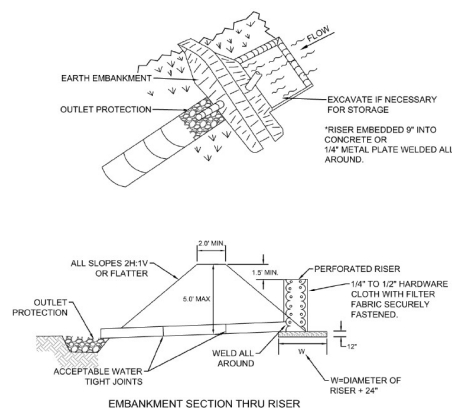
3e. | CONSTRUCTION BMPs — C-SCM



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6.0 New Sediment Trap Designs

Pipe Discharge Sediment Trap



3e. | CONSTRUCTION BMPs — C-SCM



68

C-SCM-12 – Temporary Sediment Basin



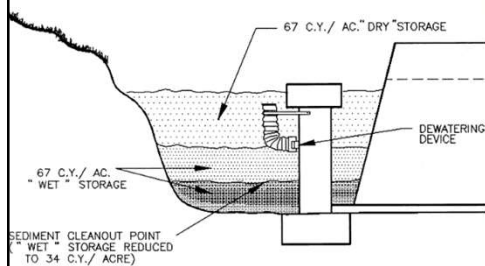
- Barrier with controlled stormwater release structure for sediment-laden runoff
- Required for drainage areas ≥ 3 acres
- Designed by a professional engineer

3e. | CONSTRUCTION BMPs – C-SCM



69

5.0 Basin Design



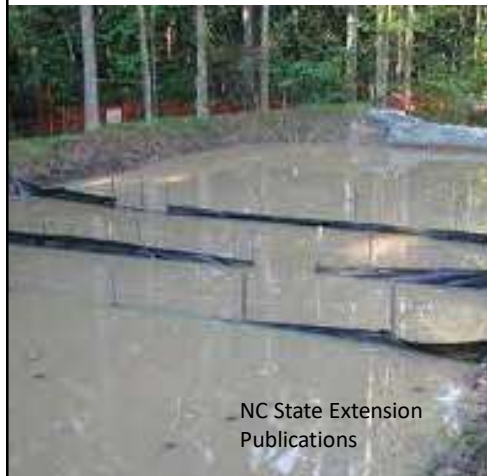
- Max. drainage area = 100 acres
- Sediment removed when half the volume of the wet storage has been reduced
 - Cleanout level must be at least 1' below bottom of dewatering device
- Clearly mark cleanout level

3e. | CONSTRUCTION BMPs – C-SCM



70

5.0 Basin Design



- Baffles may be installed so the inflow of sediment laden water does not immediately flow to the primary spillway.
- Baffles redirect flow to increase flow length. Flow length should be **2x** the basin's width.
- Typically constructed of plywood in Virginia

