Module 5: Construction Best Management Practices

Learning Objectives **2**
5a. Design Specifications for Construction BMPs **3**
C-BMPs and related minimum standards 4
Structural construction best management practices 6
5b. Erosion Control Measures – C-ECM **7**
Diversions 8
5c. Environmentally Sensitive Area Protection – C-ENV **12**
5d. Perimeter Control Measures – C-PCM **17**
5e. Sediment Control Measures – C-SCM **19**
Sediment traps and basins 23
5f. Surface Stabilization Measures – C-SSM **26**
Benefits of vegetative groundcover 28
Methods of establishing vegetative stabilization 29
Seeding vs. sodding 31
Helpful information for establishing vegetation 32
5g. Native vs. Invasive Plant Species for Erosion and Sediment Control **33**
Summary **36**

Learning Objectives

At the end of this module, you will be able to:

- Correlate the Virginia Stormwater Management Handbook (VSWHB) Best Management Practice (BMP) with the applicable Minimum Standard(s).
- Understand the nomenclature, organization, and the expanded listing of the Construction Best Management Practices (C-BMPs) found in the updated VSWHB.
- Review the C-BMP groupings and basic designs to learn how they address erosion concerns at construction sites.
- Address non-native and invasive species and their detrimental effect on Virginia's native vegetation with vegetative options that do not have these drawbacks.

5a. Design Specifications for Construction BMPs

The Virginia Stormwater Management Handbook (VSWHB) provides guidance on the standards and specifications for construction best management practices (C-BMPs). Formerly referred to as erosion and sediment controls (E&S or ESC), C-BMPs are practices installed during the construction phase of regulated land-disturbing activities (LDAs) to control potential impacts of construction on local watersheds by erosion and sedimentation into state waters.

The Handbook builds on the C-BMPs established in the 1992 Virginia Erosion and Sediment Control Handbook (VESCH) by incorporating the latest in industry standards and practices, correcting errors and omissions, and consolidating information from multiple sources into one update (VSWHB, Chapter 7).

The C-BMPs can be broadly grouped as either vegetative controls or structural controls (Module 2). Vegetative controls (groundcover) should be considered the first line of defense against erosion. Structural controls can be considered the second line of defense against sedimentation as a result of erosion.

The new VSWHB has changed the nomenclature of many C-BMPs from the previous Handbook. The nomenclature following the "C" identifies the subcategory of the construction BMP:

- C-ECM – Erosion Control Measures;
- C-ENV – Environmentally Sensitive Area Protection;
- C-PCM – Perimeter Control Measures;
- C-SCM – Sediment Control Measures; and
- C-SSM – Surface Stabilization Measures.

The trailing number is the unique identifier for the BMP (e.g., Silt Fence [C-PCM-04]).

The C-BMPs in the Handbook are how regulated LDAs meet the Minimum Standards (covered in Module 4). The boxes on the following two pages show the groupings of the Minimum Standards and the various Handbook practices that can be used to meet them.

C-BMPS AND RELATED MINIMUM STANDARDS

Soil Stabilization for Erosion Control MS-1, 2, 3, and 5
C-ENV-15 Seeding, Mulching, and Soil Stabilization (Wetlands/Streams) (MS-1, 3)
C-SCM-01 Dust Control (MS-2)
C-SCM-13 Concrete Washout Pit (MS-2)
C-SSM-01 Tree Preservation and Protection (MS-1)
C-SSM-02 Topsoiling (MS-1, 2)
C-SSM-03 Surface Roughening (MS-1, 7)
C-SSM-04 Compost Blankets (MS-1)
C-SSM-05 Soil Stabilization Blankets and Matting (MS-1, 3)
C-SSM-06 Sodding (MS-1, 3)
C-SSM-07 Bermudagrass and Zoysiagrass Establishment (MS-1) Note: MS-3 is not listed in the VSWHB.
C-SSM-08 Trees, Shrubs, Vines, and Ground Cover (MS-1, 5, 7)
C-SSM-09 Temporary Seeding (MS-1, 2)
C-SSM-10 Permanent Seeding (MS-1, 3)
C-SSM-11 Mulching (MS-1)

Underground Utilities MS-16
C-ECM-10 Subsurface Drain (MS-9, 16)
C-SCM-10 Dewatering Structure (MS-4, 6) Note: MS-16 is not listed in the VSWHB.

Sediment Control MS-4 and 6
C-ECM-01 Straw Wattles (MS-4)
C-ECM-02 Impermeable Diversion Fence (MS-4)
C-ECM-04 Temporary Diversion Dike (MS-4, 8)
C-ECM-05 Diversion (MS-4, 5, 8, 9, 19)
C-ENV-10 Trenchless Silt Fence (MS-4)
C-ENV-11 Wetland Berm (MS-4)
C-ENV-12 Wetland Weir Outlet (MS-4)
C-ENV-13 Wetland Cell Sediment Trap (MS-4, 6)
C-PCM-01 Safety Fence (MS-4)
C-PCM-02 Straw Bale Barrier (MS-4)
C-PCM-03 Brush Barrier (MS-4)
C-PCM-04 Silt Fence (MS-4)
C-PCM-05 Compost Filter Sock (MS-4)
C-SCM-02 Construction Road Stabilization (MS-4, 17)
C-SCM-03 Temporary Stone Construction Entrance (MS-4, 17)
C-SCM-04 Inlet Protection (MS-4) Note: MS-10 is not listed in the VSWHB.
C-SCM-06 Wood Chip Filter Berm (MS-4)
C-SCM-08 Rock Filter Outlet (MS-4)
C-SCM-09 Turbidity Curtain (MS-4, 12, 14)
C-SCM-10 Dewatering Structure (MS-4, 6) Note: MS-16 is not listed in the VSWHB.
C-SCM-11 Temporary Sediment Trap (MS-4, 6)
C-SCM-12 Temporary Sediment Basin (MS-4, 6, 19)

Slope Protection MS-7, 8, and 9

C-ECM-03 Slope Interruption Device (MS-7)

C-ECM-04 Temporary Diversion Dike (MS-4, 8)

C-ECM-05 Diversion (MS-4, 5, 8, 9, 19)

C-ECM-06 Temporary Fill Diversion (MS-8)

C-ECM-07 Temporary Right-of-Way Diversion (MS-8)

C-ECM-08 Waterbars and Sheet Flow Breakers (MS-8)

C-ECM-09 Stormwater Conveyance Channel (MS-8)

C-ECM-10 Subsurface Drain (MS-9, 16)

C-ECM-11 Paved Flume (MS-8, 11)

C-ECM-12 Temporary Slope Drain (MS-8,)

C-ECM-14 Temporary Level Spreader (MS-8, 11)

C-SSM-03 Surface Roughening (MS-1, 7)

C-SSM-08 Trees, Shrubs, Vines, and Ground Cover (MS-1, 5, 7)

Construction Entrances MS-17

C-SCM-02 Construction Road Stabilization (MS-4, 17)

C-SCM-03 Temporary Stone Construction Entrance (MS-4, 17)

Stormwater Quantity MS-19

C-ECM-05 Diversion (MS-4, 5, 8, 9, 19)

C-SCM-12 Temporary Sediment Basin (MS-4, 6, 19)

Channels, Culverts, and Outlets MS-10 and 11

C-ECM-05 Diversion (MS-4, 5, 8, 9, 19)

C-ECM-11 Paved Flume (MS-8, 11)

C-ECM-13 Riprap (MS-11)

C-ECM-14 Temporary Level Spreader (MS-8, 11)

C-ECM-15 Outlet Protection (MS-11)

C-ECM-16 Flexible Transition Mat (MS-11)

C-ENV-07 Gabions (MS-11, 15)

C-SCM-04 Inlet Protection (MS-4) Note: MS-10 is not listed in the VSWHB.

