

1. THE DRAINAGE AREA OF THE DITCH OR SWALE BEING PROTECTED SHALL NOT EXCEED 2 ACRES WHEN VDOT #1 COARSE AGGREGATE IS USED ALONE AND SHALL NOT EXCEED 10 ACRES WHEN A COMBINATION OF CLASS 1 RIPRAP (ADDED FOR STABILITY) AND VDOT #1 COARSE AGGREGATE IS USED.
2. THE MAXIMUM HEIGHT OF THE DAM SHALL BE 3.0 FEET.
3. THE CENTER OF THE CHECK DAM MUST BE AT LEAST 6 INCHES LOWER THAN THE OUTER EDGES. FIELD EXPERIENCE HAS SHOWN THAT MANY DAMS ARE NOT CONSTRUCTED TO PROMOTE THIS "WEIR" EFFECT. STORMWATER FLOWS ARE THEN FORCED TO THE STONE-SOIL INTERFACE, THEREBY PROMOTING SCOUR AT THE POINT AND SUBSEQUENT FAILURE OF THE STRUCTURE TO PERFORM ITS INTENDED FUNCTION.
4. FOR ADDED STABILITY, THE BASE OF THE CHECK DAM CAN BE KEYED INTO THE SOIL APPROXIMATELY 6 INCHES.
5. THE MAXIMUM SPACING BETWEEN THE DAMS SHOULD BE SUCH THAT THE TOE OF THE UPSTREAM DAM IS AT THE SAME ELEVATION AS THE TOP OF THE DOWNSTREAM DAM.
6. HAND OR MECHANICAL PLACEMENT WILL BE NECESSARY TO ACHIEVE COMPLETE COVERAGE OF THE DITCH OR SWALE AND TO INSURE THAT THE CENTER OF THE DAM IS LOWER THAN THE EDGES.
7. FILTER CLOTH MAY BE USED UNDER THE STONE TO PROVIDE A STABLE FOUNDATION AND TO FACILITATE THE REMOVAL OF THE STONE.

Plate 3.20-1

ROCK CHECK DAM
DEVELOPED FROM VADEQ 1992 MANUAL

TEMPORARY BRIDGE CROSSING
DEVELOPED FROM VADEQ 1992 MANUAL

Plate 3.24-1

Plate 3.25-3

FLUME PIPE CROSSING
DEVELOPED FROM VADEQ 1992 MANUAL

Plate 3.26-3

STRAW BALE/SILT FENCE PIT
DEVELOPED FROM VADEQ 1992 MANUAL

Plate 3.29-3

Source: Michigan Soil Erosion and Sedimentation Guide

FILL SLOPE TREATMENT & TRACKING

TAKEN FROM VADEQ 1992 MANUAL

Plate 3.36-1

TYPICAL ORIENTATION OF TREATMENT
SOIL STABILIZATION BLANKET
DEVELOPED FROM VADEQ 1992 MANUAL

Plate 3.36-2

SOIL STABILIZATION BLANKET INSTALLATION CRITERIA DEVELOPED FROM VADEQ 1992 MANUAL

[illegible]

 Mountain Valley
PIPELINE

JEFFERSON NATIONAL FOREST — E&S DETAILS

MOUNTAIN VALLEY PIPELINE PROJECT — H600 LINE

GILES COUNTY THROUGH MONTGOMERY COUNTY, VIRGINIA

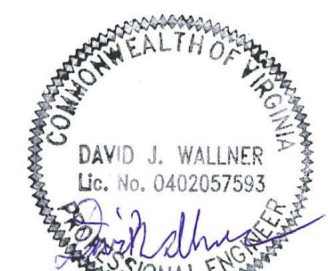
MOUNTAIN VALLEY PIPELINE, LLC
555 SOUTHPOINTE BOULEVARD, SUITE 200
CANONSBURG, PA 15317




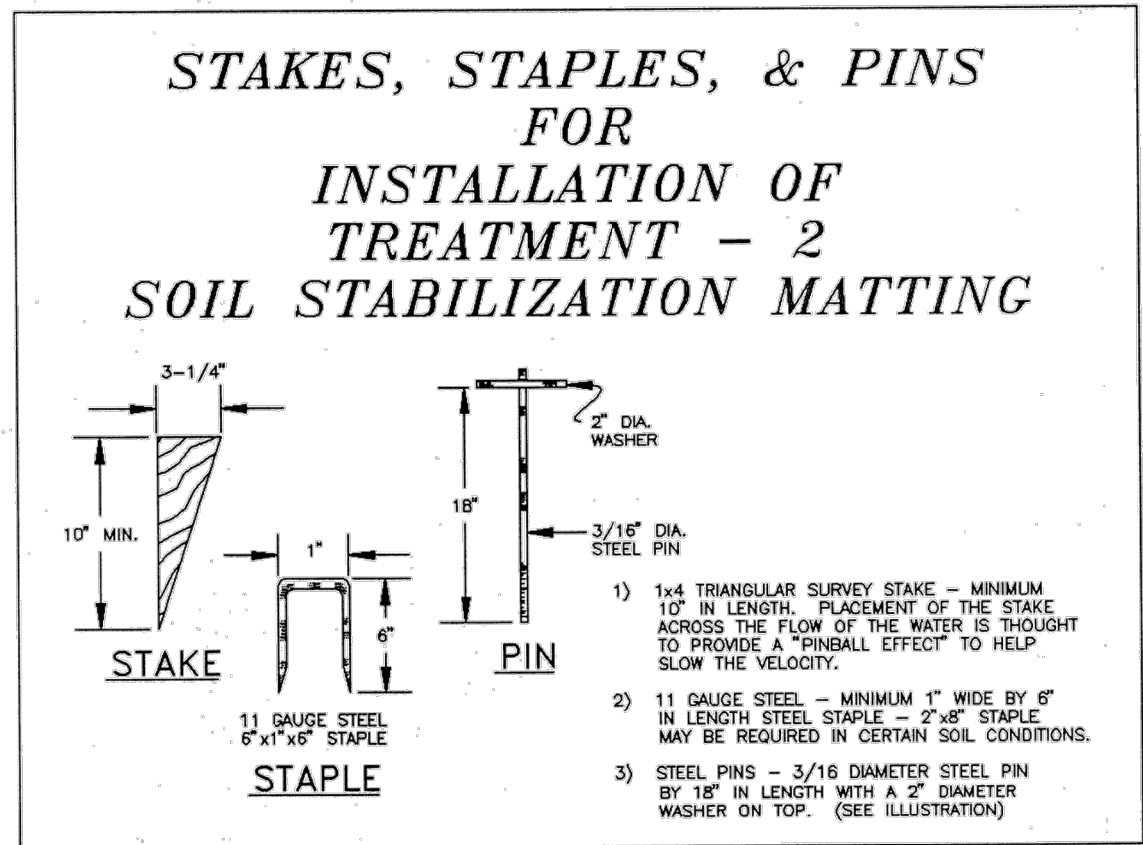
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PITTSBURGH, PA 15220

GENERAL DETAIL SET



DRAWN BY:		KAL
CHECKED BY:		HT
APPROVED BY:		RE
DATE:	10/26/2017	 REVISION
SCALE:	AS SHOWN	
SHT. NO. 002JNF OF 13.06JNF		

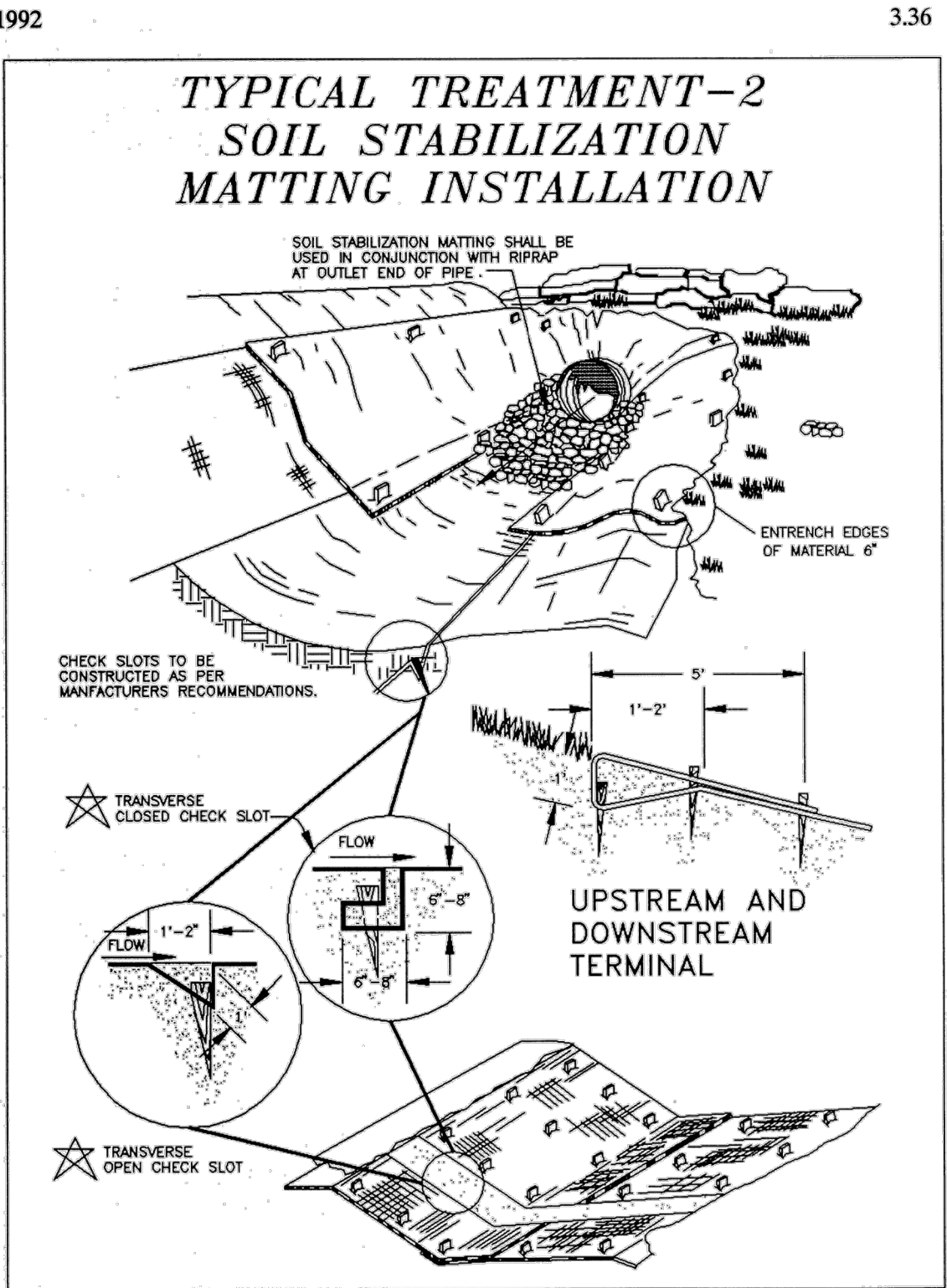


Source: Product literature from Greenstreak, Inc. Plate 3.36-3

Installation Requirements

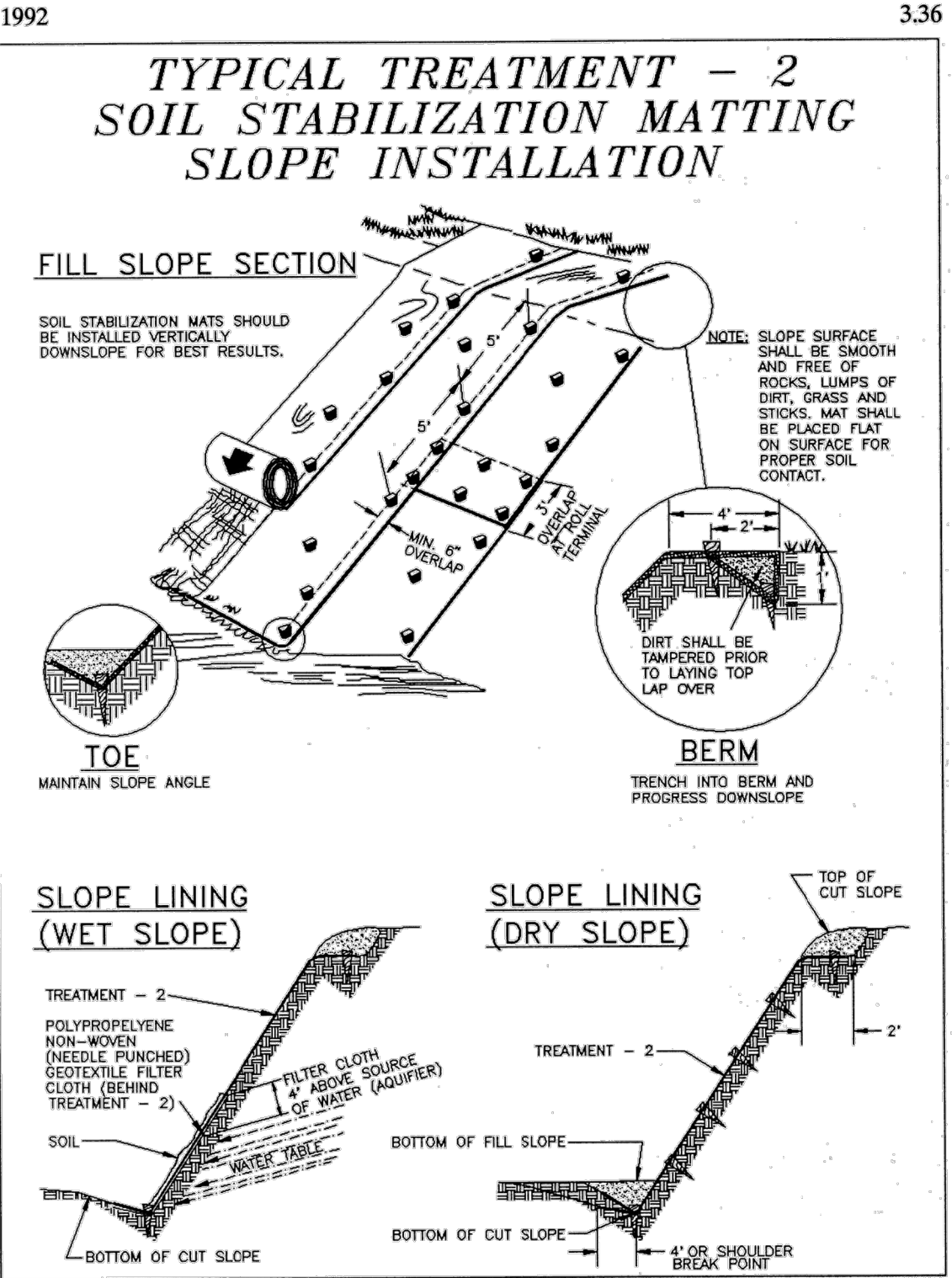
Site Preparation - After site has been shaped and graded to approved design, prepare a friable seedbed relatively free from clods and rocks more than 1 inch in diameter, and any foreign material that will prevent contact of the soil stabilization mat with the soil surface. If necessary, redirect any runoff away from the ditch or slope during installation.

