

DESIGN FLOW SUMMARY TABLE											
FEATURE ID	P-1	P-2	P-3	P-3a	P-4	OP-1	OP-4	SCC-1	SCC-2	SCC-3	SCC-4
DESIGN EVENT FREQUENCY	10	10	10	10	10	10	10	10	10	10	10
RAINFALL INTENSITY (IN/HR)	6.3	6.2	6.2	6.3	6.3	6.3	6.3	6.3	5.8	6.3	6.3
RAINFALL DEPTH (IN. **)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
POST-DEVELOPMENT											
DRAINAGE ID	DA-3+5+7	DA-3+7	DA-3+7	DA-3+7	DA-4	DA-3+5+7	DA-4	DA-1	DA-2	DA-3+7	DA-4
DRAINAGE AREA SIZE (AC.)	4.65	3.25	3.25	3.25	1.3	4.65	1.3	0.06	10.1	3.25	1.3
COMPOSITE RUNOFF CURVE NUMBER	66	61	61	61	86	66	86	89	63	61	86
TIME OF CONCENTRATION (MIN)	6	5.5(*)	5.2(*)	5(*)	6	6	6	6	7.3	6	6
DESIGN FLOW (FT <sup>3</sup> /S)	15.5	8.2	8.2	8.2	8.1	15.5	8.1	0.4	25.6	8.2	8.1

(\*) - MINIMUM T<sub>c</sub> = 5 MINUTES IS USED FOR RATIONAL METHOD ONLY. NRCS METHOD REQUIRES A MINIMUM T<sub>c</sub> = 6 MINUTES.

(\*\*) - RAINFALL DEPTH IS USED FOR NRCS METHOD ONLY.

DRAINAGE PIPE SUMMARY TABLE					
ID	P-1 (Culvert)	P-2	P-3	P-3a	P-4 (Culvert)
DESIGN FLOW (FT <sup>3</sup> /S)	15.5	8.0	8.1	8.2	8.1
DESIGN VELOCITY (FT/S)	12.2	6.8	6.9	6.9	11.00
PIPE DIAMETER (IN.)	24	15	15	15	18
PIPE SLOPE (%)	5.0%	8.0%	40.0%	9.5%	5.0%
PIPE MATERIAL	RCP	RCP	RCP	RCP	RCP
PIPE OWNERSHIP	WVWA	WVWA	WVWA	WVWA	WVWA
UPSTREAM STRUCTURE TOP ELEVATION	1625.00	1635.35	1652.10	1653.50	1673.00
UPSTREAM STRUCTURE TYPE	VDOT ES-1	VDOT MH-1	VDOT MH-1	VDOT DI-7 w/ FLUME CONNECTION	VDOT ES-1
UPSTREAM INVERT ELEVATION	1623.00	1627.00	1644.75	1648.95	1671.50
DOWNSTREAM STRUCTURE TOP ELEVATION	1623.00	1628.25	1635.35	1652.10	1671.75
DOWNSTREAM STRUCTURE TYPE	VDOT ES-1	VDOT ES-1	VDOT MH-1	VDOT MH-1	VDOT EW-1
DOWNSTREAM INVERT ELEVATION	1621.00	1625.00	1628.75	1646.10	1669.50
DESIGN UPSTREAM WATER LEVEL	1625.4	1628.1	1645.9	1650.1	1673.4