C-SCM-05 Culvert Inlet Protection (MS-10)

C-SCM-07 Rock Check Dams (MS-11)

Watercourses MS-12, 13, 14, and 15

C-ENV-01 Vegetative Streambank Stabilization (MS-15)

C-ENV-02 Structural Streambank Stabilization (MS-15)

C-ENV-03 Temporary Vehicular Stream Crossing (MS-13, 15)

C-ENV-04 Utility Stream Crossing (MS-12, 14)

C-ENV-05 Cofferdam Crossing (MS-12, 14)

C-ENV-06 Stable Wetland Crossing (MS-12, 14)

C-ENV-07 Gabions (MS-11, 15)

C-ENV-08 Pump Around Diversion (MS-12, 14)

C-ENV-09 Overnight Channel Protection (MS-12, 14)

C-ENV-14 Modified Turbidity Curtain for Streams (MS-4, 12, 14)

C-SCM-09 Turbidity Curtain (MS-4, 12, 14)

STRUCTURAL CONSTRUCTION BEST MANAGEMENT PRACTICES

Structural C-BMPs are meant to filter sediment-laden water before it leaves a construction site. In most cases, these types of controls are no more than 60% – 75% effective in filtering sediment, and the smaller particles, such as clay, are very difficult to filter. Structural controls are generally more expensive than vegetative methods.

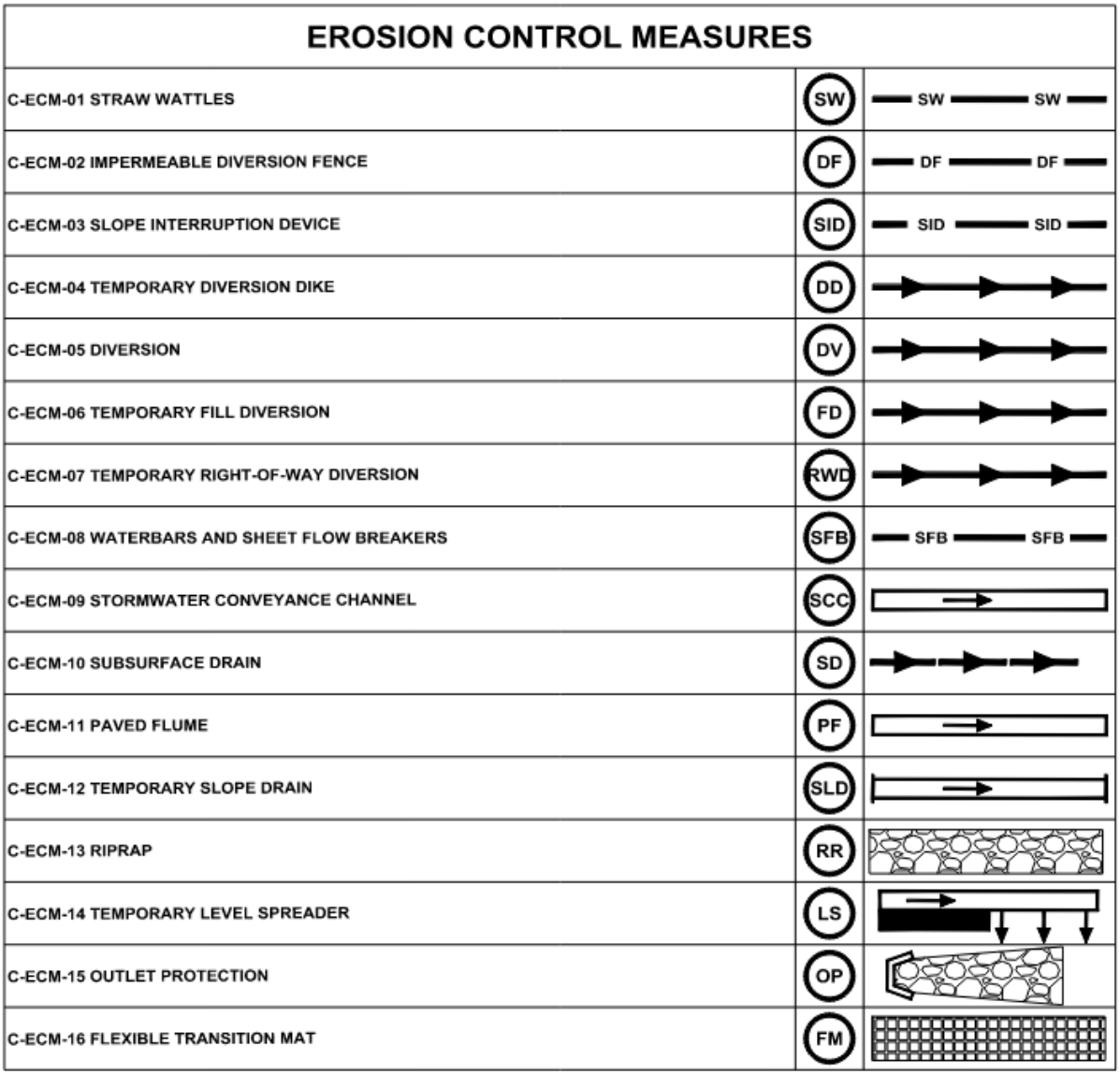
Overview of the C-BMPs

The following are overviews of the C-BMPs, in the order they are listed in Chapter 7.4. The Handbook and the entire contents of each C-BMP may be viewed at https://online.encodeplus.com/regs/deq-va/index.aspx.

The C-BMPs are numbered and categorized in the Handbook as follows.

5b. Erosion Control Measures – C-ECM

These C-BMPs are intended to prevent sheet, rill, and gully erosion. They also reduce the overland flow velocities, shorten the length of flow, and divert and convey runoff safely through the site.



VSWHB 7.3.1 Erosion Control Measures

C-ECM-01 Straw Wattles

Straw wattles are temporary erosion and sediment control C-BMPs consisting of weed- and seed-free agricultural straw wrapped in biodegradable netting, tubular plastic, or similar encasing material for the purpose of slowing water and trapping sediment. Straw wattles generally have a maximum longevity of 12 to 18 months.

C-ECM-02 Impermeable Diversion Fence

Impermeable diversion fence is a temporary barrier of impermeable sheeting over chain-link fence located to direct water to a desired location. Impermeable diversion fence should be removed and properly disposed of when the tributary area is permanently stabilized.

C-ECM-03 Slope Interruption Device

A slope interruption device is a three-dimensional tubular runoff and erosion control device used for sediment filtration and slope interruption. Immediately repair or replace damaged devices in accordance with the manufacturer's specifications.

DIVERSIONS

Diversions are a significant sub-group under the Construction Erosion Control Measures. Different diversions address short-term and long-term collection and direction of channeled stormwater across a job site.

C-ECM-04 Temporary Diversion Dike

A temporary diversion dike is a temporary ridge of compacted soil constructed to convey clean stormwater runoff through or around a disturbed land area. In most cases, temporary diversion dikes collecting sediment-laden water work as conveyance in conjunction with other erosion and sediment control devices. Temporary diversion dikes are often used as a perimeter control in association with a sediment trap, a sediment basin, or a series of sediment-trapping facilities on moderate to large construction sites.