STAKES, STAPLES, & PINS FOR INSTALLATION
OF SOIL STABILIZATION MATTING
DEVELOPED FROM VADEQ 1992 MANUAL



Source: VDOT Road and Bridge Standards Plate 3.36-4

TYPICAL TREATMENT
SOIL STABILIZATION MATTING INSTALLATION
DEVELOPED FROM VADEQ 1992 MANUAL

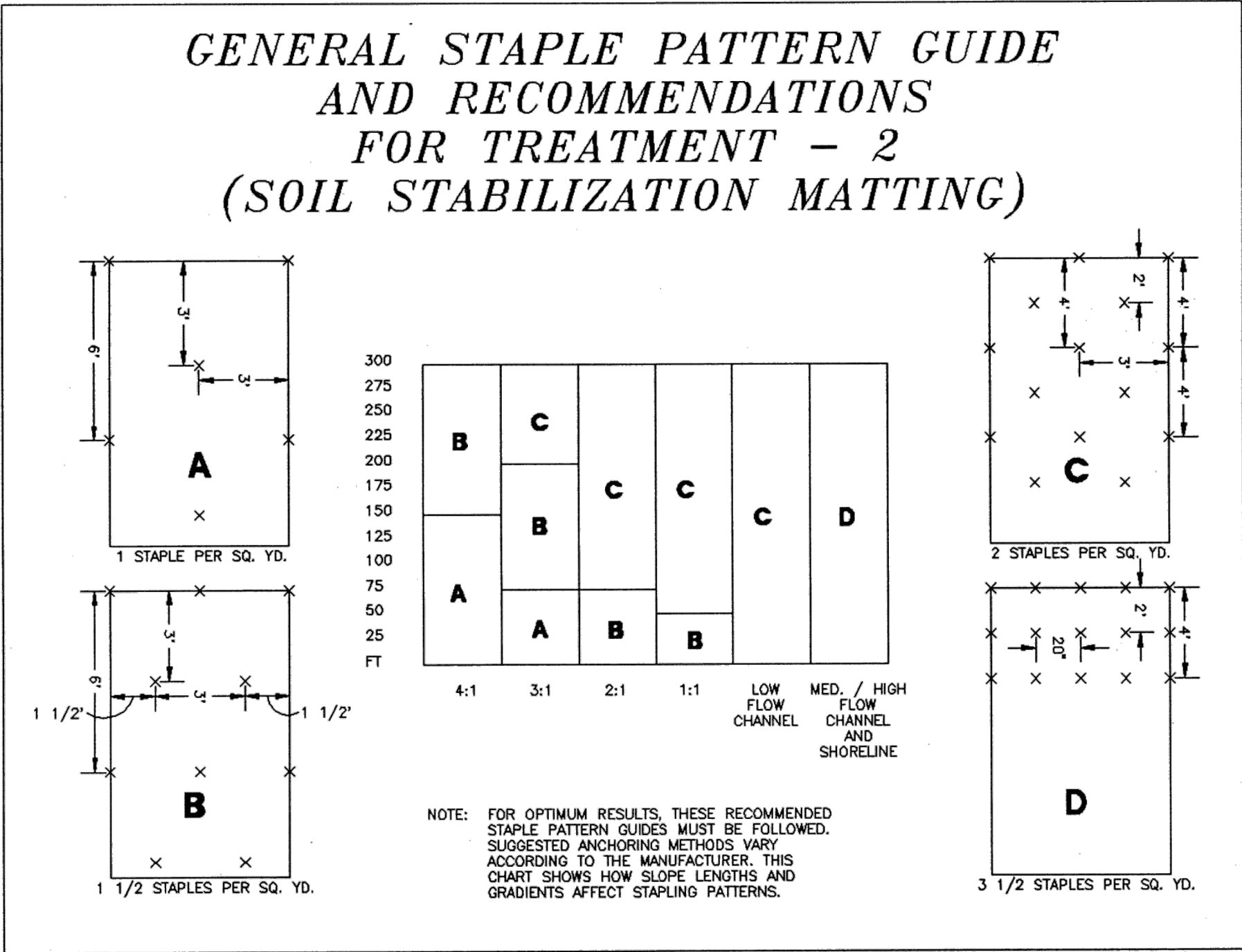


Source: VDOT Road and Bridge Standards Plate 3.36-5

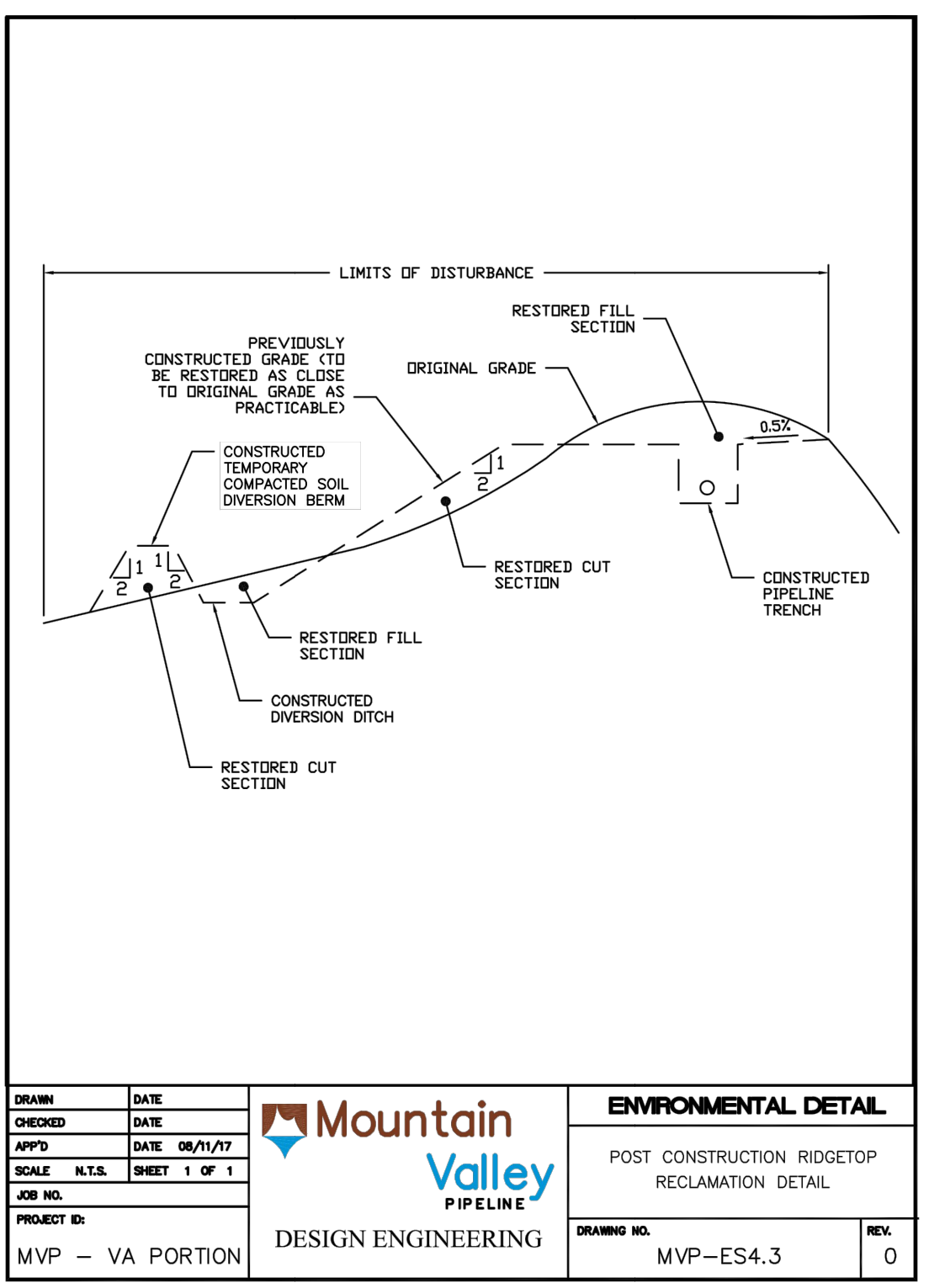
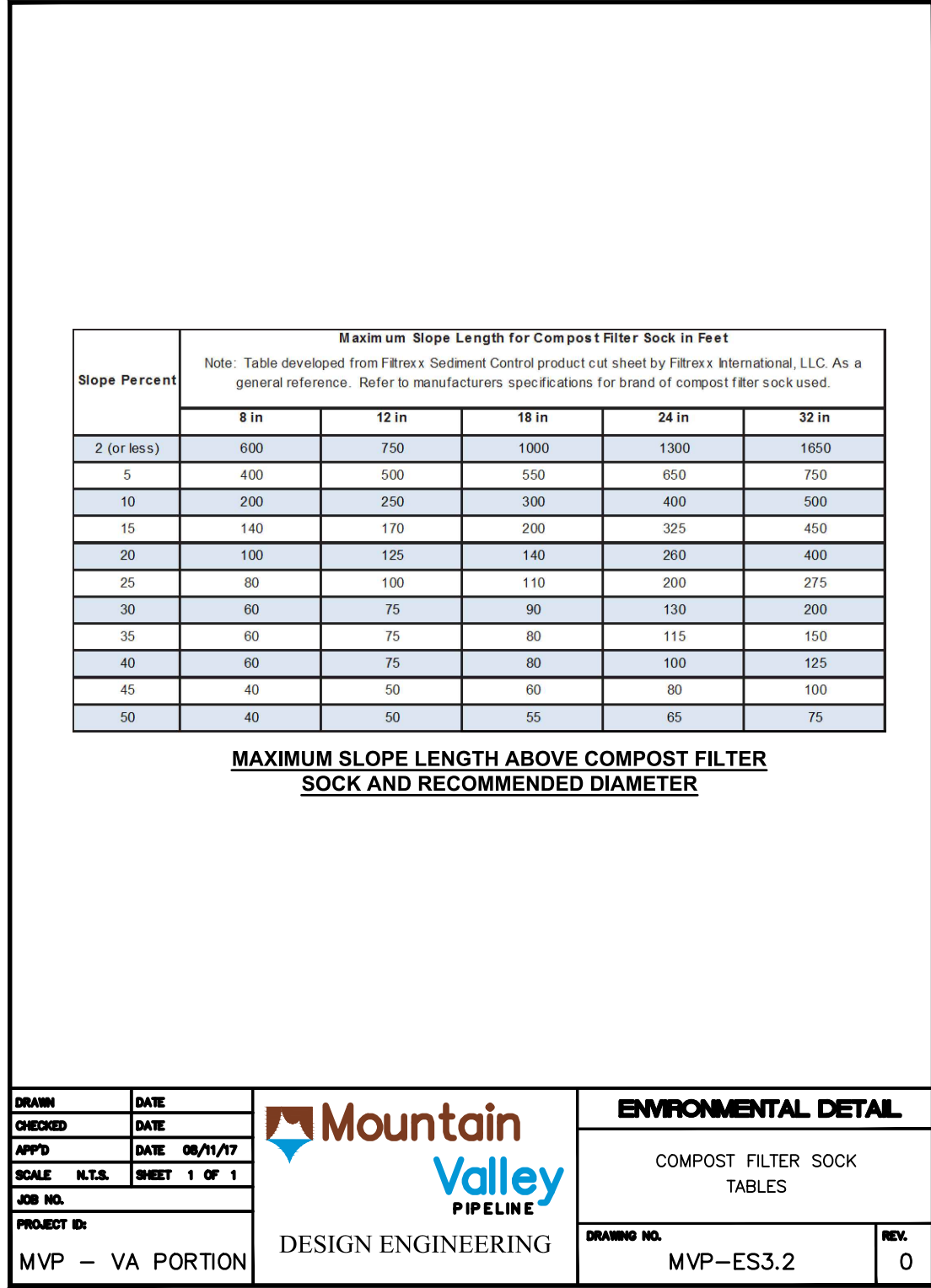
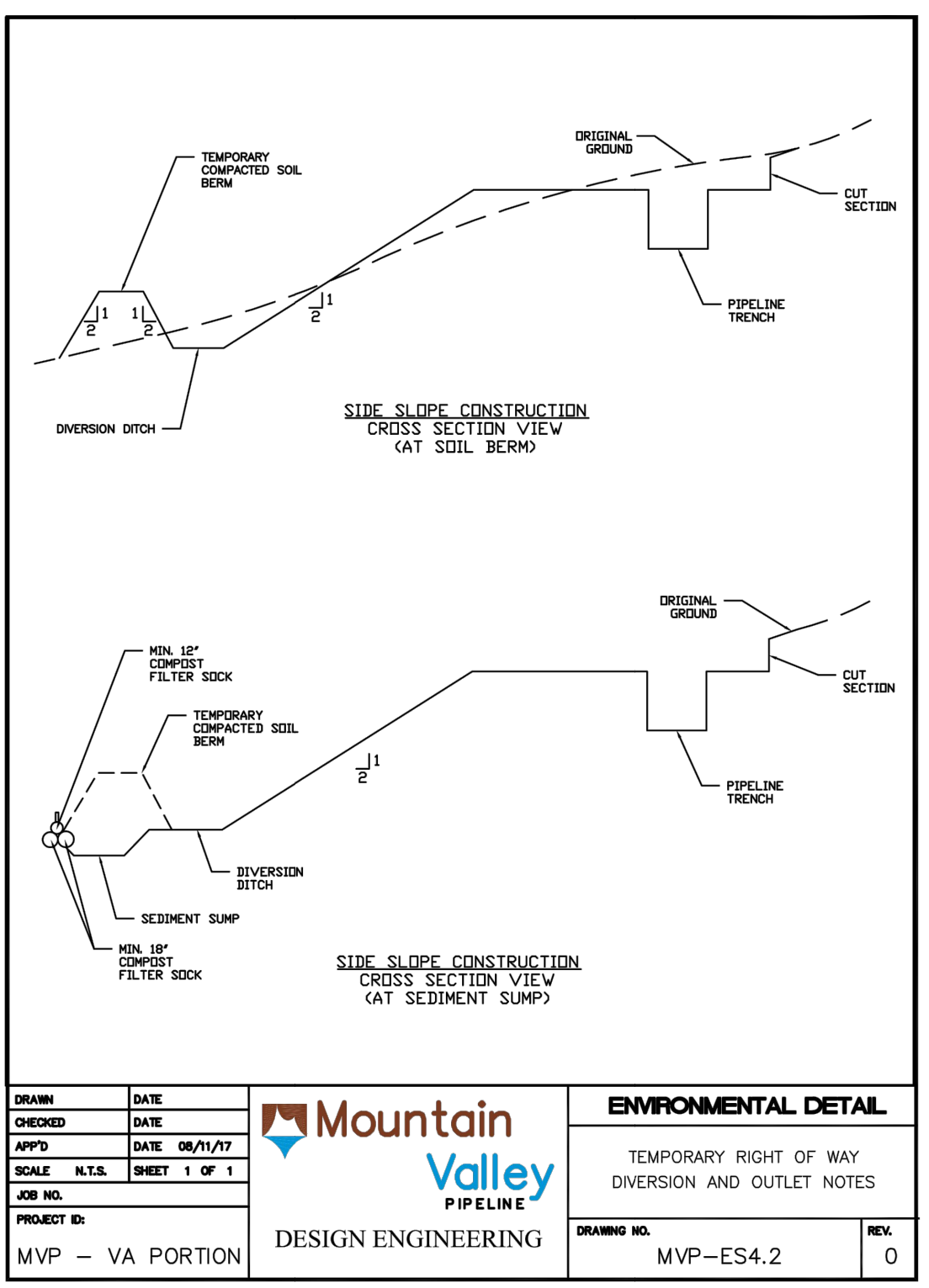
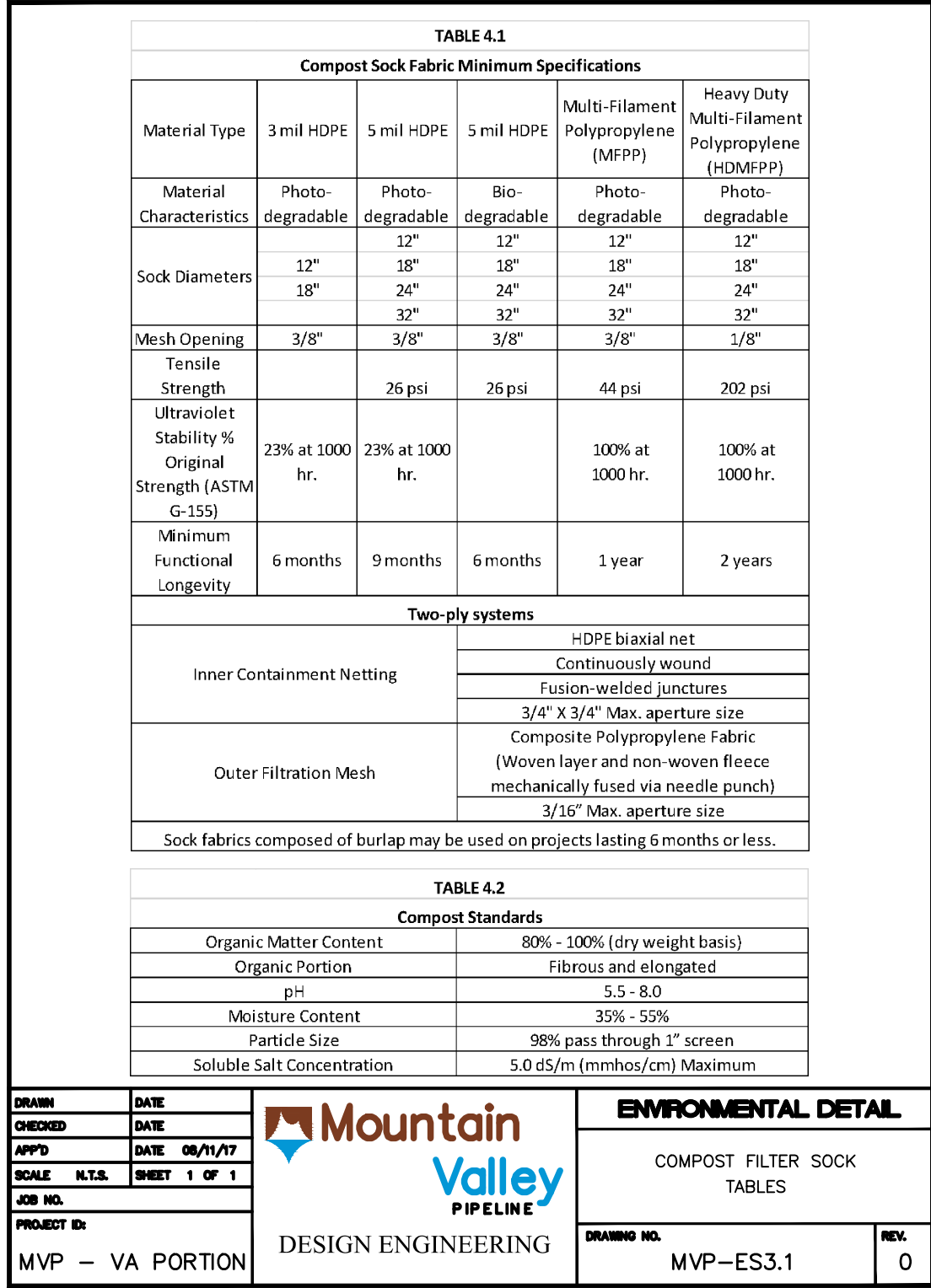
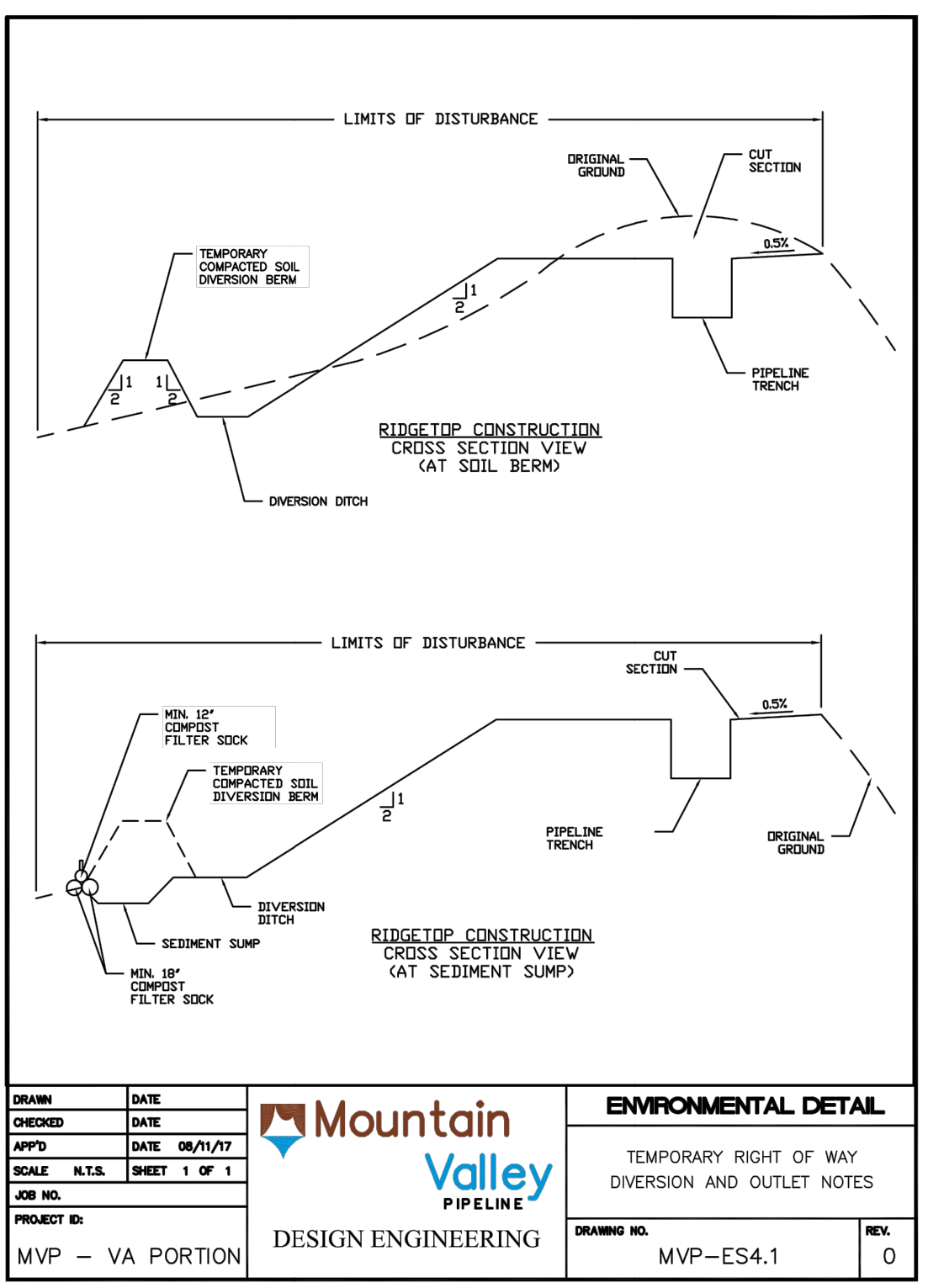
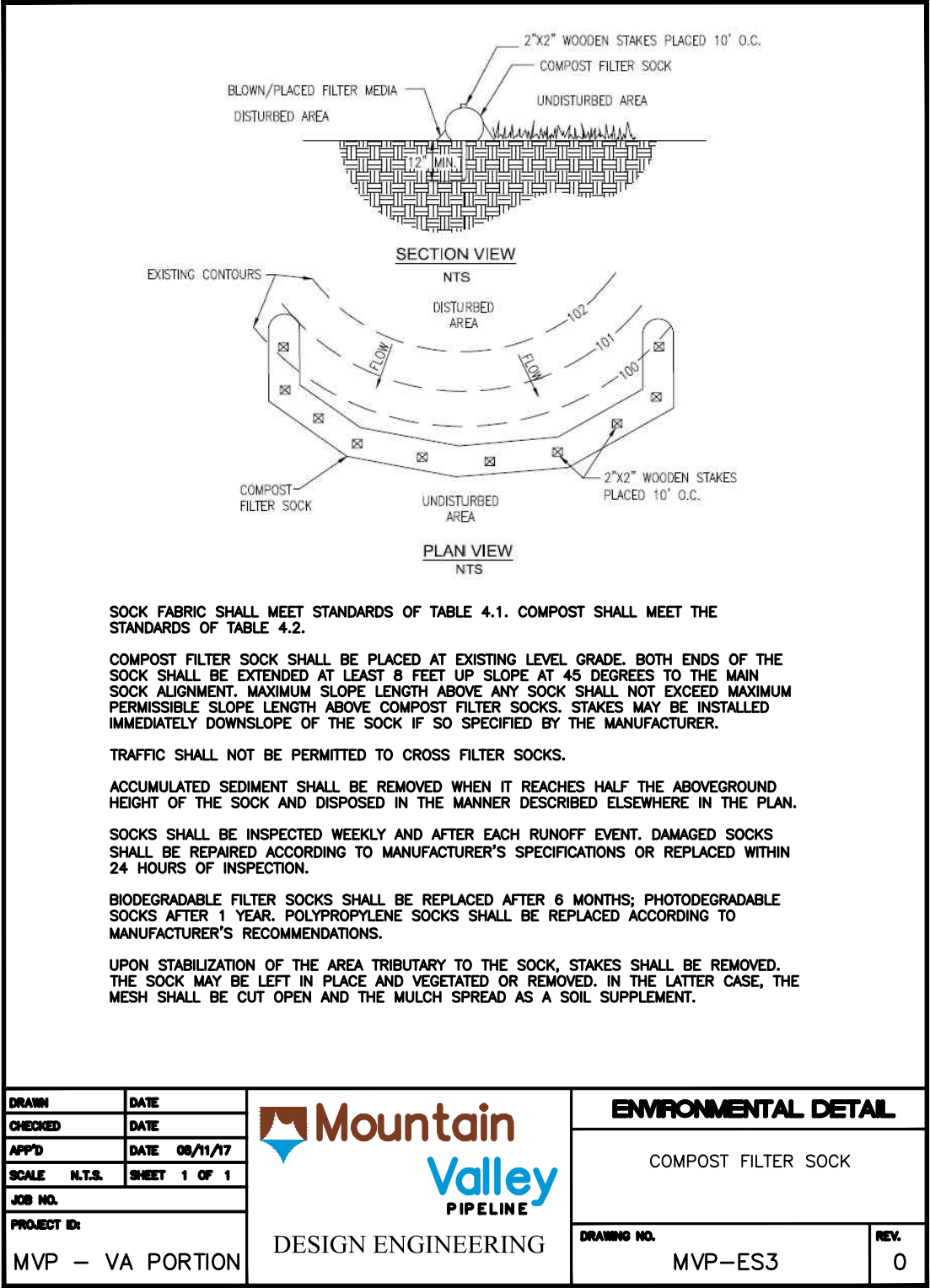
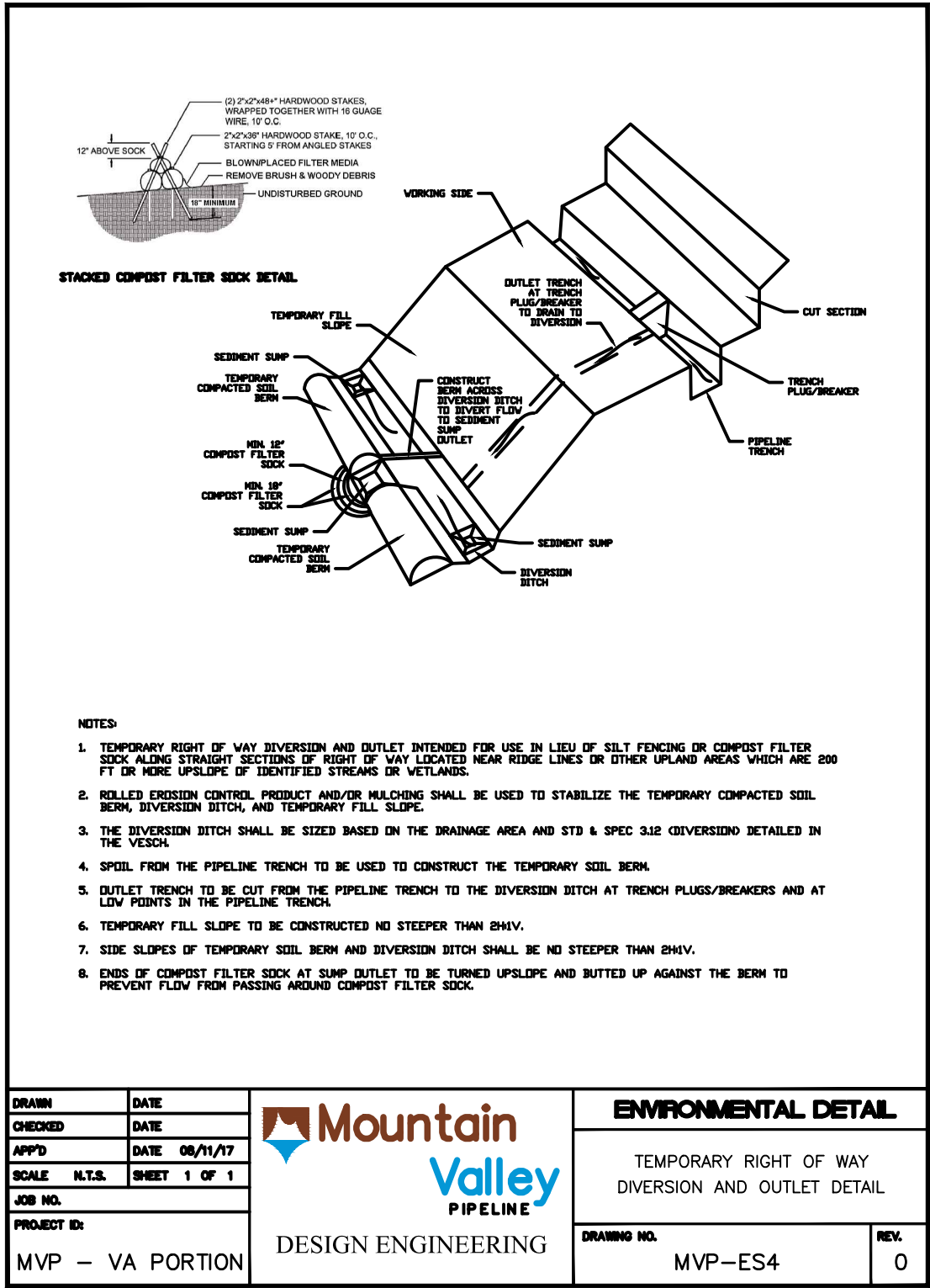
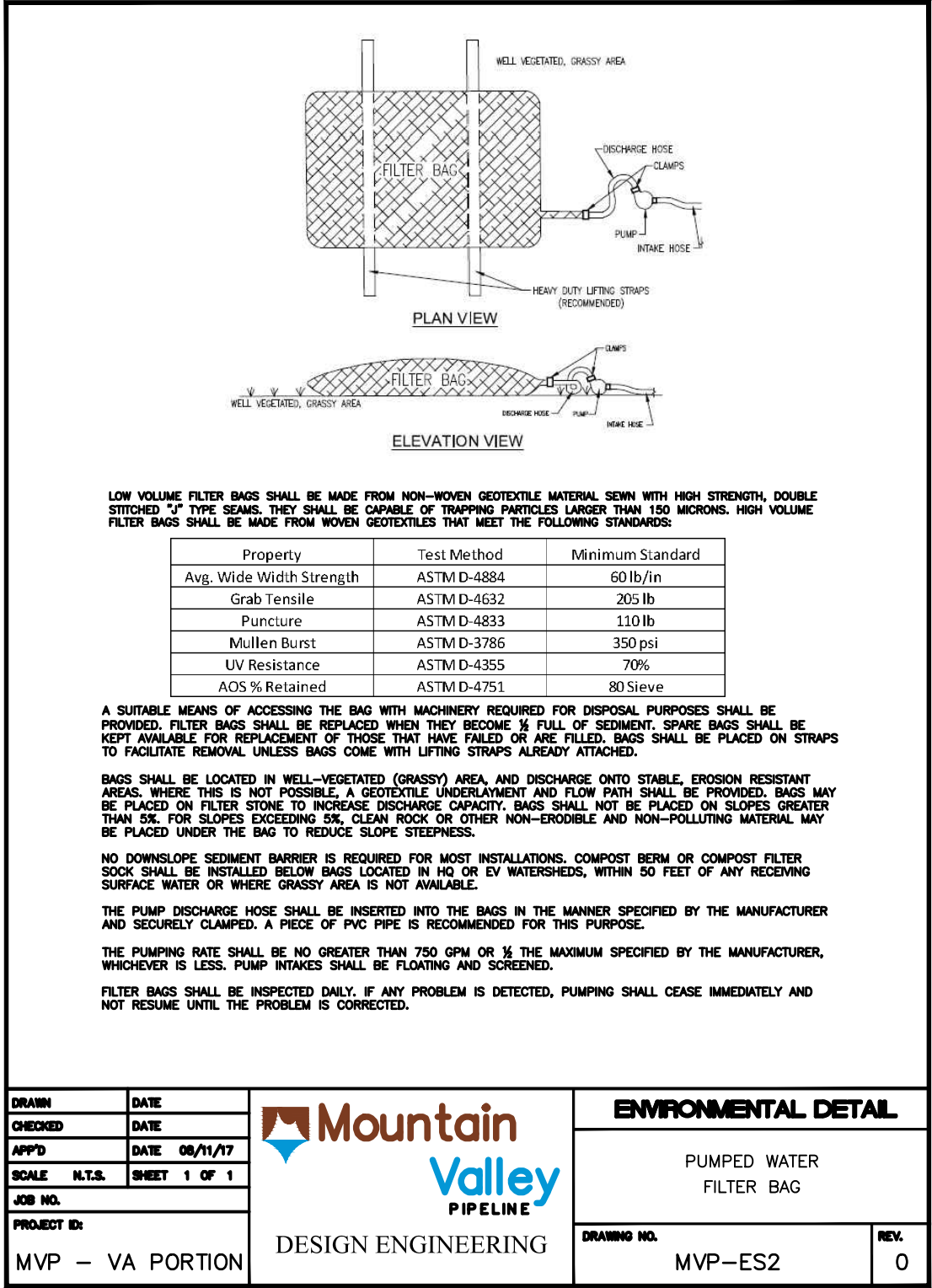
SOIL STABILIZATION MATTING SLOPE