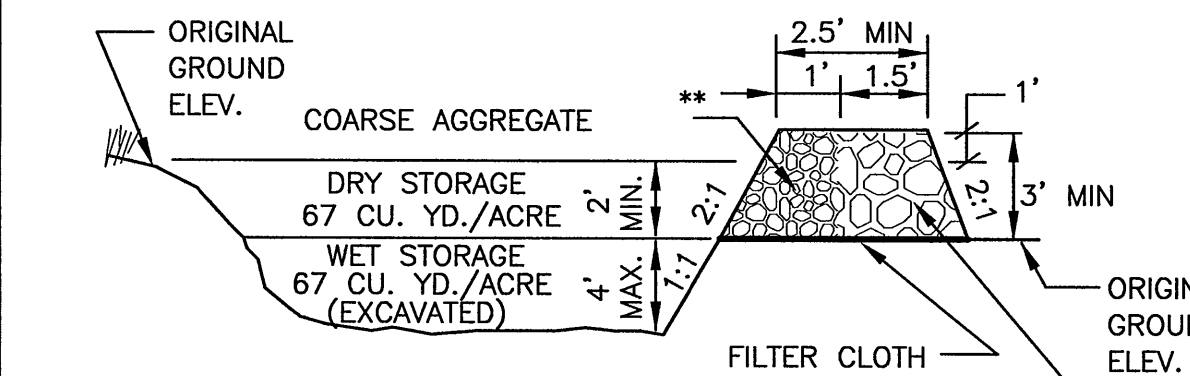
STORMWATER CONVEYANCE CHANNEL (SCC) SUMMARY TABLE				
ID	SCC-1	SCC-2	SCC-3	SCC-4
DESIGN FLOW (FT <sup>3</sup> /S)	0.4	25.6	8.2	8.1
BOTTOM WIDTH, B (FT)		0	1	0
CHANNEL DEPTH, D (IN.)	12	18	12	18
DESIGN WATER DEPTH	0.20	1.00	0.30	0.70
SIDE SLOPES, Z <sub>s</sub> = 1	3.0	3.0	2.0	3.0
CHANNEL SLOPE, MAXIMUM (FT/FT)	0.2000	0.2000	0.2000	0.2000
FLOW VELOCITY (FT/S)	2.9	8.2	17.6	6.15
LINING MATERIAL	VDOT EC-3, TYPE A (MATTING)	VDOT EC-1, CLASS I (RIPRAP)	VDOT PG-5 (CONCRETE DITCH)	VDOT EC-1, CLASS I (RIPRAP)
MANNING'S "n"	0.0500	0.0500	0.0130	0.0500

OUTLET PROTECTION (OP) SUMMARY TABLE			
ID	OP-1	OP-2	OP-3
DESIGN FLOW (FT <sup>3</sup> /S)	15.5	8.1	5.5
TAILWATER DEPTH (FT)	0.76	0.61	0.40
DISCHARGE VELOCITY (FT/S)	12.2	11.0	16.3
RIPRAP GRADATION, D <sub>50</sub> SIZE (FT)	1.1	1.1	0.8
APRON LENGTH (FT)	13.00	10.00	9.00
UPSTREAM APRON WIDTH (FT)	6.00	4.50	3.75
DOWNSTREAM APRON WIDTH (FT)	15.00	11.50	10.25
SIDE SLOPES (H : V)	2	2	2
APRON DEPTH (IN.)	26	26	20

