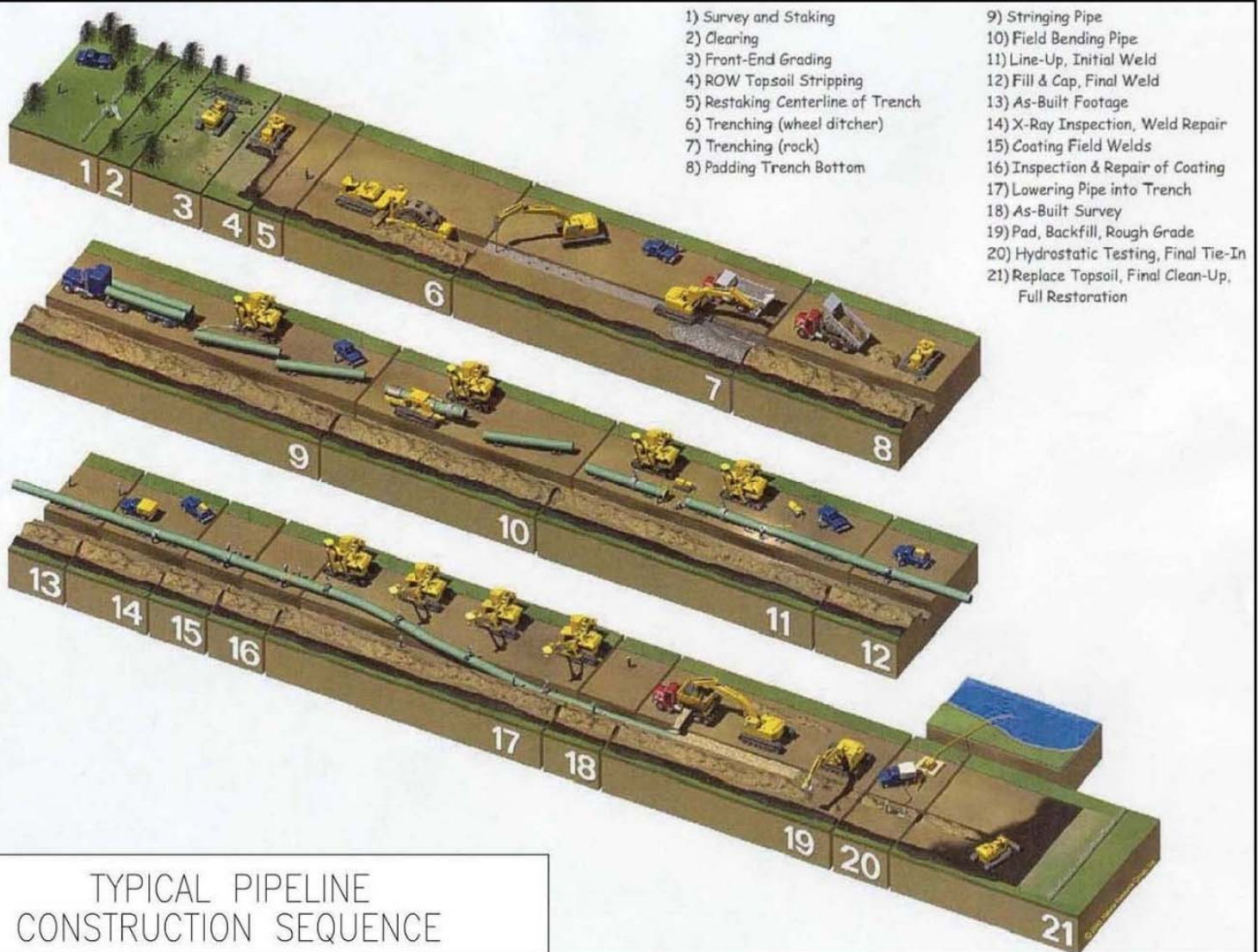
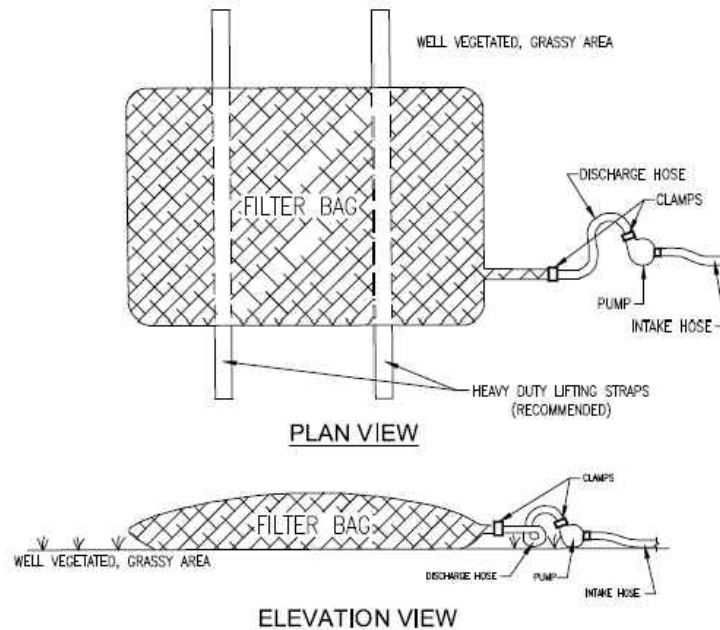


APPENDIX B - FIGURES





LOW VOLUME FILTER BAGS SHALL BE MADE FROM NON-WOVEN GEOTEXTILE MATERIAL SEWN WITH HIGH STRENGTH, DOUBLE STITCHED "J" TYPE SEAMS. THEY SHALL BE CAPABLE OF TRAPPING PARTICLES LARGER THAN 150 MICRONS. HIGH VOLUME FILTER BAGS SHALL BE MADE FROM WOVEN GEOTEXTILES THAT MEET THE FOLLOWING STANDARDS:

Property	Test Method	Minimum Standard
Avg. Wide Width Strength	ASTMD-4884	60 lb/in
Grab Tensile	ASTMD-4632	205 lb
Puncture	ASTMD-4833	110 lb
Mullen Burst	ASTMD-3786	350 psi
UV Resistance	ASTMD-4355	70%
AOS % Retained	ASTMD-4751	80 Sieve

A SUITABLE MEANS OF ACCESSING THE BAG WITH MACHINERY REQUIRED FOR DISPOSAL PURPOSES SHALL BE PROVIDED. FILTER BAGS SHALL BE REPLACED WHEN THEY BECOME $\frac{1}{2}$ FULL OF SEDIMENT. SPARE BAGS SHALL BE KEPT AVAILABLE FOR REPLACEMENT OF THOSE THAT HAVE FAILED OR ARE FILLED. BAGS SHALL BE PLACED ON STRAPS TO FACILITATE REMOVAL UNLESS BAGS COME WITH LIFTING STRAPS ALREADY ATTACHED.


BAGS SHALL BE LOCATED IN WELL-VEGETATED (GRASSY) AREA, AND DISCHARGE ONTO STABLE, EROSION RESISTANT AREAS. WHERE THIS IS NOT POSSIBLE, A GEOTEXTILE UNDERLAYMENT AND FLOW PATH SHALL BE PROVIDED. BAGS MAY BE PLACED ON FILTER STONE TO INCREASE DISCHARGE CAPACITY. BAGS SHALL NOT BE PLACED ON SLOPES GREATER THAN 5%. FOR SLOPES EXCEEDING 5%, CLEAN ROCK OR OTHER NON-ERODIBLE AND NON-POLLUTING MATERIAL MAY BE PLACED UNDER THE BAG TO REDUCE SLOPE STEEPNESS.

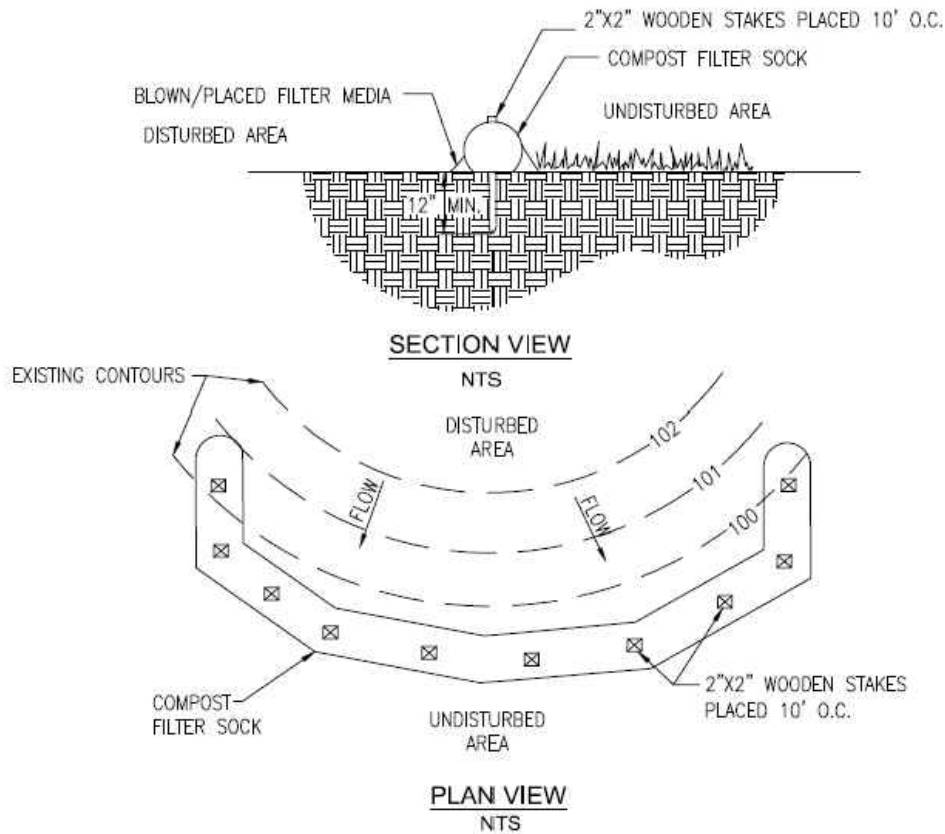
NO DOWNSLOPE SEDIMENT BARRIER IS REQUIRED FOR MOST INSTALLATIONS. COMPOST BERM OR COMPOST FILTER SOCK SHALL BE INSTALLED BELOW BAGS LOCATED IN HQ OR EV WATERSHEDS, WITHIN 50 FEET OF ANY RECEIVING SURFACE WATER OR WHERE GRASSY AREA IS NOT AVAILABLE.

THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED. A PIECE OF PVC PIPE IS RECOMMENDED FOR THIS PURPOSE.

THE PUMPING RATE SHALL BE NO GREATER THAN 750 GPM OR $\frac{1}{2}$ THE MAXIMUM SPECIFIED BY THE MANUFACTURER, WHICHEVER IS LESS. PUMP INTAKES SHALL BE FLOATING AND SCREENED.

FILTER BAGS SHALL BE INSPECTED DAILY. IF ANY PROBLEM IS DETECTED, PUMPING SHALL CEASE IMMEDIATELY AND NOT RESUME UNTIL THE PROBLEM IS CORRECTED.

DRAWN	DATE	 Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL	
CHECKED	DATE		PUMPED WATER FILTER BAG	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DESIGN ENGINEERING MVP-ES2	DRAWING NO.
PROJECT ID:	PXXXX			0



SOCK FABRIC SHALL MEET STANDARDS OF TABLE 4.1. COMPOST SHALL MEET THE STANDARDS OF TABLE 4.2.

COMPOST FILTER SOCK SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE SOCK SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN SOCK ALIGNMENT. MAXIMUM SLOPE LENGTH ABOVE ANY SOCK SHALL NOT EXCEED MAXIMUM PERMISSIBLE SLOPE LENGTH ABOVE COMPOST FILTER SOCKS. STAKES MAY BE INSTALLED IMMEDIATELY DOWNSLOPE OF THE SOCK IF SO SPECIFIED BY THE MANUFACTURER.

TRAFFIC SHALL NOT BE PERMITTED TO CROSS FILTER SOCKS.

ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES HALF THE ABOVEGROUND HEIGHT OF THE SOCK AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN.

SOCKS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED SOCKS SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.

BIODEGRADABLE FILTER SOCKS SHALL BE REPLACED AFTER 6 MONTHS; PHOTODEGRADABLE SOCKS AFTER 1 YEAR. POLYPROPYLENE SOCKS SHALL BE REPLACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

UPON STABILIZATION OF THE AREA TRIBUTARY TO THE SOCK, STAKES SHALL BE REMOVED. THE SOCK MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH SHALL BE CUT OPEN AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.


DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		COMPOST FILTER SOCK	
APP'D	DATE			
SCALE	N.T.S.		DRAWING NO.	REV.
JOB NO.	SHEET 1 OF 1			
PROJECT ID:			MVP-ES3	0
PXXXX				

TABLE 4.1

Compost Sock Fabric Minimum Specifications

Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photo-degradable	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable
Sock Diameters		12"	12"	12"	12"
	12"	18"	18"	18"	18"
	18"	24"	24"	24"	24"
		32"	32"	32"	32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Tensile Strength		26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years
Two-ply systems					
Inner Containment Netting			HDPE biaxial net		
			Continuously wound		
			Fusion-welded junctures		
			3/4" X 3/4" Max. aperture size		
Outer Filtration Mesh			Composite Polypropylene Fabric (Woven layer and non-woven fleece mechanically fused via needle punch)		
			3/16" Max. aperture size		
Sock fabrics composed of burlap may be used on projects lasting 6 months or less.					

TABLE 4.2

Compost Standards

Organic Matter Content	80% - 100% (dry weight basis)
Organic Portion	Fibrous and elongated
pH	5.5 - 8.0
Moisture Content	35% - 55%
Particle Size	98% pass through 1" screen
Soluble Salt Concentration	5.0 dS/m (mmhos/cm) Maximum

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


 DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

COMPOST FILTER SOCK
TABLES

DRAWING NO.


MVP-ES3.1

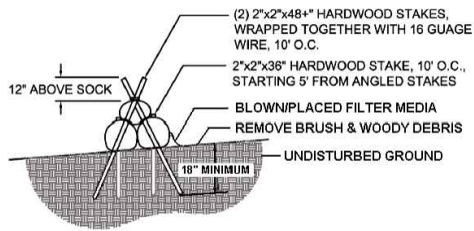
REV.

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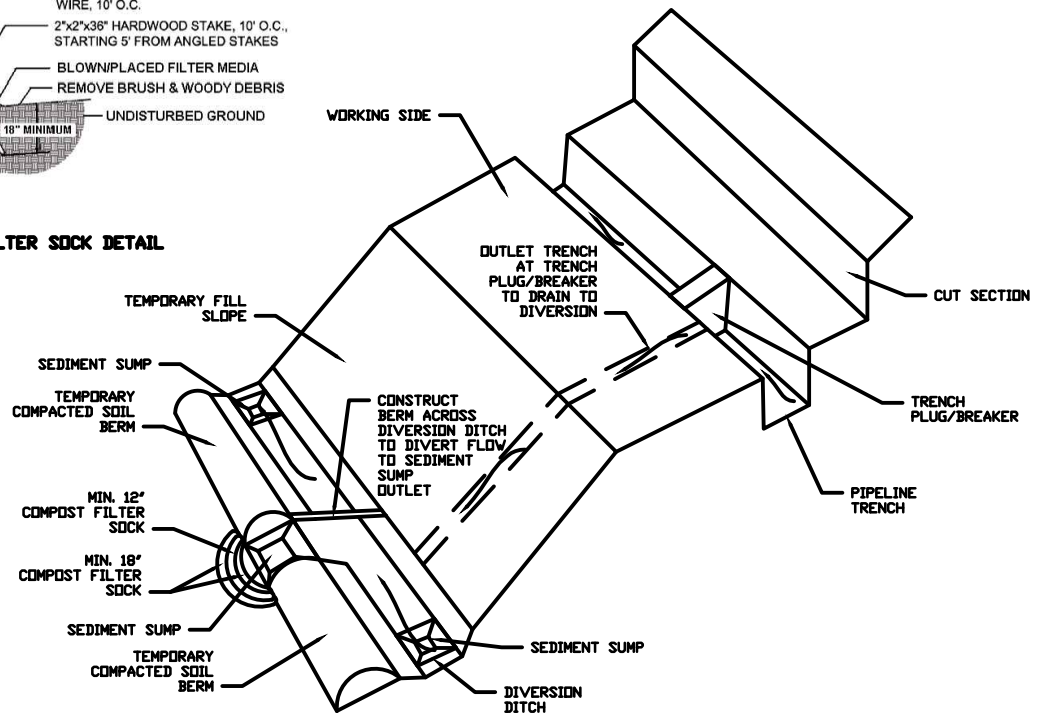
Slope Percent	Maximum Slope Length for Compost Filter Sock in Feet				
	Note: Table developed from Filtrexx Sediment Control product cut sheet by Filtrexx International, LLC. As a general reference. Refer to manufacturers specifications for brand of compost filter sock used.				
	8 in	12 in	18 in	24 in	32 in
2 (or less)	600	750	1000	1300	1650
5	400	500	550	650	750
10	200	250	300	400	500
15	140	170	200	325	450
20	100	125	140	260	400
25	80	100	110	200	275
30	60	75	90	130	200
35	60	75	80	115	150
40	60	75	80	100	125
45	40	50	60	80	100
50	40	50	55	65	75

**MAXIMUM SLOPE LENGTH ABOVE COMPOST FILTER
SOCK AND RECOMMENDED DIAMETER**

DRAWN	DATE	 <p style="font-size: 1.2em; margin: 0;">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		<p>COMPOST FILTER SOCK TABLES</p>	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX		MVP-ES3.2	0	



STACKED COMPOST FILTER SOCK DETAIL



NOTES:

1. TEMPORARY RIGHT OF WAY DIVERSION AND OUTLET INTENDED FOR USE IN LIEU OF SILT FENCING OR COMPOST FILTER SOCK ALONG STRAIGHT SECTIONS OF RIGHT OF WAY LOCATED NEAR RIDGE LINES OR OTHER UPLAND AREAS WHICH ARE 200 FT OR MORE UPSLOPE OF IDENTIFIED STREAMS OR WETLANDS.
2. ROLLED EROSION CONTROL PRODUCT AND/OR MULCHING SHALL BE USED TO STABILIZE THE TEMPORARY COMPACTED SOIL BERM, DIVERSION DITCH, AND TEMPORARY FILL SLOPE.
3. THE DIVERSION DITCH SHALL BE SIZED BASED ON THE DRAINAGE AREA AND STD & SPEC 3.12 (DIVERSION) DETAILED IN THE VESCH.
4. SPOIL FROM THE PIPELINE TRENCH TO BE USED TO CONSTRUCT THE TEMPORARY SOIL BERM.
5. OUTLET TRENCH TO BE CUT FROM THE PIPELINE TRENCH TO THE DIVERSION DITCH AT TRENCH PLUGS/BREAKERS AND AT LOW POINTS IN THE PIPELINE TRENCH.
6. TEMPORARY FILL SLOPE TO BE CONSTRUCTED NO STEEPER THAN 2H:1V.
7. SIDE SLOPES OF TEMPORARY SOIL BERM AND DIVERSION DITCH SHALL BE NO STEEPER THAN 2H:1V.
8. ENDS OF COMPOST FILTER SOCK AT SUMP OUTLET TO BE TURNED UPSLOPE AND BUTTED UP AGAINST THE BERM TO PREVENT FLOW FROM PASSING AROUND COMPOST FILTER SOCK.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

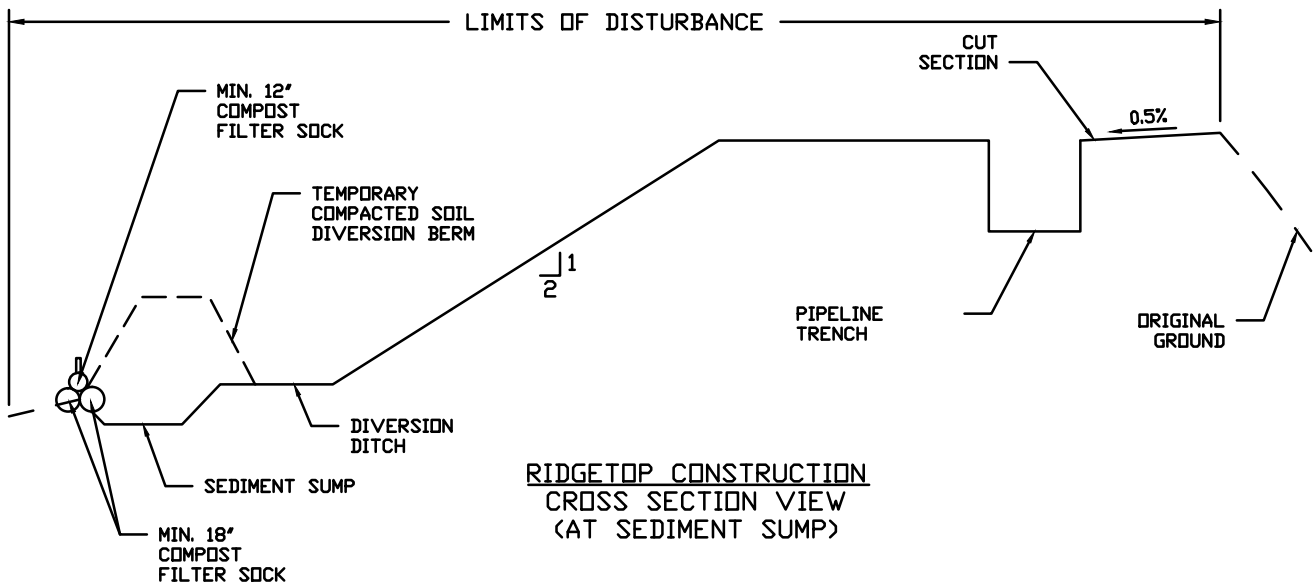
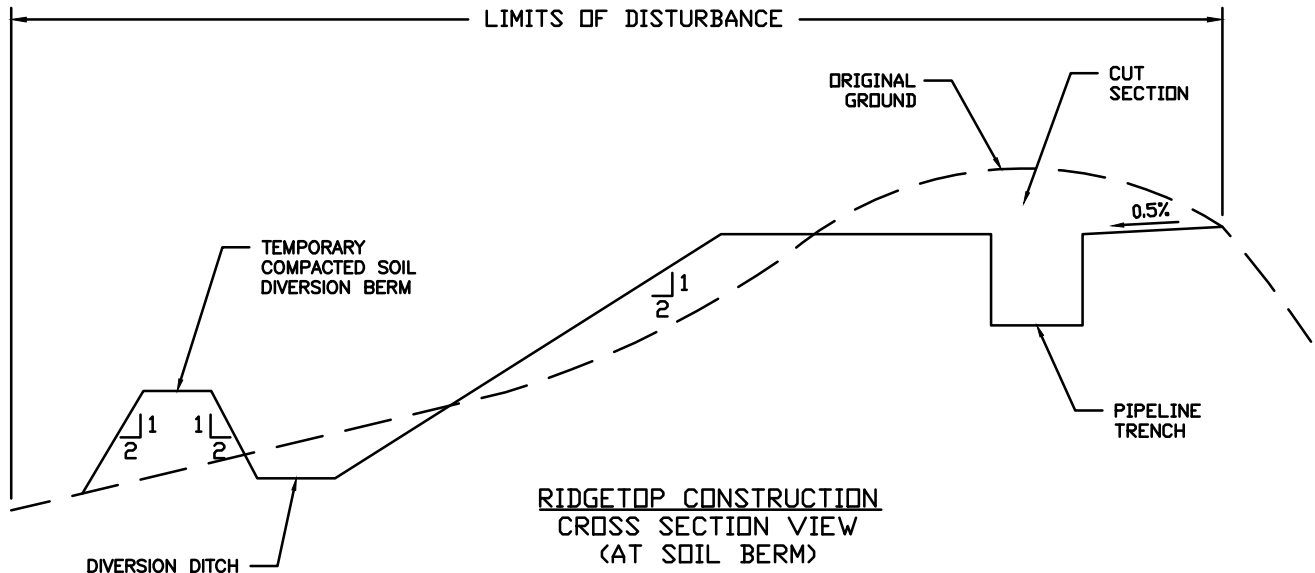
TEMPORARY RIGHT OF WAY
DIVERSION AND OUTLET DETAIL

DRAWING NO.

MVP-ES4

REV.

0



DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

Mountain Valley
PIPELINE
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

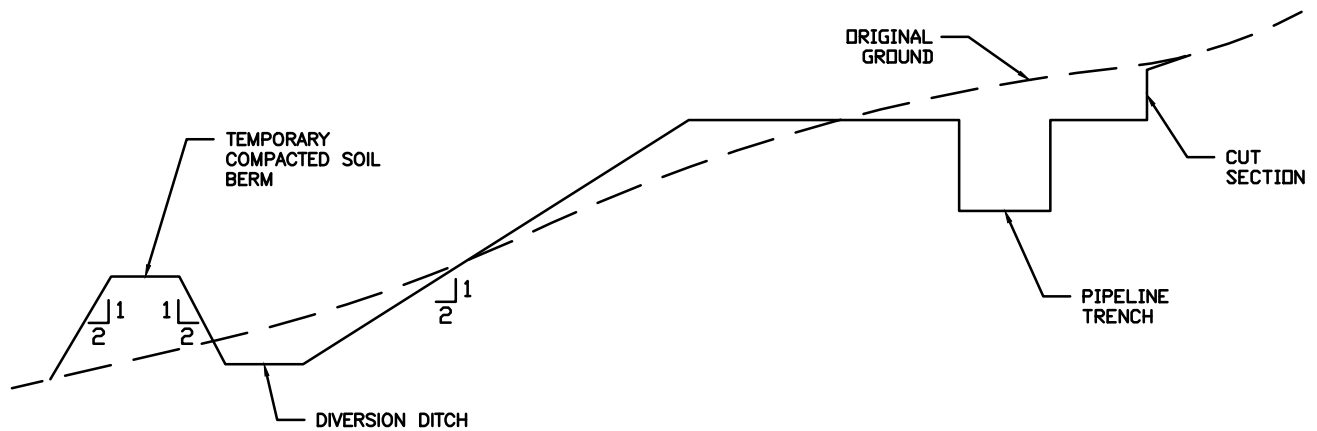
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DIVERSION AND OUTLET DETAIL

DRAWING NO.