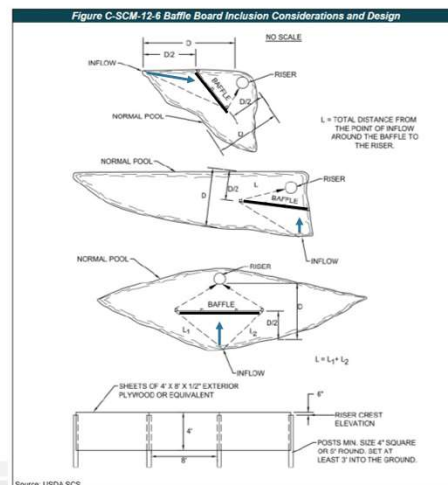
3e. | CONSTRUCTION BMPs — C-SCM



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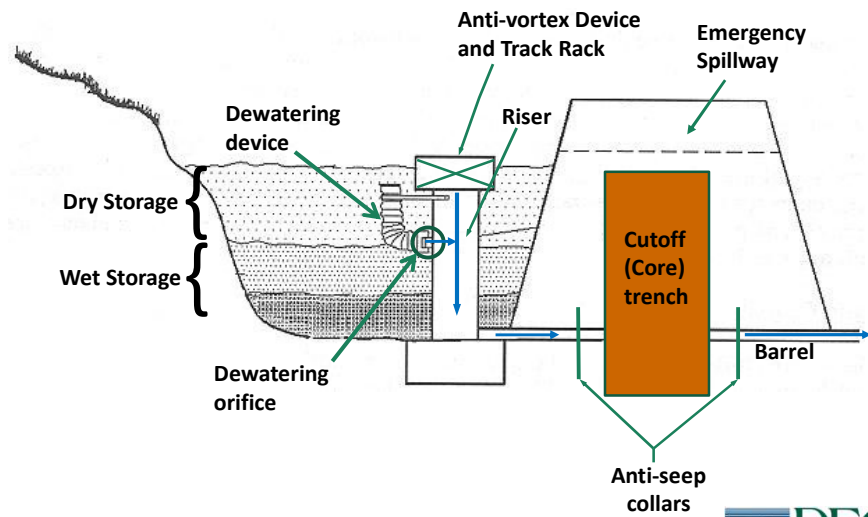
Ways to enhance sediment removal and settling from sediment basins

- Baffles



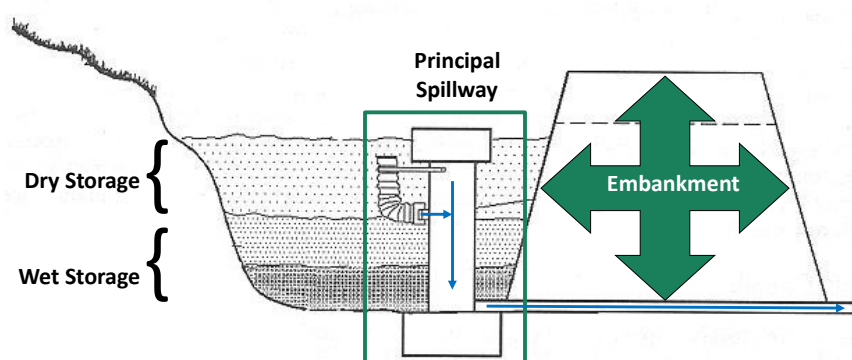
72

Key Parts of Basin Construction



73

Key Parts of Basin Construction



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Sediment Basin Examples



3e. | CONSTRUCTION BMPs — C-SCM



75

Sediment Basin Problem



3e. | CONSTRUCTION BMPs — C-SCM



76

Sediment Basin Problem



3e. | CONSTRUCTION BMPS — C-SCM



77

Sediment Basin Problem



TN Erosion and Sediment Control

3e. | CONSTRUCTION BMPS — C-SCM



78

A dry SB is a sad SB.



- Check the plan and weather
 - Temporary measure?
 - Co-located practice?
 - Drought
- Gear up!
 - Boots
 - Insect repellent
 - Walking stick

3e. | CONSTRUCTION BMPS — C-SCM



79

A dry SB is a sad SB.



Look over the embankment for overly green, fast-growing vegetation that is outgrowing the vegetation around it along the outer toe of the embankment or near the discharge point of the barrel pipe.



3e. | CONSTRUCTION BMPS — C-SCM



80

A dry SB is a sad SB.



Walk the outer embankment area

- Squishy under foot, seepage under or through the embankment, animal burrows, debris, stone, not sufficiently compacted or keyed (core trench)
- Discharge from the barrel pipe, waterproofing failed or a hole in the pipe



3e. | CONSTRUCTION BMPS – C-SCM



81

A dry SB is a sad SB.