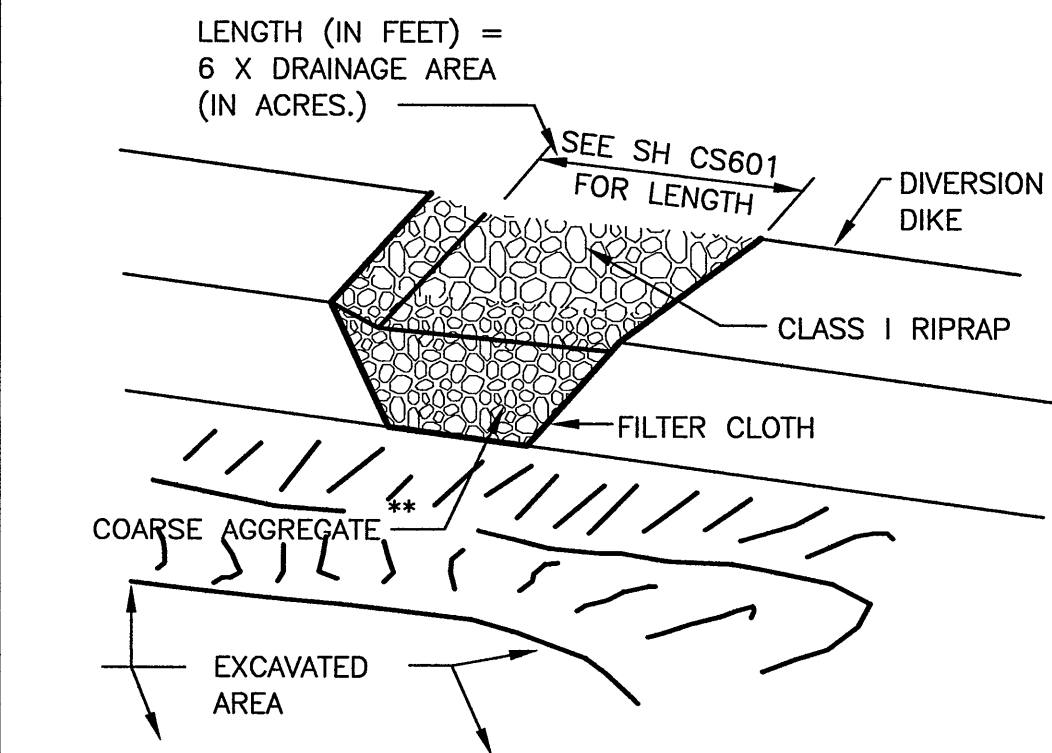
SEDIMENT TRAP (ST) SUMMARY TABLE			
ID	ST-1	ST-2	ST-3
DRAINAGE AREA (ACRES)	2.05	1.30	1.10
DRY STORAGE VOLUME (CY)	141.6	97.2	79.4
WET STORAGE VOLUME (CY)	170.4	111.4	87.7
EXCAVATION DEPTH (FT)	4	4	4
BOTTOM ELEVATION	1622.0	1672.0	1612.0
SEDIMENT CLEANOUT ELEVATION	1624.7	1674.7	1614.7
OUTLET CREST ELEVATION	1628.0	1678.0	1618.0
TOP OF EMBANKMENT ELEVATION	1629.0	1679.0	1619.0
OUTLET SPILLWAY LENGTH, ACROSS FLOW (FT)	13.0	8.0	7.0
EMBANKMENT TOP WIDTH (FT)	2.5	2.5	2.5

TEMPORARY SLOPE DRAIN (TSD) SUMMARY TABLE	
ID	TSD-1
DRAINAGE AREA (ACRES)	2.6
PIPE DIAMETER (IN.)	15 (*)

(\*) - 15" IS USED IN LIEU OF 24" SINCE THE AREA CONTRIBUTING IS UNDISTURBED AND WOODED. REFER TO CALCULATIONS FOR FLOW AND FACTOR OF SAFETY INFORMATION.



### CROSS SECTION OF OUTLET



### OUTLET (PERSPECTIVE VIEW)

\*\* COARSE AGGREGATE SHALL BE #3, #357 OR #5  
REF: VDOT SECTION 414

### TEMPORARY SEDIMENT TRAP (ST)

NO SCALE

### Summary of Fertilizer Specification Revisions for Establishment of Turf

Standards & Specifications		2003 Urban Nutrient Management Technical Bulletin
3.31 Temporary Seeding		<b>10-10-10</b> fertilizer applied at a rate of <b>450 lbs. / acre</b> or <b>10 lbs. / 1,000 ft<sup>2</sup></b>
3.32 Permanent Seeding	Mixed Grasses & Legumes	<b>10-20-10</b> fertilizer applied at a rate of <b>500 lbs. / acre</b> or <b>12 lbs. / 1,000 ft<sup>2</sup></b>
	Legume stands only	Apply the equivalent of 100 lbs. of phosphate (P <sub>2</sub> O <sub>5</sub> ) and 100 lbs. of Potash (K <sub>2</sub> O) per acre. <b>NO NITROGEN (N)</b>
	Grass stands only	<b>10-20-10</b> fertilizer applied at a rate of <b>500 lbs. / acre</b> or <b>12 lbs. / 1,000 ft<sup>2</sup></b>
3.33 Sodding		<b>10-10-10</b> fertilizer applied at a rate of <b>450 lbs. / acre</b> or <b>10 lbs. / 1,000 ft<sup>2</sup></b> . NOTE: For cool season grasses apply fertilizer in fall or spring. For warm season grasses apply the fertilizer in late spring or summer only.
3.34 Bermudagrass & Zoysiagrass Establishment		<b>10-10-10</b> fertilizer applied at a rate of <b>500 lbs. / acre</b> or <b>12 lbs. / 1,000 ft<sup>2</sup></b> . Apply additional phosphorus and potassium 30-60 days later based on the soil test. Apply an additional equivalent of 1 lb./1,000 ft <sup>2</sup> of nitrogen when the P & K are applied.