NOTE:
FOR LANDS ON THE JEFFERSON NATIONAL FOREST, IF THE USE OF STABILIZATION NETTING IS REQUIRED/PERMITTED, WILDLIFE FRIENDLY GEOTEXTILES MUST BE USED. THESE PRODUCTS MUST EITHER NOT CONTAIN NETTING, OR NETTING MUST BE MADE OF 100% BIODEGRADABLE NON-PLASTIC MATERIALS SUCH AS JUTE, SISAL, OR COIR FIBER. PLASTIC NETTING (SUCH AS POLYPROPYLENE, NYLON, POLYETHYLENE, AND POLYESTER), EVEN IF ADVERTISED AS BIODEGRADABLE, IS NOT ACCEPTED ALTERNATIVE. ANY NETTING USED MUST ALSO HAVE A LOOSE-WEAVE DESIGN WITH MOVABLE JOINTS BETWEEN HORIZONTAL AND VERTICAL TWINES TO REDUCE THE CHANCE FOR WILDLIFE ENTANGLEMENT, INJURY, OR DEATH. (CA COASTAL COMMISSION, 2012)

Source: Product literature from North American Green



GENERAL STAPLE PATTERN GUIDE
& RECOMMENDATIONS FOR TREATMENT
DEVELOPED FROM VADEQ 1992 MANUAL



Wetland/Wet Seed Mix	
Scientific Name	Common Name
<i>Baptisia australis</i>	Blue False Indigo
<i>Elymus hystrix (Hyetrix patula)</i>	Bottlebrush Grass
<i>Anemone canadensis</i>	Canadian Burnet
<i>Panicum clandestinum (Dichanthelium c.) 'Tioga'</i>	Deertongue, 'Tioga'
<i>Carex crinita</i>	Fringed (Nodding) Sedge
<i>Lobelia siphilitica</i>	Great Blue Lobelia
<i>Vernonia noveboracensis</i>	New York Ironweed
<i>Juncus tenuis</i>	Path Rush
<i>Eupatorium purpureum</i>	Purple Node Joe Pye Weed
<i>Panicum rigidulum (P. stipitatum)</i>	Redtop Panicgrass
<i>Juncus effusus</i>	Soft Rush
<i>Eupatorium maculatum (Eupatoriadelphus maculatus)</i>	Spotted Joe Pye Weed
<i>Carex squarrosa</i>	Squarrose Sedge
<i>Asclepias incarnata</i>	Swamp Milkweed
<i>Panicum virgatum 'Cave-In-Rock'</i>	Switchgrass, 'Cave-In-Rock'
<i>Carex stricta</i>	Tussock Sedge
<i>Senna hebecarpa (Cassia h.)</i>	Wild Senna
<i>Scirpus cyperinus</i>	Woolgrass

DRAWN	DATE		ENVIRONMENTAL DETAIL	
CHECKED	DATE		US FOREST SERVICE (NATIONAL FOREST) LANDS	
APP'D	DATE 06/11/17		TEMPORARY EROSION CONTROL SPECIES	
SCALE	N.T.S. SHEET 1 OF 1			
JOB NO.				
PROJECT ID:		DESIGN ENGINEERING	DRAWING NO.	REV.
MVP – VA PORTION			MVP–ES12.5	0




NOTES:

A BONDED FIBER MATRIX (BFM) IS AN EFFECTIVE METHOD OF STABILIZING STEEP SLOPES WHEN USED PROPERLY. BFM MAKE USE OF A CROSS-LINKED HYDROCOLLOID TACKIFIER TO BOND THERMALLY PROCESSED WOOD FIBERS. APPLICATION RATES VARY ACCORDING TO SITE CONDITIONS. FOR SLOPES UP TO 3H:1V THE BFM SHOULD BE APPLIED AT A RATE OF 3,000 LB/ACRE. STEEPER SLOPES MAY NEED AS MUCH AS 4,000 LB/ACRE.

BFMs SHOULD ONLY BE USED WHEN NO RAIN IS FORECASTED FOR AT LEAST 48 HOURS FOLLOWING HE APPLICATION. THIS IS TO ALLOW THE TACKIFIER SUFFICIENT TIME TO CURE PROPERLY. ONCE PROPERLY APPLIED, A BFM IS TYPICALLY 90% EFFECTIVE IN PREVENTING ACCELERATED EROSION. BFM'S SHOULD NOT BE APPLIED BETWEEN SEPTEMBER 30 AND APRIL 1.

A POLYMER STABILIZED FIBER MATRIX (PSFM) CAN ALSO BE AN EFFECTIVE METHOD OF STABILIZING STEEP SLOPES WHEN USED PROPERLY. PSFMs MAKE USE OF A LINEAR SOIL STABILIZING TACKIFIER THAT WORKS DIRECTLY ON SOIL TO MAINTAIN SOIL STRUCTURE, MAINTAIN PORE SPACE CAPACITY AND FLOCCULATE DISLODGED SEDIMENT THAT WILL SIGNIFICANTLY REDUCE RUNOFF TURBIDITY. PROPERLY APPLIED, A PSFM MAY BE AS MUCH AS 99% EFFECTIVE.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BONDED FIBER MATRIX	
APP'D	DATE 06/11/17			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID:		MVP-ES40	P	
MVP – VA PORTION				


Typical Polymer Stabilized Fiber Matrix Application Rates									
Maximum Rainfall of < 20"	SLOPE		Soil Stabilizer (gal/sqacre)		Fiber (lb/sqacre)				
	6:1	5:1	4:1	3:1	2:1	1.5:1	1:1		
	4	5	6	7	8	9	10		
	1,500	1,500	1,500	1,800	2,000	2,500	3,000		
Maximum Rainfall of > 20" and for Site Winterization	SLOPE		Soil Stabilizer (gal/sqacre)		Fiber (lb/sqacre)				
	<5:1	4:1	<3:1						
	8	8	10						
	2,000	2,500	3,000						

NOTES:

UNLIKE ROLLED BLANKETS, THERE IS NO NEED TO SMOOTH THE SLOPE PRIOR TO APPLICATION OF HYDRAULICALLY APPLIED BLANKETS. IN FACT SOME ROUGHENING OF THE SURFACE, EITHER NATURAL OR MECHANICALLY INDUCED, IS PREFERABLE. HOWEVER, LARGE ROCKS, THOSE > 9 INCHES, AND EXISTING WELLS SHOULD BE REMOVED PRIOR TO APPLICATION. TRACKING OR GROOVING OF SLOPES SHOULD BE CONSIDERED TO SLOW WATER FLOWS DURING A STORM EVENT. SLOPE INTERRUPTION DEVICES SUCH AS STAIR STEP GRADING OR BENCHING SHOULD BE APPLIED PRIOR TO THE APPLICATION. MIXING AND APPLICATION RATES SHOULD FOLLOW MANUFACTURER'S RECOMMENDATIONS.