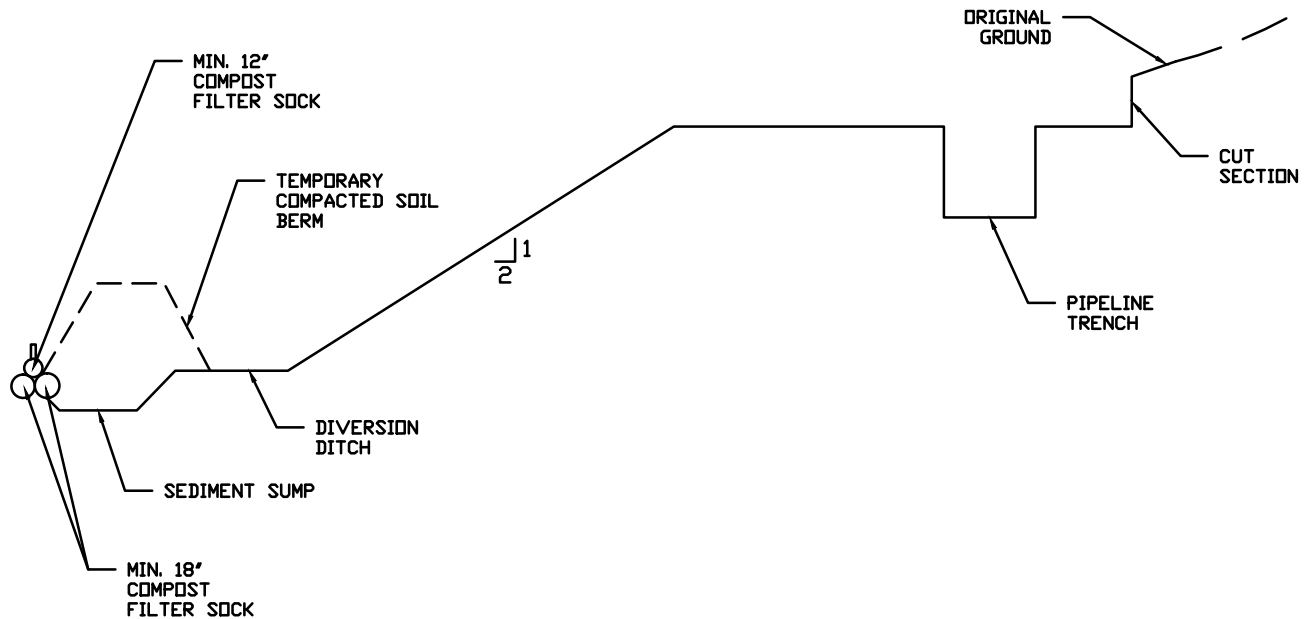
MVP-ES4.1

REV.

0



SIDE SLOPE CONSTRUCTION
CROSS SECTION VIEW
(AT SOIL BERM)



SIDE SLOPE CONSTRUCTION
CROSS SECTION VIEW
(AT SEDIMENT SUMP)

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



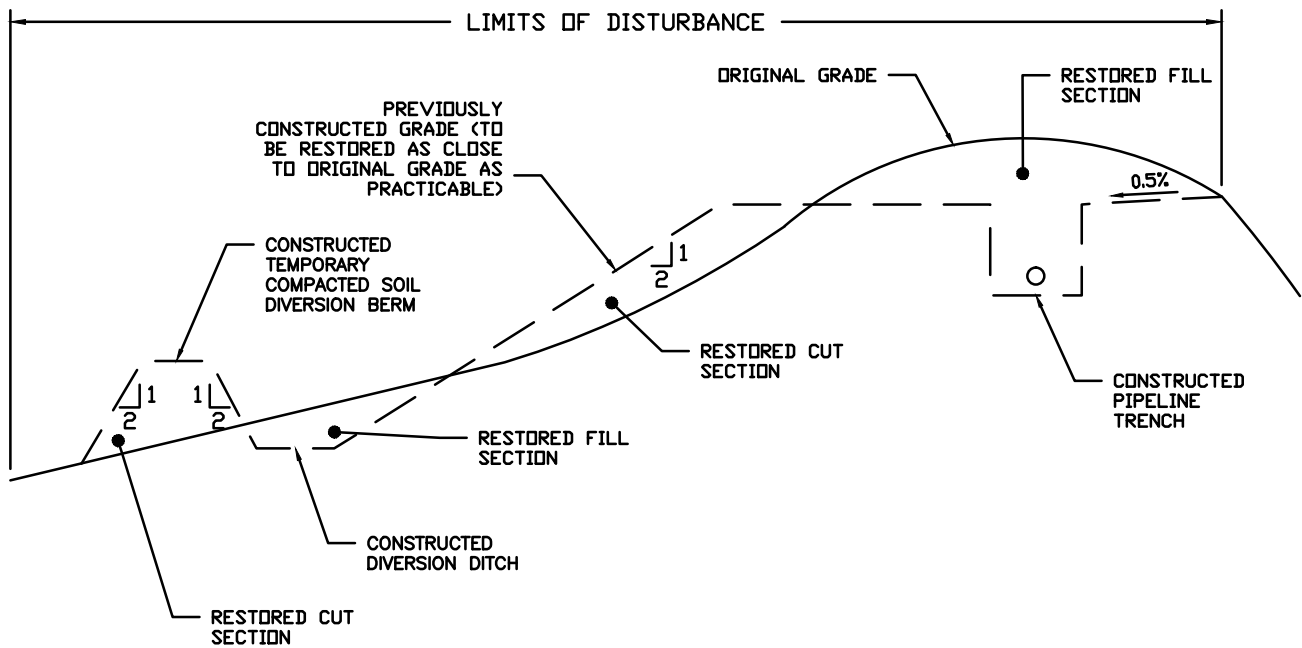
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

TEMPORARY RIGHT OF WAY
DIVERSION AND OUTLET DETAIL

DRAWING NO.
MVP-ES4.2

REV.
0



DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

POST CONSTRUCTION RIDGETOP
RECLAMATION DETAIL

DRAWING NO.
MVP-ES4.3

REV.
0

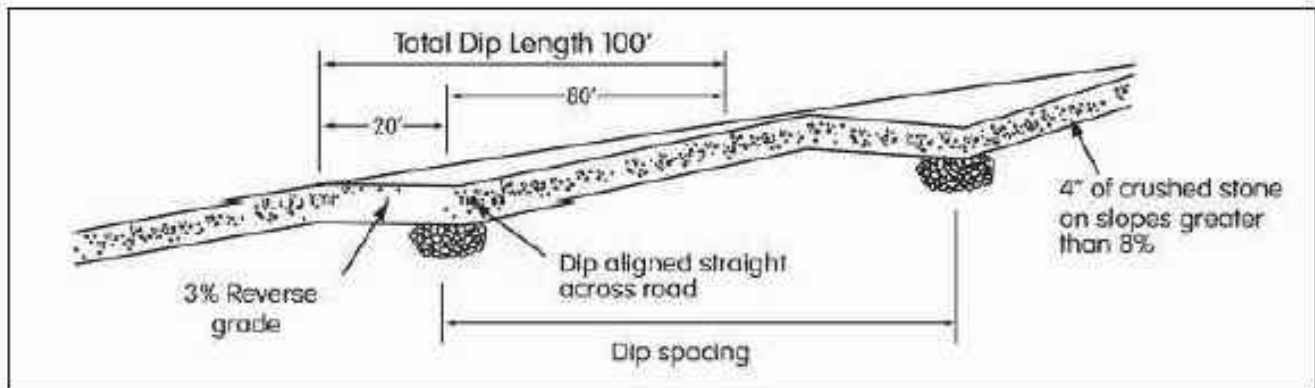


Table II-4 Spacing of Broad-Based Dips

Road Grade (%)	Distance Between Drains (Ft)
2	300
3	235
4	200
5	180
6	165
7	155
8	150
9	145
10	140

DESIGN CRITERIA:

1. MAXIMUM ROAD GRADE ON WHICH DIPS CAN BE CONSTRUCTED IS 10%
2. A 3% REVERSE GRADE SHOULD BE CONSTRUCTED IN THE EXISTING ROADBED, BY CUTTING UPGRADE OF THE DIP LOCATION.
3. BROADBASED DIP SHOULD BE ARMORED WITH STONE TO WITHSTAND EXPECTED TRAFFIC.
4. DRAINAGE OUTLET PROTECTION SHALL BE PROVIDED WITH APPROPRIATE SEDIMENT BARRIER STRUCTURES.
5. SPACING: REFER TO TABLE II-4.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

Mountain Valley
PIPELINE
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

BROAD BASED DIP

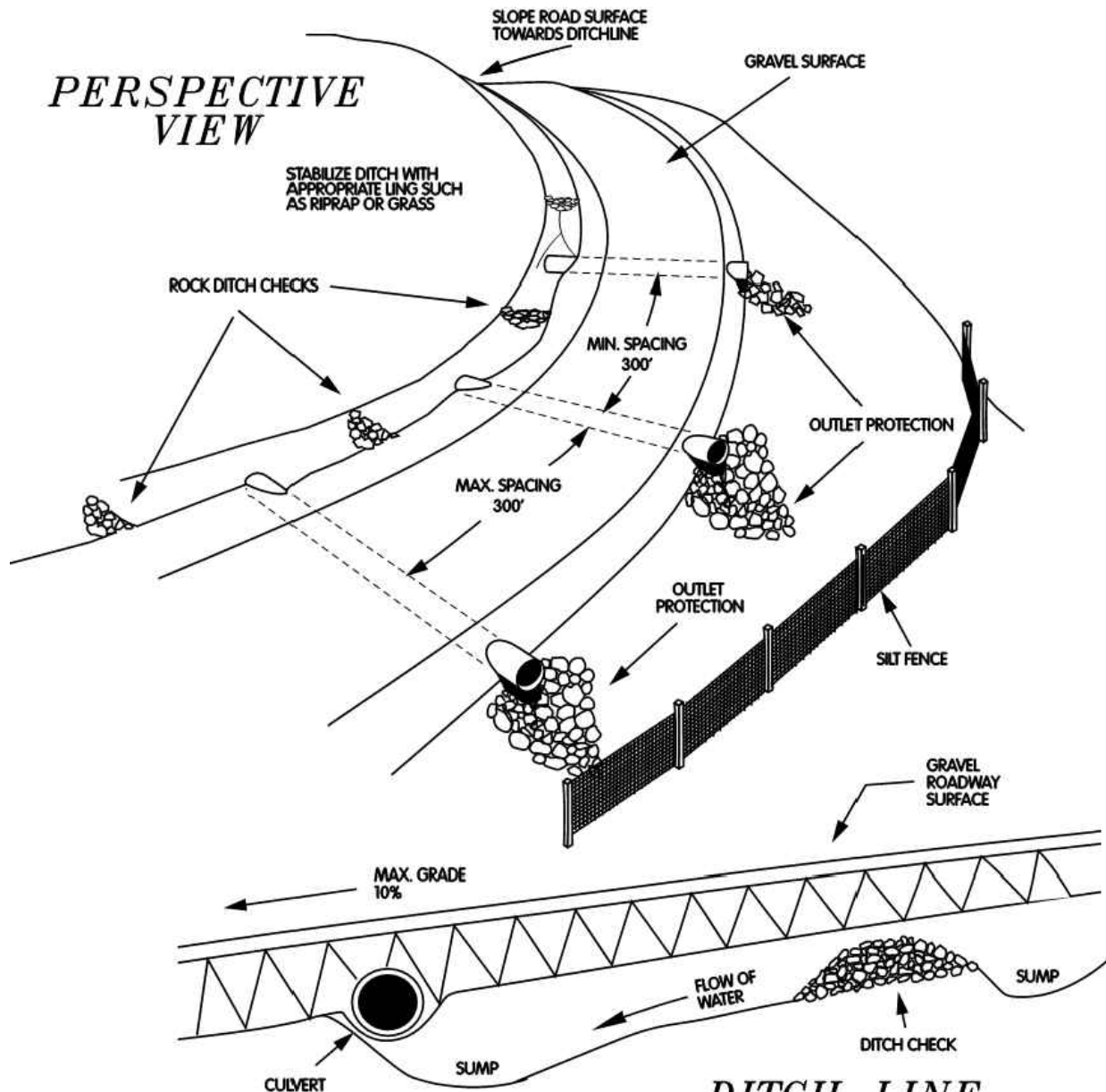
DRAWING NO.

MVP-ES5

REV.

0

PERSPECTIVE VIEW



DITCH LINE CROSS SECTION

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

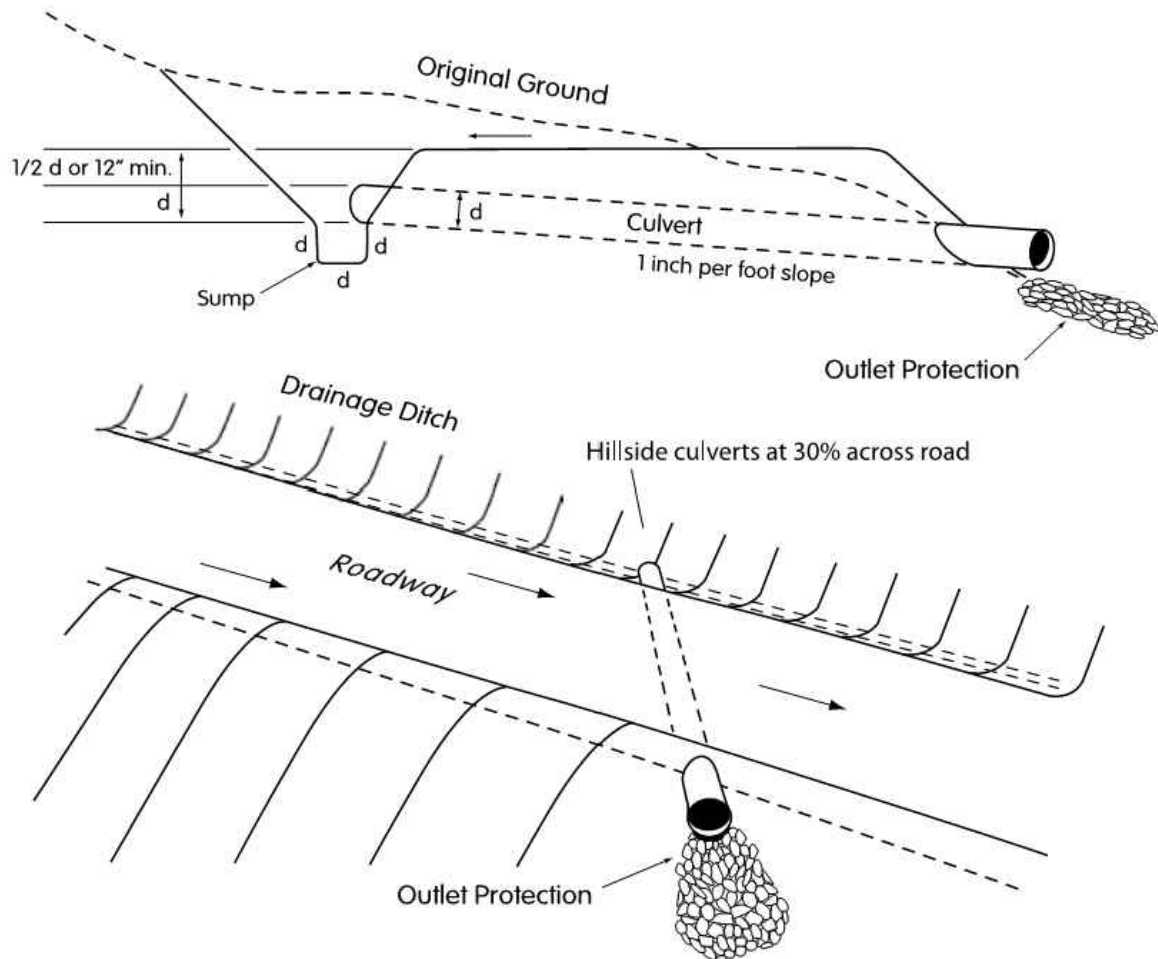
Mountain Valley
PIPELINE
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

ACCESS ROADS

DRAWING NO.
MVP-ES6

REV.
0



DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


Mountain
Valley
 PIPELINE
 DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

DITCH RELIEF CULVERT

DRAWING NO.

MVP-ES7

REV.

0

TABLE 3.3- Sizing and Spacing of Ditch Relief Culverts for Temporart Access Roads

Road Grade (%)	Culvert Spacing* (ft)	Length of Upslope Drainage (ft)				
		<300	300-400	400-500	500-600	>600
		Minimum Culvert Size (in)				
2	300	12	15	15	15	18
3	235	12	15	15	15	18
4	200	12	15	15	15	18
5	180	12	12	15	15	15
6	165	12	12	12	15	15
7	155	12	12	12	12	15
8	150	12	12	12	12	15
9	145	12	12	12	12	15
10	140	12	12	12	12	15
12	135	12	12	12	12	15

*Culvert spacing may be adjusted slightly to take advantage of natural drainage courses

**TABLE 3.4 - Recommended Maximum Spacing of Ditch Relief Culverts (18" dia. CMP)
For Permanent Access Roads**

Road Grade Percent	Soil Type in Ditch				
	Gravel, Sandy Gravels, Aggregate Surfacing	Silty Gravels, Clayey Gravels	Plastic and Nonplastic Inorganic Clays	Inorganic Silts, Silty or Clayey Sands	Sands, Silty Sands, and Gravelly Sands
	Culvert Spacing Feet*				
2	390	315	245	170	95
4	335	275	210	145	85
6	285	230	180	125	75
8	240	195	150	105	65
10	200	160	125	90	55
12	160	130	105	75	45
14	135	110	85	60	35

*Culvert spacing may be adjusted slightly to take advantage of natural drainage courses

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

 **Mountain Valley**
PIPELINE
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

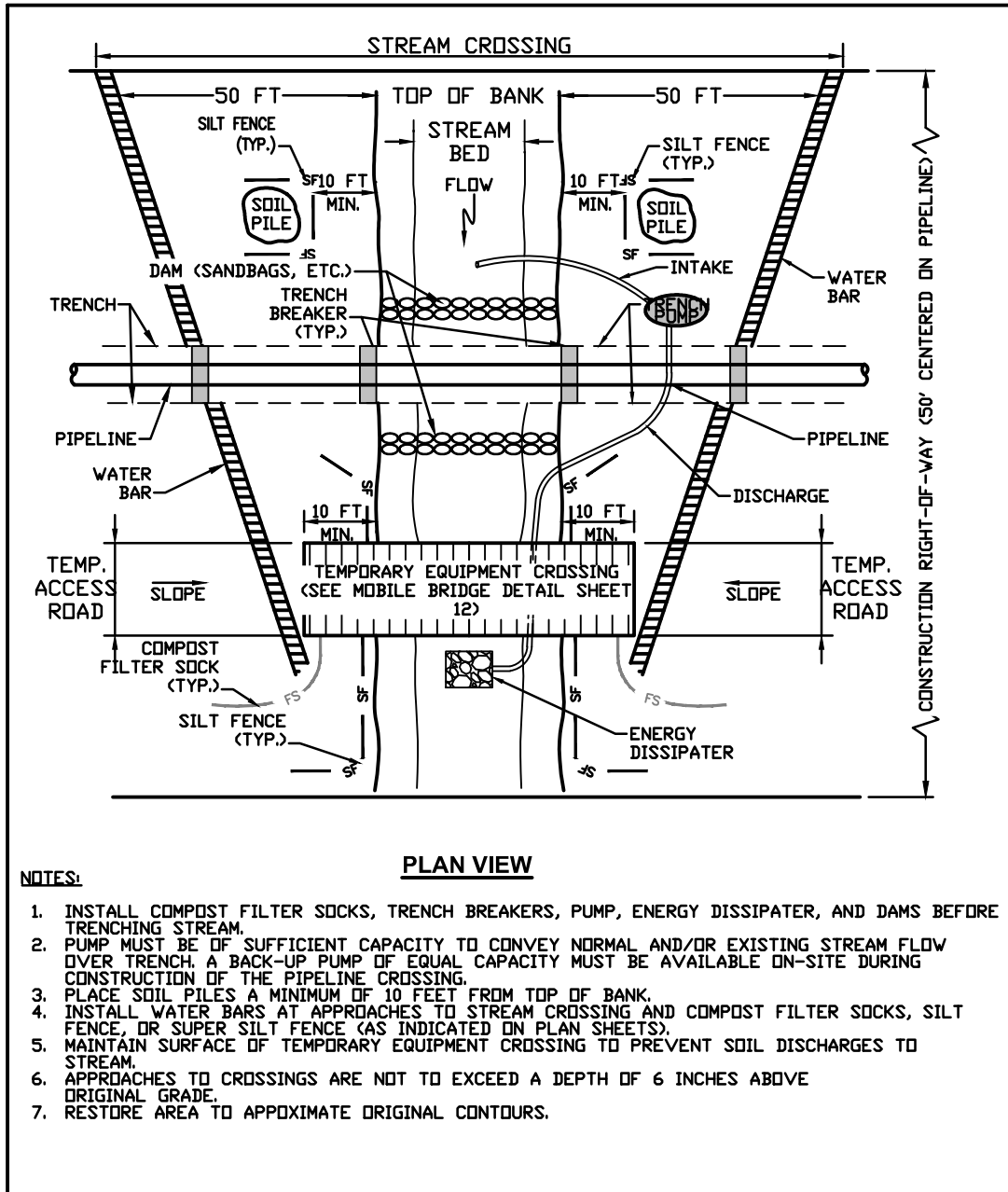
DITCH RELIEF CULVERT
SPACING

DRAWING NO.

MVP-ES7.1

REV.