TABLE 3.31-B  
(Revised June 2003)  
**TEMPORARY SEEDING SPECIFICATIONS**  
QUICK REFERENCE FOR ALL REGIONS

SEED		
APPLICATION DATES	SPECIES	APPLICATION RATES
Sept. 1 - Feb. 15	50/50 Mix of Annual Ryegrass (lolium multi-florum) & Cereal (Winter) Rye (Secale cereale)	50 - 100 (lbs/acre)
Feb. 16 - Apr. 30	Annual Ryegrass (lolium multi-florum)	60 - 100 (lbs/acre)
May 1 - Aug. 31	German Millet	50 (lbs/acre)

### FERTILIZER & LIME

- Apply 10-10-10 fertilizer at a rate of 450 lbs. /acre (or 10 lbs. /1,000 sq. ft.)
- Apply Pulverized Agricultural Limestone at a rate of 2 tons/acre (or 90 lbs. / 1,000 sq. ft.)

### NOTE:

- 1 - A soil test is necessary to determine the actual amount of lime required to adjust the soil pH of site.
- 2 - Incorporate the lime and fertilizer into the top 4 - 6 inches of the soil by disking or by other means.
- 3 - When applying Slowly Available Nitrogen, use rates available in *Erosion & Sediment Control Technical Bulletin #4*, 2003 Nutrient Management for Development Sites at <http://www.dcr.state.va.us/sw/e&s.htm#rubs>

### EROSION AND SEDIMENT CONTROL NARRATIVE FALLING CREEK DAM REHABILITATION

#### PROJECT DESCRIPTION

The purpose of this project is the rehabilitation of an existing spillway and the reinforcement of the downstream face of an earthen dam for a 21 acre reservoir that is owned and maintained by the Western Virginia Water Authority located in Bedford County, Virginia. The total disturbed area for this project is 5.4 acres.

#### EXISTING SITE CONDITIONS

The site consists of a reservoir, roadway and water treatment plant. The north portion consists of a 21 acre reservoir and access road. The east portion consists of the access road and wooded area draining towards the center of the site. The south portion consists of the water treatment facility. The west portion consists of the principal spillway and wooded area draining towards the spillway.

#### ADJACENT PROPERTY

The site consists of multiple tracts owned by the Western Virginia Water Authority covering a large unknown acreage. The construction site is located in the interior of the property. Adjacent property to the North and East is property owned by the Western Virginia Water Authority. Adjacent properties to the South are owned by Forrest Lawhom and Y.W. Murphy. Adjacent properties to the West are Falling Creek Estates, consisting of single family homes, and large acre tracts owned by Myrtle Gray and Elizabeth Richardson.

#### OFF-SITE AREAS

It is anticipated that waste material will need to be hauled away and imported materials will be needed for the articulated concrete block (ACB) and gabion construction. The contractor shall waste or borrow from permitted sites.

#### SOILS

All disturbed areas shall be covered either by the new facility, pavement, or grass. Existing soils are mostly plastic silts and clays, classified as CL, CH, ML, or MH. Soil designations are shown on sheet CS106 and correspond to NRCS Soil Survey contained in the E&S Control calculations.

#### CRITICAL EROSION AREAS

Areas along the principal spillway have been designated as critical due to potential erosion problems during periods of rain. These areas have been stabilized with silt fence and soil stabilization blankets where necessary, and care should be taken to minimize land disturbance and ensure that sediment is trapped on site. Much of the site is steep and shall be stabilized with blanket matting except where another form of stabilization is used (e.g. ACB, riprap, gabions, or grouted riprap).