C-ECM-05 Diversion

A diversion is a channel constructed across a slope with a supporting earthen ridge on the lower side. Diversions may be temporary conveyances to manage stormwater runoff at construction sites or they may be permanent stormwater management structures.

C-ECM-06 Temporary Fill Diversion

A temporary fill diversion is a channel with a supporting ridge of soil on the lower side, constructed along the top of an active earth fill, at the end of each workday. Use of a temporary fill diversion is only for less than one week.

C-ECM-07 Temporary Right-of-Way Diversion

A temporary right-of-way diversion is a ridge of compacted soil, loose rock, or gravel constructed across disturbed steep slopes and similar sloping areas that is removed following construction once permanent stabilization has begun. Temporary right-of-way diversions are typically used to control stormwater runoff on access roads and skid trails, pipeline and utility line corridors, and long slope areas where perimeter controls may not be adequate to handle the runoff from the disturbed area. Temporary right-of-way diversions maybe removed once final grading is completed and permanent vegetative stabilization is being conducted or they may be converted to a waterbar – (See C-ECM-08 Waterbars and Sheet Flow Breakers).

C-ECM-08 Waterbars and Sheet Flow Breakers

Waterbars and sheet flow breakers are used to shorten sheet flow length, reduce velocity, and flatten slopes within a terrain at pre-designed intervals. Waterbars and sheet flow breakers are permanent best management practices, intended to remain after permanent stabilization of the site has been achieved.

Waterbars and sheet flow breakers are typically used to control stormwater runoff on logging roads and skid trails, pipeline and utility line corridors, recreational trails, and long slope areas susceptible to rill erosion caused by sheet flow of stormwater.

C-ECM-09 Stormwater Conveyance Channel

A stormwater conveyance channel is a permanent, designed waterway that is shaped, sized, and lined with appropriate vegetation or structural material such that the channel safely conveys stormwater runoff within or away from a developing area.

C-ECM-10 Subsurface Drain

A subsurface drain is a perforated conduit (such as pipe, tubing, or tile) installed below grade to intercept, collect, and convey excess groundwater to a satisfactory outlet location.

C-ECM-11 Paved Flume

A paved flume is a permanent paved channel constructed on a slope to convey water from a higher to lower elevation in a short distance.

C-ECM-12 Temporary Slope Drain

A temporary slope drain is a flexible tubing or conduit extending from the top to the bottom of a cut or fill slope. This practice applies on cut or fill slopes where there is a potential for upslope flows to move over the face of the slope, causing erosion and preventing adequate stabilization. When the protected area has been permanently stabilized, remove the temporary measures, properly dispose of materials, and appropriately stabilize all disturbed areas.

C-ECM-13 Riprap

Riprap is a permanent, erosion-resistant ground cover of large, loose, angular stone installed with filter fabric or granular underlining. Use of riprap applies where soil and water interface and the soil conditions, water turbulence and velocity, expected vegetative cover, and other conditions are such that the soil may erode under the design flow conditions.

C-ECM-14 Temporary Level Spreader

A temporary level spreader is a flow control measure that receives concentrated, potentially erosive inflow, and converts to a sheet flow condition by discharging across a horizontal level weir onto areas of undisturbed soil that is stabilized by existing vegetation.

C-ECM-15 Outlet Protection

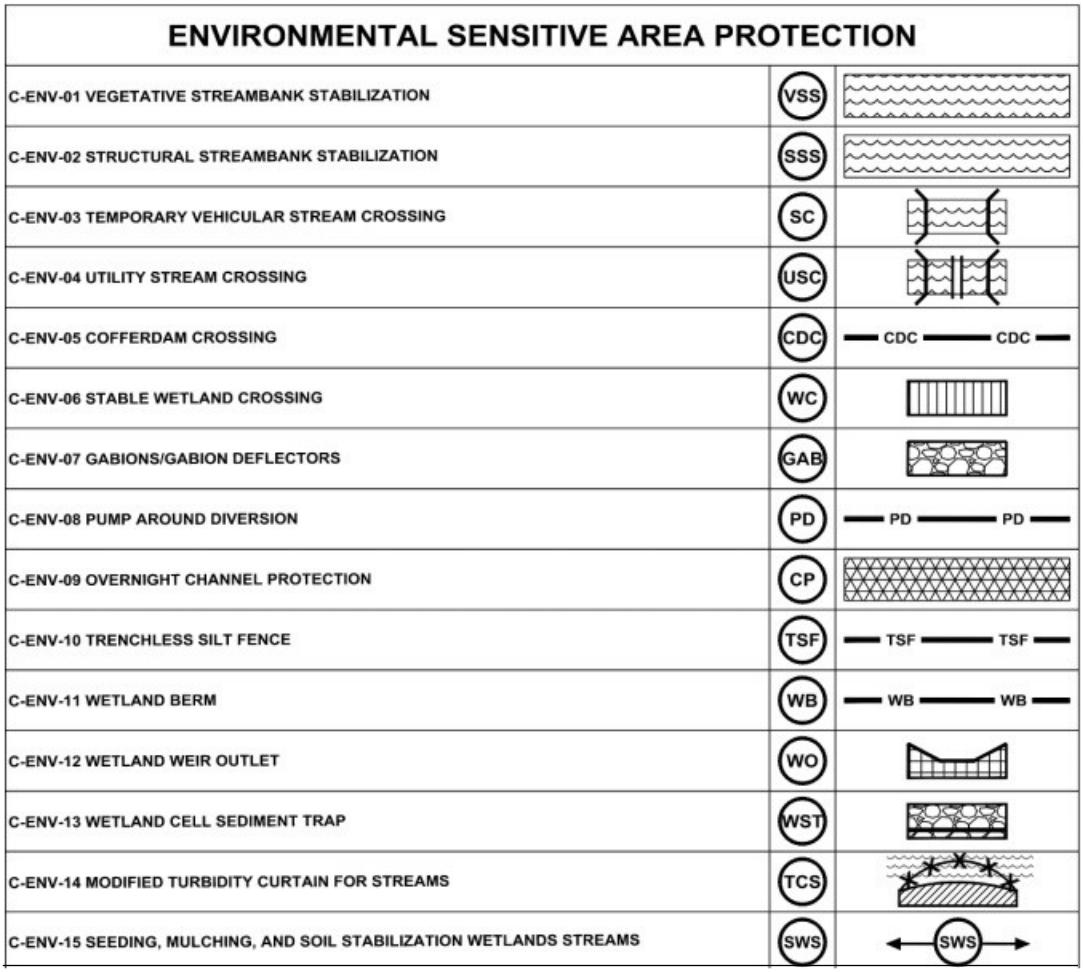
Outlet protection takes the form of structurally lined aprons or other forms of energy-dissipating devices placed at the outlets of pipes, curb openings, ditch turnouts, or paved channel sections to slow discharge velocity from the outlet to prevent an erosive condition. Riprap outlet structures should be inspected weekly and after significant (0.5-inch or greater) rainfall events to identify any erosion around or below the riprap or if stones have been dislodged. Immediately do all needed repairs to prevent further damage. Accumulated sediment and debris must be removed.

C-ECM-16 Flexible Transition Mat

A flexible scour-protection system that is used as a synthetic alternative to riprap outlet protection. The mat is a high-density polyethylene (HDPE), ultraviolet (UV) stabilized, plastic sheet approximately 4 feet by 4 feet by 0.5 inch thick that contains multiple voids that allow vegetation to grow through or small gravel and pebbles to accumulate and stabilize the area. The mat protects the area at pipe outlets from scour until the water spreading out in the channel diminishes the turbulent forces.