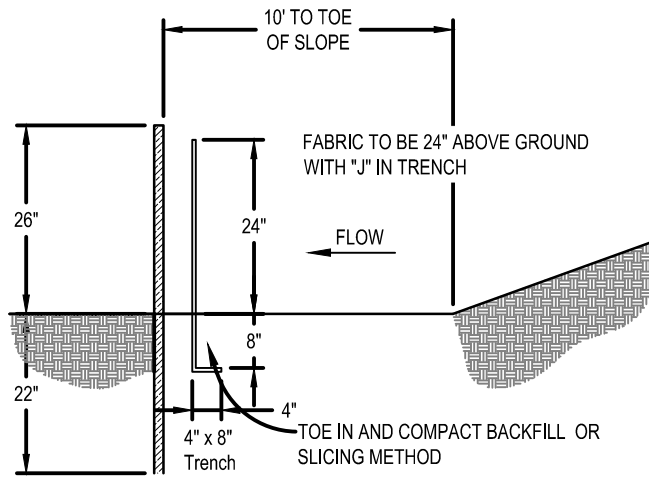
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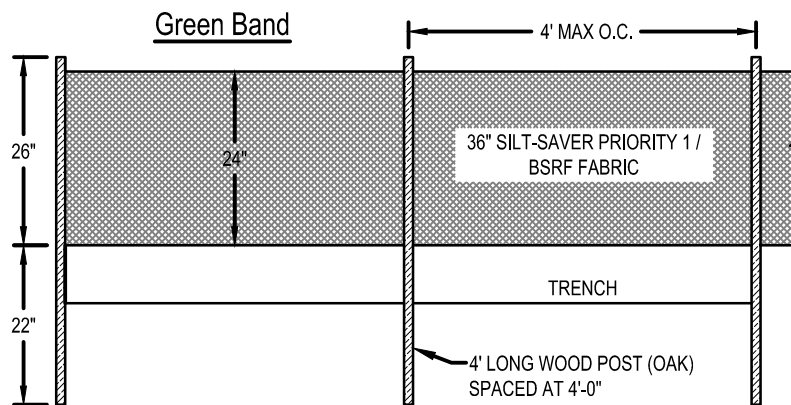
DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


DESIGN ENGINEERING

ENVIRONMENTAL DETAIL	
STREAM CROSSING PUMP STATION	
DRAWING NO.	REV.
MVP-ES8	0



SIDE VIEW




FRONT ELEVATION

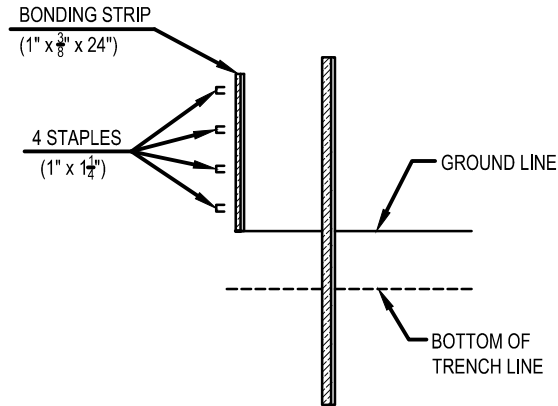
PRIORITY 1

TAKEN FROM SILT-SAVER, INC OR EQUAL

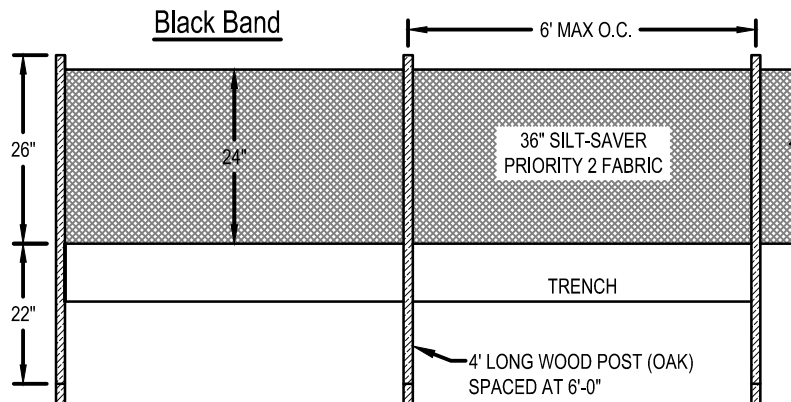
NOTES:

THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

DRAWN	DATE	 <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BELTED SILT RETENTION FENCE (BSRF)	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES9	
JOB NO.			REV. 0	
PROJECT ID: PXXXX				



POST (OAK)
(1-3/4" X 1-1/4" X 48")




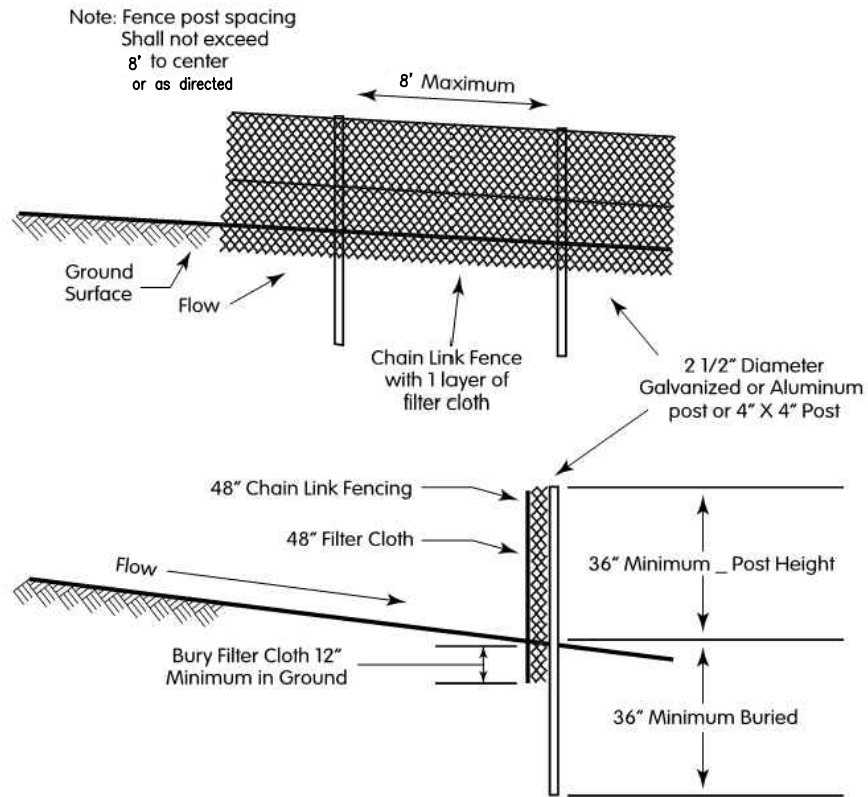
FRONT ELEVATION

PRIORITY 2
TAKEN FROM SILT-SAVER, INC OR EQUAL

NOTES:

THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

DRAWN	DATE	 <div><div>Mountain</div><div>Valley</div><div>PIPELINE</div></div> <div>DESIGN ENGINEERING</div>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BELTED SILT RETENTION FENCE (BSRF)	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES9.1	REV. 0
JOB NO.				
PROJECT ID: PXXXX				




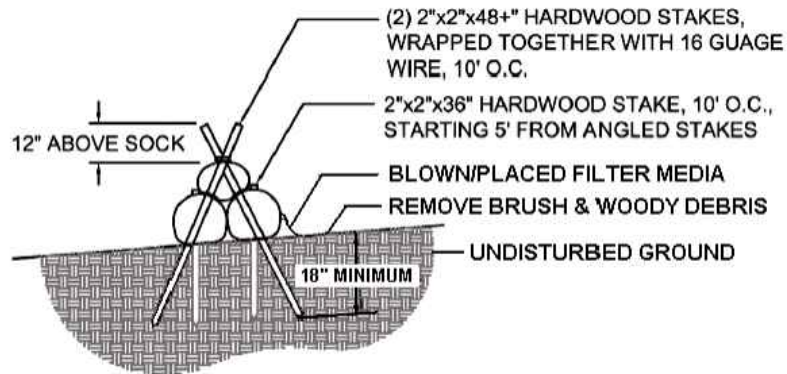
SUPER SILT FENCE

TAKEN FROM WVDEP 2006 MANUAL

NOTES:


THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

DRAWN	DATE	 <p style="text-align: center;">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		SUPER SILT FENCE	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX			MVP-ES9.2	0



NOTES:

THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

DRAWN	DATE	 <p>Mountain Valley PIPELINE</p> <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		STACKED COMPOST FILTER SOCK DETAIL CROSS SECTION VIEW	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO.	
JOB NO.			REV.	
PROJECT ID:			MVP-ES9.3	0
PXXXX				


Forest Regeneration Woody Seed Mix and Application Rates.

Species	Common Name	Seeding Rate (lbs/acre)
Oak-Hickory Forest a\		
<i>Fagus grandifolia</i>	American Beech	0.3
<i>Liriodendron tulipifera</i>	Tulip Poplar	0.3
<i>Pinus strobus</i>	White Pine	0.3
<i>Pinus virginiana</i>	Virginia Pine	0.3
<i>Prunus serotina</i>	Black Cherry	0.3
<i>Amelanchier canadensis</i>	Canadian Serviceberry	0.3
<i>Cercis canadensis</i>	Eastern Redbud	0.3
<i>Cornus florida</i>	Flowering Dogwood	0.3
<i>Diospyros virginiana</i>	Persimmon	0.3
<i>Ilex opaca</i>	American Holly	0.3
<i>Nyssa sylvatica</i>	Black Gum	0.3
<i>Sassafras albidum</i>	Sassafras	0.3
<i>Hamamelis virginiana</i>	Witch Hazel	0.3
<i>Lindera benzoin</i>	Spicebush	0.3
<i>Vaccinium angustifolium</i>	Lowbush Blueberry	0.3
<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	0.3
<i>Vitis aestivalis</i>	Grape	0.3

a\ Oak and hickory species to be planted as bare root seedlings in addition to this mix. Refer to Section 5.9 Bare Root Seedling Planting for more information. At minimum, 3 of the 5 overstory, 4 of the 7 understory, and 2 of the 4 shrub species will comprise the woody seed mix for Oak-Hickory Forests.

NOTE:

WOODY SEED MIX TO BE USED IN COMBINATION WITH MVP-ES11.2 UPLAND MEADOW SEED MIX.

DRAWN	DATE	 Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL	
CHECKED	DATE			
APP'D	DATE		FOREST REGENERATION WOODY SEED MIX AND APPLICATION RATES	
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID:		MVP-ES11.1	0	
PXXXX		DESIGN ENGINEERING		

Upland Meadow Seed Mix and Application Rates in Virginia.

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Elymus virginicus</i>	Virginia Wildrye	4.00	5.0 - 7.4	June to October
<i>Schizachyrium scoparium</i>	Little Bluestem	11.68	5.0 - 8.4	July to October
<i>Sorghastrum nutans</i>	Indiangrass	1.00	5.0 - 7.8	August to October
<i>Asclepias syriaca</i>	Common Milkweed	0.10		June to August
<i>Asclepias tuberosa</i>	Butterfly Milkweed	0.10	4.8 - 6.8	June to August
<i>Chamaecrista fasciculata</i>	Partridge Pea	0.60	5.5 - 7.5	July to September
<i>Chamaecrista nictitans</i>	Sensitive Partridge Pea	0.06		June to October
<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	0.44	6.0 - 7.0	April to July
<i>Eupatorium coelestinum</i>	Mistflower	0.04	5.5 - 7.5	July to October
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.40		July to August
<i>Lespedeza virginica</i>	Slender Bushclover	0.10		July to September
<i>Liatris graminifolia</i>	Grassleaf Blazing Star	0.10	5.8 - 6.8	August to October
<i>Monarda fistulosa</i>	Wild Bergamot	0.10	6.0 - 8.0	June to September
<i>Penstemon laevigatus</i>	Appalachian Beardtongue	0.10		late May to late August
<i>Pycnanthemum incanum</i>	Hoary Mountainmint,	0.20		May to June
<i>Rudbeckia fulgida</i> var. <i>fulgida</i>	Orange Coneflower	0.02	< 6.8	summer
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.04		July to October

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Senna hebecarpa</i>	Wild Senna	0.60	6.0 - 7.0	May to July
<i>Solidago juncea</i>	Early Goldenrod	0.10		July to August
<i>Solidago nemoralis</i>	Gray Goldenrod	0.04		June to July
<i>Tradescantia ohiensis</i>	Ohio Spiderwort	0.04	6.5 - 7.5	August to September
<i>Tradescantia virginiana</i>	Virginia Spiderwort	0.10		late April to mid-July
		20.00		

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



ENVIRONMENTAL DETAIL

UPLAND MEADOW SEED MIX
AND APPLICATION RATES

DRAWING NO.


MVP-ES11.2

REV.

0

Upland Steep Slope Seed Mix and Application Rates in Virginia.

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Agrostis perennans</i>	Autumn Bentgrass	3.15	5.5 - 7.5	Midsummer
<i>Elymus virginicus</i>	Virginia Wildrye	9.05	5.0 - 7.4	June to October
<i>Panicum clandestinum</i>	Deertongue	4.50	4.0 - 7.5	May to September
<i>Schizachyrium scoparium</i>	Little Bluestem	11.25	5.0 - 7.4	July to October
<i>Sorghastrum nutans</i>	Indiangrass	14.40	5.0 - 7.8	August to October
<i>Asclepias syriaca</i>	Common Milkweed	0.09		June to August
<i>Aster pilosus</i>	Heath Aster	0.05	5.4 - 7.0	After fall frost
<i>Chamaecrista fasciculata</i>	Partridge Pea	0.45	5.5 - 7.5	July to September
<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	0.45	6.0 - 7.0	April to July
<i>Eupatorium coelestinum</i>	Mistflower	0.05	5.5 - 7.5	July to October
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.45		July to August
<i>Liatris graminifolia</i>	Grassleaf Blazing Star	0.09	5.8 - 6.8	August to October
<i>Monarda fistulosa</i>	Wild Bergamot	0.23	6.0 - 8.0	June to September
<i>Pycnanthemum incanum</i>	Hoary Mountainmint	0.05	< 6.8	summer
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.45	6.0 - 7.0	May to July
<i>Senna hebecarpa</i>	Wild Senna	0.23		July to August
<i>Solidago nemoralis</i>	Gray Goldenrod	0.05	6.5 - 7.5	August to September
<i>Tradescantia ohiensis</i>	Ohio Spiderwort	0.05		late April to mid-July
		45.00		

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		UPLAND STEEP SLOPE SEED MIX AND APPLICATION RATES	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID:		MVP-ES11.3	0	
PXXXX				


Wetlands Seed Mix and Application Rates in Virginia.

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Alisma subcordatum</i>	Mud Plantain	0.04		
<i>Carex gynandra</i>	Fringed Sedge	0.10	5.0 - 7.0	Midsummer
<i>Carex lupulina</i>	Hop Sedge	1.00		May to June
<i>Carex lurida</i>	Shallow Sedge	3.00	6.2 - 7.0	June to October
<i>Carex scoparia</i>	Blunt Broom Sedge	1.00	4.9 - 6.8	June to July
<i>Carex vulpinoidea</i>	Fox Sedge	6.90	4.6 - 6.9	July to August
<i>Cinna arundinacea</i>	Wood Reedgrass	0.40	6.8 - 8.9	June to August
<i>Elymus virginicus</i>	Virginia Wildrye	4.00	4.0 - 8.5	August to September
<i>Juncus effusus</i>	Soft Rush	0.60	5.0 - 7.4	June to October
<i>Onoclea sensibilis</i>	Sensitive Fern	0.20	5.5 - 7.0	May to June
<i>Scirpus cyperinus</i>	Woolgrass	0.20		June to October

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Scirpus polyphyllus</i>	Many Leaved Bulrush	0.20	4.8 - 7.2	July to September
<i>Asclepias incarnata</i>	Swamp Milkweed	0.40		July to August
<i>Eupatorium coelestinum</i>	Mistflower	0.10	5.0 - 8.0	June to July
<i>Eupatorium fistulosum</i>	Joe Pye Weed	0.14	5.5 - 7.5	July to October
<i>Eupatorium perfoliatum</i>	Boneset	0.20	4.5 - 7.0	July to September
<i>Helenium autumnale</i>	Common Sneezeweed	0.10		July to October
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.40	4.0 - 7.5	August to September
<i>Ludwigia alternifolia</i>	Seedbox	0.10		July to August
<i>Mimulus ringens</i>	Square Stemmed Monkeyflower	0.10		August to September
<i>Verbena hastata</i>	Blue Vervain	0.72		June to September
<i>Vernonia noveboracensis</i>	New York Ironweed	0.10		June to October
		20.00		


NOTE:

ANNUAL RYEGRASS WILL BE USED AT A RATE OF 40 LBS/AC FOR STABILIZATION OF WETLANDS DISTURBED BY THE PROJECT.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		WETLAND SEED MIX AND APPLICATION RATES	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX		MVP-ES11.4	0	

Riparian Seed Mix and Application Rates in Virginia.


Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Alisma subcordatum</i>	Autumn Bentgrass	0.04	5.0 - 7.0	Midsummer
<i>Carex gynandra</i>	Big Bluestem	0.10		May to June
<i>Carex lupulina</i>	Virginia Wildrye	1.00	6.2 - 7.0	June to October
<i>Carex lurida</i>	Soft Rush	3.00	4.9 - 6.8	June to July
<i>Carex scoparia</i>	Path Rush	1.00	4.6 - 6.9	July to August
<i>Carex vulpinoidea</i>	Deertongue	6.90	6.8 - 8.9	June to August
<i>Cinna arundinacea</i>	Indiangrass	0.40	4.0 - 8.5	August to September
<i>Elymus virginicus</i>	Swamp Milkweed	4.00	5.0 - 7.4	June to October
<i>Juncus effusus</i>	Partridge Pea	0.60	5.5 - 7.0	May to June
<i>Onoclea sensibilis</i>	Mistflower	0.20		June to October
<i>Scirpus cyperinus</i>	Joe Pye Weed	0.20	4.8 - 7.2	July to September
<i>Scirpus polyphyllus</i>	Boneset	0.20		July to August
<i>Asclepias incarnata</i>	White Avens	0.40	5.0 - 8.0	June to July
<i>Eupatorium coelestinum</i>	Common Sneezeweed	0.10	5.5 - 7.5	July to October
<i>Eupatorium fistulosum</i>	Oxeye Sunflower	0.14	4.5 - 7.0	July to September
<i>Eupatorium perfoliatum</i>	Wild Bergamot	0.20		July to October
<i>Helenium autumnale</i>	Slender Mountainmint	0.10	4.0 - 7.5	August to September
<i>Heliopsis helianthoides</i>	Blackeyed Susan	0.40		July to August
<i>Ludwigia alternifolia</i>	Wild Senna	0.10		August to September
<i>Mimulus ringens</i>	Blue Vervain	0.10		June to September
<i>Verbena hastata</i>	New York Ironweed	0.72		June to October
		20.00		

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		RIPARIAN SEED MIX AND APPLICATION RATES	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID: PXXXX		MVP-ES11.5	0	

Native tree and shrub species for bare root plantings within riparian areas and forested wetlands.


Species	Common Name	Indicator Status	Riparian Planting ¹	Forested Wetland Planting ²
Native Trees				
<i>Acer rubrum</i>	Red Maple	FAC	X	X
<i>Acer saccharinum</i>	Silver Maple	FACW	X	X
<i>Betula nigra</i>	River Birch	FACW	X	X
<i>Carpinus caroliniana</i>	American Hornbeam	FAC	X	X
<i>Carya glabra</i>	Pignut Hickory	FACU	X	
<i>Carya ovata</i>	Shagbark Hickory	FACU	X	
<i>Chionanthus virginicus</i>	White Fringe Tree	FAC+	X	
<i>Diospyros virginiana</i>	Common Persimmon	FAC-	X	

Species	Common Name	Indicator Status	Riparian Planting ¹	Forested Wetland Planting ²
<i>Fraxinus pennsylvanica</i>	Green Ash	FACW	X	X
<i>Juniperus virginiana</i>	Eastern Red Cedar	FACU	X	X
<i>Liquidambar styraciflua</i>	Sweet Gum	FAC	X	X
<i>Liriodendron tulipifera</i>	Tuliptree	FACU	X	X
<i>Nyssa sylvatica</i>	Black Gum	FAC	X	
<i>Platanus occidentalis</i>	American Sycamore	FACW-	X	X
<i>Populus deltoids</i>	Eastern Cottonwood	FAC	X	
<i>Quercus bicolor</i>	Swamp White Oak	FACW+	X	X
<i>Quercus falcata</i>	Cherrybark Red Oak	FACW	X	X
<i>Quercus phellos</i>	Willow Oak	FAC+	X	X
<i>Quercus nigra</i>	Water Oak	FAC	X	
<i>Quercus palustris</i>	Pin Oak	FACW	X	X
<i>Salix nigra</i>	Black Willow	FACW	X	X
<i>Ulmus americana</i>	American Elm	FACW-	X	X

DRAWN	DATE	 <p>Mountain Valley PIPELINE</p> <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		NATIVE TREE AND SHRUB SPECIES FOR BARE ROOT PLANTINGS WITHIN RIPARIAN AREAS AND FORESTED WETLANDS	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:				
PXXXX		DRAWING NO. MVP-ES11.6		REV. 0

Native Shrubs

<i>Alnus serrulata</i>	Brook-side Alder	OBL		X
<i>Amelanchier canadensis</i>	Canada Serviceberry	FAC	X	
<i>Aronia arbutifolia</i>	Red Chokecherry	FACW	X	X
<i>Baccharis halimifolia</i>	Groundsel Bush	FACW-	X	X
<i>Cephalanthus occidentalis</i>	Buttonbush	OBL		X
<i>Cornus amomum</i>	Silky Dogwood	FACW	X	X
<i>Cornus stolonifera</i>	Red-osier Dogwood	FAC	X	X
<i>Hamamelis virginiana</i>	American Witchhazel	FAC-	X	
<i>Ilex verticillata</i>	Common Winterberry	FACW+	X	X
<i>Itea virginica</i>	Virginia Willow	OBL		X
<i>Iva frutescens</i>	Marsh Elder	FACW+	X	X
<i>Leucothoe racemosa</i>	Fetter-bush	FACW	X	X
<i>Lindera benzoin</i>	Spicebush	FACW-	X	X
<i>Lyonia ligustrina</i>	Maleberry	FACW	X	X
<i>Magnolia virginiana</i>	Sweetbay Magnolia	FACW+	X	X
<i>Physocarpus opulifolius</i>	Eastern Ninebark	FACW-	X	X
<i>Sambucus canadensis</i>	American Elder	FACW-	X	X
<i>Vaccinium corymbosum</i>	Highbush Blueberry	FACW-	X	X
<i>Virburnum dentatum</i>	Arrow-wood	FAC	X	
<i>Viburnum prunifolium</i>	Black-haw	FACU	X	

DRAWN	DATE	 <p style="font-size: 1.2em; margin: 0;">Mountain Valley</p> <p style="font-weight: bold; margin: 0;">PIPELINE</p> <p style="font-size: 1.2em; margin: 0;">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		NATIVE TREE AND SHRUB SPECIES FOR BARE ROOT PLANTINGS WITHIN RIPARIAN AREAS AND FORESTED WETLANDS	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX		MVP-ES11.7	0	

Stream crossings proposed for bare-root seedling plantings.

Waterbody Name	MP	County	State	Valuable Resource
Kimballton Branch	199.1, 199.4	Giles	VA	headwaters of wild trout stream, coldwater stream

Waterbody Name	MP	County	State	Valuable Resource
Stony Creek	200.4	Giles	VA	candy darter, green floater, coldwater stream, wild trout stream
Little Stony Creek	204.4	Giles	VA	coldwater stream, wild trout stream
Sinking Creek	211.2	Giles	VA	candy darter, green floater, coldwater stream, wild trout stream, non-listed mussels
UNT Craig Creek	219.2	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	219.3	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Craig Creek	219.7	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Craig Creek	219.7	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	219.8	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	220.0	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Mill Creek	222.2	Montgomery	VA	upstream of Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
North Fork Roanoke River	227.2	Montgomery	VA	Roanoke logperch present, non-listed mussels present, orange fin madtom, coldwater stream, wild trout
North Fork Roanoke River	227.4	Montgomery	VA	Roanoke logperch present, non-listed mussels present, orange fin madtom, coldwater stream, wild trout
Bradshaw Creek	230.7	Montgomery	VA	Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
Bradshaw Creek	231.5	Montgomery	VA	Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
Roanoke River	235.4	Montgomery	VA	Roanoke logperch present, orange fin madtom, non-listed mussels present
Bottom Creek	241.1	Roanoke	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout
Bottom Creek	242.5	Roanoke	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE			
APP'D	DATE		STREAM CROSSINGS PROPOSED FOR BARE ROOT SEEDING PLANTINGS	
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX		MVP-ES11.8	0	

Mill Creek	245.1	Roanoke	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
Green Creek	247.1	Franklin	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
Green Creek	247.4	Franklin	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
North Fork Blackwater River	249.7	Franklin	VA	Roanoke logperch suitable habitat, coldwater stream wild trout stream

Waterbody Name	MP	County	State	Valuable Resource
Teels Creek	258.2	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	260.3	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	261.0	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	261.8	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	262.3	Franklin	VA	Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek contributing sediment impacts
Little Creek	262.6	Franklin	VA	Roanoke logperch suitable habitat, numerous crossings upstream contributing sediment impacts
Little Creek	263.3	Franklin	VA	Roanoke logperch suitable habitat, non-listed mussels present, numerous crossings upstream contributing sediment impacts
Maggodee Creek	269.4	Franklin	VA	Roanoke logperch suitable habitat
Blackwater River	269.7	Franklin	VA	Roanoke logperch present, non-listed mussels present
UNT to Jacks Creek	278.8	Franklin	VA	orangefin madtom
Turkey Creek	280.5	Franklin	VA	orangefin madtom
Strawfield Creek	282.3	Franklin	VA	orangefin madtom
Parrot Branch	282.9	Franklin	VA	orangefin madtom
Jonnikin Creek	284.4	Pittsylvania	VA	orangefin madtom
UNT to Rocky Creek	287.1	Pittsylvania	VA	orangefin madtom
Pigg River	289.1	Pittsylvania	VA	Roanoke logperch present, orangefin madtom, mussels present including yellow lampmussel (VA threatened)
Harpen Creek	289.9	Pittsylvania	VA	Roanoke logperch suitable habitat, orangefin madtom
Harpen Creek	292.0	Pittsylvania	VA	orangefin madtom

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



ENVIRONMENTAL DETAIL

STREAM CROSSINGS PROPOSED FOR
BARE ROOT SEEDING PLANTINGS

DRAWING NO.
MVP—ES11.9

REV.
0

Name	Ph preference	Wetland Indicator Status
Annual Ryegrass (<i>Lolium Multiflorum</i> (L. perenne var. italicum))	5.0–7.9	NI/moderate
German/Foxtail Millet (<i>Setaria italica</i>)	5.3–6.9	FACU
Cereal Rye (<i>Secale cereale</i>)	5.2–8.0	NI/damp
Browntop Millet (<i>Panicum ramosum</i>)	5.5–6.9	FACU


NOTES:

- 1): MINIMUM SEED RATE WILL BE 50 LBS/ACRE
- 2): UTILIZE APPROPRIATE SEED FOR TIME OF YEAR

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		VIRGINIA TEMPORARY EROSION CONTROL SEED MIX	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID: PXXXX		DRAWING NO. MVP-ES11.10		REV. 0


Upland Area Seed Mixes within the Jefferson National Forest

Scientific Name	Common Name	Growth Habit	pH Preference
Upland Areas - Non-native Species for Erosion Control			
<i>Lolium perenne</i> subsp. <i>multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa</i> (<i>Panicum ramosum</i>)	Browntop millett	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italica</i>	Foxtail millet	Graminoid	5.3 – 6.9
Upland Areas - Native Species			
<i>Chasmanthium laxum</i> ^a	Slender woodoats	Graminoid	4.5 – 7.0
<i>Eragrostis spectabilis</i> ^a	Purple lovegrass	Graminoid	4.0 – 7.5
<i>Panicum virgatum</i>	Switchgrass	Graminoid	4.5 – 8.0
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Tridens flavus</i> ^a	Purpletop	Graminoid	4.5 – 6.5
<i>Apocynum cannabinum</i> ^a	Indian hemp	Forb	4.5 – 7.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Desmodium canadense</i>	Showy ticktrefoil	Forb	wide tolerance
<i>Desmodium paniculatum</i>	Panicleleaf ticktrefoil	Forb	6.0 – 7.0
<i>Elymus virginicus</i> ^b	Virginia wildrye	Graminoid	5.0 – 7.4
<i>Geum canadense</i> ^a	White avens	Forb	4.5 – 7.5
<i>Heliopsis helianthoides</i>	Oxeye sunflower; Smooth oxeye	Forb	unknown
<i>Monarda fistulosa</i> ^b	Wild bergamot	Forb	6.0 – 8.0
<i>Pycnanthemum</i> spp. ^b	Mountain mint	Forb	unknown
<i>Rubus allegheniensis</i> ^a	Common blackberry; Allegheny blackberry	Forb/ Subshrub	4.6 – 7.5
<i>Rudbeckia hirta</i>	Blackeyed Susan	Forb	6.0 – 7.0
<i>Solidago canadensis</i> ^a	Canada goldenrod	Forb	4.8 – 7.5
<i>Tradescantia virginiana</i> ^a	Virginia spiderwort	Forb	4.0 – 8.0

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		US FOREST SERVICE (NATIONAL FOREST) LANDS UPLAND AREA SEED MIX	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID:		MVP-ES12.1	0	
PXXXX				


Riparian Seed Mixes within Jefferson National Forest

Scientific Name	Common Name	Habit	pH Preference
Non-native Species for Erosion Control			
<i>Lolium perenne</i> subsp. <i>multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa</i> (<i>Panicum ramosum</i>)	Browntop millett	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italica</i>	Foxtail millet	Graminoid	5.3 – 6.9
Native Species			
<i>Agrostis perennans</i>	Autumn bentgrass; upland bentgrass	Graminoid	5.5 – 7.5
<i>Elymus virginicus</i>	Virginia Wildrye	Graminoid	5.0 - 7.4
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Asclepias incarnata</i>	Swamp milkweed	Forb	5.0 – 8.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Eutrochium fistulosum</i> (<i>Eupatorium fistulosum</i>)	Joe pye weed	Forb	4.5 – 7.0
<i>Eupatorium maculatum</i>	Spotted joe pye weed	Forb	5.5 – 7.0
<i>Eupatorium perfoliatum</i>	Boneset	Forb	unknown
<i>Helenium autumnale</i>	Common sneezeweed	Forb	4.0 – 7.5
<i>Senna hebecarpa</i>	Wild senna; American senna	Forb	unknown
<i>Senna marilandica</i>	Maryland senna	Forb / Subshrub	4.0 – 7.0
<i>Vernonia noveboracensis</i>	New York ironweed	Forb	4.5 -8.0

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		US FOREST SERVICE (NATIONAL FOREST) LANDS RIPARIAN SEED MIX	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	
PROJECT ID:		MVP–ES12.2		0
PXXXX				

Species for hydroseed mixes within the Jefferson National Forest.