#### EROSION AND SEDIMENT CONTROL MEASURES

All structural erosion and sediment control practices shall be constructed and maintained in accordance with the minimum standards and specifications of the Virginia Erosion and Sediment Control Handbook, hereafter referred to as the Handbook.

#### STORMWATER MANAGEMENT

Falling Creek Reservoir is privately owned by the Western Virginia Water Authority (WVWA) and serves as a water supply source for the City of Roanoke with restricted development inside the watershed. The water quality requirements are met since both the percent of impervious area for the both pre- and post-developed condition area is less than 16 percent. The existing reservoir currently functions as a stormwater quantity BMP for a watershed area of approximately 880 acres such that the rehabilitation measures included in this project do not require the construction of an additional BMP.

#### STRUCTURAL PRACTICES

1. Temporary Stone Construction Entrance - 3.02  
A stabilized stone pad with a filter fabric underliner located at points of vehicular ingress and egress on a construction site.
2. Silt Fence Barrier - 3.05  
Silt fence barrier shall be placed downslope of areas with minimal grades to filter sediment-laden runoff.
3. Storm Drain Inlet Protection - 3.07  
A sediment filter or an excavated impounding area around storm drain drop inlet or curb inlet.
4. Culvert Inlet Protection - 3.08  
All culvert inlets shall be protected during construction. Sediment-laden water shall be filtered before entering the culvert inlet.
5. Temporary Diversion Dike - 3.09  
Temporary diversion dikes shall be installed to divert runoff to the temporary sediment traps.
6. Diversion - 3.12  
A temporary or permanent channel constructed across a slope with a supporting earthen ridge on the lower side to divert off-site runoff away from disturbed areas. This practice shall be used temporarily along the western portion of the site. A permanent diversion (concrete ditch and flume) shall be used along the east. A temporary diversion dike can be used to divert off-site runoff from the east until the concrete ditch and flume are completed.
7. Temporary Sediment Trap - 3.13  
A temporary ponding area formed by constructing an earthen embankment with a stone outlet. There are three sediment traps - one for the borrow pit, one at the toe of the dam embankment, and one to the west of Falling Creek.
8. Temporary Slope Drain - 3.15  
A flexible tubing or conduit extending from the top to the bottom of a cut or fill slope.
9. Paved Flume - 3.16  
A permanent paved channel constructed on a slope.
10. Outlet Protection - 3.18  
Structurally lined aprons or other acceptable energy dissipating devices placed at the outlets of pipes or paved channel sections.
11. Rock Check Dam - 3.20  
Rock check dams shall be constructed across swales and drainage ditches to reduce the velocity of concentrated stormwater flows.

#### VEGETATIVE PRACTICES

1. Topsoiling (stockpile) - 3.30  
Topsoil shall be stripped from areas to be graded and stockpiled for later use. Stockpiles shall be located on-site and shall be stabilized with temporary vegetation.
2. Temporary Seeding - 3.31  
All denuded areas, which shall be left dormant for extended periods of time, shall be seeded with fast germinating temporary vegetation immediately following grading. Selection of the seed mixture shall depend on the time of year it is applied.
3. Mulch - 3.35  
Mulch (straw or fiber) shall be used on relatively flat areas and shall be applied as a second step in the seeding operation.
4. Soil Stabilization Blankets & Matting - 3.36  
The installation of a protective covering (blanket) or a soil stabilization mat on a prepared planting area of a steep slope, channel or shoreline.

#### PERMANENT STABILIZATION

All areas disturbed by construction and not covered by impervious surface shall be stabilized with permanent seeding immediately following finished grading. Seeding shall be done according to Standard and Specification 3.32, PERMANENT SEEDING, of the handbook. Erosion control blankets shall be installed over steep fill slopes that have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow seed to germinate properly. Mulch (straw or fiber) shall be used on relatively flat areas. In all seeding operations, seed, fertilizer, and lime shall be applied prior to mulching.