5c. Environmentally Sensitive Area Protection – C-ENV

These C-BMPs are intended for use in environmentally sensitive areas, typically stream corridors, wetlands, and floodplains. They can be applied where crossing or working within an environmentally sensitive area is necessary.



VSWHB 7.3.5 Environmentally Sensitive Area Protection

C-ENV-01 Vegetative Streambank Stabilization

Vegetative streambank stabilization is the use of vegetation to stabilize streambanks to protect from the erosive forces of flowing water along banks in creeks, streams, and rivers subject to erosion from excess runoff.

C-ENV-02 Structural Streambank Stabilization

Structural streambank stabilization constitutes methods of stabilizing the banks of live streams with permanent structural measures to protect streambanks from the erosive forces of flowing water.

C-ENV-03 Temporary Vehicular Stream Crossing

A temporary vehicular stream crossing is a temporary structural span installed across a flowing watercourse for use by construction traffic. Structures may include bridges, round pipes, pipe arches, or oval pipes. The crossing provides a means for construction traffic to cross flowing streams without damaging the channel or banks and keep sediment out of the stream.

C-ENV-04 Utility Stream Crossing

Utility stream crossing is a strategy for crossing small waterways when in-stream utility construction is involved. Utility stream crossings help prevent sediment from entering a stream and minimize the amount of disturbance within the stream. Newer trenchless utility installation prevents disturbance within the watercourse and is a preferred method if it is practical. However, where in-stream work is unavoidable, consider providing adequate mitigation of sediment loss while minimizing the encroachment and time working in the channel.

C-ENV-05 Cofferdam Crossing

A cofferdam is a temporary structure within a waterway or body of water designed to provide a dry work area for temporary construction and to contain disturbed soil and/or suspended sediments. Cofferdams allow work to be performed in a body of water while minimizing turbidity and sedimentation in adjacent and/or downstream areas. Cofferdams designed using this standard may necessitate review by a licensed engineer depending on the size and scale of the cofferdam.

C-ENV-06 Stable Wetland Crossing

A stable wetland crossing is a method or temporary structure used to cross a wetland with vehicles and/or equipment and/or strategy for crossing wetlands when in-wetland utility

construction is involved. Remove practices from wetlands upon completion and when access is no longer required.

C-ENV-07 Gabions

Gabions are rectangular baskets fabricated from a hexagonal mesh of heavily galvanized steel wire filled with rock material. Gabions slow the velocity of concentrated runoff and stabilize slopes with seepage problems and/or non-cohesive soils. Gabions can be used on steeper slopes than riprap and are sometimes the only feasible option for stabilizing an area where there is not enough room to accommodate a "softer," vegetated solution.

C-ENV-08 Pump Around Diversion

The pump-around diversion is a dewatering practice used for temporarily pumping flow around segments of a stream channel during construction; the practice involves installing a temporary pump-around system and instream barriers to divert flow around sections or reaches of the stream.

Complete the associated work and remove the pump-around diversion at the end of each working day and stabilize the work area. If the length of time to complete and stabilize the work area will exceed one working day, use alternative practices.

C-ENV-09 Overnight Channel Protection

Overnight channel protection is the temporary stabilization of a stream channel bed using secured filter fabric while in-stream work is not actively taking place. This practice is used during stream restoration projects when there is active disturbance to an existing natural stream channel bed. Overnight channel protection is used within an existing or proposed stream channel when active work needs to temporarily cease for a period of less than 24 hours due to inclement weather or other short duration stoppage of work. Overnight channel protection is also used when temporary vehicle access to the stream channel is needed for a period of less than 24 hours to deliver equipment and/or materials and where a crossing has not been installed. If longer periods of work stoppage or vehicular access to the stream channel are needed, additional measures are required.

C-ENV-10 Trenchless Silt Fence

Trenchless silt fence is a temporary sediment barrier consisting of a synthetic filter fabric stretched across and attached to supporting posts with no trench; used where trenched silt fence would adversely impact the root system of woody vegetation that is to be preserved. Remove the silt fence when the fence has served its useful purpose but not before the upslope area has been permanently stabilized.

C-ENV-11 Wetland Berm

A wetland berm is an earthen berm structure used in the creation, restoration, and enhancement of wetlands through the collection and retention of water that flows by gravity or other means to the bermed area.

C-ENV-12 Wetland Weir Outlet

A wetland weir outlet is an overflow water control structure that regulates the volume of water impounded in the created, restored, or enhanced wetland.

C-ENV-13 Wetland Cell Sediment Trap

Wetland mitigation bank projects create and restore wetlands through the construction of wetland cells that are large, flat areas used as "giant" sediment traps where applicable during construction.

C-ENV-14 Modified Turbidity Curtain for Streams

A modified turbidity curtain is a floating or staked barrier installed across stream flow that may also be referred to as a floating boom, silt barrier, or silt curtain. Do not use modified turbidity curtains for streams as the primary control for stream projects; always use this practice in conjunction with other measures. The cross-stream application of a turbidity curtain in stream restoration projects may minimize the transport of sediment from in-stream work areas. Only leave the curtain in place during working hours and remove the curtain after each working day or when there is an immediate threat of significant rain.

C-ENV-15 Seeding, Mulching, and Soil Stabilization (Wetlands/Streams)

Seeding, mulching, and soil stabilization for wetlands and streams involves establishment of perennial vegetative cover on disturbed areas by planting seed; applying a protective blanket of mulch to the soil surface during the establishment of seeding; and planting of forb, shrubs, and/or trees in stream and/or wetland areas during restoration.

5d. Perimeter Control Measures – C-PCM

These C-BMPs are intended to 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.

PERIMETER CONTROL MEASURES		
C-PCM-01 SAFETY FENCE	SAF	
C-PCM-02 STRAW BALE BARRIER	STB	
C-PCM-03 BRUSH BARRIER	BB	
C-PCM-04 SILT FENCE	SF	SF SF
C-PCM-05 COMPOST FILTER SOCK	CFS	CFS CFS

VSWHB 7.3.4 Perimeter Control Measures

C-PCM-01 Safety Fence

Safety fence is a protective barrier installed to prevent access by the public to a land-disturbing activity or erosion control measure. Safety fence can also be used to delineate the limits of environmentally sensitive areas to be protected and to prevent encroachment by construction activity.

C-PCM-02 Straw Bale Barrier

A straw bale barrier is a temporary barrier made of anchored straw used to intercept and filter sediment-laden runoff from small drainage areas. Straw bale barriers should be limited as perimeter control measures to areas where no other practice is feasible. Straw bale barriers can be used where effectiveness is required for less than three months.

Do not use straw bale barriers where water may concentrate in defined ditches and minor swales, in live streams or where there is a possibility of a washout, or where rock or another hard surface prevents the full and uniform anchoring of the barrier.

C-PCM-03 Brush Barrier

A brush barrier is a temporary sediment barrier constructed at the perimeter of a disturbed area to protect the clearing and grubbing residue materials from leaving the site.

C-PCM-04 Silt Fence

Silt fence (and its derivatives: wire-supported/reinforced and super silt fence) is a temporary sediment barrier, preferred for use in sheet flow conditions, consisting of a synthetic filter fabric entrenched and attached to supporting posts. A silt fence is replaced when clogged with sediment and can no longer be cleaned.