HYDRAULICALLY APPLIED BLANKETS ARE TYPICALLY APPLIED IN TWO STAGES, UNLESS SPECIFICALLY RECOMMENDED TO BE APPLIED IN ONE. APPLICATION BY THE MANUFACTURER, THE SEED MIXTURE AND SOIL AMENDMENTS SHOULD BE APPLIED FIRST. IF THE SEED IS APPLIED AT THE SAME TIME AS THE HYDRAULICALLY APPLIED BLANKET, THE BONDED FIBERS MAY KEEP THE SEED FROM MAKING SUFFICIENT CONTACT WITH THE SOIL TO GERMINATE. AFTER THE SEED MIXTURE IS APPLIED, THE BFM, FGM, OR PSFM SHOULD BE SPRAYED OVER THE AREA AT THE REQUIRED APPLICATION RATE. (SEE ABOVE TABLES)

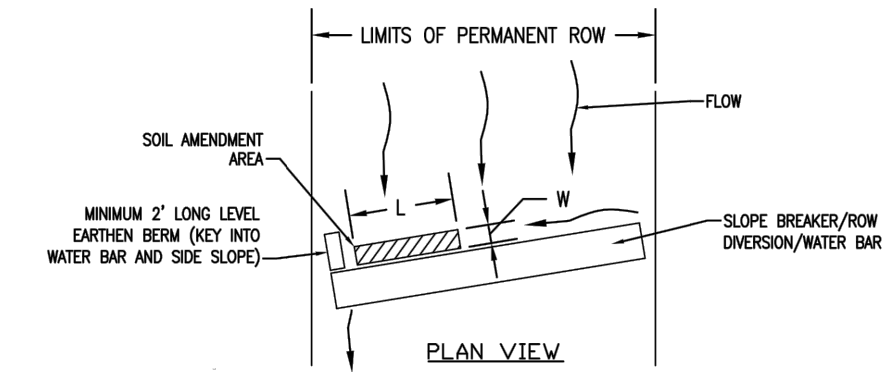
HYDRAULIC EROSION CONTROL PRODUCTS (HEPC USED ON JNF LANDS MUST BE SUITABLE FOR WILDLIFE

DRAWN	DATE	 Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BONDED FIBER MATRIX	
APP'D	DATE 06/11/17			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	
PROJECT ID:		DESIGN ENGINEERING	MVP – ES40.1	P
MVP – VA PORTION				



University of Minnesota FS 07009
A geotextile underlayment shall be used under the wood mat.
Source: PaDEP, E&S Pollution Control Manual, March 2012


DRAWN	DATE		ENVIRONMENTAL DETAIL	
CHECKED	DATE		TIMBER MAT/WETLAND CROSSING	
APP'D	DATE 06/11/17			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	
PROJECT ID:		DESIGN ENGINEERING	MVP-ES37	P
MVP - VA PORTION				

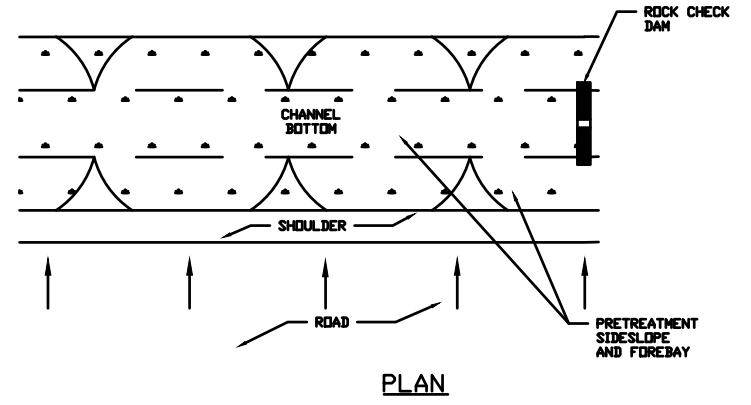


NOTES:

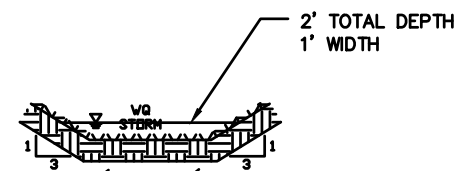
1. WIDTH "W" OF SOIL AMENDMENT PER PERMANENT DIVERSION DIKE/WATERBAR WITH SOIL AMENDMENT SCHEDULE
2. THE INCORPORATION DEPTH "D" IS ASSUMED TO BE 1 FT PER TABLE 4.9 IN VA DEQ STORMWATER DESIGN SPEC. 14. AN INCORPORATION DEPTH OF 2 FT IS USED IN CASES WHERE ADDITIONAL STORAGE CAPACITY IS NEEDED IN ORDER TO MEET WATER QUANTITY REQUIREMENTS.
3. DEVELOPED FROM VA DSWC PLATE 309-1.
4. SEE SHEET 0.7, TEMPORARY RIGHT OF WAY DIVERSION/WATERBAR ADDITIONAL DETAILS FOR PLAN VIEW.

Division Dikes/Waterbars with Compost Schedule				
Drainage Area	Division Dike Identification #	Soil Amendment Depth (D) (ft)	Soil Amendment Width (W) (ft)	Minimum Length of Soil Amendment (L) (ft)
DA-GI-002	WB-G18-001	1	2	30
DA-GI-018C	WB-G18-002	1	2	5
DA-GI-020A	WB-G18-003	1	2	40
DA-GI-022A	WB-G18-004	2	2	26
DA-GI-026D	WB-G18-005	1	2	40
DA-GI-027C	WB-G18-006	1	3	44
DA-GI-028B	WB-G18-007	1	2	33
DA-GI-034A	WB-G18-008	1	2	41

DRAWN	DATE		ENVIRONMENTAL DETAIL DIVERSION DIKE/WATERBARS WITH COMPOST		
CHECKED	DATE				
APPROVED	DATE 06/11/17				
SCALE	N.T.S. SHEET 1 OF 1				
JOB NO.					
PROJECT ID:		DESIGN ENGINEERING	DRAWING NO.		REV.
MVP – VA PORTION			MVP–ES38		P




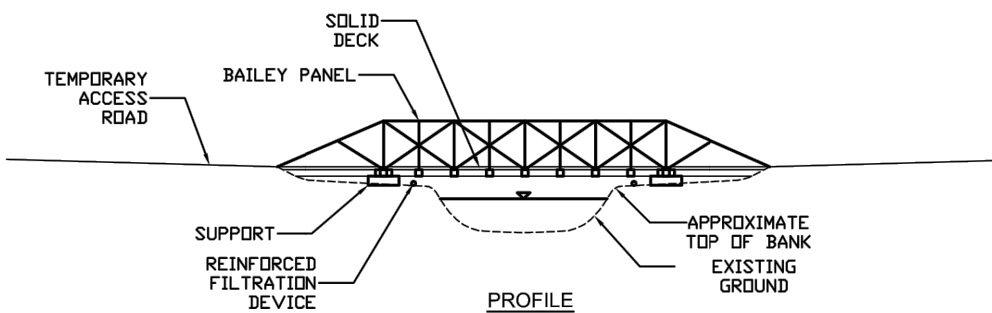
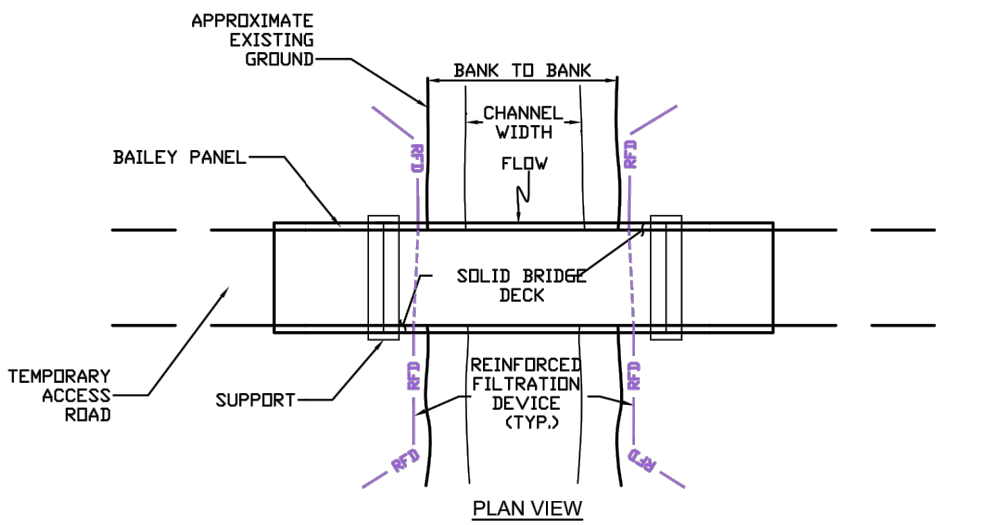
LONGITUDINAL PROFILE



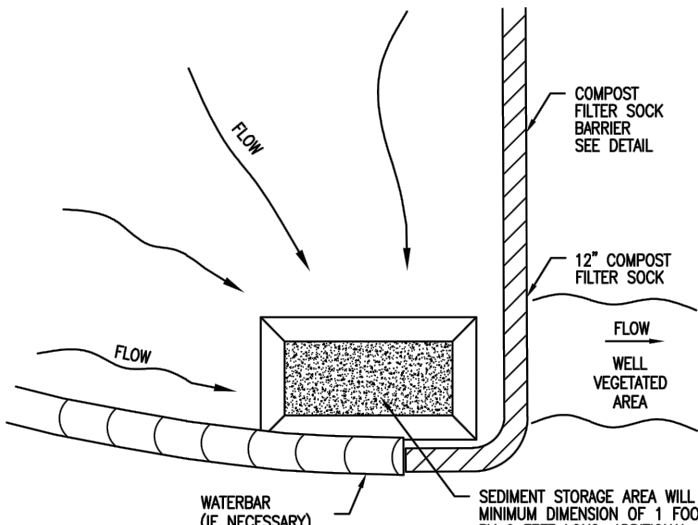
NOTES:

1. GRASS LINED CHANNEL TO BE SIZED PER VIRGINIA BMP CLEARINGHOUSE SPECIFICATION NO. 3.

DRAWN	DATE		ENVIRONMENTAL DETAIL POCAHONTAS ROAD PERMANENT GRASS-LINED CHANNEL		
CHECKED	DATE				
APP'D	DATE 06/11/17				
SCALE	N.T.S. SHEET 1 OF 1				
JOB NO.					
PROJECT ID:		DESIGN ENGINEERING	DRAWING NO.		REV.
MVP – VA PORTION			MVP–ES39		





DRAWN	DATE		ENVIRONMENTAL DETAIL	
CHECKED	DATE			
APPD	DATE 06/11/17			
SCALE N.T.S.	SHEET 1 OF 1		MODULAR TEMPORARY BAILEY BRIDGE	
JOB NO.				
PROJECT ID:		DESIGN ENGINEERING	DRAWING NO.	REV.
MVP – VA PORTION			MVP–ES41	P



NOTES:

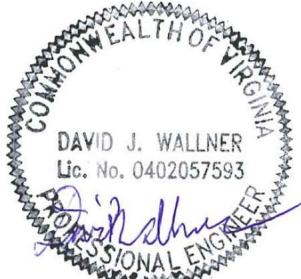
1. SLUMP FILTER MAY BE USED IN CONJUNCTION WITH WATERBAR (AS DIRECTED BY DIVER REPRESENTATIVE).
2. SLUMP FILTER SHALL BE LOCATED ENTIRELY WITHIN PROPOSED RIGHT OF WAY.
3. BMP SHOULD BE CHECKED WEEKLY AND AFTER EACH STORMWATER EVENT FOR SEDIMENT ACCUMULATION, PROPER OPERATION, AND COMPOST FILTER SOCK INTEGRITY.
4. ADDITIONAL COMPOST FILTER SOCKS MAY BE NECESSARY BEYOND WHAT IS SHOWN ON DETAIL TO MEET INTENDED BMP REQUIREMENTS.

DRAWN	DATE		ENVIRONMENTAL DETAIL	
CHECKED	DATE		TYPICAL SLUMP FILTER	
APPROVED	DATE 06/11/17			
SCALE	N.T.S. SHEET 1 OF 1			
JOB NO.			DRAWING NO.	
PROJECT ID:		DESIGN ENGINEERING	MVP-ES42	P
MVP – VA PORTION				