Walk the outer embankment area

- Discharge under the barrel pipe – Insufficient compaction, erosion under the pipe
- Also - Karst topography – fissures, piping



3e. | CONSTRUCTION BMPS – C-SCM



82

An exception - 5.0 Dewatering Skimmers



- Basins with skimmers or alternate designs may have a lower dewatering orifice level

3e. | CONSTRUCTION BMPs — C-SCM



83

C-SCM-13 – Concrete Washout Pit



1.0 Definition - Temporary excavated or above-ground lined constructed pit or a prefabricated or fabricated container

- Concrete truck mixers and equipment can be washed after their loads have been discharged
- Prevent highly alkaline runoff from entering storm drainage systems or leaching into soil

3e. | CONSTRUCTION BMPs — C-SCM



84

7.0 Operations and Maintenance



- Deactivate, remove, and replace damaged or leaking facilities
- Remove hardened material at 75% storage capacity
- Pump excess wash into a vessel and dispose off-site
- Replace plastic liner when cleaning of the facility

3e. | CONSTRUCTION BMPs — C-SCM



85

Module 3f.

Surface Stabilization Measures C-SSM



86

Surface Stabilization Measures C-SSM

- On final grade, vegetative cover is established to protect disturbed soil from surface runoff including both temporary and permanent vegetative cover - often the final landscape
- Eleven BMPs are designated as C-SSMs
- Full details for each measure are found in the online Stormwater Management Handbook, Chapter 7

3f. | CONSTRUCTION BMPs — C-SSM



87

Surface Stabilization Measures C-SSM

- Tree preservation (C-SSM-01)



- Growing media, soil treatment, and vegetation establishment and protection (C-SSM-02-05)



3f. | CONSTRUCTION BMPs — C-SSM



88

Surface Stabilization Measures C-SSM

- Sodding, warm season grasses, landscaping, temporary and permanent seeding (C-SSM-06-10)

Seeding C-SSM-09 and C-SSM-10	<ul style="list-style-type: none"> • Temporary → annuals • Permanent → perennials • Land use • Certified seed • Seed mix • Time of year requirements
Sodding C-SSM-06	<ul style="list-style-type: none"> • Permanent • VCI Certified • Planted within 36 hours of harvesting
Sprigging/ Plugging C-SSM-07	<ul style="list-style-type: none"> • Permanent warm season grasses → Bermuda grass and Zoysia grass • VCI Certified • Planted within 36 hours of harvesting
Planting C-SSM-08	<ul style="list-style-type: none"> • Containerized • Ball and burlap • Bare Root

3f. | CONSTRUCTION BMPs — C-SSM



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Surface Stabilization Measures C-SSM

- Mulching (C-SSM-11)



If an area cannot be seeded within the time required by MS-1 for reasons such as frost or drought, the site must still be stabilized. The “go to” method in these cases is mulch.

3f. | CONSTRUCTION BMPs — C-SSM



90

Module 3g.

Native vs. Invasive Plant Species for Erosion and Sediment Control



91

Native vs Non-Native and Invasive Plant Species - Table C-SSM-10-1

What is a Native Species?

Native species are those that naturally occur in the region in which they evolved.

What Are Invasive Non-Native Species and Why Are They of Concern?

Because of a lack of natural controls like insect pests and competitors, some invasive non-native plants may escape cultivation, displace native plant species, reduce wildlife habitats, and alter ecosystem processes. The majority of invasive non-native plants are problematic due to their ability to easily and rapidly disperse across the landscape.

Should Invasive Plants Referenced in the DCR Handbook Be Avoided?

Yes. DCR strongly discourages the use of the highly invasive **Common Reed** and **Chinese Lespedeza** (among others).



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Q&A



3a. Design Specs
for C-BMPs



3d. Perimeter
Control Measures
C-PCMs



3b. Erosion Control
Measures C-ECMs



3e. Sediment
Control Measures
C-SCM



3c. Environmentally
Sensitive Area
Protection C-ENV



3f. Surface
Stabilization
Measures C-SSM



3g. Native vs. Invasive
Plant Species