Scientific Name	Common Name	Growth Habit	pH Preference
Non-native Species for Temporary Erosion Control			
<i>Lolium perenne</i> subsp. <i>multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa</i> (<i>Panicum ramosum</i>)	Browntop millet	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italica</i>	Foxtail millet	Graminoid	5.3 – 6.9
Native – Highly Preferred			
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Tridens flavus</i>	Purpletop	Graminoid	4.5 – 6.5
Native – Preferred			
<i>Agrostis perennans</i>	Autumn bentgrass; Upland bentgrass	Graminoid	5.5 – 7.5
<i>Dichanthelium clandestinum</i>	Deertongue	Graminoid	4.0 – 7.5
<i>Elymus canadensis</i>	Canada wildrye	Graminoid	5.0 – 7.9
<i>Desmodium canadense</i>	Showy ticktrefoil	Forb	wide tolerance
<i>Heliopsis helianthoides</i>	Oxeye sunflower; Smooth oxeye	Forb	unknown
<i>Lespedeza virginica</i>	Slender bushclover; Slender lespedeza	Forb	acid tolerant
<i>Liatris spicata</i>	Dense blazing star; Spiked gayfeather	Forb	5.6 - 7.5
<i>Senna hebecarpa</i>	Wild senna; American senna	Forb	unknown
Native – Moderately Preferred			
<i>Panicum virgatum</i>	Switchgrass	Graminoid	4.5 – 8.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Rudbeckia hirta</i>	Blackeyed Susan	Forb	6.0 – 7.0

DRAWN	DATE	 <p>Mountain Valley PIPELINE</p> <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		US FOREST SERVICE (NATIONAL FOREST) LANDS HYDROSEED MIX	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	
PROJECT ID:		MVP-ES12.3		0
PXXXX				

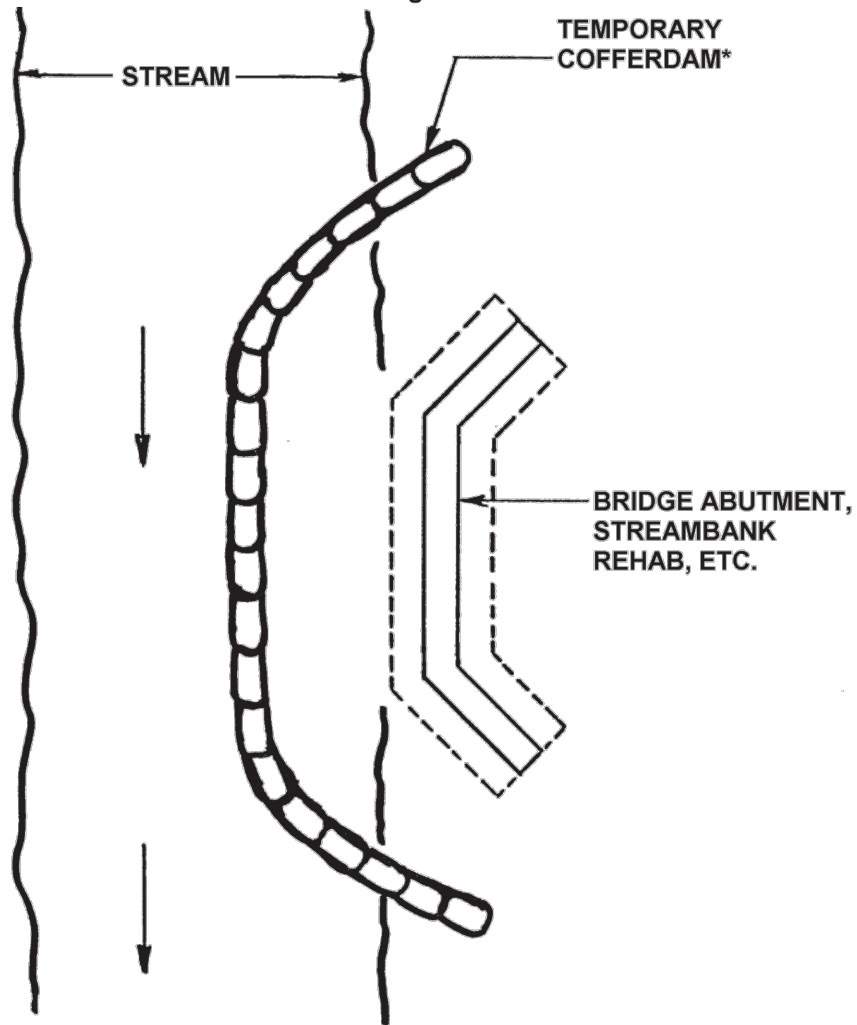
Name	Ph preference	Wetland Indicator Status
Annual Ryegrass (<i>Lolium Multiflorum</i> (L. perenne var. italicum))	5.0–7.9	NI/moderate
German/Foxtail Millet (<i>Setaria italica</i>)	5.3–6.9	FACU
Cereal Rye (<i>Secale cereale</i>)	5.2–8.0	NI/damp
Browntop Millet (<i>Panicum ramosum</i>) (introduced in VA & south; possibly ok for WV?)	5.5–6.9	FACU

NOTES:

- 1): A MINIMUM OF (2) OF THE ABOVE LISTED SPECIES SHALL BE UTILIZED
- 2): APPLY WHENEVER EROSION CONTROL IS NEEDED OUTSIDE OF NORMAL (PERMANENT) SEEDING SEASONS
- 3): APPLY CONCURRENT WITH PERMANENT EROSION CONTROL
- 4): APPLY PRIOR TO PERMANENT SEEDING WITH WILDLIFE MIXES


DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		US FOREST SERVICE (NATIONAL FOREST) LANDS	
APP'D	DATE		TEMPORARY EROSION CONTROL SPECIES	
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO.	REV.
JOB NO.			MVP-ES12.4	0
PROJECT ID: PXXXX				

MVP-ES13 Cofferdam Stream
Crossing Methodn



PA DEP

- * Sandbags (Standard Construction Detail #3-15), Jersey barriers (Figure 3.13) or other non-erosive material, no earth fill.

DRAWN	DATE	 <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		COFFERDAM STREAM CROSSING METHOD	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES13.1	
JOB NO.			REV. P	
PROJECT ID: PXXXX				

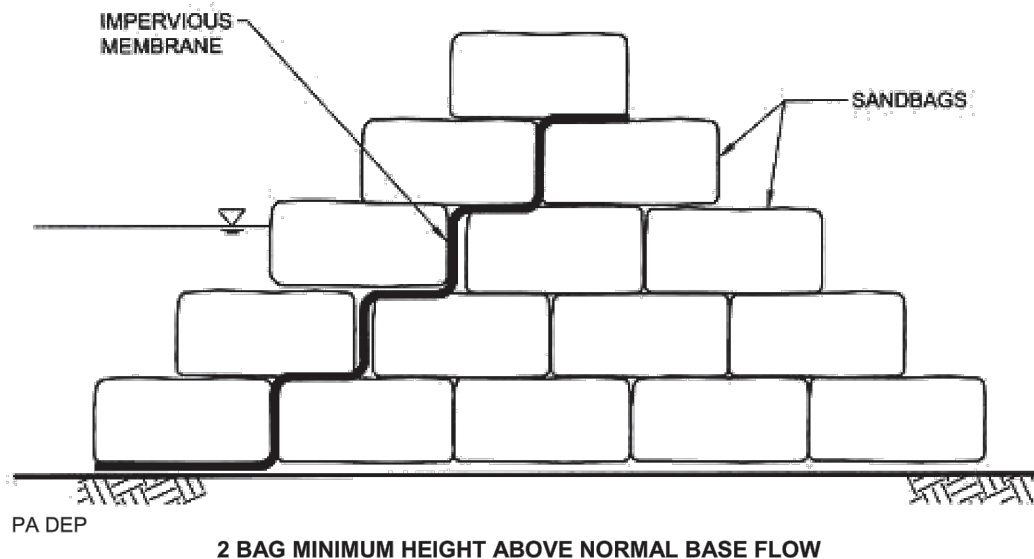
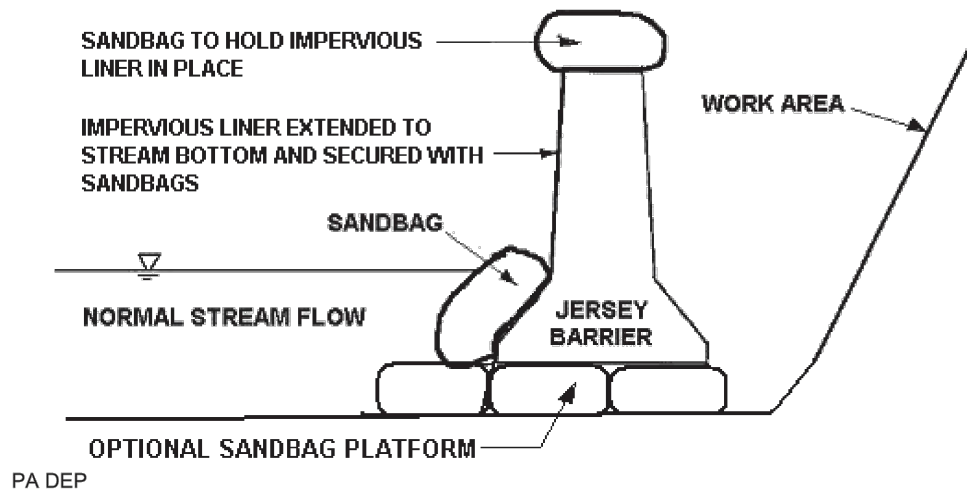



FIGURE 3.13
Jersey Barrier Cofferdam – End View

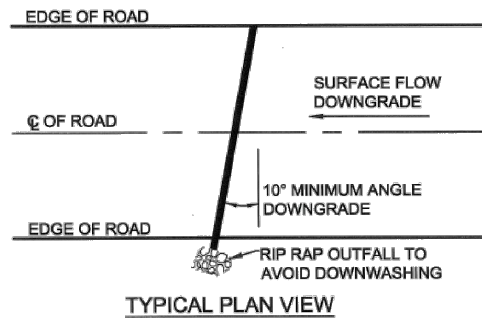
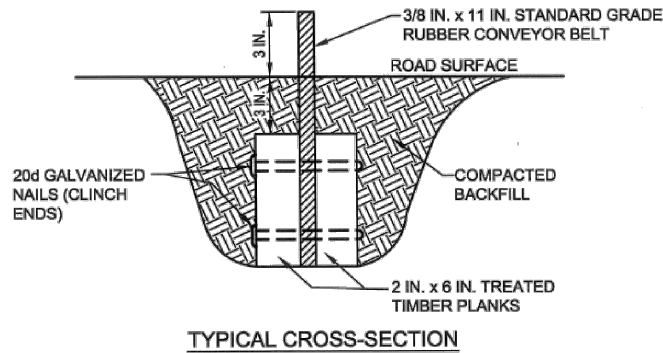


NOTES: AT NO TIME, SHOULD MORE THE 60% OF THE STREAM CHANNEL WIDTH BE DIVERTED DURING PIPELINE INSTALLATION.

GRUBBING SHALL NOT TAKE PLACE WITHIN 50 FEET OF TOP-OF-BANK UNTIL ALL MATERIALS REQUIRED TO COMPLETE CROSSING ARE ON SITE AND PIPE IS READY FOR INSTALLATION. TRENCH BREAKERS SHALL BE INSTALLED WITHIN THE TRENCH ON BOTH SIDES OF THE STREAM CHANNEL (MVP TYPICAL DETAIL MVP-20). WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO A PUMPED WATER FILTER BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY RECEIVING SURFACE WATER. HAZARDOUS OR POLLUTANT MATERIAL STORAGE AREAS SHALL BE LOCATED AT LEAST 100 FEET BACK FROM THE TOP OF STREAMBANK. ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA. ALL DISTURBED AREAS WITHIN 50 FEET OF TOP-OF-BANK SHALL BE BLANKETED OR MATTED WITHIN 24 HOURS OF INITIAL DISTURBANCE FOR MINOR STREAMS OR 48 HOURS OF INITIAL DISTURBANCE FOR MAJOR STREAMS UNLESS OTHERWISE AUTHORIZED.

DRAWN	DATE	 <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		COFFERDAM STREAM CROSSING METHOD	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES13.2	
JOB NO.			REV. P	
PROJECT ID:	PXXXX			

STANDARD CONSTRUCTION DETAIL Water Deflector



USDA Forest Service

Deflector shall be inspected weekly and after each runoff event.

Accumulated sediment shall be removed from deflector within 24 hours of inspection.

Belt shall be replaced when worn and no longer effective.

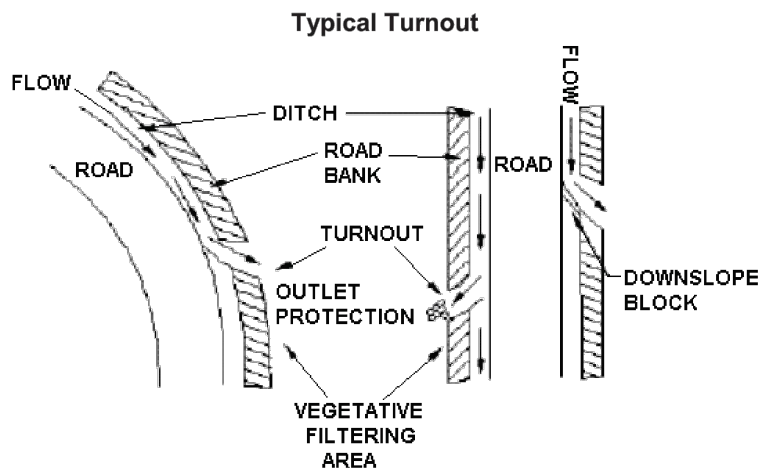
Deflectors may be used to direct runoff from an access road to a well-vegetated area or sediment removal facility.

A deflector is typically constructed from rubber belting ranging from 5/16" to 1/2" thick held between two 2" x 6" wooden planks.

This method of directing runoff from an access road works best on low traffic roads. deflectors can be used on roads with grades exceeding 10%.


Table 11-4 Spacing of Broad-Based Dips	
Road Grade (%)	Distance Between Drains (Ft)
2	300
3	235
4	200
5	180
6	165
7	155
8	150
9	145
10	140

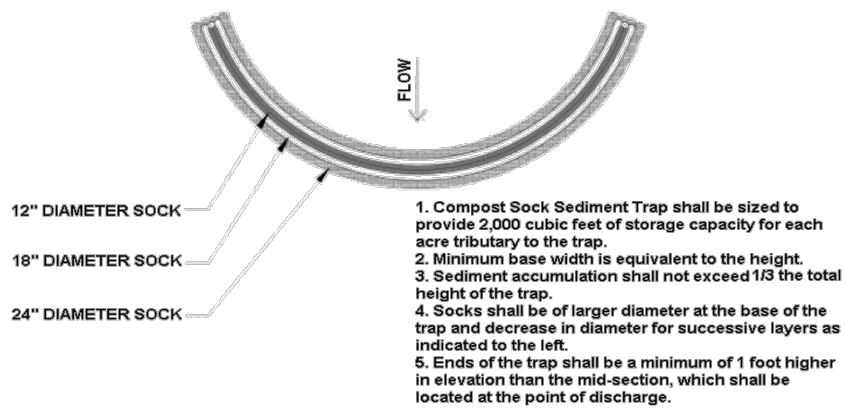
DRAWN	DATE	<p style="font-size: 24px; font-weight: bold; margin: 0;">Mountain Valley</p> <p style="font-size: 18px; font-weight: bold; margin: 0;">PIPELINE</p> <p style="font-size: 24px; font-weight: bold; margin: 0;">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		WATER DEFLECTOR	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX		MVP-ES14	P	



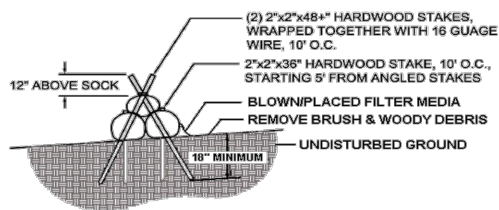
Indiana CCD

TURNOUT - SEDIMENT REMOVAL EFFICIENCY: VERY LOW. THIS DEVICE IS NOT AN ABACT FOR SPECIAL PROTECTION WATERSHEDS, BUT MAY BE USED TO MAKE OTHER BMPS WHICH ARE ABACT WORK MORE EFFECTIVELY. CHANNELS THAT DRAIN WATER AWAY FROM ROADS OR ROADSIDE DITCHES INTO WELL-VEGETATED AREAS ARE KNOWN AS TURNOUTS. TURNOUTS ARE TYPICALLY LOCATED ALONG CROWNED ROADWAYS WHERE RUNOFF CANNOT SHEET FLOW OFF THE ROADWAY. LIKE DITCH RELIEF CULVERTS, THE PURPOSE OF TURNOUTS IS TO MINIMIZE THE VOLUME OF WATER IN A ROADSIDE DITCH. TURNOUTS SHOULD BE LOCATED SO AS TO TAKE ADVANTAGE OF NATURAL DRAINAGE COURSES OR BUFFER AREAS WHEREVER POSSIBLE. AN EXCAVATED SUMP AT THE END OF THE TURNOUT CAN BE EFFECTIVELY USED TO POND AND SETTLE OUT SEDIMENT PRIOR TO DISCHARGING TO A VEGETATED BUFFER. WHERE A SUITABLE VEGETATIVE FILTER STRIP IS NOT AVAILABLE, A COMPOST FILTER SOCK, ROCK FILTER OR OTHER SEDIMENT REMOVAL BMP SHOULD BE INSTALLED AT THE OUTLET OF THE TURNOUT.

DRAWN	DATE	 <p style="text-align: center;">Mountain Valley PIPELINE</p> <p style="text-align: center;">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		ROAD TURNOUT DETAIL	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO. MVP-ES15	REV. P
PROJECT ID: PXXXX				



PLAN VIEW



Adapted from Filtrexx

STAKING DETAIL


Compost sock sediment traps shall not exceed three socks in height and shall be stacked in pyramidal form as shown above. Minimum trap height is one 24" diameter sock. Additional storage may be provided by means of an excavated sump 12" deep extending 1 to 3 feet upslope of the socks along the lower side of the trap.

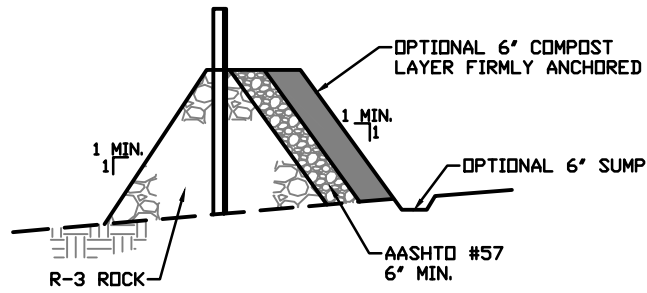
Compost sock sediment traps shall provide 2,000 cubic feet storage capacity with 12" freeboard for each tributary drainage acre. (See manufacturer for anticipated settlement.)

The maximum tributary drainage area is 5.0 acres. Since compost socks are "flow-through," no spillway is required.

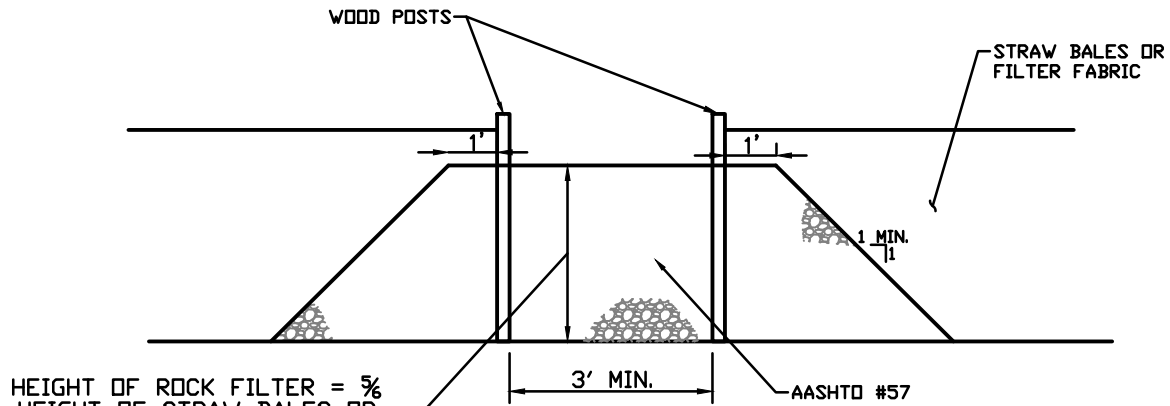
Compost sock sediment traps shall be inspected weekly and after each runoff event. Sediment shall be removed when it reaches 1/3 the height of the socks.

Photodegradable and biodegradable socks shall not be used for more than 1 year.

DRAWN	DATE		ENVIRONMENTAL DETAIL	
CHECKED	DATE		COMPOST SOCK SEDIMENT TRAP	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO.	
JOB NO.			REV.	
PROJECT ID:		DESIGN ENGINEERING	MVP-ES16	P
PXXXX				




OUTLET CROSS SECTION

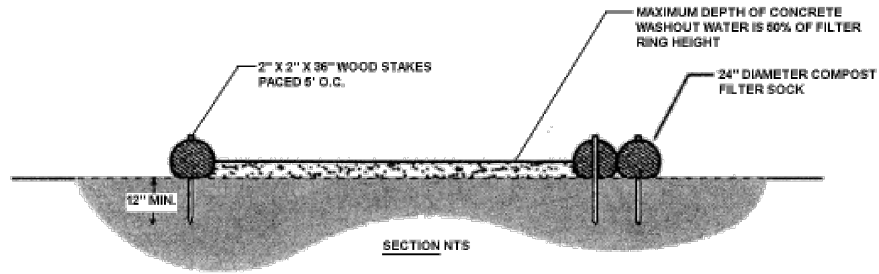


UP-SLOPE FACE

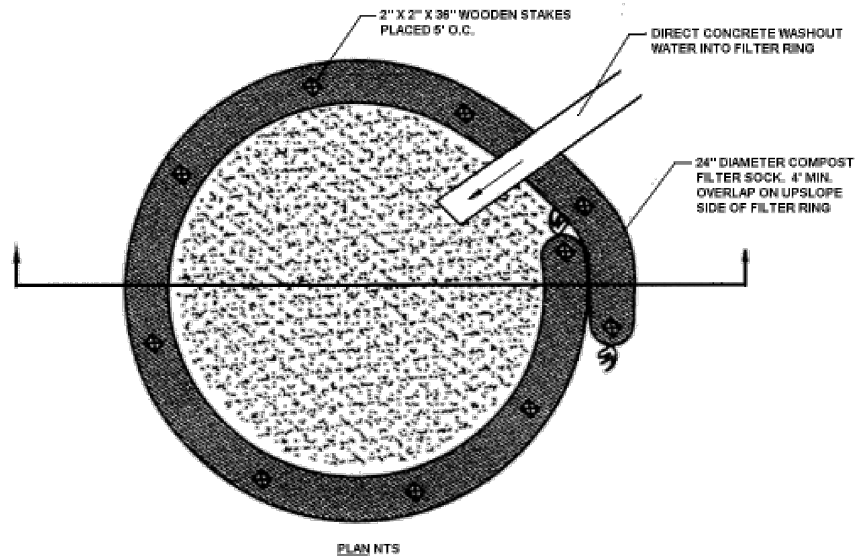
A ROCK FILTER OUTLET SHALL BE INSTALLED WHERE FAILURE OF A SILT FENCE OR STRAW BALE BARRIER HAS OCCURRED DUE TO CONCENTRATED FLOW. ANCHORED COMPOST LAYER SHALL BE USED ON UPSLOPE FACE IN HQ AND EV WATERSHEDS.

SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE HEIGHT OF THE OUTLET.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		ROCK FILTER OUTLET	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO.	
JOB NO.			REV.	
PROJECT ID:			MVP-ES17	P
PXXXX				



NOTES:
 1. INSTALL ON FLAT GRADE FOR OPTIMUM PERFORMANCE
 2. 18" DIAMETER FILTER SOCK MAY BE STACKED ONTO DOUBLE 24" DIAMETER SOCKS IN PYRAMIDAL CONFIGURATION FOR ADDED HEIGHT.




A suitable impervious geomembrane shall be placed at the location of the washout prior to installing the socks.
 Adapted from Filtrexx

Wherever compost sock washouts are used, a suitable impervious geomembrane should be placed at the location of the washout. Compost socks should be staked in the manner recommended by the manufacturer around perimeter of the geomembrane so as to form a ring with the ends of the sock located at the upslope corner. Care should be taken to ensure continuous contact of the sock with the geomembrane at all locations. where necessary, socks may be stacked and staked so as to form a triangular cross-section.

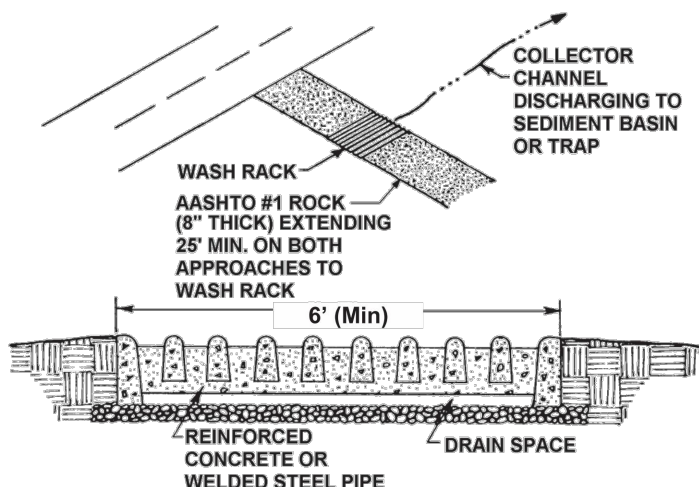
For any project on which concrete will be poured or otherwise formed on site, a suitable washout facility must be provided for the cleaning of chutes, mixers, and hoppers of the delivery vehicles unless such a facility will be used at the source of the concrete. Under no circumstances may wash water from these vehicles be allowed to enter any surface waters. Make sure that proper signage is provided to drivers so that they are aware of the presence of washout facilities. Washout facilities should not be placed within 50 feet of storm drains, open ditches or surface waters. They should be in a convenient location for the trucks, preferably near the place where the concrete is being poured, but far enough from other vehicular traffic to minimize the potential for accidental damage or spills. Wherever possible, they should be located on slopes not exceeding a 2% grade.

Maintenance

All concrete washout facilities should be inspected daily. Damaged or leaking washouts should be deactivated and repaired or replaced immediately. Accumulated materials should be removed when they reach 75% capacity. Plastic liners should be replaced with each cleaning of the washout facility.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		COMPOST SOCK WASHOUT PIT TYPICAL	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO.	
JOB NO.			MVP-ES18	
PROJECT ID:				REV.
PXXXX				P

Rock Construction Entrance with Wash Rack



Modified from Smith Cattleguard Company

IF EXCESSIVE AMOUNTS OF SEDIMENT ARE BEING DEPOSITED ON ROADWAY, EXTEND LENGTH OF ROCK CONSTRUCTION ENTRANCE BY 70 FOOT INCREMENTS UNTIL CONDITION IS ALLEVIATED OR INSTALL WASH RACK.

Wash rack shall be 20 feet (min.) wide or total width of access.

Wash rack shall be designed and constructed to accommodate anticipated construction vehicular traffic.

A water supply shall be made available to wash the wheels of all vehicles exiting the site.


MAINTENANCE: Rock construction entrance thickness shall be constantly maintained to the specified dimensions by adding rock. A stockpile of rock material shall be maintained on site for this purpose. Drain space under wash rack shall be kept open at all times. Damage to the wash rack shall be repaired prior to further use of the rack. All sediment deposited on roadways shall be removed and returned to the construction site immediately. Washing the roadway or sweeping the deposits into roadway ditches, sewers, culverts, or other drainage courses is not acceptable.

At a minimum, rock construction entrances with wash racks should be constructed to the length, width, and thickness dimensions shown on standard construction detail #3-2. A metal wash rack or livestock grate is an acceptable alternative to the reinforced concrete one shown in the standard detail. Approaches to the wash rack should be lined with aashto #1 at a minimum of 25' on both sides. The wash rack should discharge to a sediment removal facility, such as a vegetated filter strip or into a channel leading to a sediment removal device (e.g. a sediment trap or sediment basin). Rock construction entrances with wash racks should be maintained to the specified dimensions by adding rock when necessary at the end of each workday. A stockpile of rock material should be maintained on site for this purpose.

Sediment deposited on paved roadways should be removed and returned to the construction site.

NOTE: Washing the roadway or sweeping the deposits into roadway ditches, sewers, culverts, or other drainage courses is not acceptable.

Damaged wash racks should be repaired as necessary to maintain their effectiveness.

DRAWN	DATE	 <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		ROCK CONSTRUCTION ENTRANCE WITH WASH RACK	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES20	
JOB NO.			REV. P	
PROJECT ID: PXXXX				

ROCK FILTER - Sediment Removal Efficiency: LOW. This device is not an ABACT for special protection watersheds. However, the efficiency may be raised to moderate (ABACT for HQ watersheds) by anchoring a 6" layer of compost on the upgradient side. Rock filters may be used to control runoff within constructed channels — at the downstream end of the channel, during construction — until the protective lining is installed or during a temporary disturbance within the channel. They may also be used below construction work within an existing channel while flow is being diverted past the work area. In such cases, the filter should be located between the work area and the discharge from the bypass system. In no case are rock filters to be placed within a channel meeting the definition of a waterbody.

Rock filters may not be used instead of appropriate channel linings. This practice often results in overtopping of the channel during storm events, scouring of the channel bottom below the filter, or erosion of the channel side slopes as sediment deposits build up behind the filter. Rock filters may not be used in roadside ditches instead of a suitable temporary protective liner until vegetation is established except at the inflows to ditch relief culverts on dirt or gravel roads or on temporary or permanent access roads.

Rock filters may not be used instead of an adequate protective lining in sediment basin emergency spillways. This can reduce the effective discharge capacity of the spillway and, in so doing, increase the possibility of embankment failure.

Rock filters should be constructed according to the specifications shown in Standard Construction Detail # 4-14.


Rock filters should be constructed with riprap sized as follows:

For channels with total depth > 3 feet, use R-4.

For channels with total depth between 2 and 3 feet, use R-3.

Rock filters should not be used in channels of less than 2 feet total depth.

The filter should be equal in height to **half** the total channel depth with a 6" depression in the center.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		ROCK FILTER	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID:		MVP—ES21.1	P	
PXXXX				

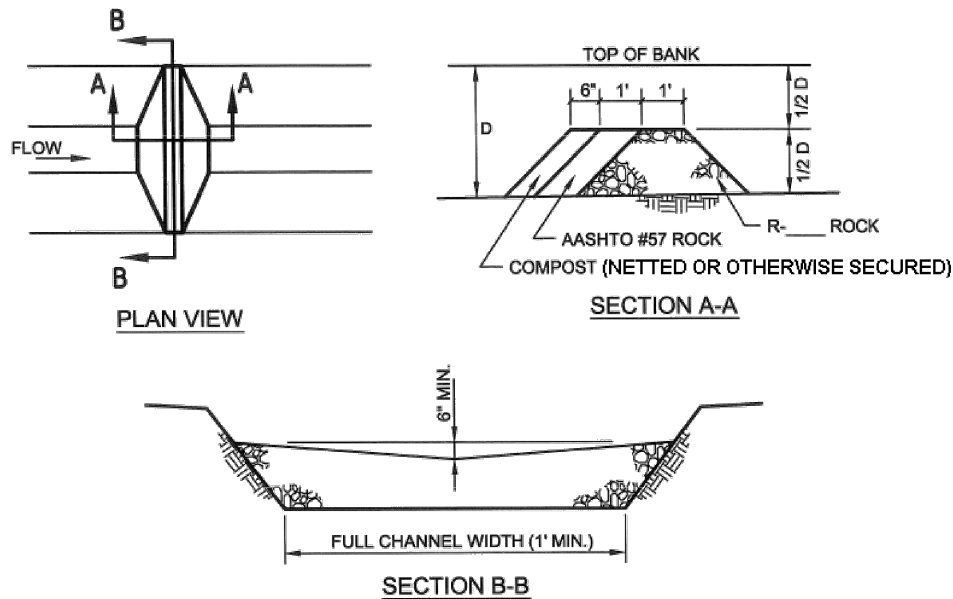
A one foot thick layer of AASHTO #57 (or smaller) stone should be placed on the upstream side of the filter. In special protection watersheds, a 6" layer of compost should be placed and anchored on top of the filter stone. NOTE: Filter fabric and straw bales should not be used in rock filters!

Rock filters should be inspected weekly and after each runoff event.

Clogged filter stone (AASHTO # 57) should be replaced.

Needed repairs should be initiated immediately after the inspection.

STANDARD CONSTRUCTION DETAIL # 4-14 Rock Filter



PA DEP


FOR $3' \leq D$ USE R-4
FOR $2' \leq D < 3'$ USE R-3
NOT APPLICABLE FOR $D < 2'$

NOTE: This table is intentionally blank and should be filled in by the plan preparer.

ROCK FILTER NO.	LOCATION	D (FT.)	RIPRAP SIZE

Sediment shall be removed when accumulations reach 1/2 the height of the filter.

Immediately upon stabilization of each channel, installer shall remove accumulated sediment, remove rock filter, and stabilize disturbed areas.


DRAWN	DATE	 Mountain Valley PIPELINE DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		ROCK FILTER	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID:	PXXXX	MVP-ES21.2	P	

VEGETATIVE FILTER STRIP - Sediment Removal Efficiency: MODERATE when used in series with another sediment removal BMP that does not result in a concentrated discharge onto the vegetative filter strip. This device, when used in this way, is an ABACT for HQ but not for EV watersheds. A vegetative filter strip consists of a well-vegetated, grassy area below a disturbed area that can be used to remove sediment from runoff prior to its reaching surface waters.

To be effective, runoff should be in the form of sheet flow, and the vegetative cover should be established prior to the disturbance. Due to the time required to establish vegetation and the need to control runoff from the areas disturbed while constructing filter strips, constructed vegetative filter strips are not recommended. The suitability of natural vegetative filter strips should be either field verified by the Department or conservation district or documented by photo(s) submitted by the applicant prior to approval. Vegetative filter strips on neighboring properties should not be proposed unless permission to use that area as a vegetative filter strip has been obtained from the owner of the property along with an agreement to leave the filter strip area undisturbed for as long as it is needed. Where control of the filter strip cannot be assured throughout its intended use, a substitute BMP that will be installed should the filter strip no longer be available should be specified in the E&S Plan.

Vegetative filter strips may be used to remove sediment from project runoff that is directed to the strip as sheet flow. The minimum filter strip width should be determined from Table 4.6.

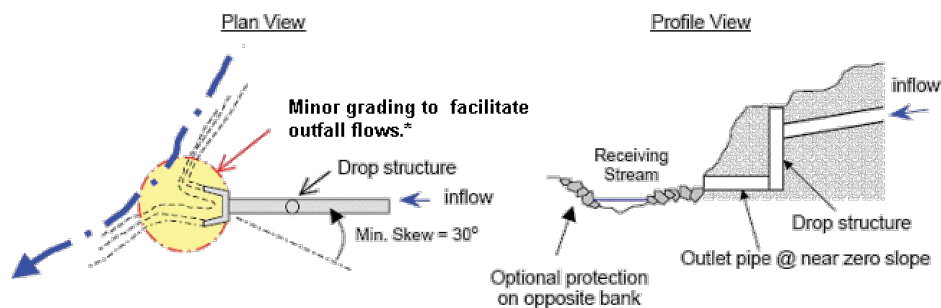
Vegetation should be an existing, well-established, perennial grass. Wooded and brushy areas are not acceptable for purposes of sediment removal.

DRAWN	DATE	 Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL	
CHECKED	DATE		VEGETATIVE FILTER STRIP	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO. MVP-ES22	
PROJECT ID: PXXXX		REV. P		
		DESIGN ENGINEERING		

RIPRAP APRON - Riprap aprons may be used to prevent scour at pipe or channel outfalls where anticipated discharge velocities do not exceed 17.0 feet per second, there is sufficient room to construct the apron, and where the aprons can be installed on a level grade. In cases where discharge velocities exceed 17.0 fps, a suitable means of velocity reduction (e.g. drop structure) should be used prior to discharging significant flows onto a riprap apron.


Aprons should be oriented so that the discharge enters the receiving channel at less than 90 degrees to the channel flow direction, as shown in Figure 9.2. In no case should the discharge enter the channel at an angle greater than 90 degrees to the channel flow direction.

**FIGURE 9.2
PROPER OUTFALL ORIENTATION TO RECEIVING STREAM**



***Chapter 105 permit(s) required. Provide sediment barrier to protect stream and outfall channels.**

Riprap aprons should be constructed according to the dimensions shown in Standard Construction Detail # 9-1 for outfalls having an endwall, or Standard Construction Detail #9-2 for outfalls with no endwall.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		RIPRAP APRON	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX			MVP-ES23.1	P

They should be constructed at or near zero grade from back to front and side to side. Where aprons are constructed with a gradient back to front, the rock size and/or apron length should be adjusted upwards to compensate. **In no case should riprap aprons be constructed with a back to front gradient exceeding 0.05 ft/ft.**

Determine whether the maximum or minimum tailwater conditions exist at the outfall for the design discharge.

Minimum tailwater exists when the depth of the flow in the receiving watercourse, as calculated by Manning's equation, is less than $\frac{1}{2}$ the diameter of the discharge pipe, or where no channel or swale exists at the point of discharge. Where this condition exists, use Figure 9.3. If the resulting apron width is wider than the existing channel width and discharge is directly into a downslope channel, as shown in Standard Construction Detail # 9-3, use the channel width as the width of the apron.


Maximum tailwater exists when the depth of flow in the receiving watercourse, as calculated by Manning's equation, is greater than $\frac{1}{2}$ the diameter of the discharge pipe. Where this condition exists, use figure 9.4. If the resulting apron width is wider than the existing channel width and discharge is directly into a downslope channel, as in Standard Construction Detail # 9-3, use the channel width as the width of the apron.

Note: Figure 9.3 and 9.4 should not be used for designing outlet protection below box culverts.

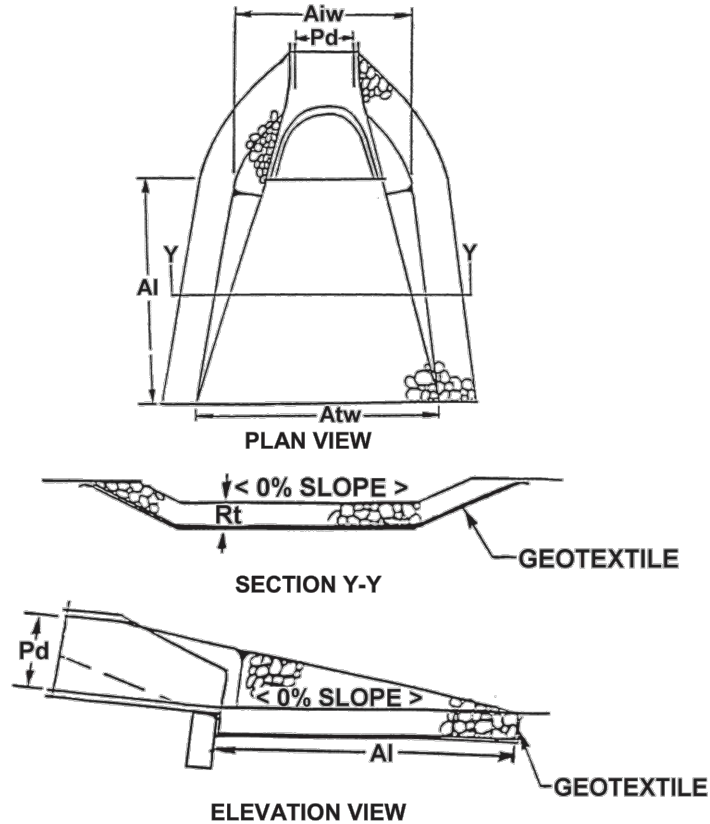
If the anticipated discharge velocity exceeds the maximum allowable in Table 6.6 for the riprap size taken from Figure 9.3 or 9.4, the size of the riprap should be increased to a size whose permissible velocity is not exceeded. If the velocity exceeds the maximum permissible for riprap, a suitable method of reducing the velocity prior to discharge onto the rock (e.g. drop structure or dissipater) should be incorporated into the design. Should a design discharge not intersect the curve corresponding to the pipe diameter, use the lowest point on that curve to determine apron dimensions.

Grouting of riprap is not recommended for most installations. Where riprap is grouted, the following applies:

1. Precautions must be taken to prevent uncured concrete from coming in contact with any surface waters.
2. Grout should be placed in a layer with thickness equivalent to the d50 stone size over the entire extent of the apron prior to rock placement.
3. After stone placement, void spaces should be filled with grout.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		RIPRAP APRON	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	
PROJECT ID:		MVP-ES23.2		P
PXXXX				

STANDARD CONSTRUCTION DETAIL # 9-1
Riprap Apron at Pipe Outlet with Flared End Section or Endwall




PA DEP

NOTE: This table is intentionally blank and should be filled in by the plan preparer.

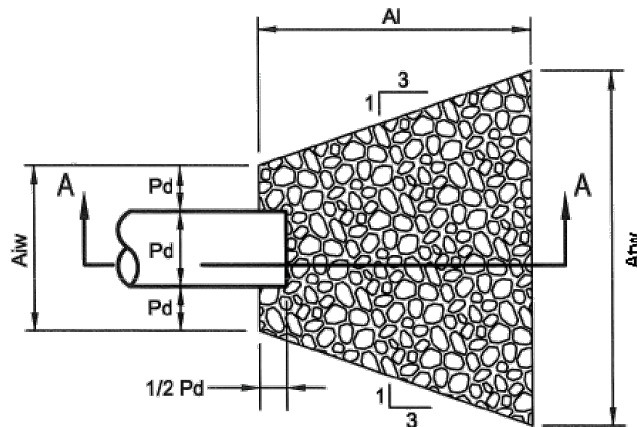
OUTLET NO.	PIPE DIA Pd (IN)	RIPRAP		LENGTH AI (FT)	APRON	
		SIZE (R-)	THICK. Rt (IN)		INITIAL WIDTH Aiw (FT)	TERMINAL WIDTH Atw (FT)

All aprons shall be constructed to the dimensions shown. Terminal widths shall be adjusted as necessary to match receiving channels.

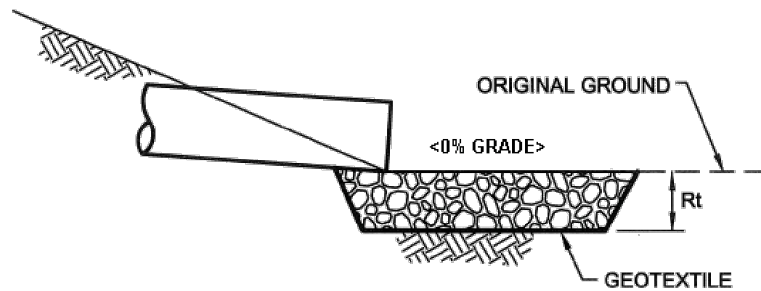
All aprons shall be inspected at least weekly and after each runoff event. Displaced riprap within the apron shall be replaced immediately.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		RIPRAP APRON	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID: PXXXX		MVP-ES23.3	P	

STANDARD CONSTRUCTION DETAIL # 9-2
Riprap Apron at Pipe Outlet without Flared Endwall



PLAN VIEW



SECTION A - A

Adapted from USDOT, FHA HEC-14


NOTE: This table is intentionally blank and should be filled in by the plan preparer.

OUTLET NO.	PIPE DIA Pd (IN)	RIPRAP		LENGTH Al (FT)	APRON	
		SIZE (R-__)	THICK. Rt (IN)		INITIAL WIDTH Aiw (FT)	TERMINAL WIDTH Atw (FT)

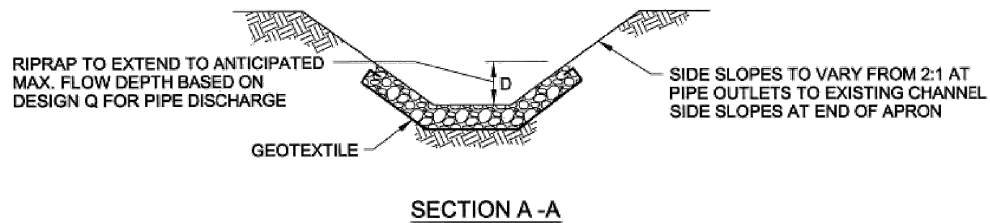
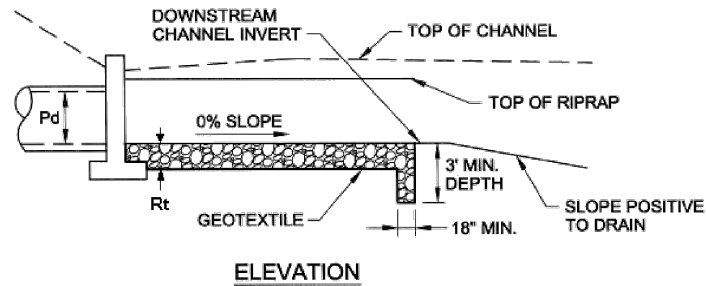
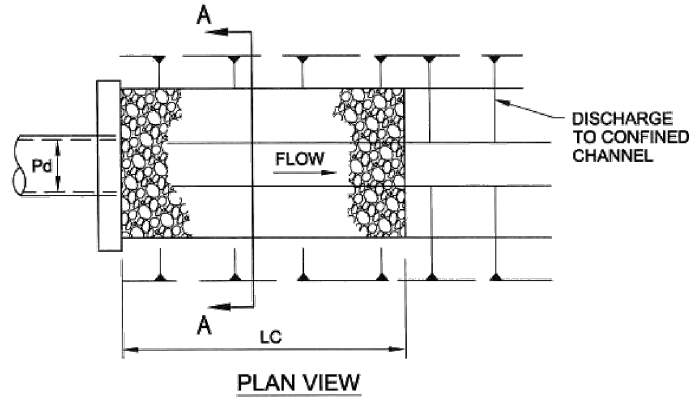
All aprons shall be constructed to the dimensions shown. Terminal widths shall be adjusted as necessary to match receiving channels.

All aprons shall be inspected at least weekly and after each runoff event. Displaced riprap within the apron shall be replaced immediately.

Extend riprap on back side of apron to at least ½ depth of pipe on both sides to prevent scour around the pipe.

DRAWN	DATE	 <p align="center">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		RIPRAP APRON	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			MVP-ES23.4	P
PXXXX				

STANDARD CONSTRUCTION DETAIL # 9-3 **Riprap Apron at Pipe Outlet to an Existing Channel**



Adapted from USDA NRCS

NOTE: This table is intentionally blank and should be filled in by the plan preparer.

OUTLET NO.	PIPE DIA Pd (IN)	RIPRAP			APRON				
		SIZE (R-___)	THICK. Rt (IN)	LENGTH LC (FT)	INITIAL BOTTOM WIDTH (at Endwall)(FT)	END WIDTH (FT)	INITIAL TOP WIDTH (at Endwall) (FT)	END TOP WIDTH (FT)	SIDE SLOPES H:V

All aprons shall be constructed to the dimensions shown. Terminal widths shall be adjusted as necessary to match receiving channels.

All aprons shall be inspected at least weekly and after each runoff event. Displaced riprap within the apron shall be replaced immediately.