Synthetic filter fabric containing ultraviolet ray inhibitors and stabilizers shall be used to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees Fahrenheit. Replace the fabric promptly if the fabric on a silt fence decomposes or becomes ineffective before the end of the expected usable life and the barrier is still necessary.

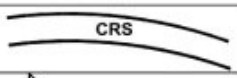
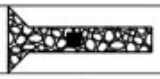
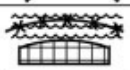
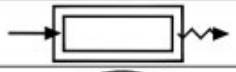
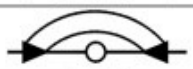
C-PCM-05 Compost Filter Sock

Compost filter sock, 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. The anticipated functional life of a biodegradable filter sock should be six months; for photodegradable socks, it should be one year.

Projects with disturbances anticipated to last longer than the functional life of a sock should plan to replace the socks periodically or use another type of BMP.

5e. Sediment Control Measures – C-SCM

These C-BMPs are intended to prevent sediment transported by surface flows from leaving the site. These C-BMPs typically provide a means to capture or filter sediment practices.

SEDIMENT CONTROL MEASURES		
C-SCM-01 DUST CONTROL	DC	
C-SCM-02 CONSTRUCTION ROAD STABILIZATION	CRS	
C-SCM-03 TEMP STONE CONSTRUCTION ENTRANCE	CE	
C-SCM-04 INLET PROTECTION	IP	
C-SCM-05 CULVERT INLET PROTECTION	CIP	
C-SCM-06 WOOD CHIP FILTER BERM	FB	
C-SCM-07 ROCK CHECK DAMS	CD	
C-SCM-08 ROCK FILTER OUTLET	RFO	
C-SCM-09 TURBIDITY CURTAIN	TC	
C-SCM-10 DEWATERING STRUCTURE	DS	
C-SCM-11 TEMPORARY SEDIMENT TRAP	ST	
C-SCM-12 TEMPORARY SEDIMENT BASIN	SB	
C-SCM-13 CONCRETE WASHOUT PIT	WOP	

VSWHB 7.3.2 Sediment Control Measures

C-SCM-01 Dust Control

Dust control is the reduction of movement of dust on the ground surface and in the air during land disturbance, demolition, and construction by use of various means including vegetative cover, mulch, tillage, irrigation, spray-on adhesives, stone, barriers, calcium chloride, as well as adhesives and permanent methods. Irrigation (application of water) is the most used dust control practice. The site is sprinkled with water until the surface is wet. Repeat as needed. Irrigation offers fast protection for haul roads and other heavy traffic routes. Mulch should not be used to control dust on areas of a site that have high traffic from construction vehicles; however, in an emergency, mulch can be used as a short-term fix if the locality allows.

C-SCM-02 Construction Road Stabilization

Construction road stabilization is the stabilization of temporary construction access routes, onsite vehicle transportation routes, and construction parking areas. Additionally, this specification applies to (but is not limited to) streets and highways, parking areas, and other traffic areas immediately after grading to reduce erosion caused by vehicles during wet weather conditions.

C-SCM-03 Temporary Stone Construction Entrance

A temporary stone construction entrance is a pad with a fabric filter liner underneath the stone located at points of vehicular ingress and egress on a construction site. There are several types of track-out controls that minimize the amount of sediment, such as dirt or mud, leaving or being tracked out from the construction site attached to vehicles.

If most mud is not removed by the vehicles traveling over the stone, wash the vehicles' tires before entering the public road. Carry wash water away from the entrance to an approved settling area or sediment removal device (e.g., sediment basin or trap, silt fence, or compost filter sock). Prevent all sediment from entering storm drains, ditches, or watercourses.

C-SCM-04 Inlet Protection

Inlet protection is a sediment filter or an excavated impounding area around a storm drain drop inlet or curb inlet. Every storm drain inlet, catch basin, curb inlet, or similar drainage structure receiving sediment-laden runoff should be protected by a combination of upstream erosion control and temporary inlet protection. Inlet protection can be accomplished using pre-manufactured proprietary devices or on-site construction.

C-SCM-05 Culvert Inlet Protection

Culvert inlet protection is a sediment filter located at the inlets of culverts. Culvert inlet protection prevents sediment from entering, accumulating in, and being transported by a culvert and associated drainage system before the permanent stabilization of a disturbed project area. Remove temporary structures when they have served their useful purpose but not before the upslope area has been permanently stabilized.

C-SCM-06 Wood Chip Filter Berm

A wood chip filter berm is constructed of mounded wood chips placed perpendicular to sheet flow to control erosion by reducing slope length in disturbed areas and retaining sediment. Wood chip berms may be constructed from processed woody material from initial site clearing operations. Sediment must be removed when accumulations reach half the height of the berm. Berms may be leveled when the tributary area has been permanently stabilized or left in place.

C-SCM-07 Rock Check Dams

Rock check dams are small temporary stone dams constructed across a swale, channel, or drainage ditch to minimize scour or the erosion rate by reducing the velocity of concentrated stormwater flows. This practice also traps sediment generated from adjacent areas or the ditch, mainly by ponding the stormwater runoff. Unless the check dams are designed and constructed to be incorporated into a permanent stormwater management control, remove check dams when their useful life concludes.

C-SCM-08 Rock Filter Outlet

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. Remove sediment when accumulations reach one-third the height of the outlet. Remove and dispose of the rock filter outlet following stabilization of disturbed areas upslope of the outlet.

Rock filter outlets are an additional perimeter control measure used when silt fence or straw bale barriers have failed due to sheet flow and/or shallow concentrated flow to a common low area along the alignment of the perimeter control, and where a sediment trap may not be warranted.

C-SCM-09 Turbidity Curtain

A turbidity curtain is a floating geotextile material that minimizes sediment transport from a disturbed area adjacent to or within a body of water. They provide sedimentation protection for a watercourse from upslope land disturbance or from dredging or filling within the watercourse.

Turbidity curtains may be used in non-tidal and tidal watercourses. In most situations, turbidity curtains are not installed across channel flow. An exception is noted in C-ENV-14 Modified Turbidity Curtain for Streams. The curtain should only remain in place during working hours and be removed after each working day or when there is an immediate threat of significant rain.

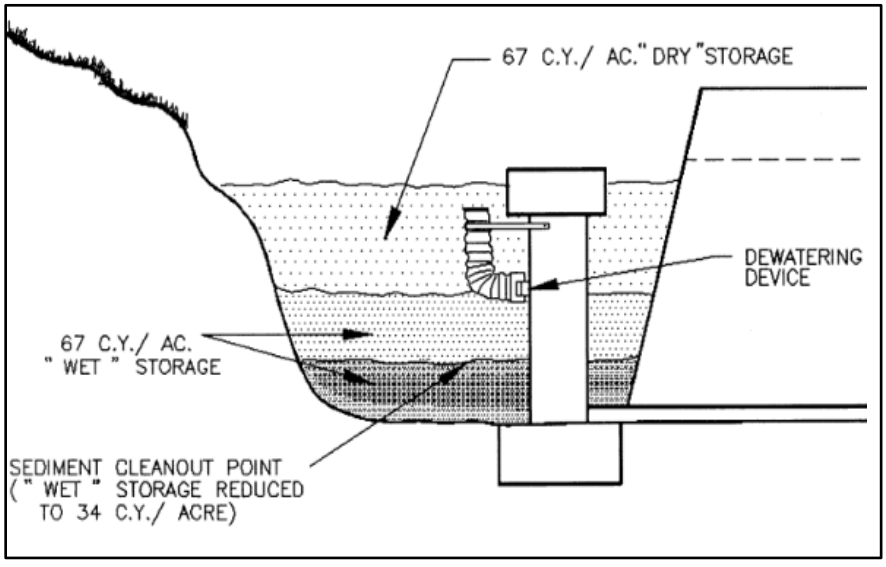
C-SCM-10 Dewatering Structure

A dewatering structure is a temporary settling and filtering device used to process water discharged from dewatering activities. A dewatering structure is designed to remove the sediment before releasing the water off-site. This practice includes varied types of dewatering structures that have different applications depending on site conditions and types of operation. Clean out levels for the practices vary slightly.