#### MANAGEMENT STRATEGIES

1. Construction shall be sequenced so that grading operations can begin and end as quickly as possible.
2. The contractor shall have a DCR-certified Responsible Land Disturber (RLD) appointed to this project and shall be responsible for the installation and maintenance of all erosion and sediment control practices.
3. After achieving adequate stabilization, the temporary E&S controls shall be removed and disturbed areas stabilized as needed. Dewater sediment from traps and haul off-site to a permitted site.
4. Sediment trapping measures shall be installed as a first step in grading and shall be seeded and mulched immediately following installation.
5. Temporary seeding or other stabilization shall follow immediately after grading.

#### MAINTENANCE

In general, all erosion and sediment control measures shall be checked daily and after each significant rainfall. The following items shall be checked in particular:

1. The silt fence barrier shall be checked regularly for undermining or deterioration of the fabric. Sediment shall be removed when the level of sediment deposition reaches half way to the top of the barrier.
2. The seeded areas shall be checked regularly to ensure that a good stand is maintained. Areas shall be fertilized and re-seeded as needed.
3. Diversion dikes and temporary diversions shall be inspected after every rainfall and repairs made if necessary. At least once every two weeks, whether storm has occurred or not, the measure shall be inspected and repairs made if necessary.
4. The construction entrance shall be maintained in a condition that shall prevent tracking or flow of mud onto public rights-of-way. All material spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains shall be removed immediately.
5. The sediment traps shall be checked regularly for sediment cleanup. Sediment shall be removed from the temporary sediment trap and the trap restored to its original dimensions when the sediment has accumulated to one half the design volume of the wet storage. Sediment removal from the trap shall be deposited in a suitable area and in such a manner that it shall not erode and cause sedimentation problems. Filter stone shall be checked regularly to ensure filtration performance is maintained. Stone choked with sediment shall be removed and cleaned or replaced. The structure shall be checked regularly to ensure that it is structurally sound and has not been damaged by erosion or construction equipment. The height of the stone outlet shall be checked to ensure that its center is at least one foot below the top of the embankment.

#### GENERAL EROSION AND SEDIMENT CONTROL NOTES

ES-1: UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND VIRGINIA REGULATIONS VR 625-02-00 EROSION AND SEDIMENT CONTROL REGULATIONS.

ES-2: THE PLAN APPROVING AUTHORITY MUST BE NOTIFIED ONE WEEK PRIOR TO THE PRE-CONSTRUCTION CONFERENCE, ONE WEEK PRIOR TO THE COMMENCEMENT OF LAND DISTURBING ACTIVITY, AND ONE WEEK PRIOR TO THE FINAL INSPECTION.

ES-3: ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE PLACED PRIOR TO OR AS THE FIRST STEP IN CLEARING.

ES-4: A COPY OF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN SHALL BE MAINTAINED ON THE SITE AT ALL TIMES.

ES-5: PRIOR TO COMMENCING LAND DISTURBING ACTIVITIES IN AREAS OTHER THAN INDICATED ON PLANS (INCLUDING, BUT NOT LIMITED TO, OFF-SITE BORROW OR WASTE AREAS), THE CONTRACTOR SHALL SUBMIT A SUPPLEMENTARY EROSION CONTROL PLAN TO THE OWNER FOR REVIEW AND APPROVAL BY THE PLAN APPROVING AUTHORITY.

ES-6: THE CONTRACTOR IS RESPONSIBLE FOR INSTALLATION OF ANY ADDITIONAL EROSION CONTROL MEASURES NECESSARY TO PREVENT EROSION AND SEDIMENTATION AS DETERMINED BY THE PLAN APPROVING AUTHORITY.

ES-7: ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBING ACTIVITIES AND DURING SITE DEVELOPMENT UNTIL FINAL STABILIZATION IS ACHIEVED.

ES-8: DURING DEWATERING OPERATIONS, WATER WILL BE PUMPED INTO AN APPROVED FILTERING DEVICE.

ES-9: THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.