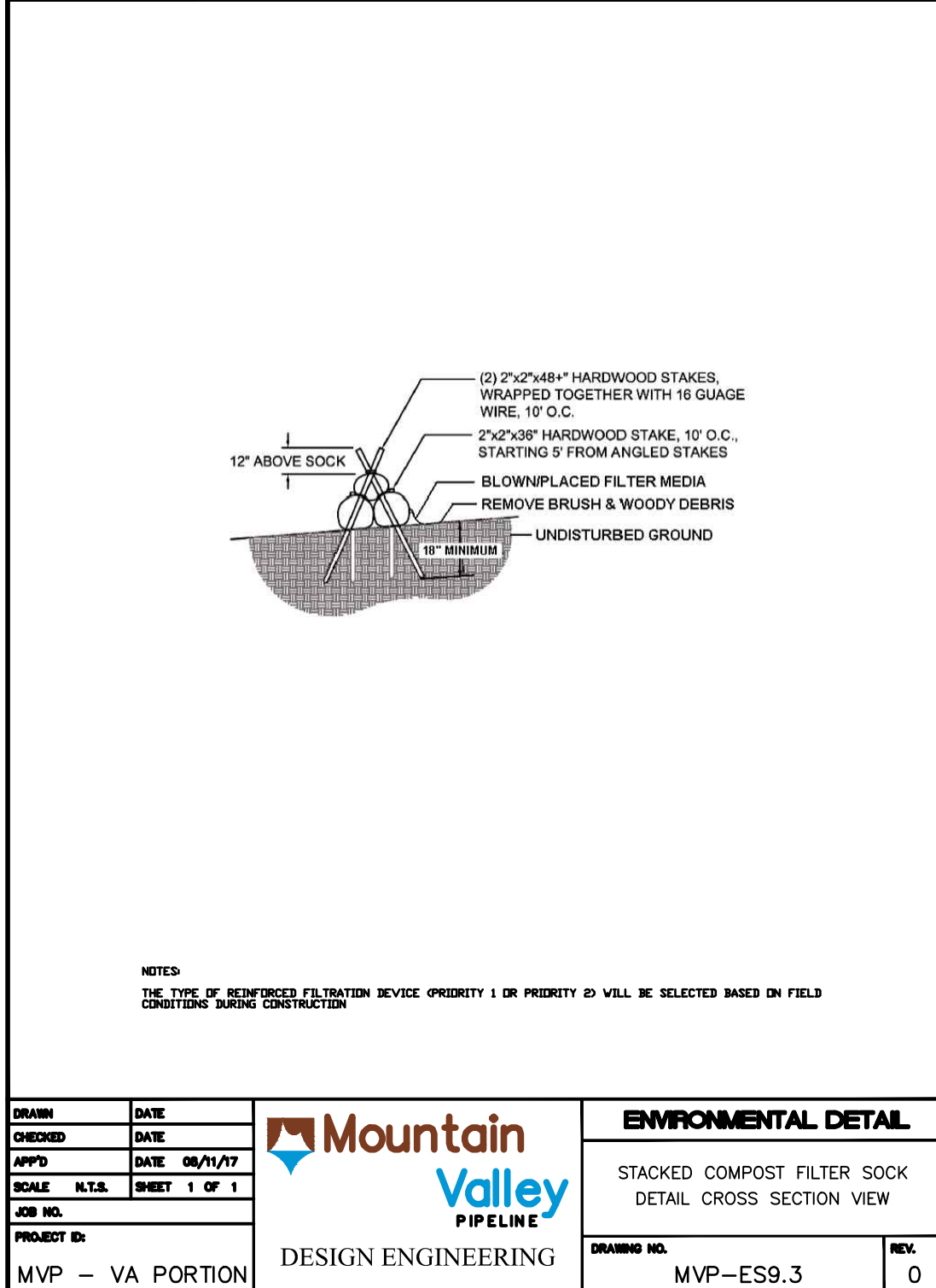
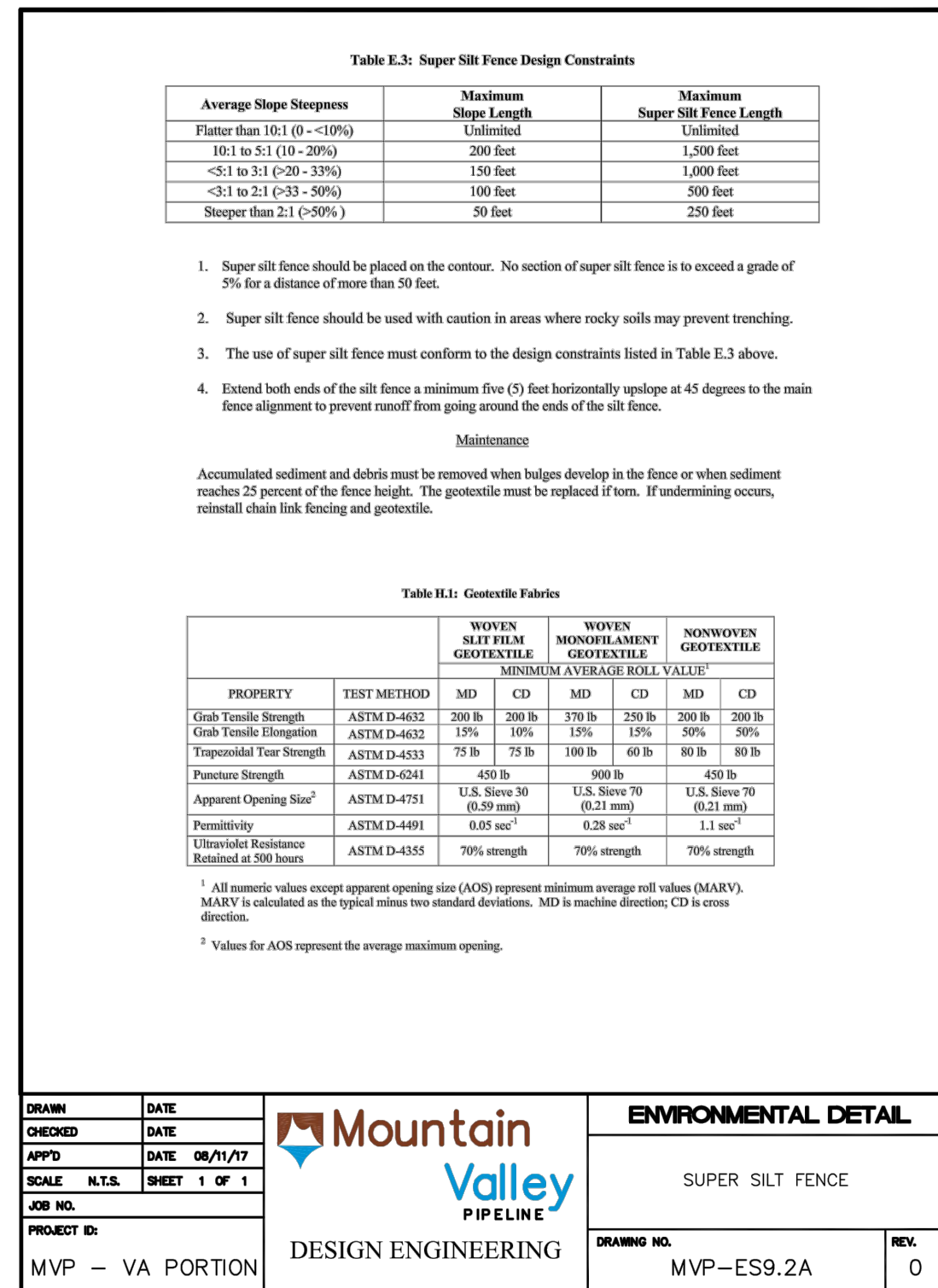
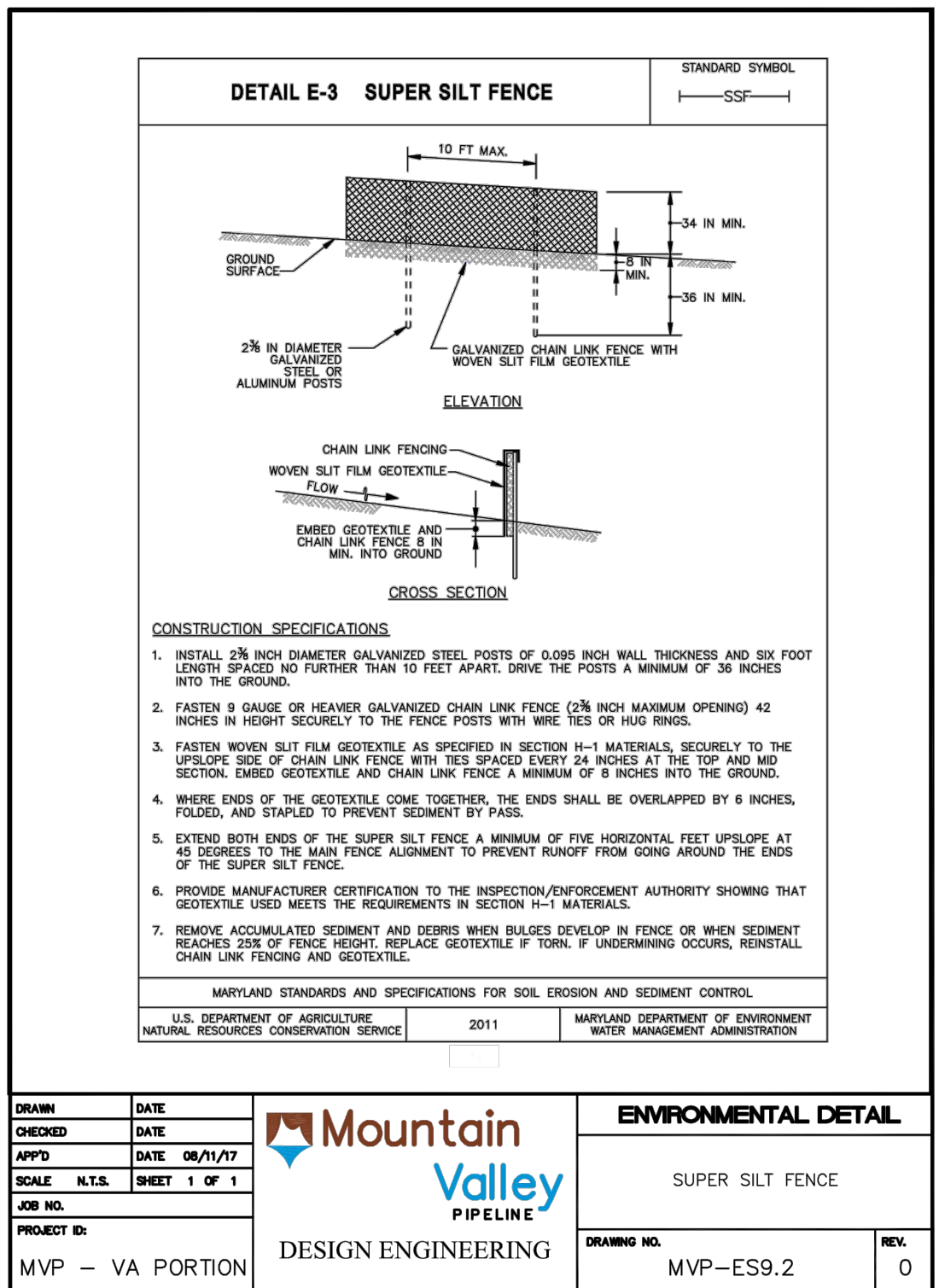
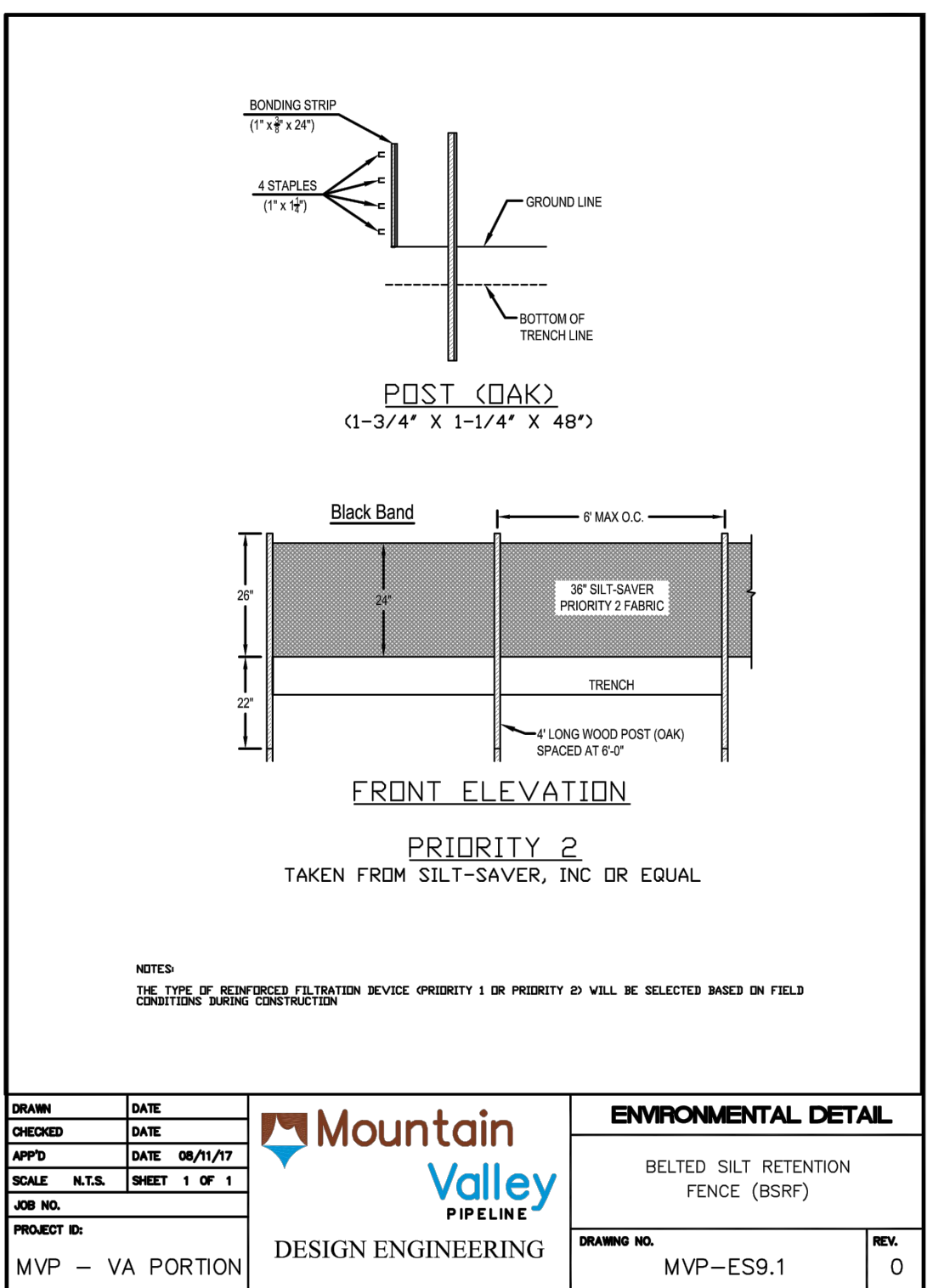
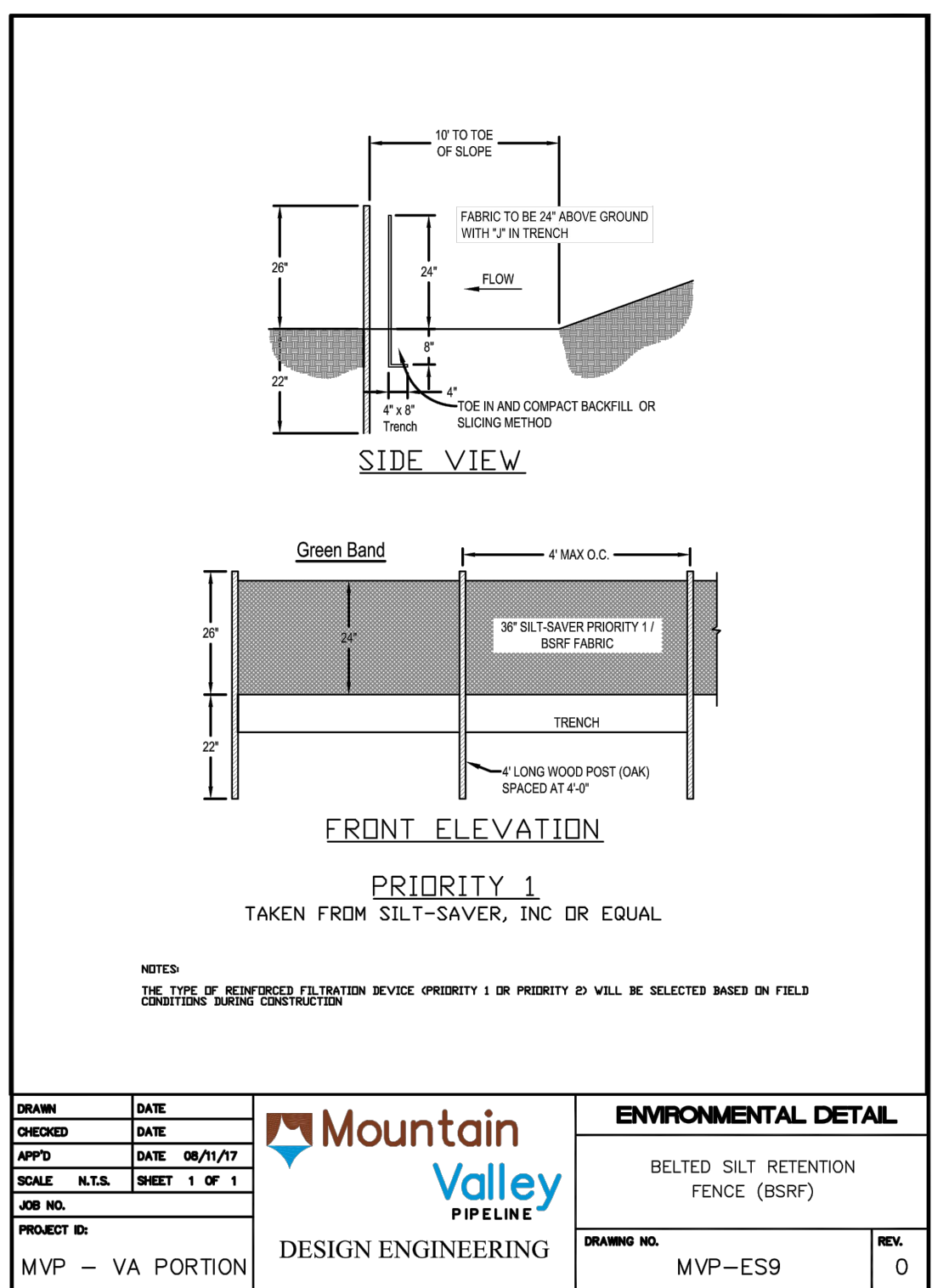
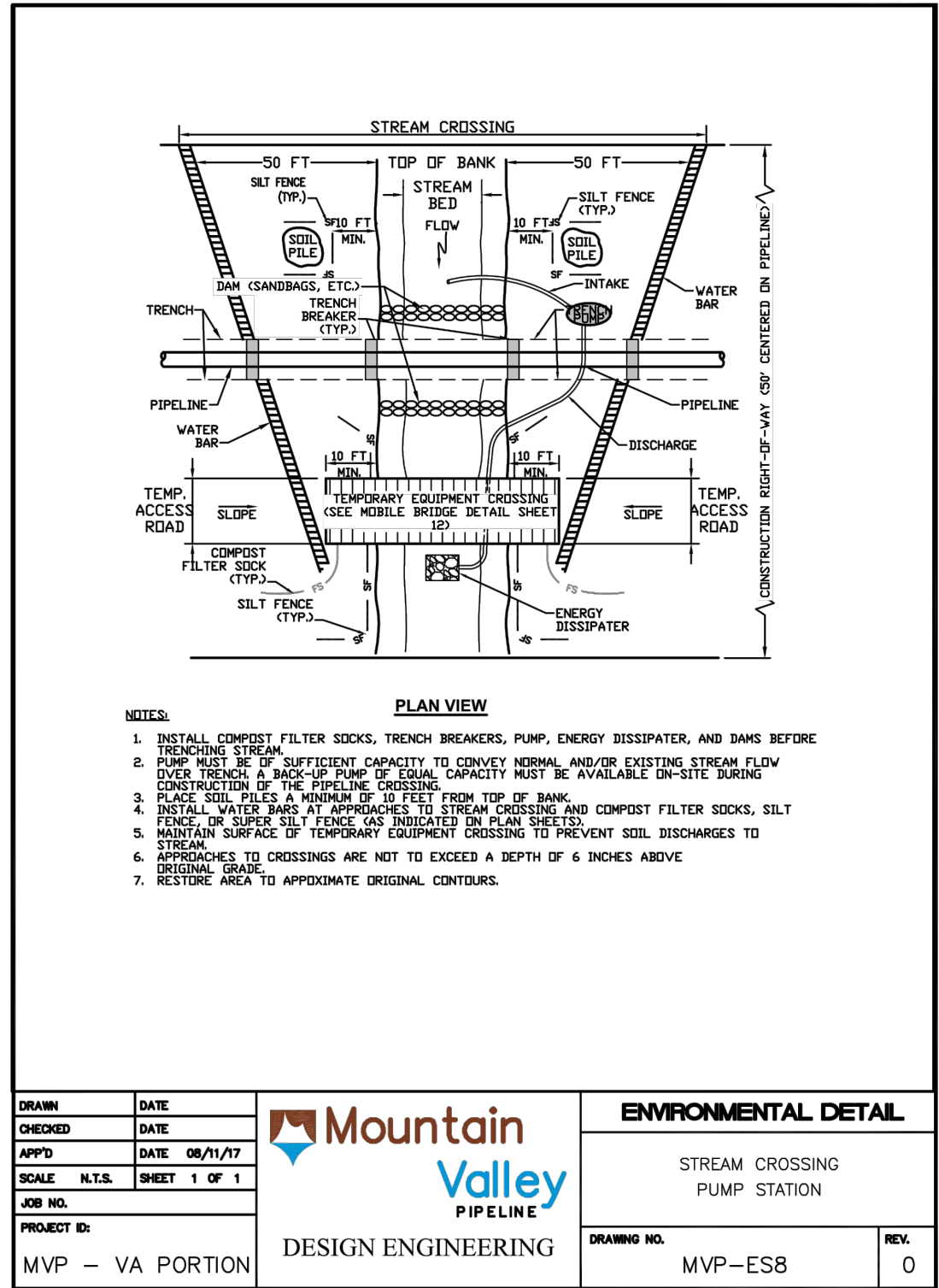
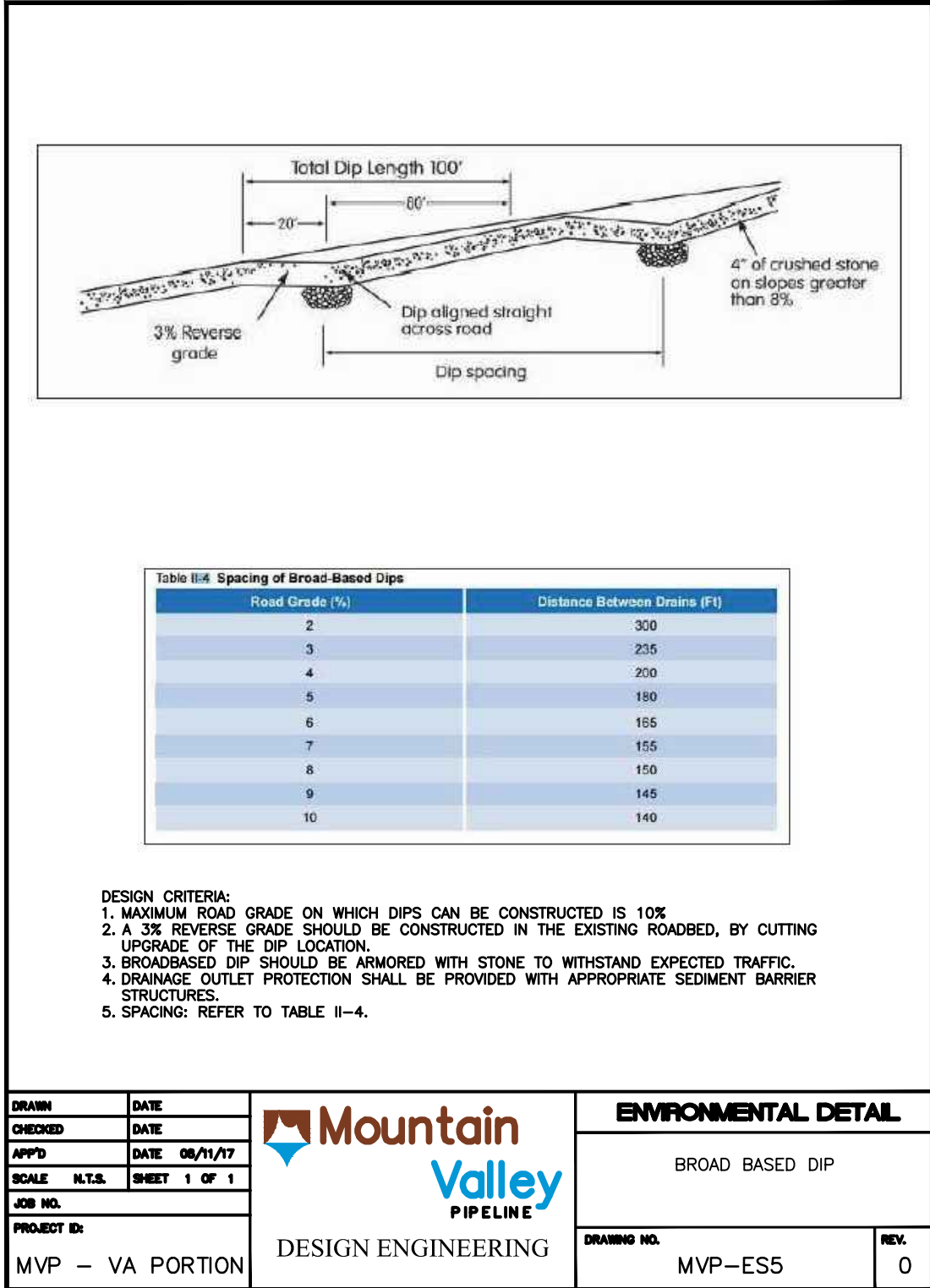

 JEFFERSON NATIONAL FOREST – E&S DETAILS
 MOUNTAIN VALLEY PIPELINE PROJECT – H600 LINE
 GILES COUNTY THROUGH MONTGOMERY COUNTY, VIRGINIA
 MOUNTAIN VALLEY PIPELINE, LLC
 555 SOUTHPOINTE BOULEVARD, SUITE 200
 CANONSBURG, PA 15317