Portable sediment tanks and filter boxes should be cleaned out once one-third of the original capacity is depleted due to sediment accumulation. For straw bale/silt fence pits and pumped water filter bags, cleanout should occur when sediment fills half of the practices' allotted sediment holding capacity.

SEDIMENT TRAPS AND BASINS

Sediment traps and basins filter sediment-laden water prior to discharge. They have a permanent pool of water called "wet storage" and an area that fills up and draws down over time, known as "dry storage". Each storage section ("wet storage" and "dry storage") has an area of 67 cubic yards/acre of drainage area for stormwater storage, making a combined total of 134 cubic yards of stormwater storage/acre. Accumulated sediment must be removed when it fills half the volume of the wet storage area.



C-SCM-11 Temporary Sediment Trap

A temporary sediment trap is a temporary ponding basin formed by constructing an embankment, often earthen or composed of compost filter sock, with a stone outlet used to detain sediment-laden runoff from areas less than three acres. This is long enough to allow much of the sediment to settle out to protect water quality in receiving streams, lakes, drainage systems, and adjacent property. The maximum useful life is 18 months.

C-SCM-12 Temporary Sediment Basin

A temporary sediment basin is a temporary barrier or dam with a controlled stormwater release structure formed by constructing an embankment of compacted soil across a drainageway. A temporary sediment basin is used to detain sediment-laden runoff from disturbed areas 3 acres or greater in "wet" and "dry" storage long enough for much of the sediment to settle out.

The maximum drainage area that a sediment basin should contain is 100 acres. These structures are limited to a useful life of 18 months unless the basins are designed as permanent impoundments. Conversion from a temporary sediment-capturing measure to a permanent stormwater best management practice should not occur until upgradient drainage areas have reached a state of final stabilization. It is recommended that these measures, by virtue of their potential to impound large volumes of water, be designed by a qualified professional.

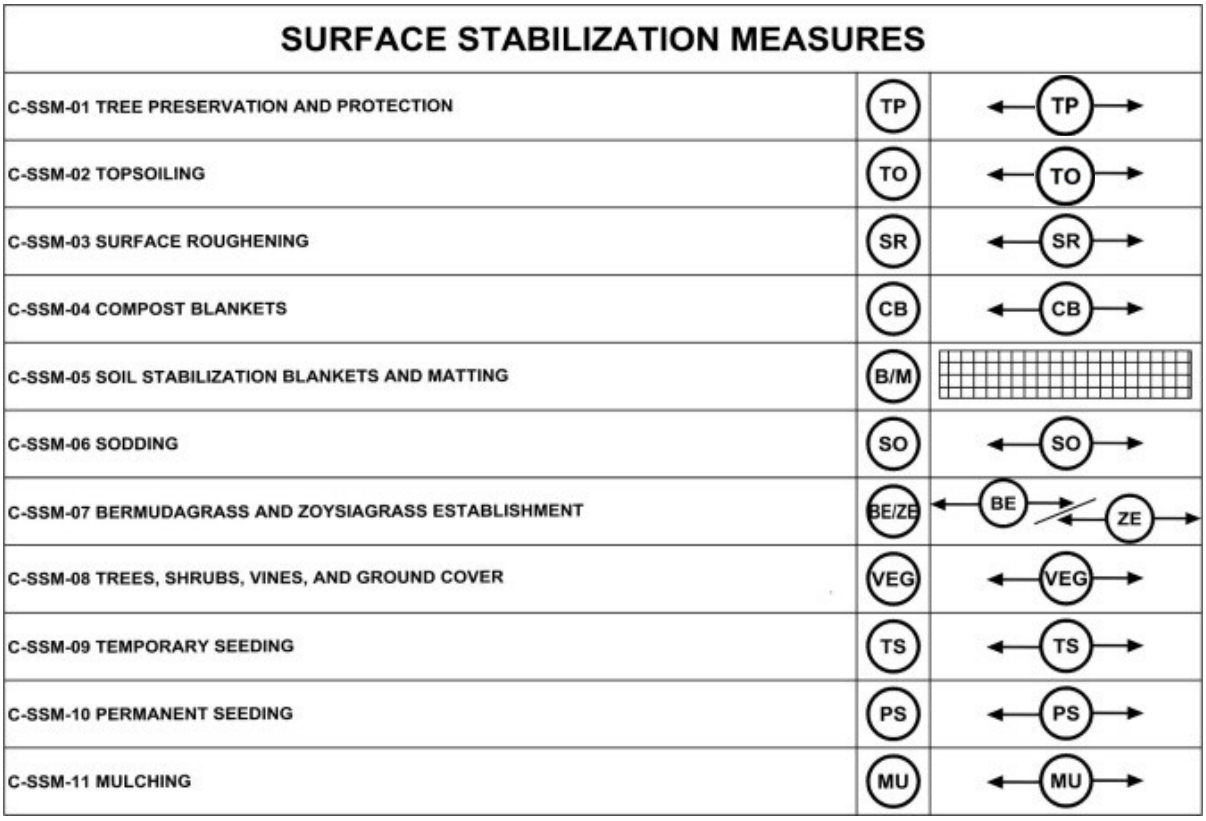
C-SCM-13 Concrete Washout Pit

A concrete washout pit is a temporary excavated or above-ground lined constructed pit or a prefabricated or fabricated container in which concrete equipment can be washed after their loads have been discharged and during cleanup to prevent highly alkaline runoff from entering storm drainage systems or leaching into soil.

Construction sites must provide washout facilities for every project for which concrete will be poured or otherwise formed on the site. Remove accumulated hardened material when 75% of the storage capacity of the structure is filled. Pump any excess wash water into a containment vessel and properly disposed of off-site.

5f. Surface Stabilization Measures – C-SSM

These C-BMPs are intended for use where final grade has been established to protect disturbed soil from surface runoff. They include both temporary covering and permanent vegetative cover that often become part of the final landscape.



VSWHB 7.3.3 Surface Stabilization Measures

C-SSM-01 Tree Preservation and Protection

Tree preservation and protection is the protection of desirable trees from mechanical and other types of injury during land disturbance and construction. Tree preservation and protection is implemented to ensure the survival of desirable trees and their root zones where the trees will be effective for erosion and sediment control, watershed protection, landscape beautification, dust and pollution control, noise reduction, shade, and other environmental benefits.

C-SSM-02 Topsoiling

Topsoiling as a C-BMP entails preserving and using the surface layer of undisturbed soil, often enriched in organic matter, to obtain a more desirable planting and growth medium and enhance final site stabilization. Organic matter influences soil characteristics, such as cohesiveness, structure, and permeability. The topsoil is the layer of soil with the most biological activity, water, and nutrients required for plant establishment; therefore, topsoil is recommended for use in high-maintenance areas.

As an alternative, when properly limed and fertilized, the subsoil can serve as a good substitute for topsoil, particularly for low-maintenance areas.