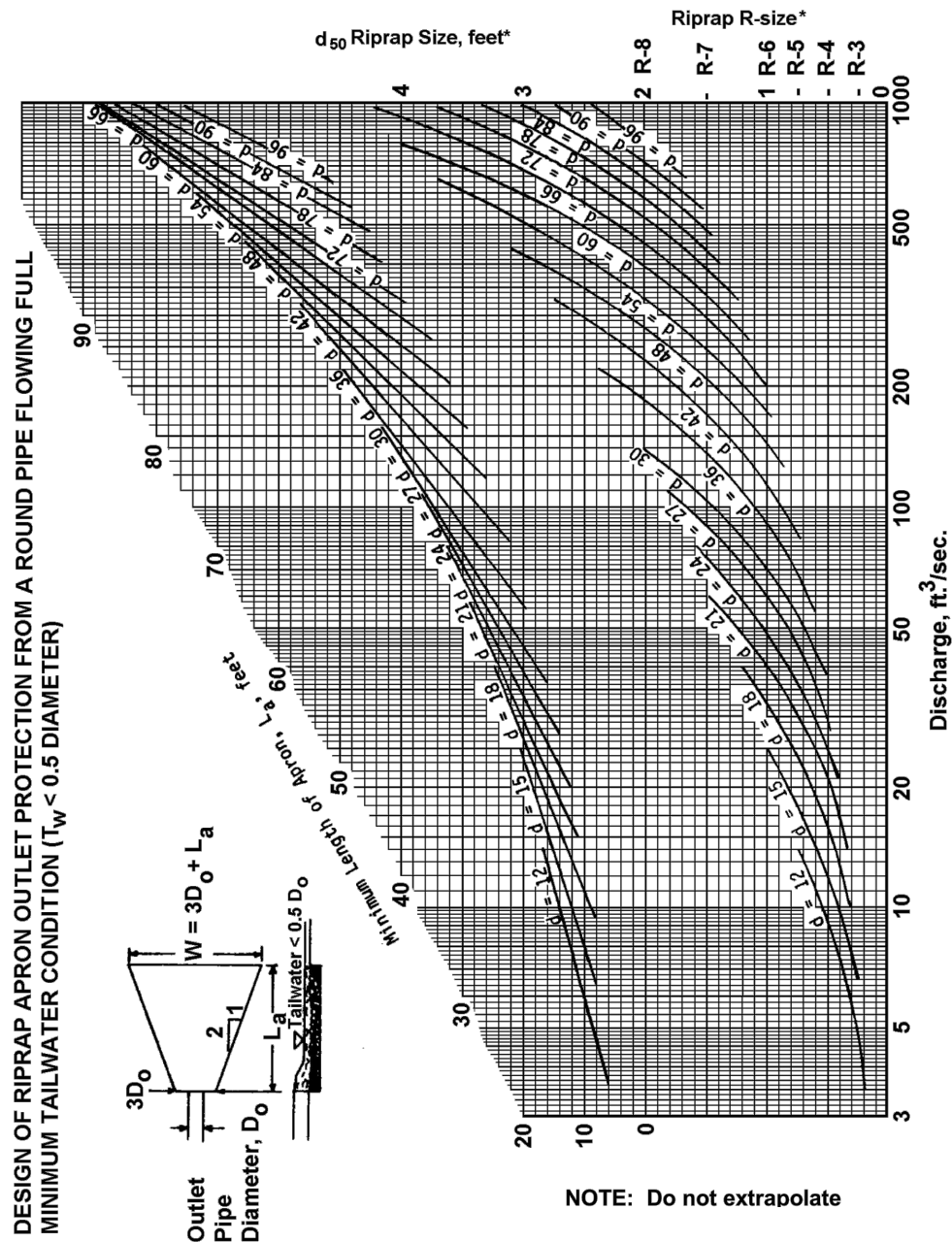
DRAWN	DATE	 <p align="center">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		RIPRAP APRON	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX		MVP-ES23.5	P	

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

Adapted from USDA - NRCS

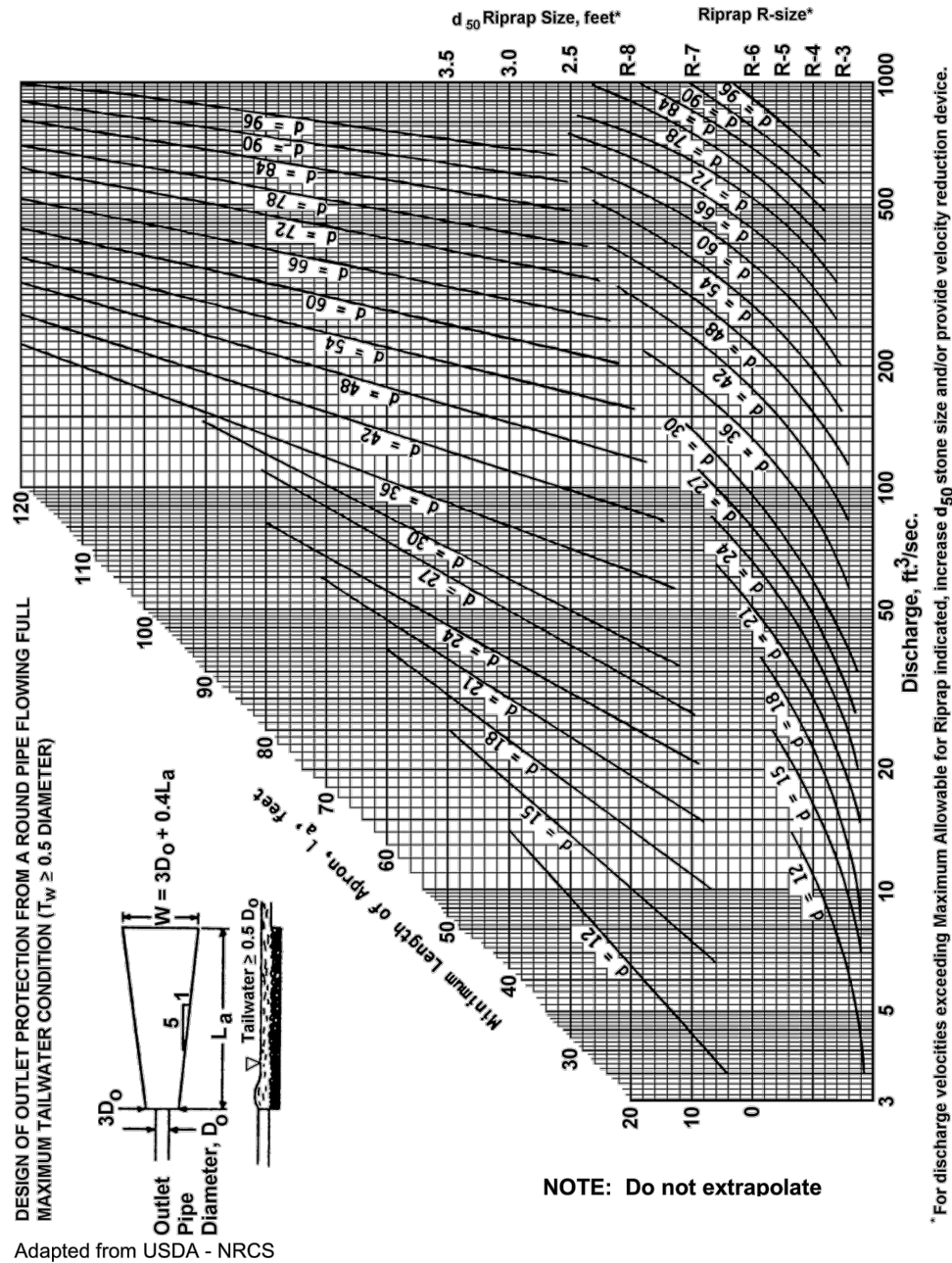
Not to be used for Box Culverts

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


DESIGN ENGINEERING

ENVIRONMENTAL DETAIL	
RIPRAP APRON	
DRAWING NO. MVP-ES23.6	REV. P

FIGURE 9.4
Riprap Apron Design, Maximum Tailwater Condition



Not to be used for Box Culverts

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


Mountain Valley
 PIPELINE
 DESIGN ENGINEERING

ENVIRONMENTAL DETAIL	
RIPRAP APRON	
DRAWING NO. MVP-ES23.7	REV. P

Determine whether maximum or minimum tailwater conditions exist at the outfall for the design discharge.

Minimum tailwater exists when the depth of flow in the receiving watercourse, as calculated by Manning's equation, is less than $\frac{1}{2}$ the diameter of the discharge pipe, or where no channel or swale exists at the point of discharge. Where this condition exists, use Figure 9.3. If the resulting apron width is wider than the existing channel width and discharge is directly into a downslope channel, as in Standard Construction Detail #9-3, use the channel width as the width of the apron.

Maximum tailwater exists when the depth of flow in the receiving watercourse, as calculated by Manning's equation, is greater than $\frac{1}{2}$ the diameter of the discharge pipe. Where this condition exists, use Figure 9.4. If the resulting apron width is wider than the existing channel width and discharge is directly into a downslope channel, as in Standard Construction Detail #9-3, use the channel width as the width of the apron.

For less than full-pipe flow conditions, calculate anticipated velocity as described at the beginning of this chapter and adjust riprap size where necessary to comply with Table 6.6. Locate the design discharge along the bottom of Figure 9.3 or 9.4. Follow a vertical line to the point where it intersects the first curve corresponding to the diameter of the discharge pipe. From that point follow a horizontal line to the right to determine the minimum R-size of the riprap. **Do not extrapolate the curve lines.** Where flows fall below the curve for a specific size of pipe, use the minimum rock size and apron dimensions indicated at the lower ends of the curves for the proposed pipe size.

Check Table 6.6 to make sure that the anticipated discharge velocity does not exceed the maximum permissible velocity for the size of riprap obtained in this step. If the anticipated discharge velocity exceeds the maximum permissible velocity, increase the size of the riprap to a size whose permissible velocity is not exceeded.

Follow the same vertical line mentioned above to the point where it intersects the second curve corresponding to the diameter of the discharge pipe. From that point, follow a horizontal line to the left and read the minimum length of the apron (L_a) in feet.

For minimum tailwater conditions, the apron width (W) may be calculated by the formula:

$$W = 3D_o + L_a$$

where D_o = Outlet pipe diameter
 L_a = Length of the apron


For maximum tailwater conditions, the apron width (W) may be calculated by the formula:

$$W = 3D_o + 0.4 L_a$$

Where the apron design width (W) exceeds the downstream watercourse bottom width and the apron is directly in line with the channel, the maximum width of the apron should be the channel width.

Grouting of riprap is not recommended for most installations. Where riprap is grouted, the following applies:

1. Precautions must be taken to prevent uncured concrete from coming into contact with any surface waters.
2. Grout should be placed in a layer with thickness equivalent to the d50 stone size over the entire extent of the apron prior to rock placement.
3. After stone placement, void spaces should be filled with grout.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		RIPRAP APRON	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			REV.	
PXXXX		MVP-ES23.8		P

EARTHEN LEVEL SPREADER

LOCATION - Earthen level spreaders are normally used where diversion ditches or dikes outlet onto areas of established vegetation — grass, typically not brush or forested. They are **not** to be used below sediment traps, sediment basins, or stormwater pipes.

Earthen level spreaders may be used for drainage areas less than or equal to 1 acre where sediment-free stormwater runoff can be released in sheet flow down a stabilized slope without causing erosion. Where the downstream slope is stabilized with grass, a minimum uniform cover of 90% is required. Wooded areas, with little or no grass cover, are not considered stabilized areas for this purpose. Earthen level spreaders should only be used where there will be no construction traffic over the level spreader.

To avoid reconcentrating flow downstream of the spreader, the maximum distance from the earthen level spreader to an existing or constructed defined drainage course is 100 feet with a 6% maximum slope and where very uniform and very stable site conditions exist. Greater distances may be considered on a case-by-case basis for very mild slopes and heavily vegetated areas but should not normally exceed 150 feet.

Earthen level spreaders should be constructed on soil, not on fill.

MAXIMUM DRAINAGE AREA - Maximum drainage area to an earthen level spreader should not exceed 1 acre.


MAXIMUM DISCHARGE and MINIMUM LENGTH - The maximum discharge for earthen level spreaders should be 1 cfs per foot of length based on the peak rate of flow from a ten-year frequency rainfall event. An acceptable simplified method to determine the length (L_{min}) is that L_{min} is equal to five feet per acre of drainage area.

DESIGN - The grade of the last 20 feet of the diversion channel that feeds the earthen level spreader should create a smooth transition from the channel grade to the earthen level spreader and, where possible, should be less than or equal to 1 percent. Construct earthen level spreaders on zero percent grades to insure uniform spreading of sediment-free runoff. Minimum width of earthen level spreaders should be 6 feet. A transition section should be constructed between the diversion channel and the earthen level spreader if the widths are different.

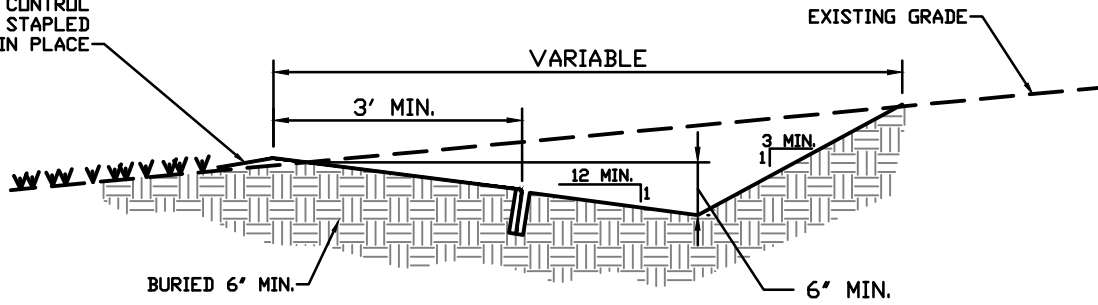
Protect the lip of an earthen level spreader with an erosion-resistant material, such as a reinforced erosion control blanket or TRM, to prevent erosion and enable vegetation to become established. For a permanent installation, a rigid lip of non-erodible material, such as pressure-treated timbers or concrete curbing, should be used. A smooth transition should be provided between the level spreader and the native ground downslope.

For a vegetated lip, the erosion-control matting should be a minimum of 4 feet wide and extend 6 inches over the level lip. The upstream edge should be buried at least six inches deep in a vertical trench. The downstream edge should be securely held in place with closely spaced, heavy-duty staples, at least 12 inches long. A rigid level lip should be entrenched at least 2 inches below the ground surface and securely anchored to prevent displacement. Immediately after the earthen level spreader is constructed, the entire area of the spreader should be appropriately seeded and mulched.

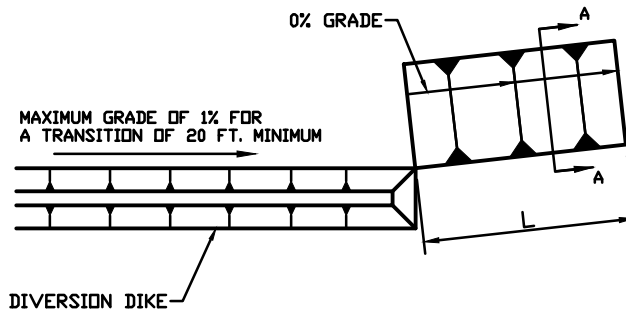
Typical details of earthen level spreaders are shown on Standard Construction Detail # 9-5.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		EARTHEN LEVEL SPREADER	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID: PXXXX			DRAWING NO. MVP—ES24.1	REV. P

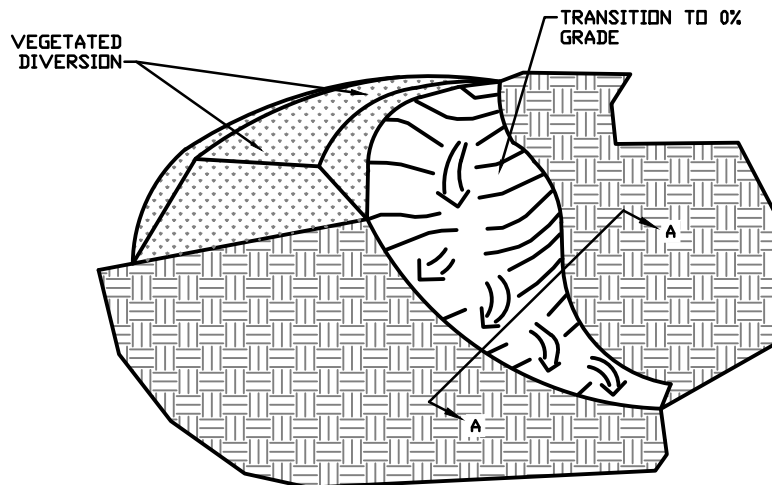
EROSION CONTROL
BLANKET STAPLED
IN PLACE



SECTION A-A



PLAN VIEW



ISOMETRIC VIEW

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

 **Mountain**
Valley
PIPELINE
DESIGN ENGINEERING

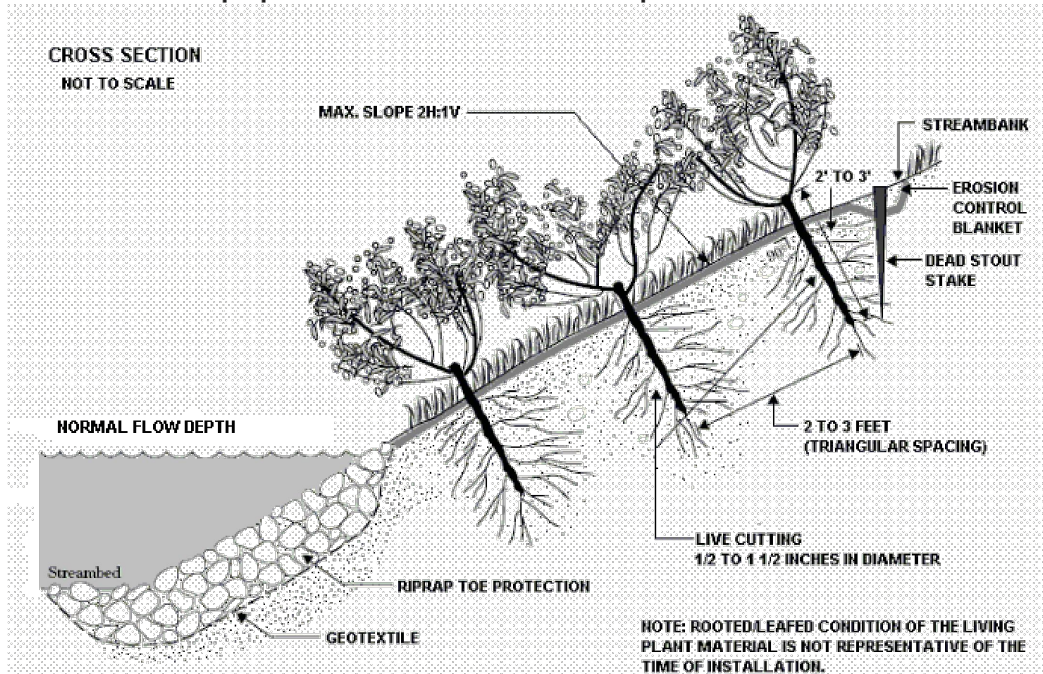
ENVIRONMENTAL DETAIL

EARTHEN LEVEL SPREADER

DRAWING NO.
MVP-ES24.2

REV.
P


Figure 15.1
Riprap Streambank Protection with Optional Live Stakes



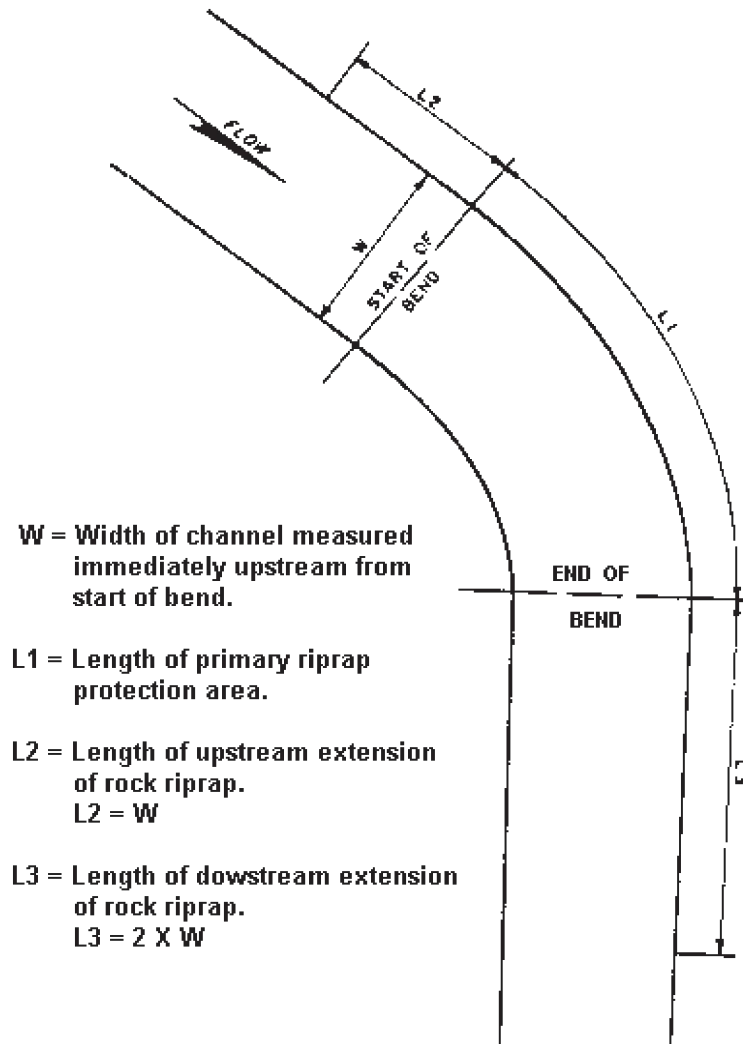
Adapted from USDA NRCS, *Engineering Field Handbook*, Chapter 16

Filter stone, as specified in Table 6.6, may be substituted for the geotextile where site and soil conditions warrant.

NOTE: Extend riprap into streambed only as far as required to provide proper toe support.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		RIPRAP STREAMBANK PROTECTION WITH OPTIONAL LIVE STAKES	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX			MVP-ES25	P

Extension of Primary Rock Riprap Protection Area



PA DEP

NOTE:

UPSTREAM AND DOWNSTREAM ENDS MUST BE KEYED INTO THE BANK AS PER PERMIT REQUIREMENTS


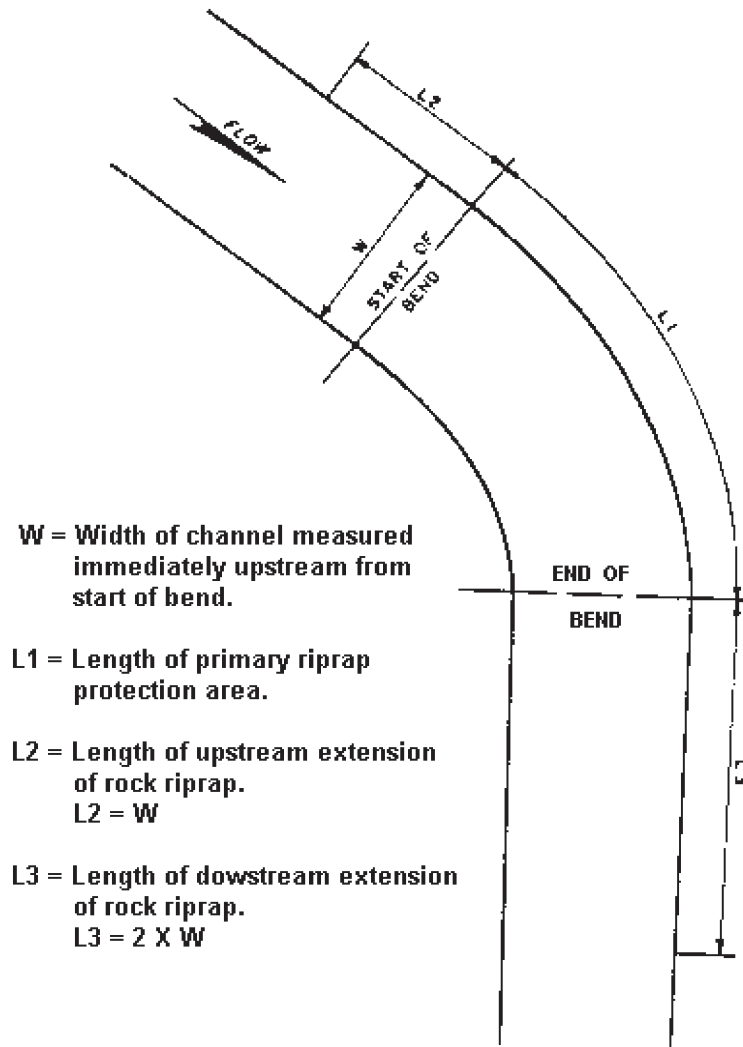

DRAWN	DATE	 Mountain Valley PIPELINE DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		ROCK RIPRAP PROTECTION AREA	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	
PROJECT ID:		MVP-ES26		P
PXXXX				

FIGURE 15.2
Extension of Primary Rock Riprap Protection Area



PA DEP

NOTE: Upstream and downstream ends must be keyed into the bank as per GP-3 requirements.