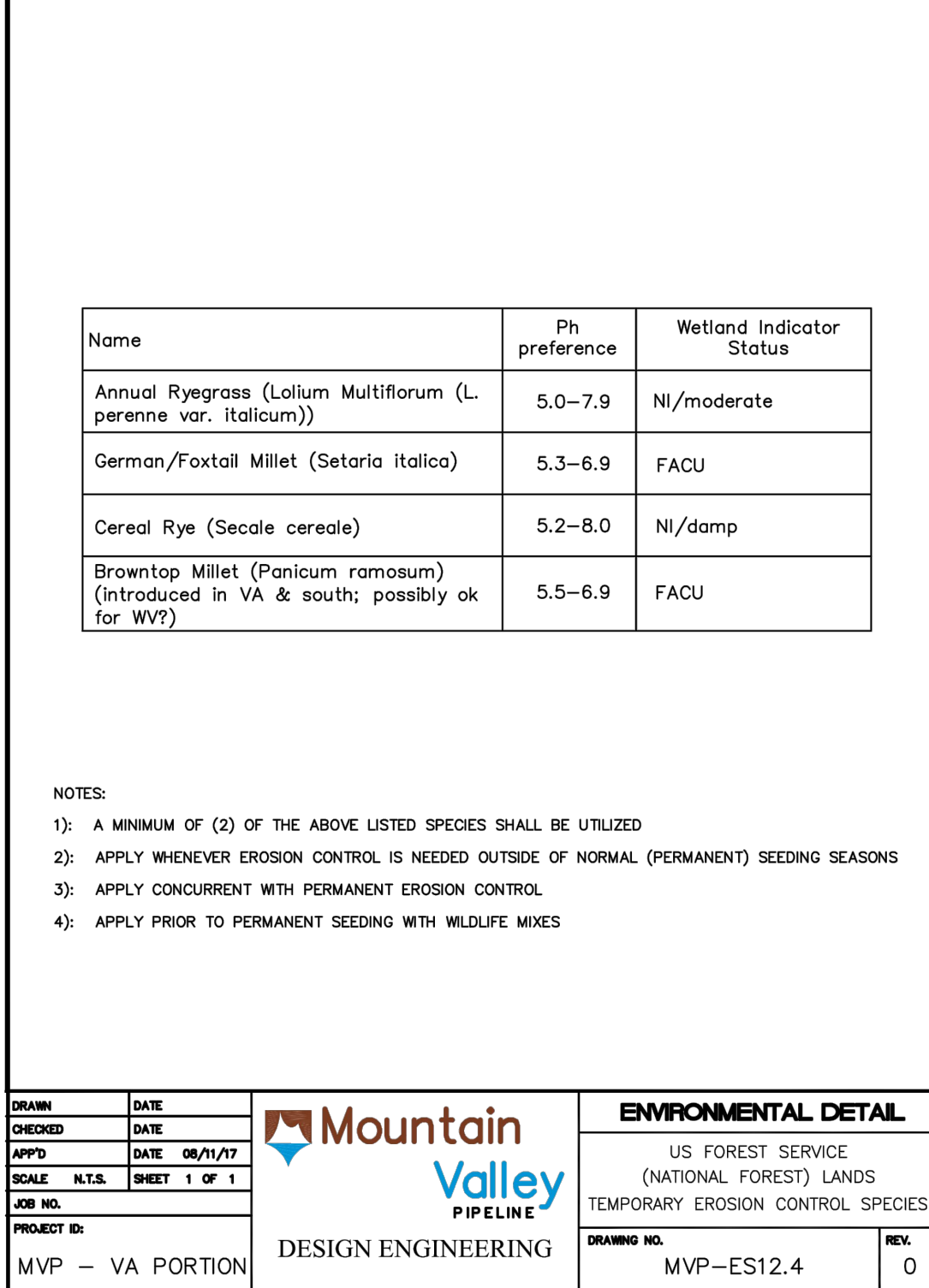
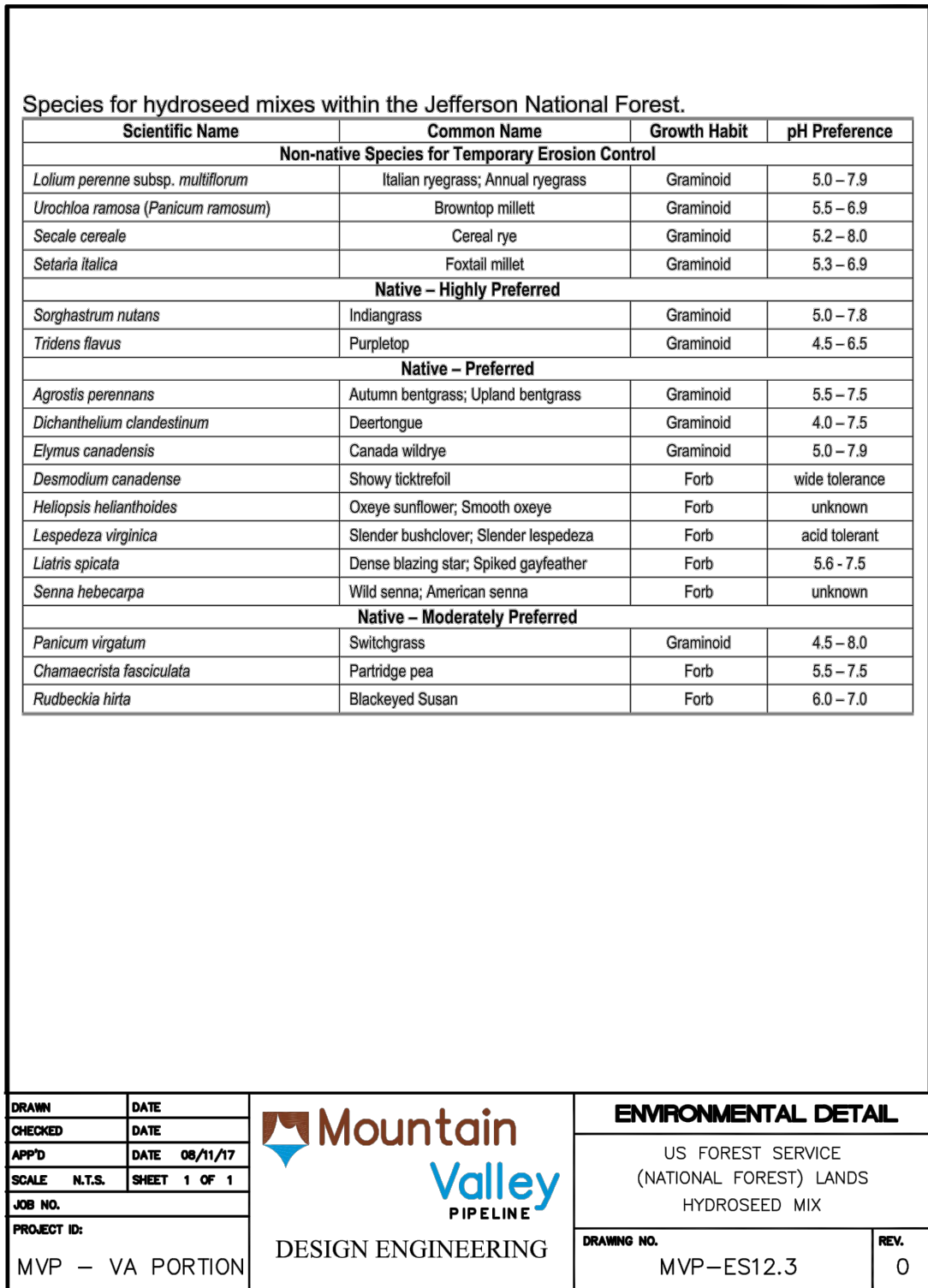
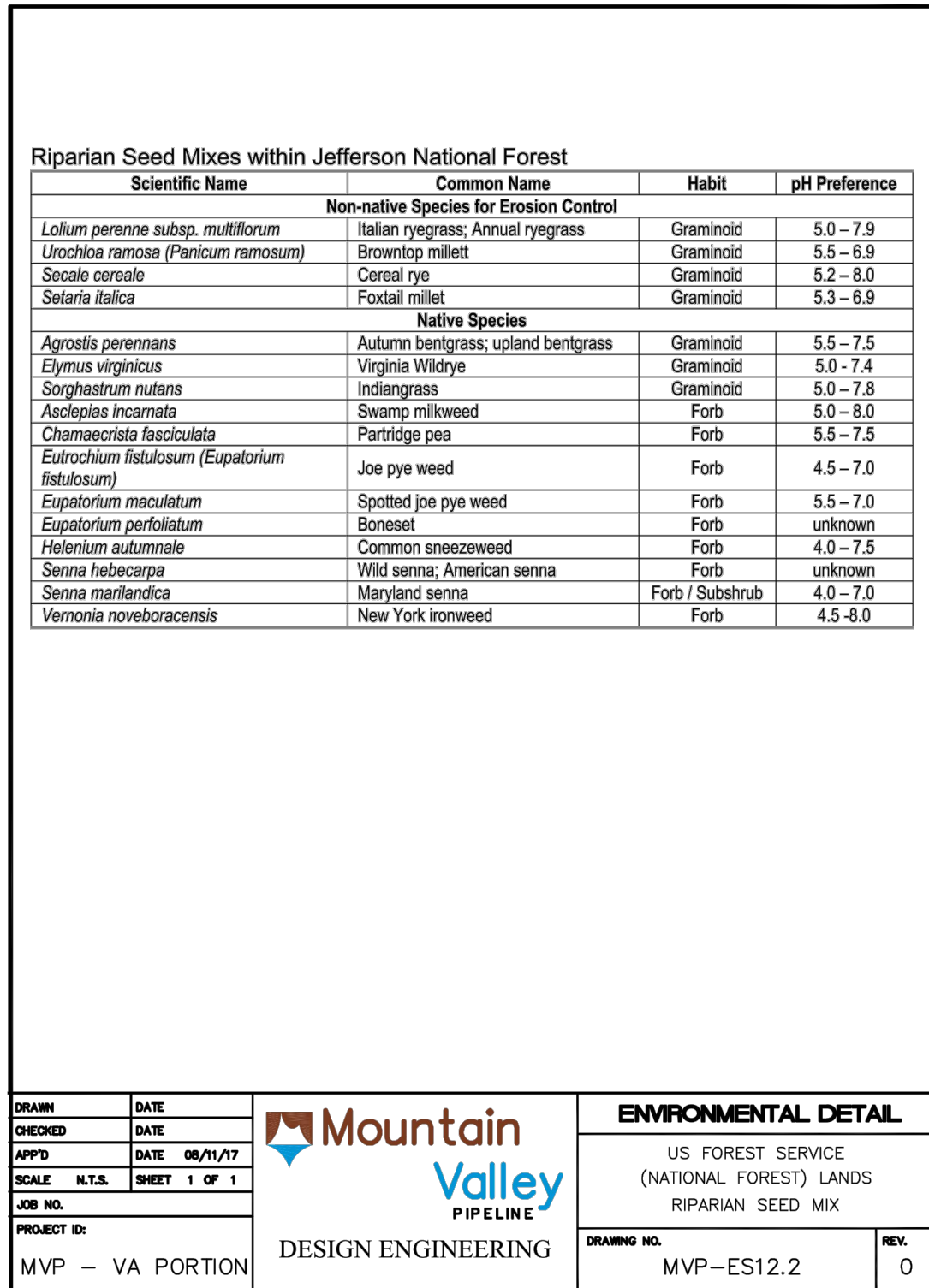
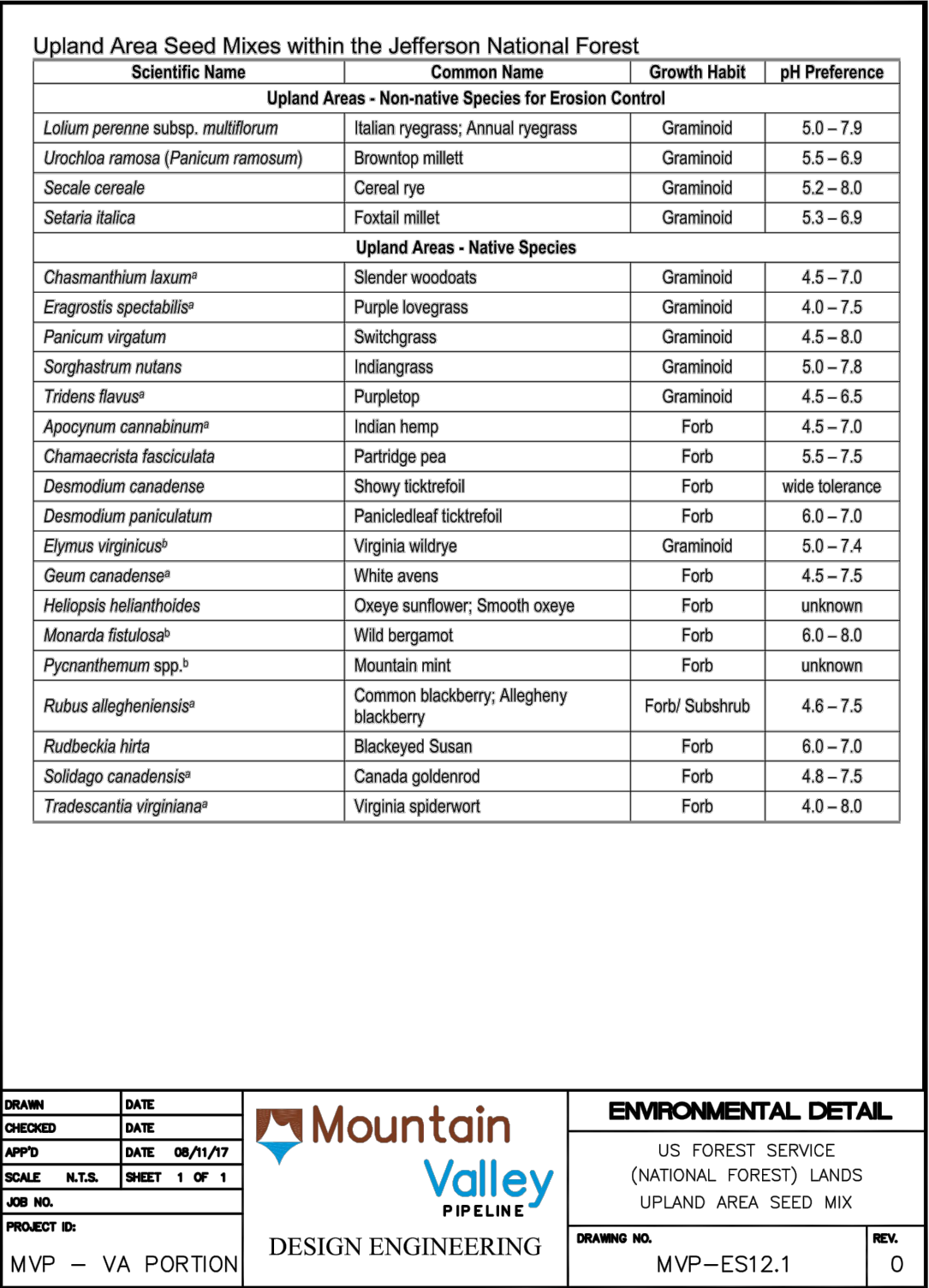
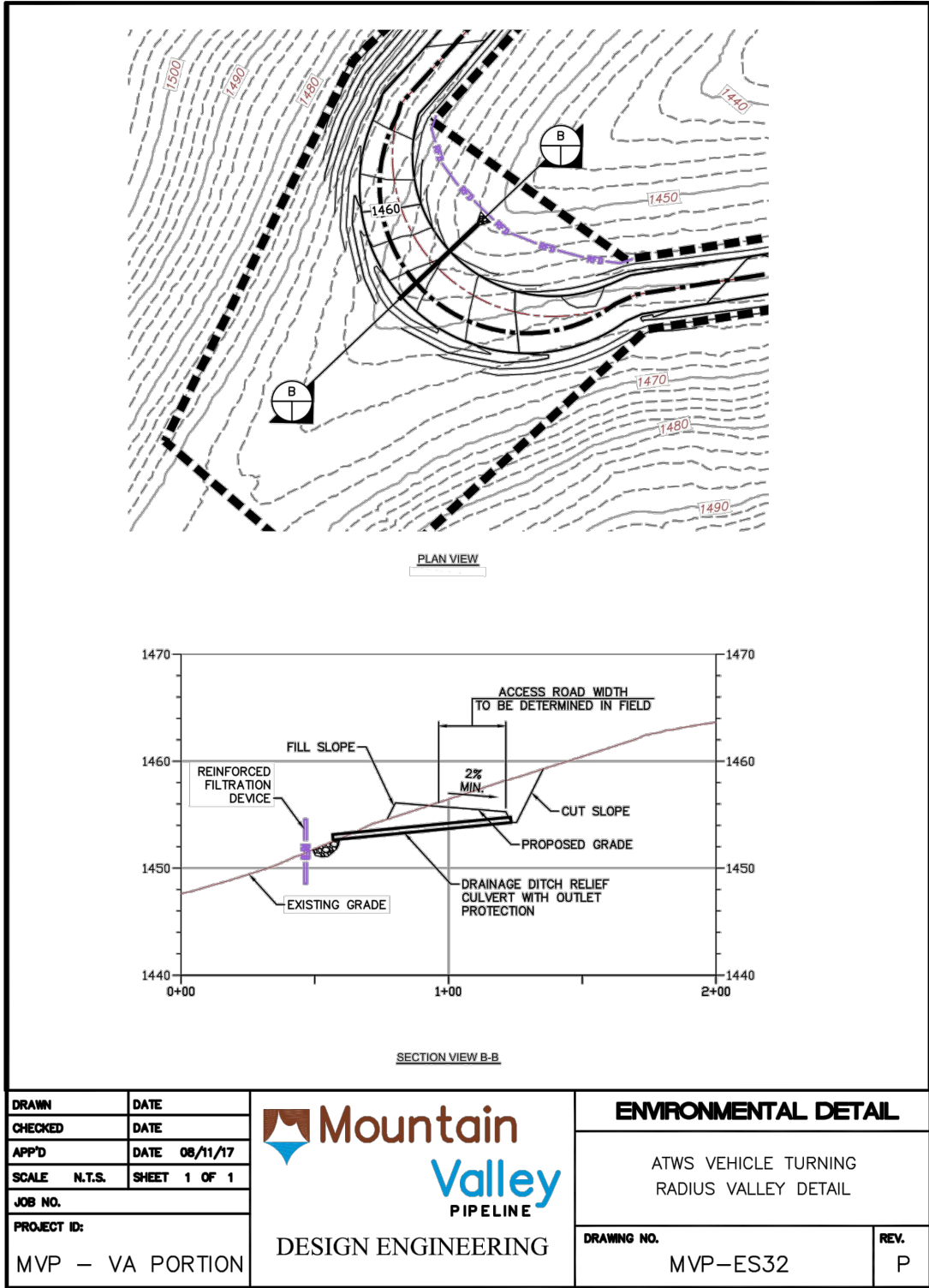
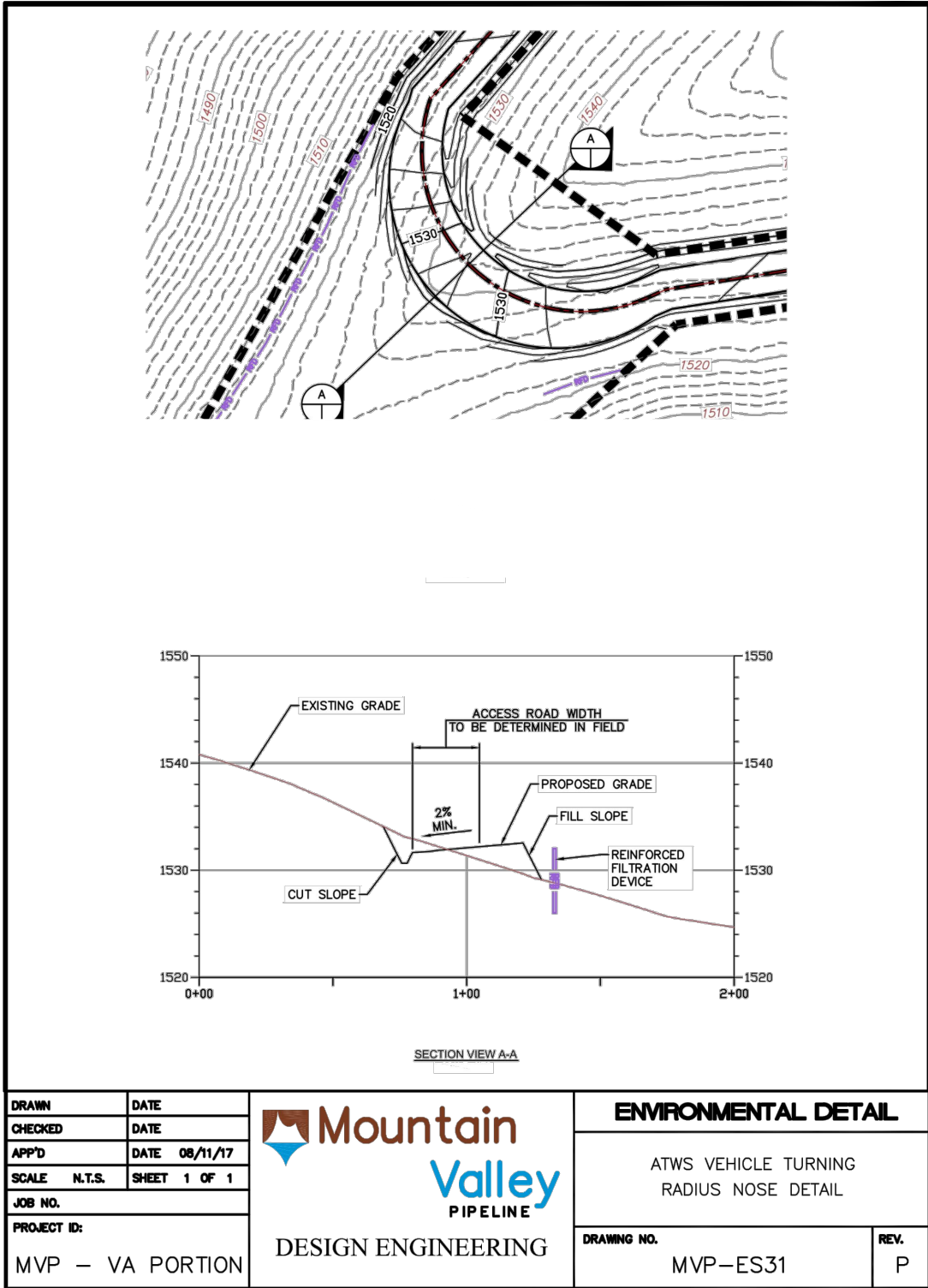
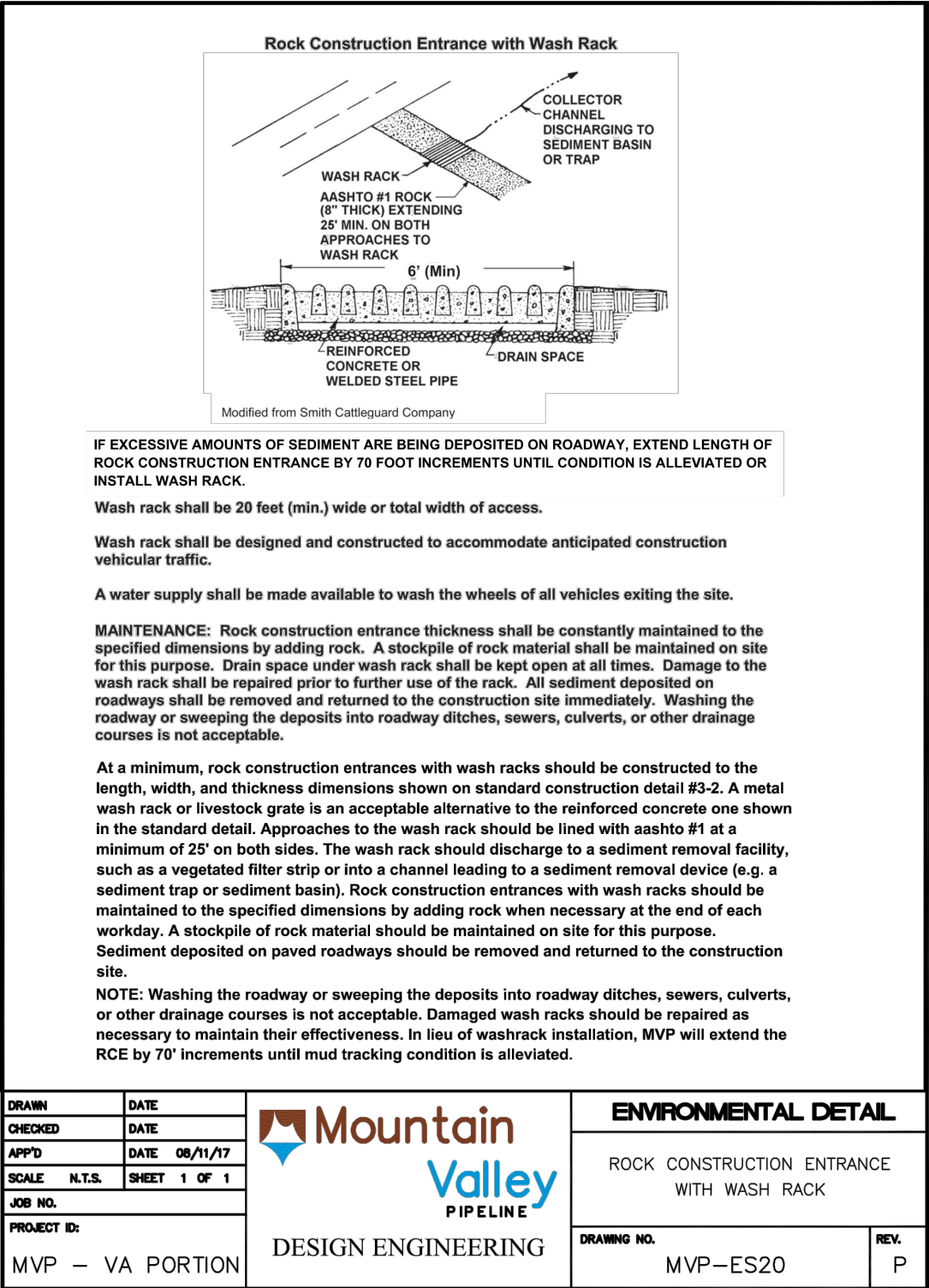
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 FOSTER PLAZA 7
 PITTSBURGH, PA 15220