C-SSM-03 Surface Roughening

Surface roughening is the practice of providing a rough soil surface with horizontal depressions to reduce runoff velocity, increase infiltration, aid the establishment of vegetation, and reduce erosion. Providing the rough soil surface with horizontal depressions is created by operating a tillage or other suitable implement on the contour or leaving slopes in a roughened condition by not fine grading them.

C-SSM-04 Compost Blankets

A compost blanket is a layer of loosely applied composted material placed on the soil in disturbed areas to reduce stormwater runoff and erosion. The compost material fills in small rills and voids to limit channelized flow, provides a more permeable surface to facilitate stormwater infiltration, and promotes revegetation.

C-SSM-05 Soil Stabilization Blankets and Matting

Soil stabilization blankets and matting are a form of protective blanket (Treatment 1) or soil stabilization matting (Treatment II) on a prepared planting area of a steep slope, channel, or shoreline, which aid in controlling erosion on critical areas by providing a microclimate that protects young vegetation and promotes its establishment.

BENEFITS OF VEGETATIVE GROUNDCOVER

Before proceeding with C-SSM-06 through C-SSM-11, general benefits of establishing vegetative cover, maintaining existing vegetation, and plant selection will be reviewed.

A good vegetative cover minimizes the potential for erosion.

Benefits of vegetative cover include:

- Lower costs to establish and maintain, compared to structural methods
- Slowing runoff and filtering sediment
- Protecting the soil from raindrop impact
- Plant roots bind the soil particles and enhance filtration and infiltration of runoff
- Dead plant materials get incorporated in the soil as organic matter, which improves soil structure and infiltration of runoff

Preserving existing vegetation

The most cost-effective measure in controlling erosion from a site is to preserve existing vegetation. This can either be done in perpetuity, by incorporating it in the post-construction landscape design, or for a shorter period, by carefully planning the phasing of a project.

Advantages of leaving undisturbed areas include:

- Minimizing clearing and grading costs
- Native vegetation is adapted to the local environment
- Vegetative buffer strips around a project help filter any runoff before it leaves the property
- Soils that are not disturbed and not compacted have higher infiltration rates than surrounding areas that have been cleared.

Plant selection and planting method

Plant selection depends on many factors, including:

- Management
- Final or temporary stabilization
- Geographic location
- Climate
- Soil
- Time of year

METHODS OF ESTABLISHING VEGETATIVE STABILIZATION

Seeding **C-SSM-09 and C-SSM-10**	•Temporary → annuals •Permanent → perennials •Land use •Certified seed •Seed mix •Time of year requirements
Sodding **C-SSM-06**	•Permanent •VCIA Certified •Planted within 36 hours of harvesting
Sprigging/ Plugging **C-SSM-07**	•Permanent warm season grasses → Bermuda grass and Zoysia grass •VCIA Certified •Planted within 36 hours of harvesting
Planting **C-SSM-08**	•Containerized •Ball and burlap •Bare Root

C-SSM-06 Sodding

Sodding is permanent stabilization of areas by laying a continuous cover of grass sod over exposed soils. Sod should be harvested, delivered, and installed within 36 hours. Sodding is usually only done in high-maintenance areas or areas that require immediate groundcover, including ditches and swales. Soil preparation, liming, and fertilizing for sodding is very similar to seeding; however, soils need to be smooth, free of rocks, boulders, and other pieces of debris. Soils should not be soggy, excessively dry, hot, or frozen. When placing sod on a slope or in a waterway, it needs to be placed in staggered rows and stapled.

C-SSM-07 Bermudagrass and Zoysiagrass Establishment

Bermudagrass and Zoysiagrass establishment is the establishment of vegetative cover with hybrid Bermudagrass or Zoysiagrass by sod or planting sprigs, stolons, or plugs of these types of grasses. Once planted, they form a dense mat in 8 to 12 weeks. Being a warm season grass, they need to be planted between May 1 and July 15. Planting outside these dates will result in insufficient establishment or complete failure; therefore, seed with a temporary cover to carry the site over until these grasses can be planted.

C-SSM-08 Trees, Shrubs, Vines, and Ground Cover

Stabilizing disturbed areas by establishing vegetative cover with trees, shrubs, vines, or ground covers.

C-SSM-09 Temporary Seeding

The establishment of a temporary vegetative cover on disturbed areas by seeding with appropriate rapidly growing annual plants. Seeding can be done by broadcasting the seed with a seed drill or with a hydro-seeder.

C-SSM-10 Permanent Seeding

Permanent seeding is the establishment of perennial vegetative cover on disturbed areas by planting seed. Seeding can be done by broadcasting the seed with a seed drill or with a hydro-seeder. Warm season species go dormant during the winter and cannot be sown or planted when frost is possible within 12 weeks of seeding. Cold season grasses may go dormant in the hot summer months and when there is a lack of irrigation. When choosing seed, areas should be considered as either high or low maintenance depending on their intended use.

Seeding vs. sodding

The chart below provides a comparison between seeding and sodding:

Seeding	Seeding	Sodding	Sodding
Positive	**Negative**	**Positive**	**Negative**
• Low cost • Wide range of species selection • Low labor requirement • Easy establishment in areas with low accessibility	• High initial erosion potential • Area unusable early on • Establishment may be poor (reseeding) • Weeds • Seasonal limitations • Watering requirements for germination • Quality of seed and vegetation not certain	• 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	• 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

C-SSM-11 Mulching

Mulching is the application of a protective blanket of straw or other plant residues/materials to the soil surface during the establishment of temporary and permanent seeding. Table C-SSM-11-5 addresses application rates for organic mulch materials. Straw mulch should be applied at a rate of 1.5-2 tons/acre. Fiber mulch (hydro-seeding) should be applied at 1,500 pounds/acre. When seeding is done with a hydro-seeder, the mulch may be included in the mixture; in that case, mulch consists of a polyacrylamide, a gum, or a cellulose-like material that contains a binder. These materials are also known as tackifiers.

> 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.

Helpful information for establishing vegetation

Virginia Turfgrass Variety Recommendations:
https://www.pubs.ext.vt.edu/SPES/spes-518/spes-518.html

Agronomy Handbook: https://pubs.ext.vt.edu/424/424-100/424-100.html

Spring Planting Considerations for Warm-Season Turfgrasses in Virginia Lawns:
https://ext.vt.edu/lawn-garden/turfandgardentips/tips/warm-season-planting.html

"Fall" Into Your Lawn: Establishing Cool-Season Turfgrasses: https://ext.vt.edu/lawn-garden/turfandgardentips/tips/Establishing-Cool-season-Turfgrasses.html

Virginia Native Plant Marketing Partnership: https://www.plantvirginianatives.org/

Native vs. Invasive Plant Species (below 1992 ESC Handbook, near end):
https://www.deq.virginia.gov/our-programs/water/stormwater/stormwater-construction/handbooks
Also included on the following pages:

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

REVISED: April 2017

FREQUENTLY ASKED QUESTIONS (FAQ)
NATIVE VS. INVASIVE PLANT SPECIES FOR EROSION & SEDIMENT CONTROL

DCR's Natural Heritage Program and other conservation agencies and organizations recognize as "invasive non-natives" certain plant species referenced by DEQ in the *Virginia Erosion and Sediment Control Handbook*. This FAQ provides information regarding Virginia native and invasive non-native plant species and guidance for using natives in lieu of invasive Non-natives for vegetative stabilization of land-disturbing activities regulated by the Virginia Erosion and Sediment Control Law and Regulations. This document promotes sound ecological stewardship, while ensuring erosion control and compliance with the law and regulations. Visit DCR's website for further information about native and invasive plant species and for information about erosion and sediment control visit DEQ's website.