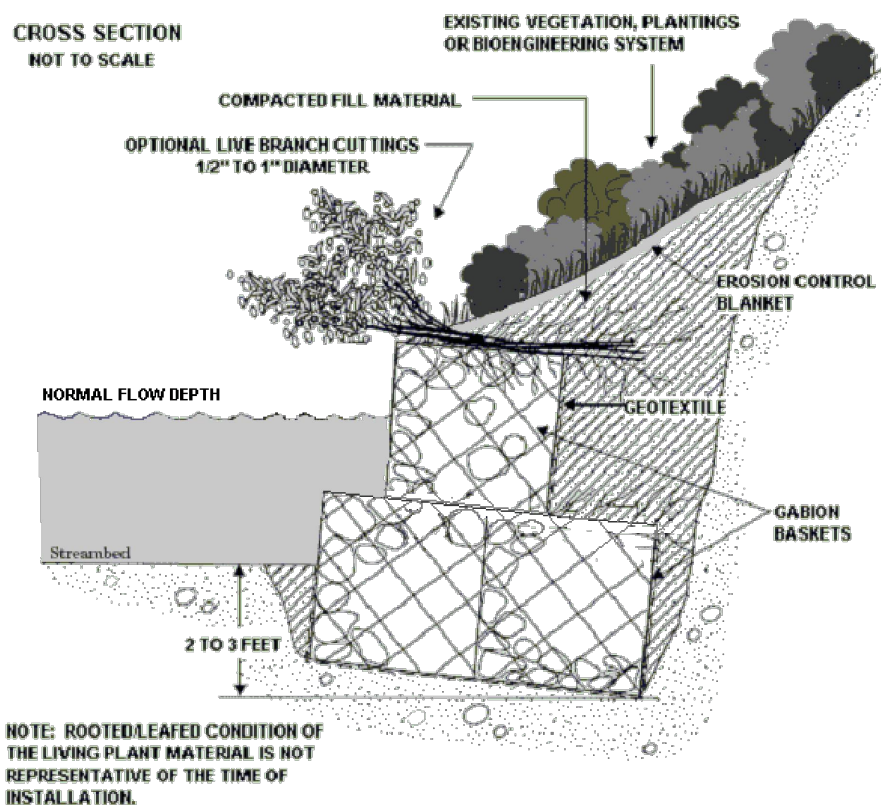
DRAWN	DATE	 <div>Mountain Valley PIPELINE</div> <div>DESIGN ENGINEERING</div>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		ROCK RIPRAP PROTECTION AREA	
APP'D	DATE		DRAWING NO. MVP-ES26	REV. P
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID: PXXXX				

GABIONS and Reno mattress have been used to stabilize stream banks for many years. Results have been mixed. While successful in many locations, gabions have failed where undermined or where the wire baskets have been damaged by abrasion or corrosion. Therefore, before specifying gabions for streambank stabilization, consideration should be given to the available substrate, pH, and anticipated sediment transport of the water. If these are not suitable, another form of stabilization should be considered.


Where gabions or Reno mattresses are proposed, they are typically installed as shown in Figure 15.3 or 15.4. As with other types of stabilization, sufficient details should be provided on the detail sheets to ensure their proper installation, and supporting calculations should be included in the narrative to show they are properly sized. Gabion and Reno mattress installations should be designed according to manufacturers' specifications.

Special attention should be given to preventing scour at the upstream and downstream ends of the baskets. Appropriate means to prevent undermining should also be taken.

FIGURE 15.3
Gabion Streambank Protection



Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

DRAWN	DATE	 <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		GABION STREAMBANK PROTECTION	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES27	
JOB NO.			REV. P	
PROJECT ID:	PXXXX			

BIOENGINEERING


A number of bioengineering techniques have been developed in recent years that effectively stabilize streambanks while providing a more natural appearance than is afforded by hard armor. The following are a few examples:

Live stakes are woody vegetative cuttings, typically willow, dogwood or other species tolerant of occasional flooding, that are capable of rooting when inserted into the ground. When properly prepared, handled, and placed, the stakes will root, grow, and form a stabilizing root mat. This mat reinforces the soil by binding soil particles, extracting excess moisture, and providing a protective cover.

Stakes should be freshly cut, healthy, straight, and at least 1 year old with side branches removed and bark intact. Cuttings should be ½" to 1 ½" diameter and 2 to 3 feet long. Bases should be cut cleanly at an angle to facilitate insertion into the soil. Tops should be square to aid in tamping.

APPLICATIONS

- Live Stakes should be installed during the dormant period.
- They are an effective streambank protection where site conditions are uncomplicated, construction time is limited, and an inexpensive method is desired.
- Live Stakes can be used to repair small earth slips and slumps in frequently wet areas.
- They can be used to peg down some erosion control blankets.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BIOENGINEERING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID: PXXXX		MVP-ES28.1	P	

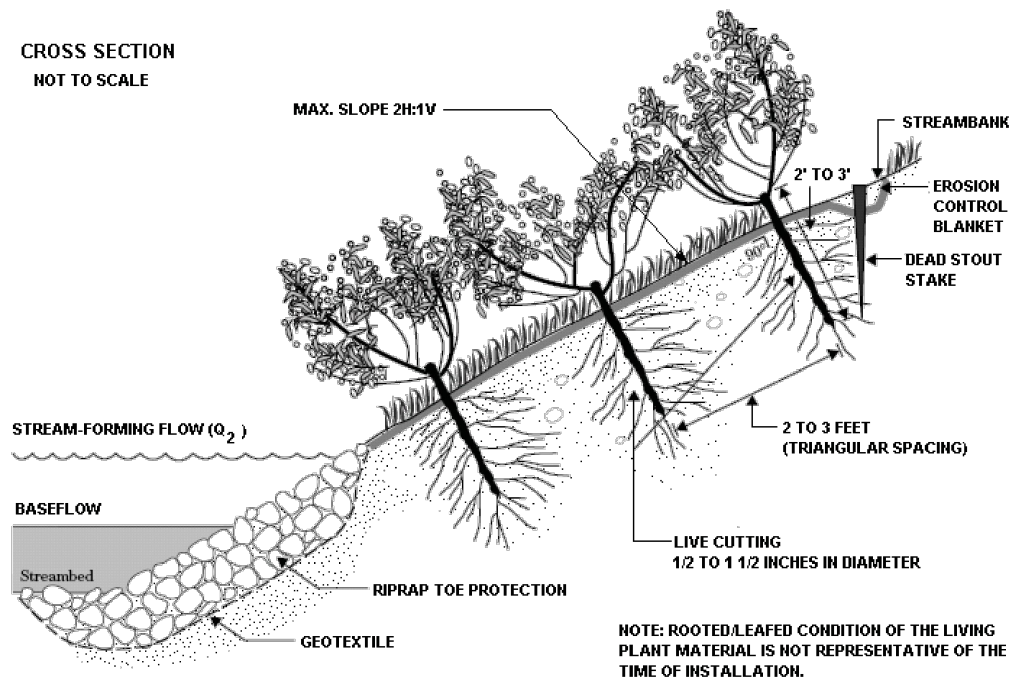
- Natural colonization by surrounding plant communities can be enhanced by the installation of live stakes.
- Intervening areas between other bioengineering techniques can be stabilized with live stakes.
- Live stakes enhance natural habitat.

INSTALLATION GUIDELINES


- Grade slopes to 2H:1V, or flatter for less cohesive soils or presence of sand lenses. Install suitable toe protection, such as properly sized riprap, below the stream-forming flow elevation (2-year storm = Q_2 , often marked by a lack of vegetation).
- Erodible slopes should be blanketed prior to inserting cuttings.
- Keep cuttings fresh and moist after they have been cut into appropriate lengths. Cuttings should be installed the same day that they are prepared. If this is not possible, it is recommended that they be soaked 24 hours prior to installation.
- Tamp cuttings into the ground at 90 degrees to the slope and angled downstream. Approximately 4/5 of the cutting should be inserted into the ground. 2 to 5 bud scars should remain above ground. Buds should be oriented up, and soil should be firmly packed around the stake.
- Care should be taken to avoid splitting the stakes during installation. Split stakes should be replaced. If there is difficulty in tamping the stakes, an iron bar can be used to make a pilot hole.
- Stakes should be placed 2 to 3 feet apart using triangular spacing.

FIGURE 15.6
Live Stakes

CROSS SECTION
NOT TO SCALE



Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BIOENGINEERING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES28.2	
JOB NO.			REV. P	
PROJECT ID:	PXXXX			

Live fascines are long bundles of branch cuttings bound together. They are typically placed in shallow trenches on slopes and streambanks to reduce erosion and shallow sliding.

Cuttings should be ¼" to 1" in diameter cut from species that root easily and have long, straight branches, such as willow or dogwood. They should be tied together with untreated twine to form a live fascine ranging from 5 to 10 feet long depending upon site conditions and handling limitations. Diameters of the bundles should be 6 to 8 inches. All buds should be oriented in the same direction. Cuttings should be staggered so that tops are evenly distributed length wise along the bundle.

APPLICATIONS

- Live fascines are an effective streambank stabilization technique. When properly installed, there is a minimum of site disturbance.
- Live fascines can be used to protect slopes from shallow — 1 to 2 foot depth — slides.
- Typically, live fascines are placed above the bankfull elevation, although for small watersheds (< 2,000 acres) they may be placed below the bankfull elevation.
- Live fascines offer immediate protection from surface erosion.
- Conditions for native plant colonization are enhanced.

INSTALLATION GUIDELINES

- Prepare the live fascine bundle and live stakes immediately prior to installation.
- Dig a 10" X 10" trench along contour at the base of the slope just above stream-forming flow, 2-year-24-hour peak flow elevation = Q_2 . Note: A suitable toe protection such as, properly sized riprap, should be installed below the trench. See Figure 15.7.
- Additional trenches should be spaced on the slope at intervals shown in Table 15.1.
- Intervals between trenches should be seeded, mulched, and covered with a suitable erosion control blanket.
- Place live fascine into the trench as shown in Figure 15.7.
- Drive dead stakes directly through the live fascine until flush with the top of the bundle. Use extra stakes at bundle overlaps.
- Tamp in live stakes immediately downslope (adjacent to) the bundle leaving the top 3" of the live stake exposed.
- Place moist soil along the sides of the bundles leaving the top of the live fascine slightly exposed.

TABLE 15.1
Live Fascine Spacing (ft)

Slope Steepness	Predominant Soils		
	Erosive	Non-erosive	Fill
3H:1V or flatter	3 to 5	5 to 7	3 to 5 *
Up to 1H:1V	3*	3 to 5	Not recommended

* Not recommended alone

Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16


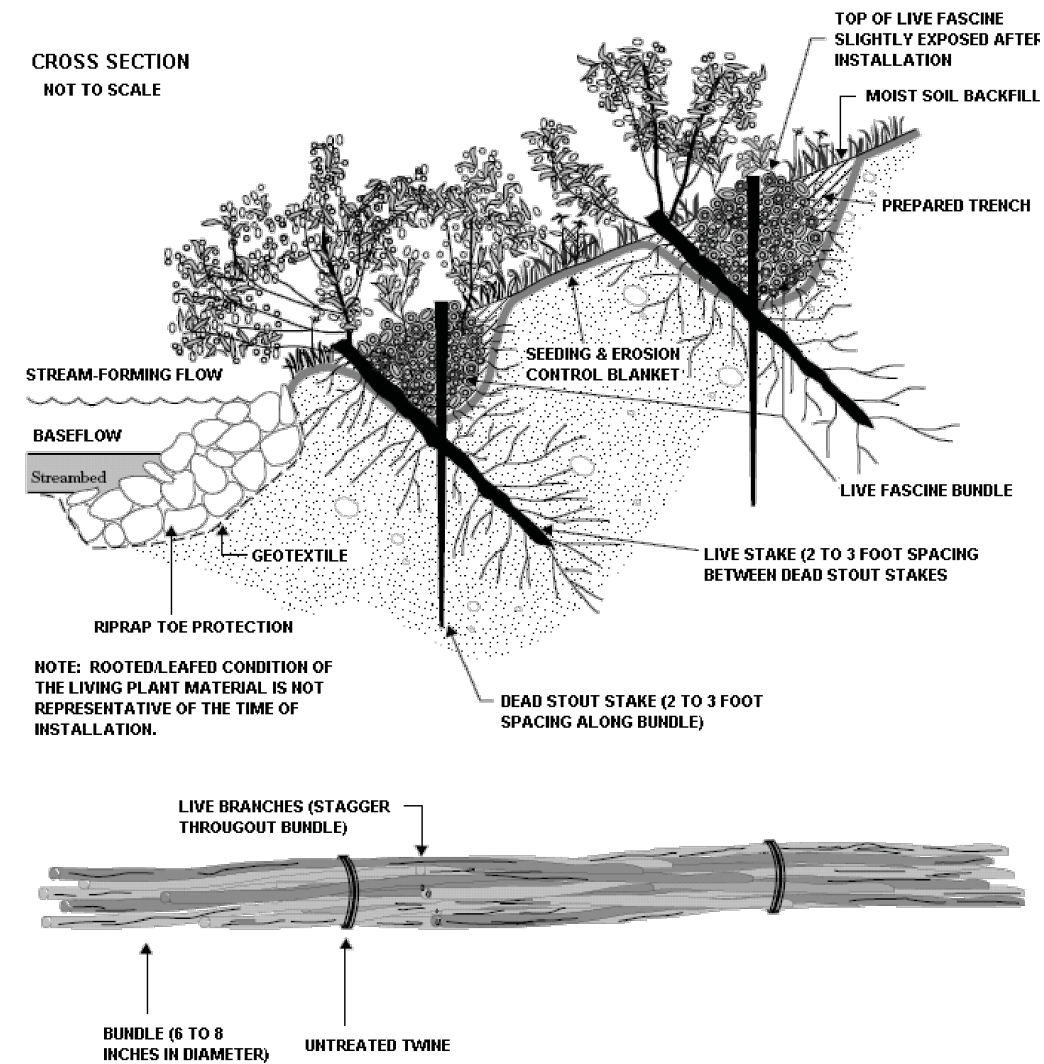

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		LIVE FASCINES	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID:		MVP—ES29.1	P	
PXXXX				

FIGURE 15.7
Live Fascines



Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

DRAWN	DATE	 <div>Mountain Valley PIPELINE</div>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		LIVE FASCINES	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO. MVP-ES29.2	
PROJECT ID: PXXXX				
		DESIGN ENGINEERING		

Branchpacking is the alternating of layers of live branches and compacted backfill to repair small scour holes and slips in streambanks. It provides a filter barrier that prevents erosion from bankfull and overbank flows. Branchpacking rapidly establishes a vegetated streambank and enhances colonization by native vegetation.

Soil is immediately reinforced. The live branches serve as tensile reinforcement. Once the plant tops begin to grow, the branchpacking system becomes increasingly effective in retarding runoff and minimizing erosion. Sediment trapped by the vegetation refills the hole, while the roots spread throughout the surrounding soil to form a unified mass.


The live branches should range from ½" to 2" in diameter and be long enough to reach from the undisturbed soil at the back of the trench and extend slightly from the rebuilt streambank.

APPLICATIONS

- Branchpacking is an effective means of repairing holes in streambanks ranging from 2 to 4 feet in height and depth.
- It is typically not effective in repairing slump areas greater than 4 feet high or 4 feet deep.

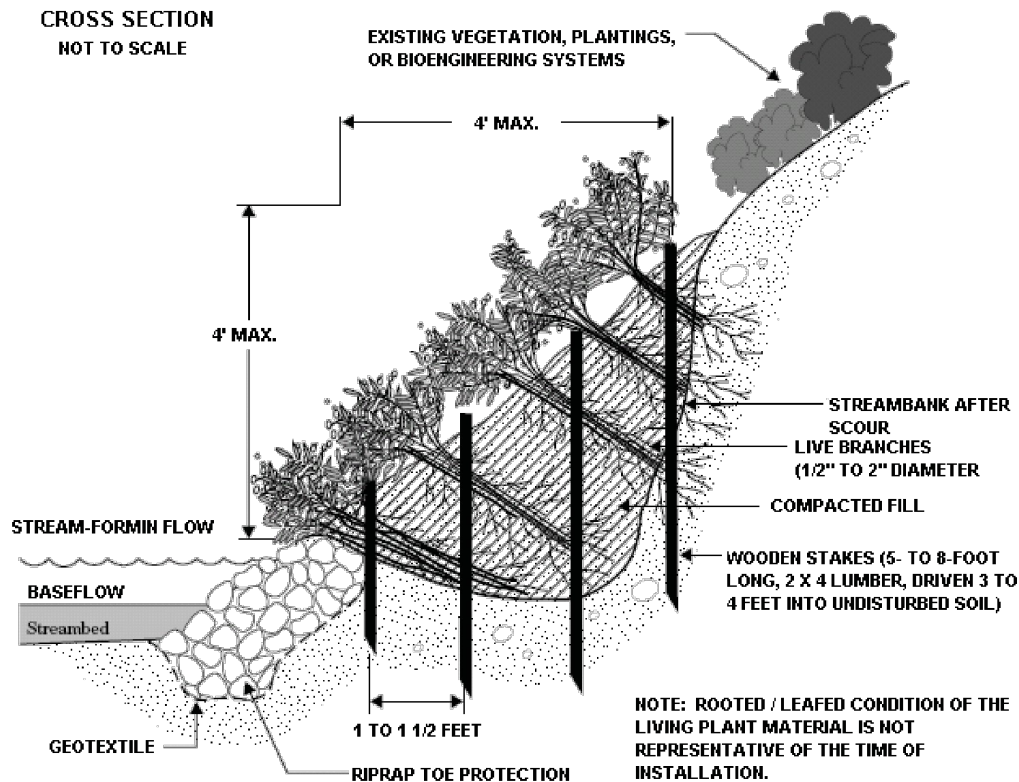
INSTALLATION GUIDELINES

- Divert any concentrated upslope runoff away from the repair area.
- Prepare the cuttings immediately prior to installation.
- Install suitable toe protection, such as, properly sized riprap or fiber log, below the stream-forming flow elevation (2-year storm elevation = Q_2).


DRAWN	DATE	 Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BRANCHPACKING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:		DESIGN ENGINEERING	MVP-ES30.1	REV. P
PXXXX				

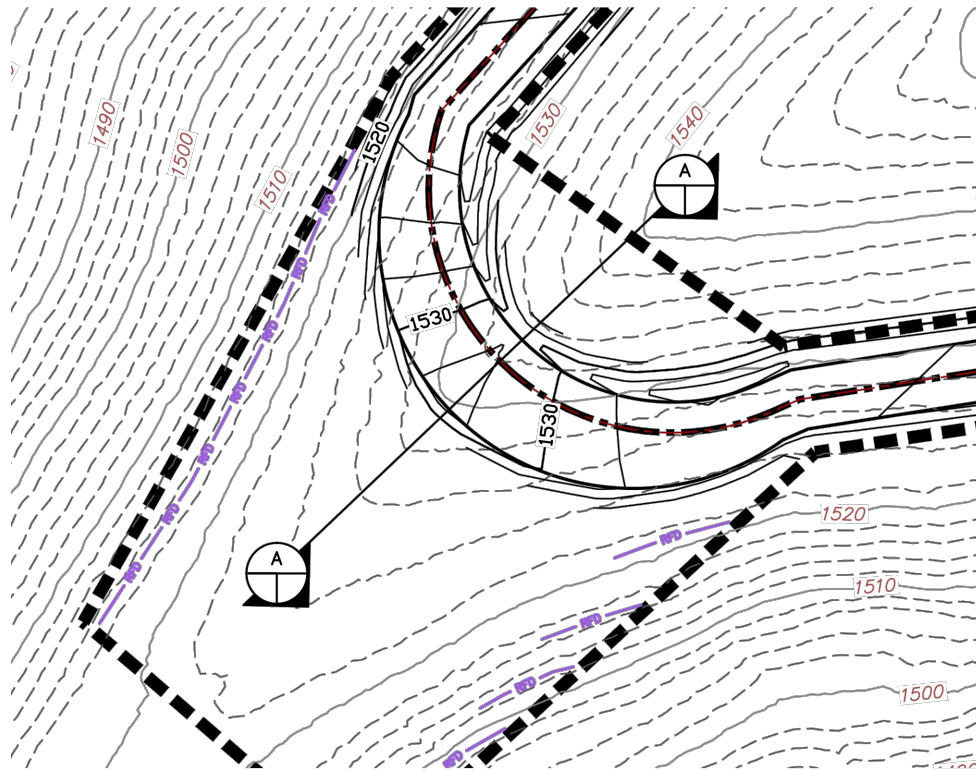
- Beginning at the lowest point just above the Q_2 elevation, drive wooden stakes vertically 3 to 4 feet into the ground. Stakes should be spaced 1 to 1 ½ feet apart as shown in Figure 15.8.
- Place initial layer of branches 4" to 6" thick in the bottom of the hole, between the vertical stakes and perpendicular to the slope face. Branches should be placed in a crisscross pattern with buds generally pointing toward the slope face. Basal ends of the branches should touch the undisturbed soil at the back of the hole.
- Cover each layer of branches with a layer of compacted soil to ensure soil contact with the branches.
- Subsequent layers of branches should be installed with the basal ends lower than the growing tips.
- The final layer should conform to the existing slope.

FIGURE 15.8
Branchpacking

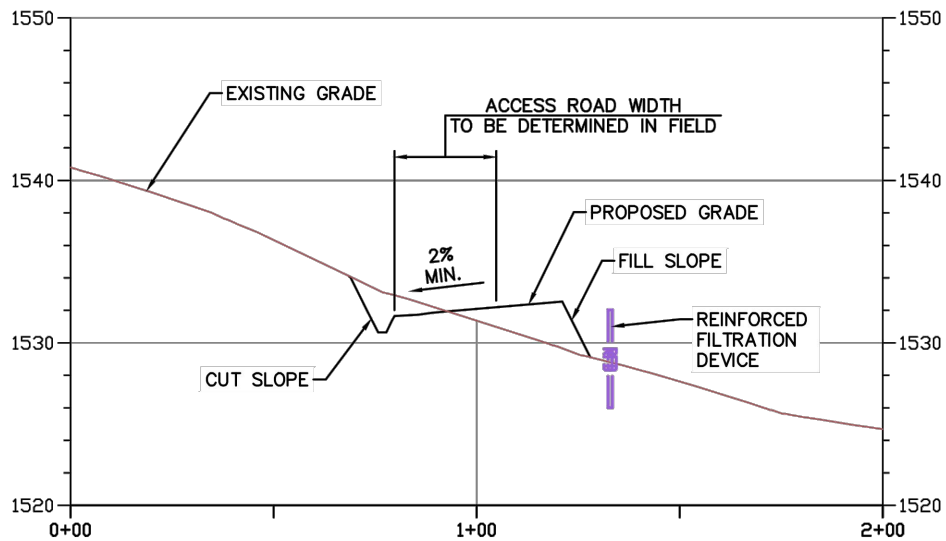


Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

DRAWN	DATE	 <p>Mountain Valley PIPELINE</p> <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BRANCHPACKING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO.	
JOB NO.			MVP-ES30.2	
PROJECT ID:	PXXXX		REV.	P



PLAN VIEW



SECTION VIEW A-A

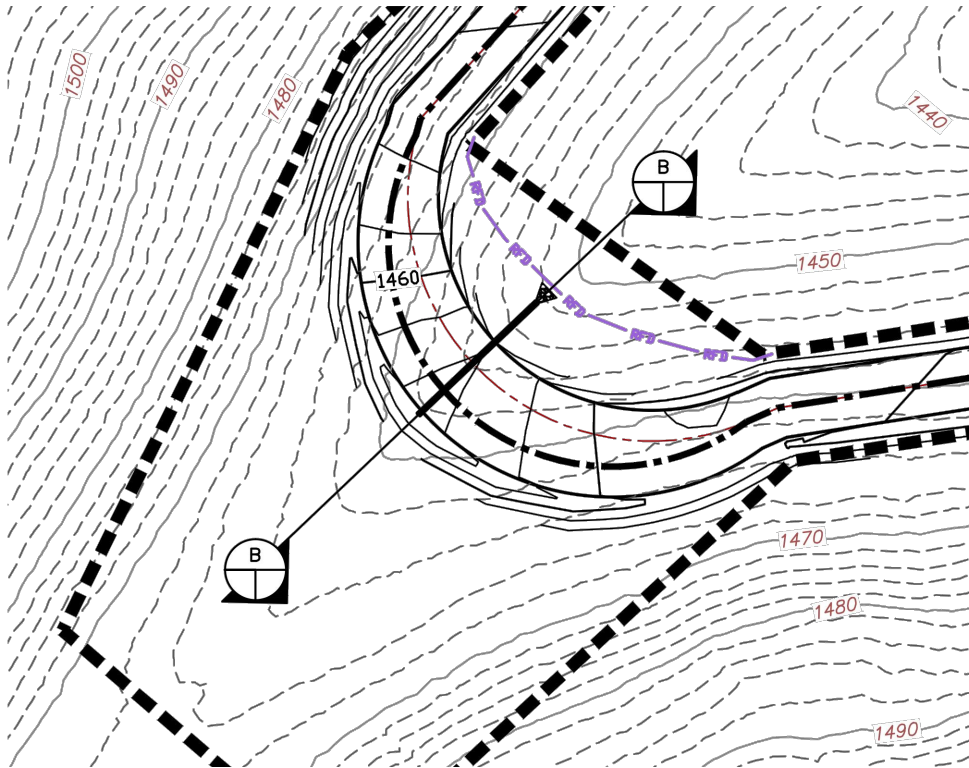
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JOB NO.	
PROJECT ID:	PXXXX