GENERAL DETAIL SET



DRAWN BY:	KAL
CHECKED BY:	HT
APPROVED BY:	RE
DATE:	10/26/2017
SCALE:	AS SHOWN
SHT. NO. 0.07JNF	OF 13.06JNF





JEFFERSON NATIONAL FOREST - E&S DETAILS
MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE
GILES COUNTY THROUGH MONTGOMERY COUNTY, VIRGINIA

Mountain Valley PIPELINE

NO.:
DATE:
DWN.:
CHKD.:
APPD.:
DESCRIPTION:
REVISIONS:

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661 ANDERSEN DRIVE
FOSTER PLAZA 7
PITTSBURGH, PA 15220

GENERAL DETAIL SET

COMMONWEALTH OF VIRGINIA
DAVID J. WALLNER
Lic. No. 0402057593
Professional Engineer

DRAWN BY: KAL
CHECKED BY: HT
APPROVED BY: RE
DATE: 10/26/2017
SCALE: AS SHOWN
SHT. NO. 0.06JNF OF 13.06JNF

POST-CONSTRUCTION STREAM CROSSING STABILIZATION FOR M.V.P.

Definition

A series of erosion and sediment control measures to limit the formation of rills and/or gullies in the landscape approaching the edge of a stream, river and other waterbody, within the permanent natural gas pipeline right-of-way.

Purpose

To minimize erosion potential along the edge of stream, river or other water body as a result of the change in land use in the permanent right-of-way of a pipeline.

Conditions Where Practice Applies


Applicable to stream, river or other water body crossings within the natural gas pipeline right-of-way.

Planning Considerations

Permanent water bars with compost filter socks and sump filters with discretionary streambank swales are required at all stream, river and other waterbody crossings in accordance with the spacing and sizing requirements shown on Plates 1-4

Based on visual observation of the post-construction field conditions by MVP Design Engineering and the MVP Environmental Inspector, the necessity for and location of streambank swales will be determined. Considerations will include but are not limited to locations where there is visual evidence of existing (or formation of) rills and/or gullies along the streambank and/or concentrated flow along the streambank with anticipated potential for erosion.

Sediment must be periodically removed from the sump filter and compost filter sock to maintain the required depth. Plans shall detail how excavated sediment is to be disposed of, such as by use in fill areas on site or removal to an approved off-site location.

DRAWN	DATE		ENVIRONMENTAL DETAIL
CHECKED	DATE		
APPROVED	DATE		
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Design Criteria

As detailed on Plates 1-3, design criteria per specific erosion and sediment control measures include:

Water Bars / Slope Breakers

Permanent water bars will be installed twenty-five (25) feet from edge of stream, river or other waterbody crossing as shown on Plate 2. Slopes greater than 65% may require site specific stabilization measures based on field conditions as approved by MVP Design Engineering and MVP Environmental Inspector.

Excavation of Sump Filter

Side slopes of sump filter should be no steeper than 1:1. The minimum depth of excavation should be one (1) foot.

Compost Filter Sock

Since the sump filter will function as a pre-treatment for sediment removal, calculation of the 2-year velocity over the compost filter sock size conservatively assumes that the sump filter is full of sediment and in need of maintenance and that no flow is occurring through the sock due to clogging or sediment deposition.

The outfall velocity from this BMP should be non-erosive for the 2-year design storm. The 2-year velocities shall meet the criteria in Table 3.99-D-A. Due to the anticipated small size of contributing drainage area, the Rational Method shall be used to calculate discharge:

$$Q = CIA$$

where,

$$Q = \text{discharge (ft}^3/\text{sec)}$$
$$i = \text{Rainfall intensity (inches/hour)}$$
$$A = \text{Contributing drainage area (acres)}$$

Discharge over the compost filter sock is calculated using the broad-crested weir equation:

$$Q = C_d L H^{3/2}$$

where,

$$Q = \text{Discharge over weir (ft}^3/\text{sec)}$$
$$C_d = \text{Weir Coefficient}$$
$$L = \text{Length of weir crest (ft)}$$
$$H = \text{Overlapping depth (ft)}$$

The velocity over the weir is calculated using the following equation:

$$v = Q/A$$

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where,

$$v = \text{Velocity (ft/sec)}$$
$$Q = \text{Discharge over weir (ft}^3/\text{sec)}$$
$$A = \text{Flow area over weir (ft}^2\text{)}$$

TABLE 3.99-D-A PERMISSIBLE VELOCITIES FOR EARTH LININGS	
Soil Types	Corrected Permissible Velocities (ft/sec.)
Fine Sand (noncolloidal)	2.0
Sandy Loam (noncolloidal)	2.0
Silt Loam (noncolloidal)	2.4
Ordinary Firm Loam	2.8
Fine Gravel	4.0
Stiff Clay (very colloidal)	4.0
Graded, Loam to Cobbles (noncolloidal)	4.0
Graded, Silt to Cobbles (colloidal)	4.4
Alluvial Silts (noncolloidal)	4.4
Alluvial Silts (colloidal)	4.0
Coarse Gravel (noncolloidal)	4.8
Cobbles and Shingles	4.4
Shales and Hard Pans	4.8

NOTE: Correction factor value = 0.8 for flow depths less than one foot has been applied to original table.
Source: Chapter 5, Engineering Calculations: Table 5-22 and Plate 5-39, *Virginia Erosion and Sediment Control Handbook*, 3rd Ed., 1992.

Example

Given: A one-acre drainage area in Giles County, an 18-inch diameter compost filter sock with an effective level weir length of 8 feet, in a Sandy Loam soil installed per details in Plate 2.

Solution:

- Calculate the discharge:
 $Q = CIA = 0.9 \times 4.07 \text{ inches/hour} \times 1 \text{ acre} = 3.66 \text{ ft}^3/\text{sec}$
- Rearranging the weir equation to solve for overtopping depth:
 $H = (Q/(C_d \times L))^2 = (3.66 \text{ ft}^3/\text{sec} / (2.99 \times 8 \text{ ft}))^2 = 0.29 \text{ ft}$
- Calculate the velocity over the compost filter sock:

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$$v = Q/A = 3.66 \text{ ft}^3/\text{sec} / (0.29 \text{ ft} \times 8 \text{ ft}) = 1.60 \text{ ft/sec}$$

4. Verify that the velocity is non-erosive in Table 3.99-D-A for Sandy Loam soil.
 $1.60 \text{ ft/sec} < 2.0 \text{ ft/sec}$

Streambank Swale

Minimum thickness (T_s , as shown on Streambank Swale Typical Cross Section on Plate 3) shall be two (2) times the D_{50} . For drainage areas one (1) acre or less, rock shall have a minimum $D_{50} = 6"$ and $T = 12$ inches for stream banks with a slope of 1:1 or flatter (i.e. $S_s=1.0$ ft/ft). If the contributing drainage area is greater than one (1) acre or if the swale is steeper than 1:1 (1.0 ft/ft), the plans shall provide calculations to determine an appropriate size stone and minimum thickness. Rock may be salvaged on-site materials and may contain topsoil, fines, sand, gravel in a mix with at least 60% rock with a D_{50} of at least 6".

Calculations (from VDOT Drainage Manual Appendix 7B-5)

Given: A one-acre drainage area in Giles County from previous example.

Solution:

CHANNEL DATA

$$Q = 3.66 \text{ (cfs)} \quad P = 3.02 \text{ (ft)} \quad n = 0.069$$

$$S_s = 1.00 \text{ (ft/ft)} \quad R = 0.18 \text{ (ft)}$$

$$d_s = 0.37 \text{ (ft)} \quad V_s = 6.81 \text{ (fps)}$$

$$A = 0.54 \text{ (ft}^2\text{)} \quad \text{Side Slope} = 4:1$$

ASSUMED ROCK SIZE - $D_{50} = 0.5 \text{ ft}$

VERIFY ASSUMED ROCK SIZE

$$\phi = 41.2^\circ \text{ (Appendix 7E-1)}$$

$$\text{Side Slope} = 4:1 \quad \alpha = 14^\circ$$

$$K_1 = [1 - (\sin^2 \theta / \sin^2 \phi)]^{0.5}$$

$$K_1 = [1 - (\sin^2 14^\circ / \sin^2 41.5^\circ)]^{0.5} = 0.93$$

For Specific Gravity = 2.65 and Stability Factor = 1.2

$$D_{50} = 0.001 \times V_s^2 / (d_m^{0.15} \times K_1^{1.5})$$

$$D_{50} = 0.001 \times 6.81^2 / (0.5^{0.15} \times 0.93^{1.5}) = 0.45 \text{ ft}$$

$$D_{50} \text{ Computed } (0.45) < D_{50} \text{ Assumed } (0.5)$$

Therefore, assumed D_{50} is appropriate.

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Construction Specifications

General

- All trees, brush, stumps, roots, obstructions and other unsuitable material shall be removed and disposed of properly.
- Disturbed areas will be returned to pre-construction conditions. Topsoil shall be replaced in accordance with the Mountain Valley Pipeline Project Specific Standards and Specifications.
- Existing suitable stream substrate shall be salvaged and replaced to streambed at pre-construction contours.
- The swales shall be excavated or shaped to the proper grade and cross-section.
- Any excess soil shall be removed and disposed of properly.

Water Bars / Slope Breakers

- Water bars / slope breakers shall be installed in accordance with WATER BAR, TYPICAL SLOPE BREAKER (SB), Std. & Spec. MVP-17 and MVP-18.
- Permanent water bars are required at all stream, river and other waterbody crossings, as well as upslope from roadway and roadcut cut slopes.
- Construct permanent water bars with compost filter sock after completion of grading in accordance with the water bar spacing and sizing requirements shown on plan and in table on Plate 3.
- Water bar closest to stream top of bank shall be located twenty-five (25) feet maximum upslope from top of bank.
- Water bars shall have a slope of one to four percent.
- Water bars on retired roadways, skidtrails, and right-of-ways shall be left in place after permanent stabilization has been achieved.

Compost Filter Socks


- Compost filter socks shall be installed in accordance with COMPOST FILTER SOCK, Std. & Spec. MVP ES-3.
- Compost filter socks shall extend at least ten feet upslope from the uppermost limit of the sump filter.

Sump Filters

- Sump filters to be installed at end of water bars. Refer to sump filter detail on Plate 2.
- Sump filter shall be located entirely within the permanent right-of-way.
- Sediment storage area shall be excavated to a minimum dimension of one-foot-deep by three-feet-wide by six-feet-long. Additional storage, if required due to a larger contributing drainage area, will either be added through increasing the sump filter dimension or stacking compost filter sock to increase BMP height.

Streambank Swales

Streambank swales shall be installed at locations determined by MVP Design Engineering and the MVP Environmental Inspector based on their visual observation of the post-construction field conditions.

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Locations shall include but are not limited to locations where there is visual evidence of formation of rills and/or gullies along the streambank and/or evidence of concentrated flow along the streambank with anticipated potential for erosion.


- On-site salvaged rock and/or riprap, if on-site rock is not salvagable, shall be installed in accordance with RIPRAP, Std. & Spec. 3.19.
- Erosion control fabric shall be installed along the edges of the riprap-lined channel as shown on Plate 3 in accordance with SOIL STABILIZATION BLANKETS AND MATTING, Std. & Spec. 3.36.