What is a Native Species?
Native species are those that naturally occur in the region in which they evolved. Plants evolve in specific habitats over extended periods of time in response to physical and biotic habitats processes that are characteristic of that place: the climate; the soils; the seasonal rainfall, drought, and frost; and interactions with other species occupying those habitats. Native species thus possess certain traits that enable them to thrive under local conditions.

What Are Invasive Non-Native Species and Why Are They of Concern?
Non-native plants, also known as exotic or non-native, are species that have been introduced intentionally or accidentally by human activity into a region in which they did not evolve. Many non-native species are well known and economically important in agriculture and horticulture, such as wheat, soybeans, and tulips. However, while some non-native plants are beneficial and have little capacity to spread in the natural environment, a few are *invasive* and pose serious threats to both natural communities and rare species. 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. Given this possibility of colonization, use of these species for erosion and sediment control should be avoided when possible.

How Many Invasive Non-Native Plant Species Have Been Identified in Virginia?
DCR's Natural Heritage Program and the Virginia Native Plant Society, in cooperation with land managers and agencies, nurserymen, landscape architects, horticulturalists, and other partners, have identified 90 (DCR 2014) invasive non-native plant species that threaten natural areas, forests, parks, and other conservation areas in Virginia. A complete list of invasive non-native plants for Virginia is available on DCR's website.

Why is Vegetative Stabilization of Land-Disturbing Activities Required?
Virginia Erosion and Sediment Control Law defines a land-disturbing activity as any land change of 10,000 sq. ft. or greater that involves clearing, grading, excavating, transporting, and filling of land. The Virginia Erosion and Sediment Control Regulations and local ordinances that implement the Law delineate strict requirements for timely temporary or permanent stabilization of land-disturbing activities, including denuded areas, soil stockpiles, earthen structures, cut and fill slopes, and watercourses, to prevent soil erosion from occurring in the first place. Planting

vegetation, namely grasses or other herbaceous plants, is an effective and economic method for achieving expedient site stabilization. A copy of the Law and Regulations are available on DEQ's website.

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**. There are equally effective alternatives that are less problematic. It is especially important to avoid using these species in stormwater channels and on streambanks, as planting in these habitats may facilitate their wider distribution. Eight plant species considered invasive non-natives are referenced within the following sections of the *E&S Handbook*: Temporary Seeding (STD&SPEC 3.31), Permanent Seeding (STD&SPEC 3.32), Stormwater Conveyance Channels (STD&SPEC 3.17), Vegetative Streambank Stabilization (STD&SPEC 3.22), and Sodding (STD&SPEC 3.33). However, DCR encourages using native plants whenever feasible as described in the remainder of this FAQ.

What Criteria Should Be Met For Native Species To Be Used for Stabilization?
The plant species chosen for stabilization must always be matched to the characteristics (climate, soils, etc.) of the site/region and must be commercially available in that region. Further, because interest in using native species for erosion and sediment control is relatively recent, alternative native species may not have been thoroughly field-tested to document their efficacy for erosion and sediment control. DCR recommends native plants for vegetative stabilization if the following criteria are met:

- Slopes < 15% slope gradient
- Soils with K factors < 0.36 (soils are not highly erodible)
- For use along roadways, species height must comply with Virginia Department of Transportation visibility requirements and not have characteristics that are highly attractive to birds and mammals
- For use on stormwater conveyance channels and streambanks, species must have proven effectiveness at the expected maximum stormwater flow volume and velocity

Generally, flat to gently sloping, open areas where there is little traffic are appropriate locales for planting most of the alternatives species suggested below. Utility easements or rights-of-way, park like areas, greenways, and other open tracks of land are excellent places to propagate native plants. However, natives may be considered even if one of these criteria is not met if there is sufficient evidence that the species is effective for erosion control.

What are Some Alternative Native Species to the Invasive Plants in the Handbook?
The table below provides a list of alternative Virginia native plants with similar attributes to the invasive non-native plants. These alternatives are offered as suggestions if the criteria listed above are met. Fact sheets for 30 invasive plant species and five brochures on using native plants for restoration and landscaping are available on DCR's website.

Invasive Non-Native Species	***Alternative Virginia Native***	
Common Name	*Common Name*	*Scientific Name*
Common Reed	Great bulrush	*Schoenoplectus tabernaemontani*
	Common Cattail	*Typha latifolia*
Chinese Lespedeza **Birdsfoot Trefoil** **Orchard Grass** **Redtop** **Weeping Lovegrass**	Roundheaded bushclover	*Lespedeza capitata*
	Patridge pea	*Chamaecrista fasciculata*
	Butterflyweed	*Asclepias tuberosa*
	Joe-pye weed	*Eutrochium dubium*
	Black-eyed Susan	*Rudbeckia fulgida*
	Big blue stem	*Andropogon gerardii*
	Indian grass	*Sorghastrum nutans*
	Side oats grama	*Bouteloua curtipendula*
Crownvetch	Roundheaded bushclover	*Lespedeza capitata*
	Patridge pea	*Chamaecrista fasciculata*
	Big blue stem	*Andropogon gerardii*
	Little blue stem	*Schizachyrium scoparium*
	Indian grass	*Sorghastrum nutans*
	Switchgrass	*Panicum virgatum*
Tall Fescue	Big blue stem	*Andropogon gerardii*
	Little blue stem	*Schizachyrium scoparium*
	Indian grass	*Sorghastrum nutans*
	Switchgrass	*Panicum virgatum*
	Broomsedge	*Andropogon virginicus*
	Deertongue	*Dichanthelium clandestinum*
	Side oats grama	*Bouteloua curtipendula*
	Canadian wildrye	*Elymus canadensis*
	Bottlebrush grass	*Elymus hystrix*
	Virginia wildrye	*Elymus virginicus*

Are There Other Considerations When Employing Alternative Native Plants? Yes. The following potential issues should also be considered when employing alternative native plants:

- Always using a native seed mix is desirable for two reasons:
  - Some natives take several seasons to fully establish, so a seed mix including some non-competing annual plant species is recommended
  - To prevent establishing a "monoculture" and encourage biodiversity, multiple natives species should be established on site when possible
- Some natives have new/unique maintenance requirements (weeding, mowing, herbicides, etc.)
- Adding compost to raise the organic content of the soil will greatly enhance the success of vegetation
- Always coordinate with and educate local government officials, property owners, and the citizenry about the benefits of natives – many natives don't produce lush green lawns, and are perceived as weeds

Who Must Approve Use of Alternative Native Plants?
Users should work with the local Native Plant Society chapter or equivalent and the erosion and sediment control program authority to select appropriate native plant species. Note that the selection of plant species for vegetative stabilization **must always** be approved by the program authority as a part of the erosion and sediment control plan.

Summary

As a program administrator, it is important to be able to:

- Discuss the importance of the Minimum Standards within the erosion program and be able to match the major VSWHB specifications with the applicable Minimum Standard(s). This will enable program administrators to build a better understanding of the application of the regulatory Minimum Standards to a site with other program staff and the regulated community.
- Explain the significance of the nomenclature and organization of the C-BMPs found in the VSWHB.
- Identify the BMP groupings and C-BMP designs and how they are utilized to address erosion concerns at construction sites.
- Discuss relevant issues related to non-native and invasive species and their detrimental effect on Virginia's native vegetation.