#### SEQUENCE OF CONSTRUCTION

1. Before any other land disturbance:
  - a. Stake out limits of work
  - b. Install construction entrance
  - c. Install and stabilize perimeter controls (silt fence, diversions, diversion dikes, and sediment traps)
  - d. Install silt fence and rock check dams on east side of access road entrance
2. As needed:
  - a. Install inlet protection, culvert inlet protection, and outlet protection for storm drainage system
  - b. Perform surface roughening along cut and fill slopes
  - c. Install temporary and permanent seeding
  - d. Install blanket mat stabilization on all slopes 3:1 or steeper
3. Restrictions:
  - a. GROUTED RIPRAP STILLING BASIN: Protect from sedimentation. Divert surface and concentrated flow from entering basin until control measures are in place or contributing areas are stabilized.
4. Upon final site stabilization:
  - a. Clean and/or remove all E&S control measures.
  - b. Inspect seeded areas as regularly to insure that a good stand of vegetation is maintained.
  - c. Fertilize and reseed areas as needed.
  - d. Dewater and dispose of sediment by hauling to permitted site.

TABLE 3.32-C  
(Revised June 2003)  
**PERMANENT SEEDING SPECIFICATIONS FOR APPALACHIAN/MOUNTAIN AREA**

LAND USE	SEED <sup>1</sup> SPECIES	APPLICATION RATES
<u>Minimum Care Lawn</u> (Commercial or Residential)	Tall Fescue <sup>1</sup> Perennial Ryegrass <sup>2</sup> Kentucky Bluegrass <sup>1</sup>	90-100% 0-10% 0-10% TOTAL: 200-250 lbs.
<u>High-Maintenance Lawn</u>	Minimum of three (3) up to five (5) varieties of Kentucky Bluegrass from approved list for use in Virginia <sup>1</sup>	TOTAL: 125 lbs.
<u>General Slope (3:1 or less)</u>	Tall Fescue <sup>1</sup> Red Top Grass or Creeping Red Fescue Seasonal Nurse Crop <sup>3</sup>	128 lbs. 2 lbs. 20 lbs. TOTAL: 150 lbs.
<u>Low-Maintenance Slope</u> (Steeper than 3:1)	Tall Fescue <sup>1</sup> Red Top Grass or Creeping Red Fescue Seasonal Nurse Crop <sup>3</sup> Crownvetch <sup>4</sup>	108 lbs. 2 lbs. 20 lbs. 20 lbs. TOTAL: 150 lbs.

1 - When selecting varieties of turfgrass, use the Virginia Crop Improvement Association (VCIA) recommended turfgrass variety list. Quality seed will bear a label indicating that they are approved by VCIA. A current turfgrass variety list is available at the local County Extension office or through VCIA at 804-746-4884 or at <http://sudan.ces.vt.edu/html/Turf/turfpublications/publications2.html>

2 - Perennial Ryegrass will germinate faster and at lower soil temperatures than Tall Fescues, thereby providing cover and erosion resistance for seedling.

3 - Use seasonal nurse crop in accordance with seeding dates as stated below:

March, April - May 15 <sup>th</sup>	Annual Rye
May 16 <sup>th</sup> - August 15 <sup>th</sup>	Foxtail Millet
August 16 <sup>th</sup> - September, October	Annual Rye
November - February	Winter Rye

4 - All legume seed must be properly inoculated. If Flatpea is used, increase to 30 lbs/acre. If Weeping Lovegrass is used, include in any slope or low maintenance mixture during warmer seeding periods, increase to 30 - 40 lbs/acre.

### FERTILIZER & LIME

- Apply 10-20-10 fertilizer at a rate of 500 lbs. /acre (or 12 lbs. /1,000 sq. ft.)
- Apply Pulverized Agricultural Limestone at a rate of 2 tons/acre (or 90 lbs. / 1,000 sq. ft.)

### NOTE:

- A soil test is necessary to determine the actual amount of lime required to adjust the soil pH of site.
- Incorporate the lime and fertilizer into the top 4 - 6 inches of the soil by disking or by other means.
- When applying Slowly Available Nitrogen, use rates available in *Erosion & Sediment Control Technical Bulletin #4*, 2003 Nutrient Management for Development Sites at