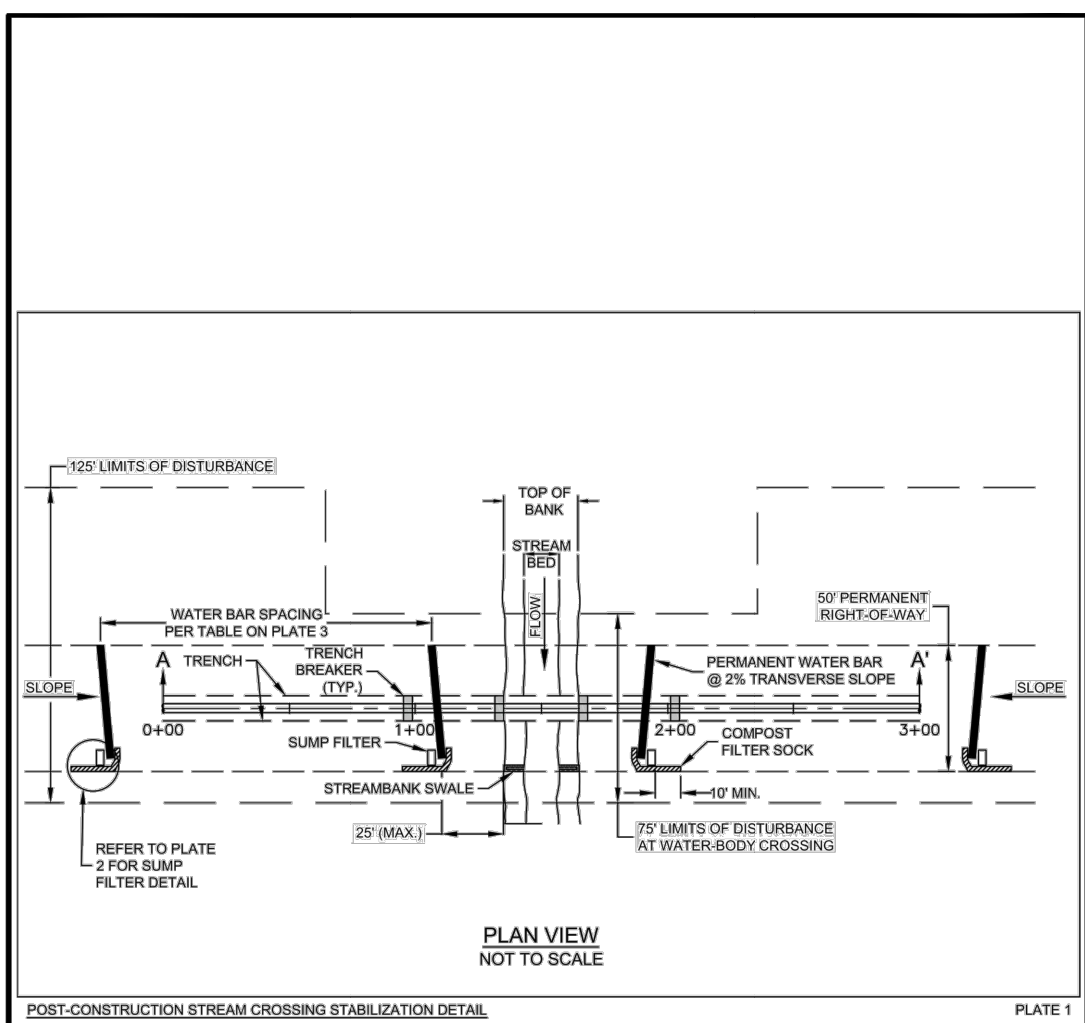
Inspections and Maintenance

- Inspections shall be conducted at a frequency of (i) at least once every four business days or (ii) at least once every five business days and no later than 48-hours following a measurable storm event.
- Damaged or eroded water bars shall be restored to original dimensions within 24-hours of inspection.
- Compost filter sock shall be inspected for sediment accumulation, integrity, and maintained as necessary. Accumulated sediment shall be removed when it reaches no more than half the aboveground height of the sock and disposed in the manner described elsewhere in the plan. Damaged socks shall be repaired according to manufacturer's specifications or replaced within 24 hours of inspection.
- Sump filter shall be inspected for sediment accumulation and proper operation. Sediment shall be removed and the sump filter restored to original dimensions when sediment has accumulated to half the design depth. Sediment removal from the sump shall be deposited in a suitable area and in such a manner that it will not erode and cause sedimentation problems.
- Streambank swales shall be inspected for integrity and proper operation. Damaged or eroded streambank swales shall be restored to original dimension within 24-hours of inspection.
- If during inspection, additional rills and/or gullies are observed, streambank swales shall be installed in accordance with the construction specifications herein at these locations within 24-hours of inspection.
- Maintenance of water bars, compost filter socks and sump filters shall be provided until roadway, skidtrail, or right-of-way has achieved permanent stabilization.

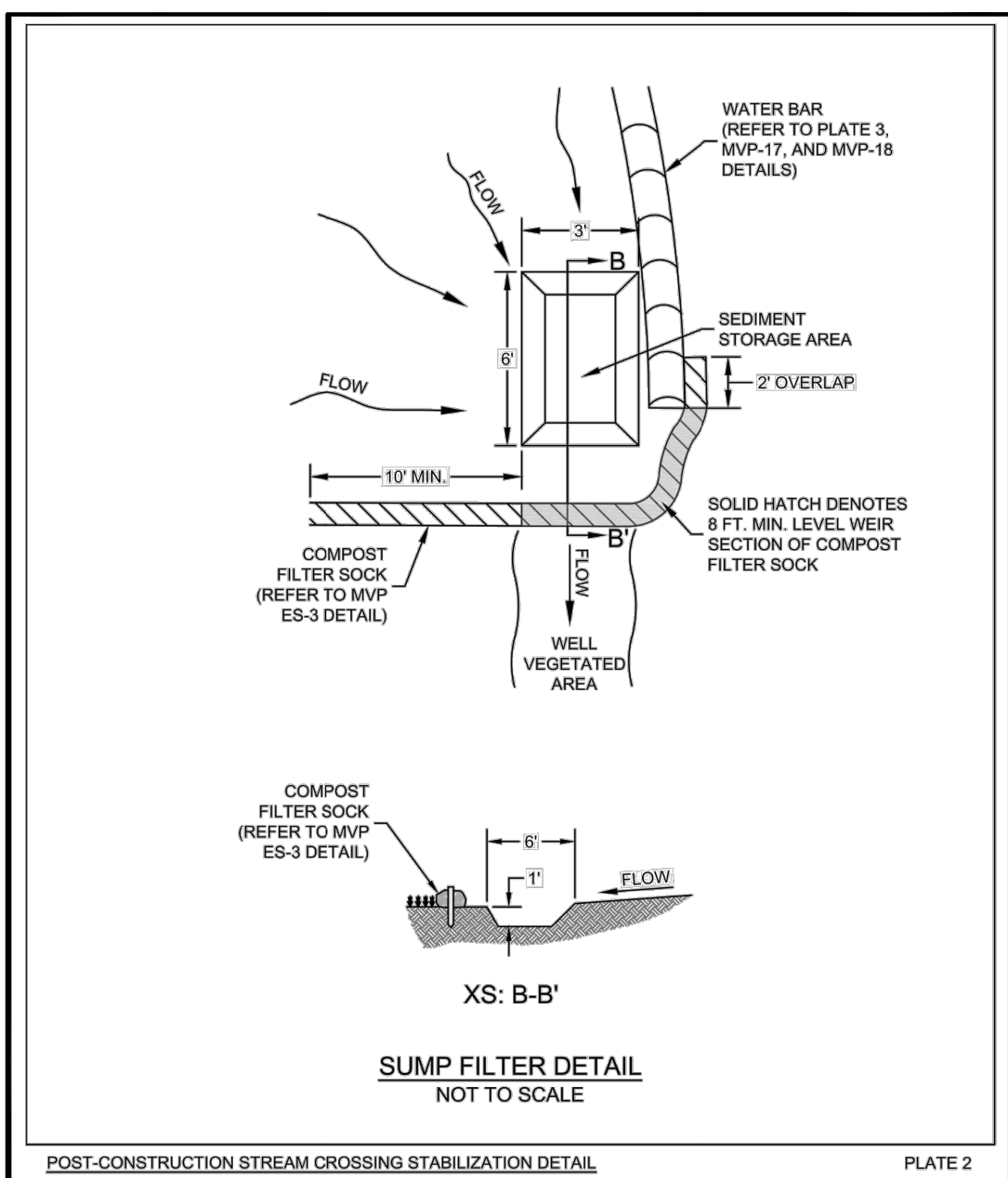
Post Stabilization

Once permanent stabilization has been achieved, sediment storage should be seeded with permanent seed mix in accordance with the Mountain Valley Pipeline Project Specific Standards and Specifications. Compost filter socks shall remain to decompose in place and streambank swales shall remain in place.

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JEFFERSON NATIONAL FOREST - E&S DETAILS
MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE
GILES COUNTY THROUGH MONTGOMERY COUNTY, VIRGINIA

MOUNTAIN VALLEY PIPELINE, LLC
555 SOUTHPOINTE BOULEVARD, SUITE 200
CANONSBURG, PA 15317

TETRA TECH

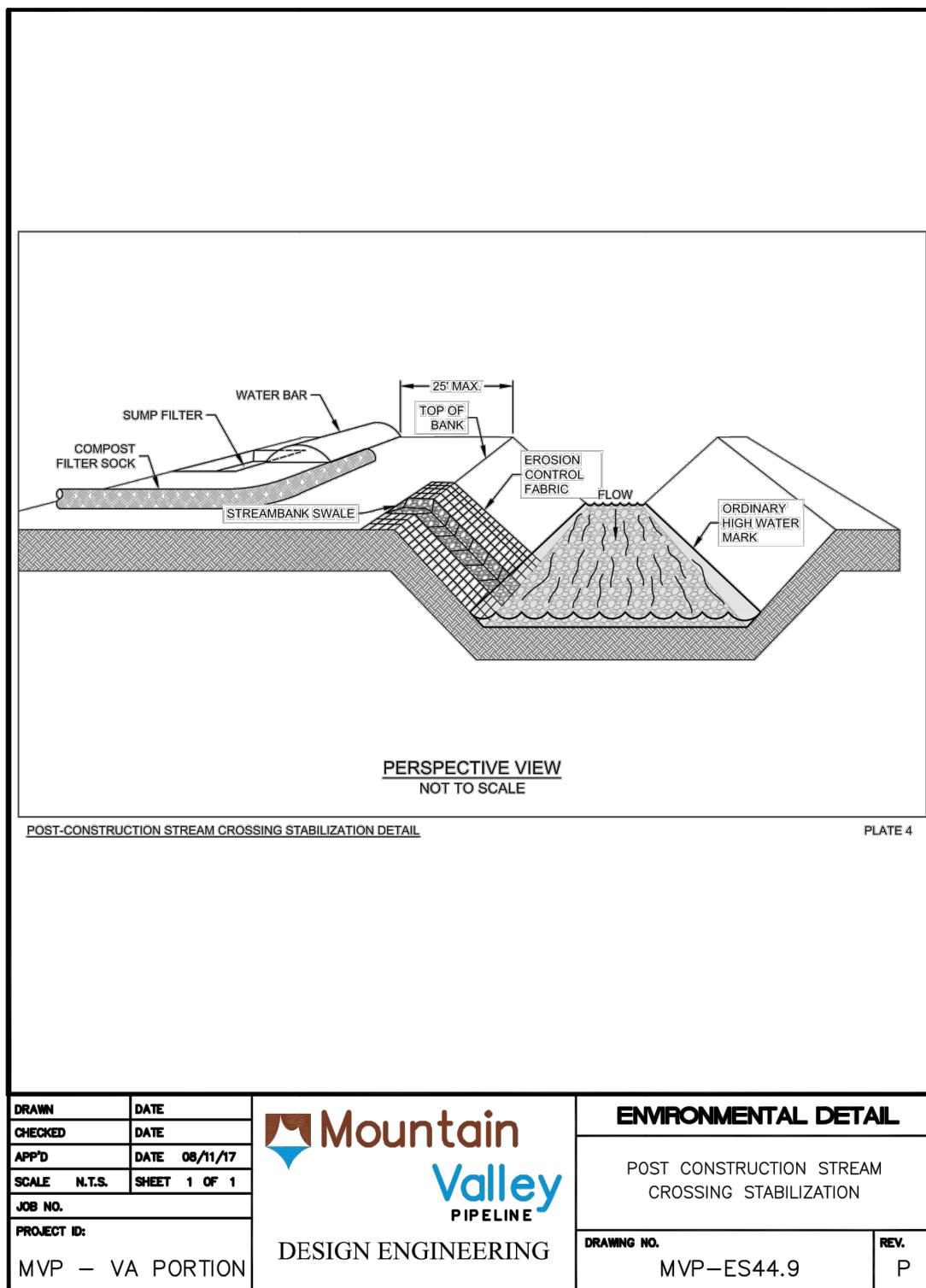
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COMMONWEALTH OF PENNSYLVANIA
DAVID J. WALLNER
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Professional Engineer

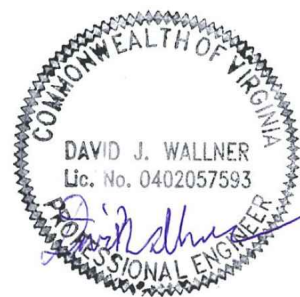
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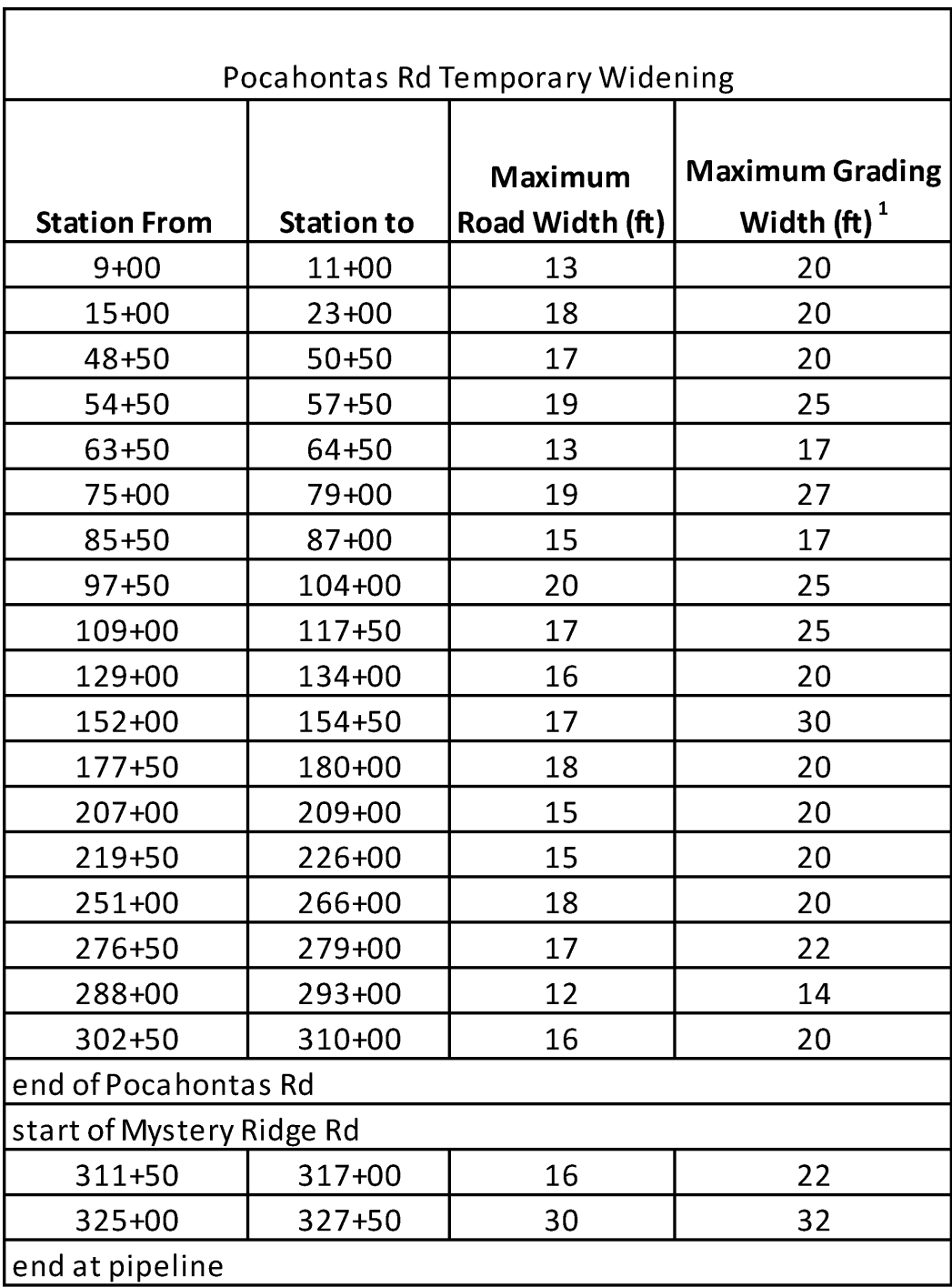
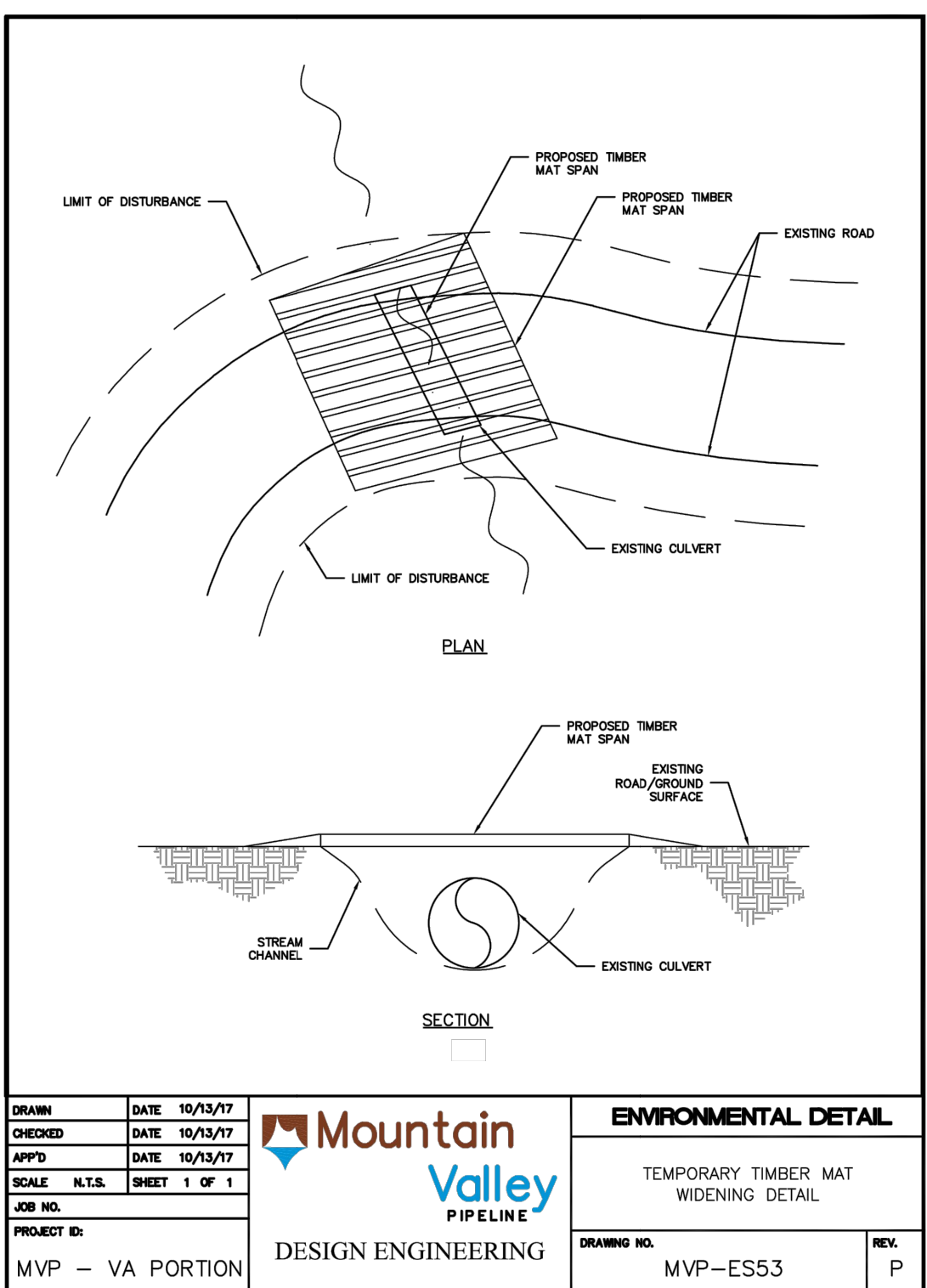


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Appendix K-53



Appendix K-54