 DESIGN ENGINEERING

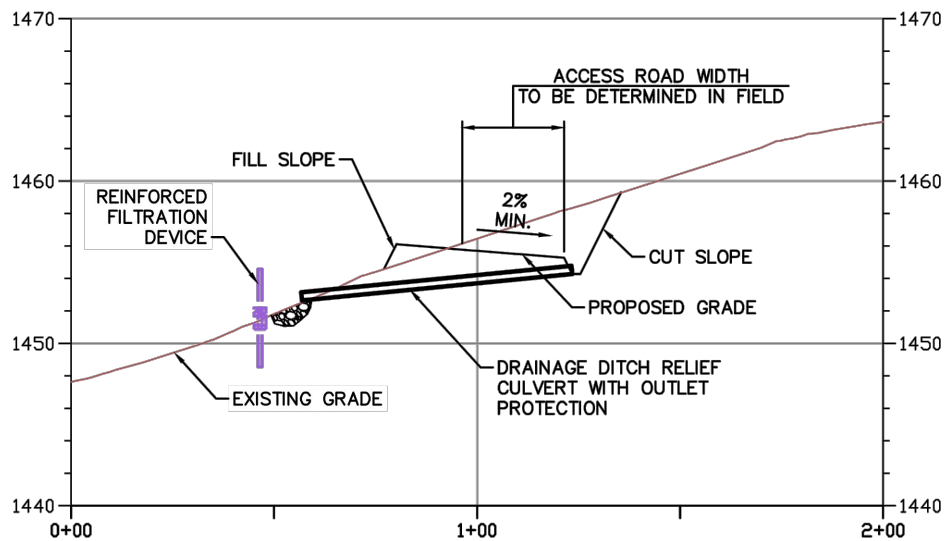
ENVIRONMENTAL DETAIL

ATWS VEHICLE TURNING
RADIUS NOSE DETAIL

DRAWING NO.	REV.
MVP-ES31	P



PLAN VIEW



SECTION VIEW B-B

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


 DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

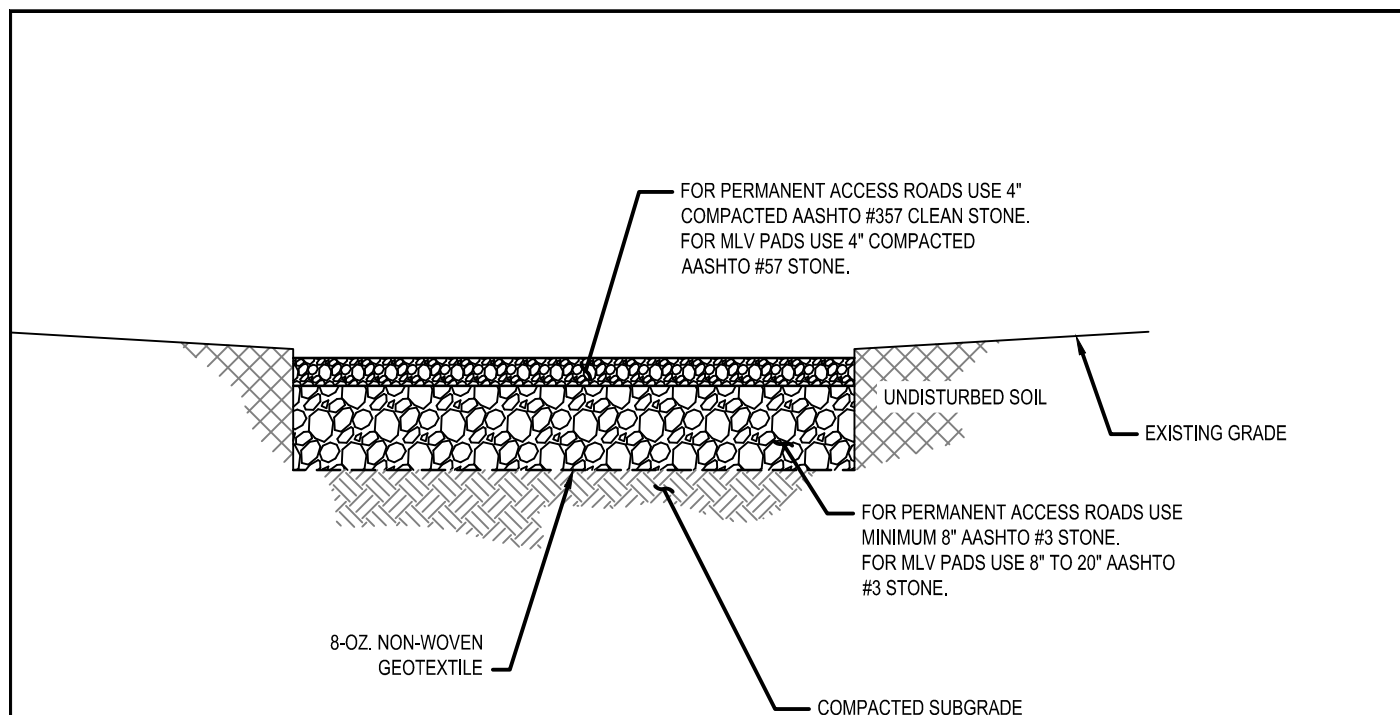
ATWS VEHICLE TURNING
RADIUS VALLEY DETAIL

DRAWING NO.

MVP-ES32


REV.

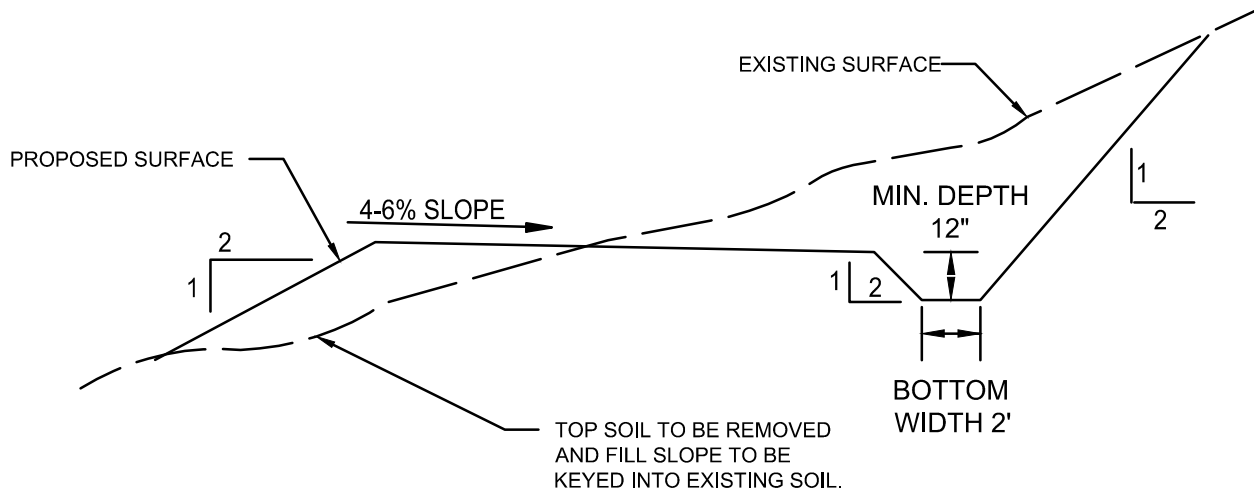
P



NOTES:


1. THICKNESS OF AASHTO #3 STONE/AGGREGATE LAYER FOR MLV PADS TO BE BETWEEN 8" AND 20" DEPENDING ON THE STORAGE VOLUME NEEDED TO MEET STORMWATER QUANTITY REQUIREMENTS.
2. THICKNESS OF AASHTO #3 STONE/AGGREGATE LAYER FOR ACCESS ROADS TO BE A MINIMUM OF 8" OR MORE AS DIRECTED.
3. COMPACT SUBGRADE PRIOR TO BACKFILL PLACEMENT. FOR BACKFILL, A MIN. 95% COMPACTION (ASTM D 698) IS REQUIRED.
4. UNSUITABLE MATERIAL SHALL BE REMOVED PRIOR TO SUBGRADE COMPACTION AND BACKFILL PLACEMENT. ADDITIONAL SUBGRADE COMPACTION NOT REQUIRED FOR MLV PADS.

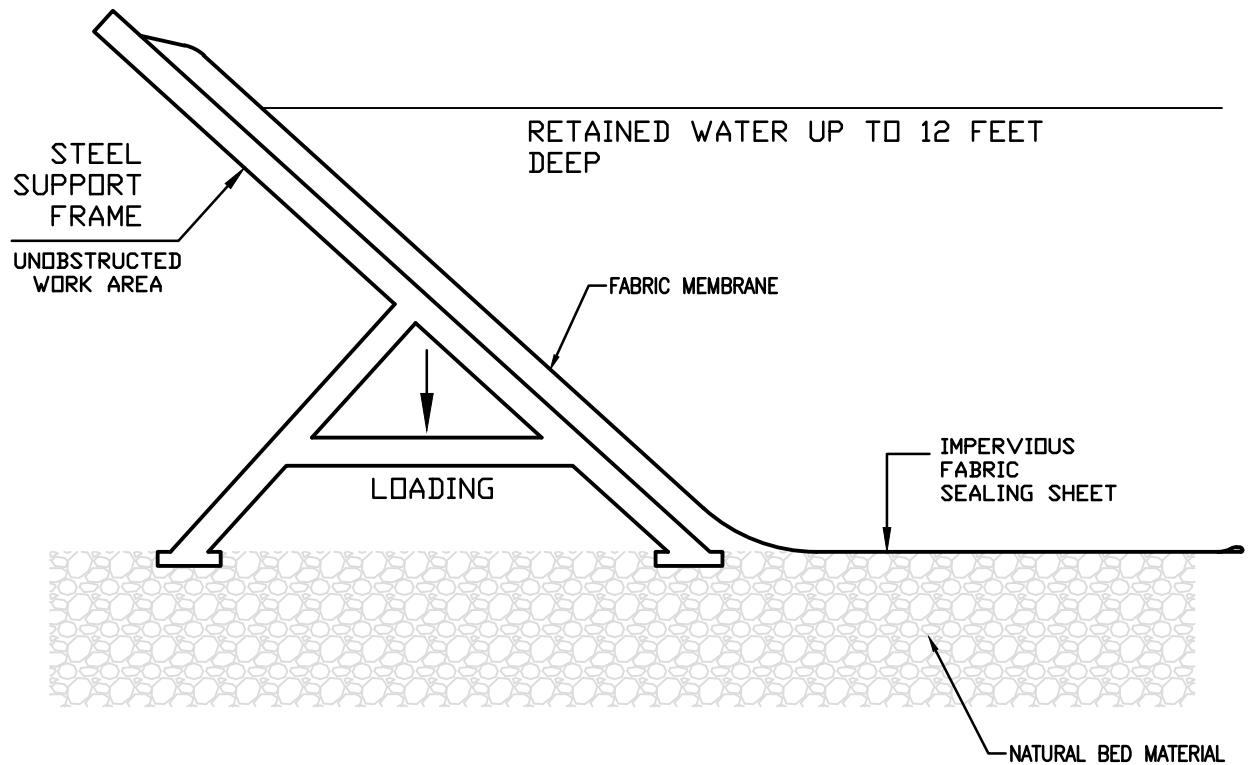
DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		GAP GRADED GRAVEL DETAIL FOR MAINLINE VALVE PADS & PERMANENT ACCESS ROADS	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO.	
JOB NO.			REV.	
PROJECT ID:	PXXXX		MVP-ES33	P




NOTE:

1. INSLOPE WITH DITCH SECTION FOR USE ON STEEP SLOPE AND AREAS WITH POOR SOILS.
2. EROSION CONTROL MATTING TO BE INSTALLED ON CUT AND FILL SLOPES STEEPER THAN 3H:1V.

DRAWN	DATE	 <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		ACCESS ROAD TYPICAL SECTION	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX			MVP-ES34	P




DRAWN	DATE	 <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		PORTADAM DETAIL	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX			MVP-ES36	P

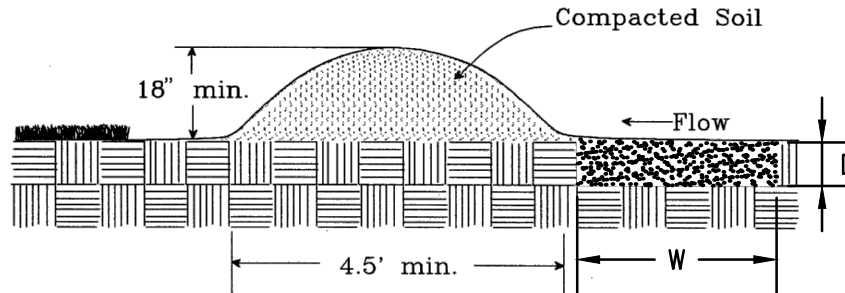


University of Minnesota FS 07009
A geotextile underlayment shall be used under the wood mat.

Source: PaDEP, E&S Pollution Control Manual, March 2012

NOTE:
CULVERTS MAY BE SUBSTITUTED WHEN
REQUIRED BY FIELD VERIFIED CONDITIONS.


DRAWN	DATE	 <p style="text-align: center;">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		TIMBER MAT/WETLAND CROSSING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES37	
JOB NO.			REV. P	
PROJECT ID:	PXXXX			

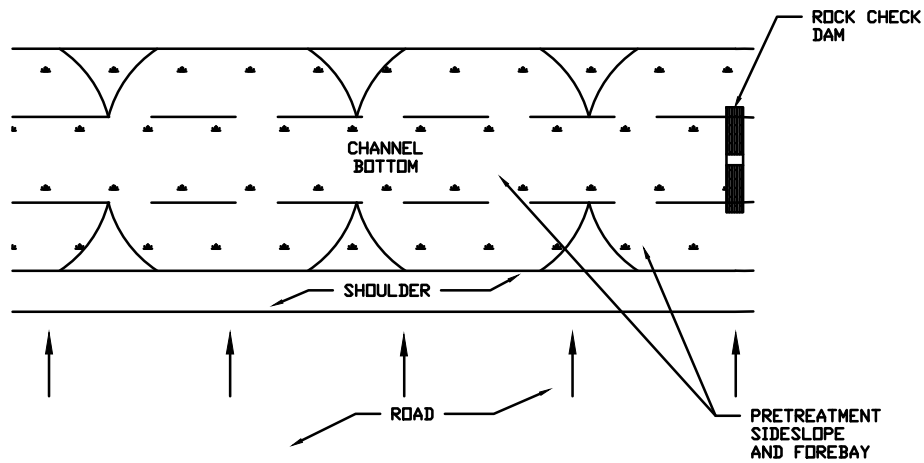


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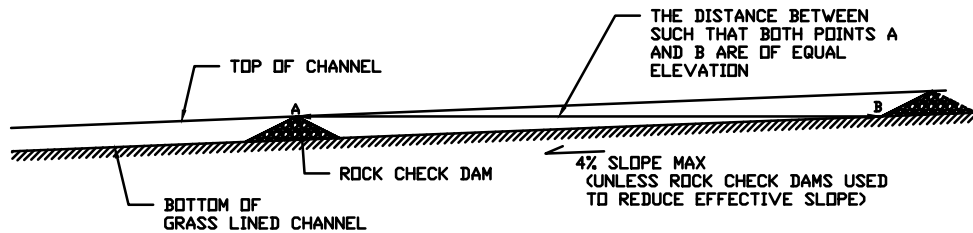
1. WIDTH "W" OF SOIL AMENDMENT PER PERMANENT DIVERSION DIKE/WATERBAR WITH SOIL AMENDMENT SCHEDULE.
2. THE INCORPORATION DEPTH "D" IS ASSUMED TO BE 1 FT PER TABLE 4.3 IN VA DEQ STORMWATER DESIGN SPEC #4.
3. DEVELOPED FROM VA. DSWC PLATE 3.09-1.
4. SEE SHEET 0.7, TEMPORARY RIGHT OF WAY DIVERSION/WATERBAR ADDITIONAL DETAILS FOR PLAN VIEW.

Permanent Diversion Dike/Waterbar with Soil Amendment Schedule				
Drainage Area	Diversion Dike Identification #	Soil Amendment Depth (D) (ft)	Soil Amendment Width (W) (ft)	Minimum Length of Soil Amendment
DA-GI-002	WB-1	1	2	10
DA-GI-006	WB-2	1	2	5

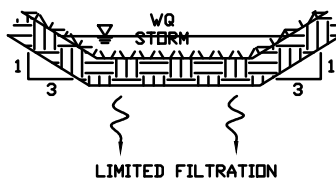
DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		DIVERSION DIKE/WATERBARS WITH COMPOST	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	
PXXXX		MVP-ES38		P



PLAN



LONGITUDINAL PROFILE



TYPICAL SECTION

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

GRASS-LINED CHANNEL

DRAWING NO.

MVP-ES39

REV.

P




NOTES:

A BONDED FIBER MATRIX (BMF) IS AN EFFECTIVE METHOD OF STABILIZING STEEP SLOPES WHEN USED PROPERLY. BMFs 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 BMF 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 THE APPLICATION. THIS IS TO ALLOW THE TACKIFIER SUFFICIENT TIME TO CURE PROPERLY. ONCE PROPERLY APPLIED, A BMF IS TYPICALLY 90% EFFECTIVE IN PREVENTING ACCELERATED EROSION. BFMs 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	 <div>Mountain Valley PIPELINE</div>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BONDED FIBER MATRIX	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO. MVP-ES40	
PROJECT ID: PXXXX		REV. P		
		DESIGN ENGINEERING		

Typical Polymer Stabilized Fiber Matrix Application Rates							
Maximum Rainfall of ≤ 20"							
SLOPE	6:1	5:1	4:1	3:1	2:1	1.5:1	1:1
Soil Stabilizer (gals/acre)	4	5	6	7	8	9	10
Fiber (lb/acre)	1,500	1,500	1,500	1,800	2,000	2,500	3,000


Maximum Rainfall of > 20" and for Site Winterization			
SLOPE	≤5:1	4:1	≥3:1
Soil Stabilizer (gals/acre)	6	8	10
Fiber (lb/acre)	2,000	2,500	3,000

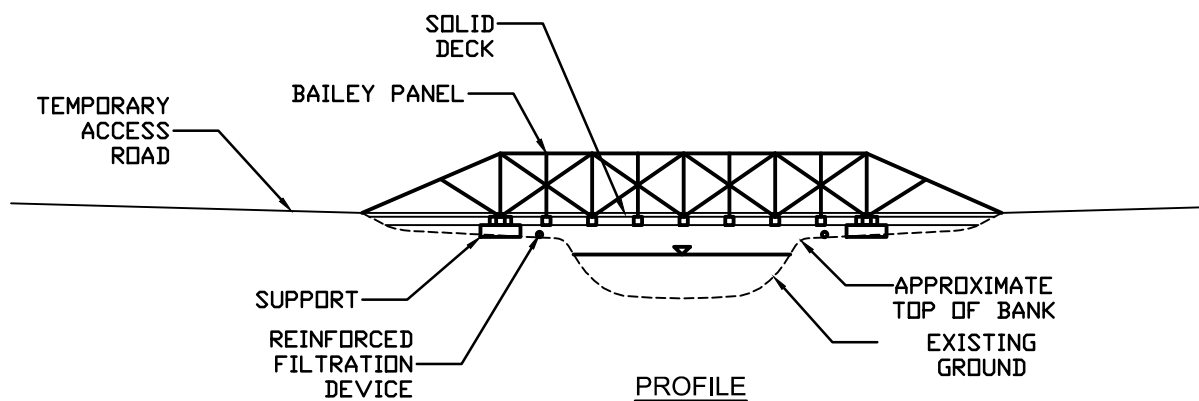
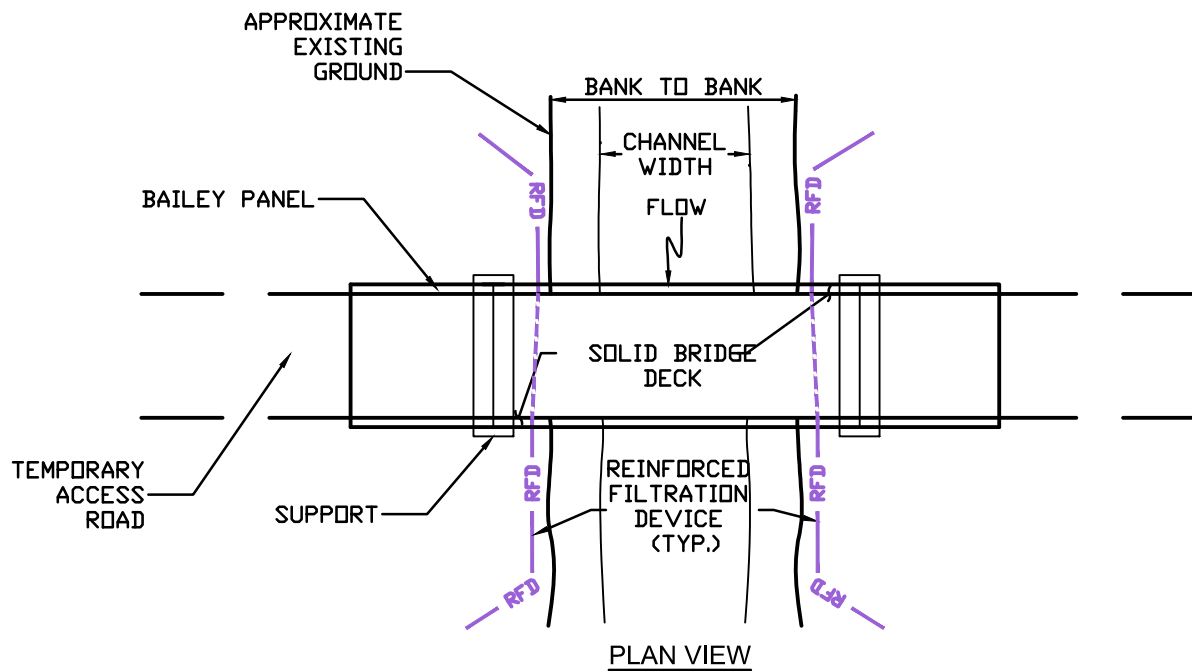
NOTES:

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 RILLS 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			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			REV.	
PXXXX		MVP-ES40.1		P
		DESIGN ENGINEERING		



DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


Mountain
Valley
 PIPELINE
 DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

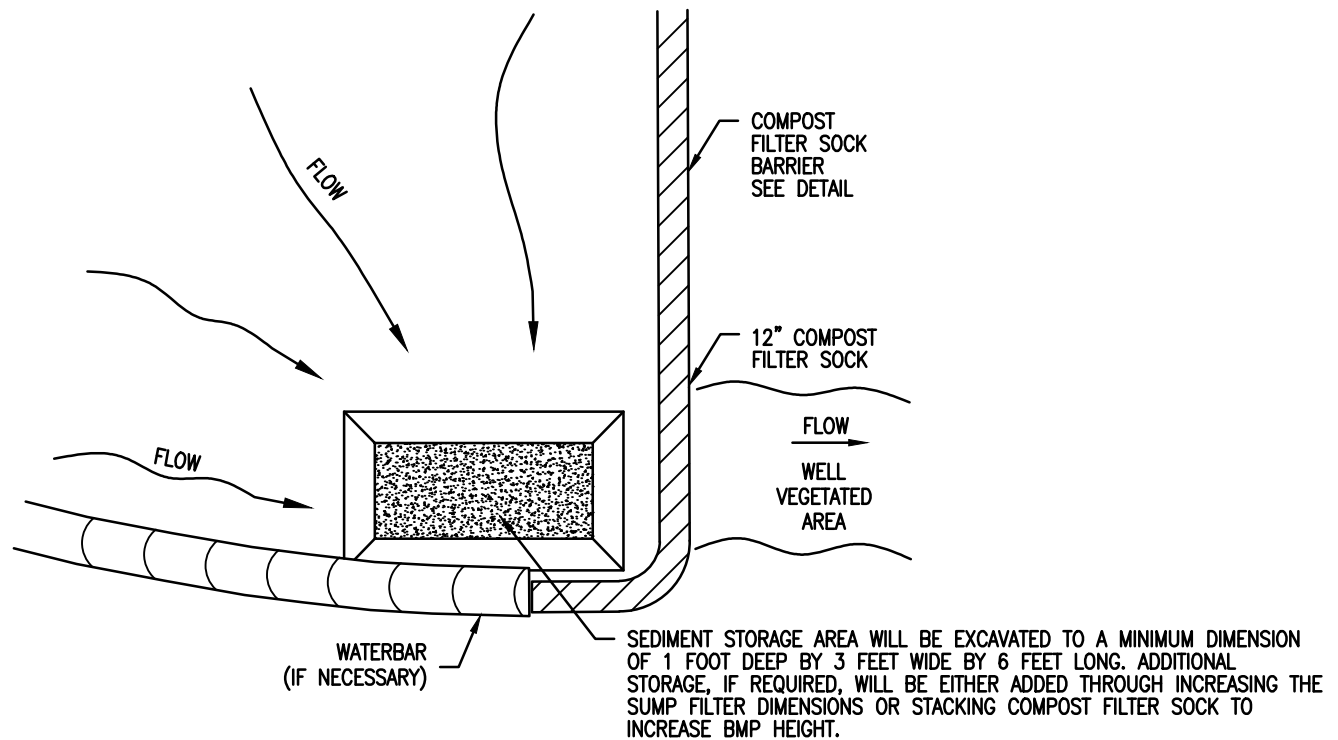
MODULAR TEMPORARY
BAILEY BRIDGE

DRAWING NO.

MVP-ES41


REV.

P

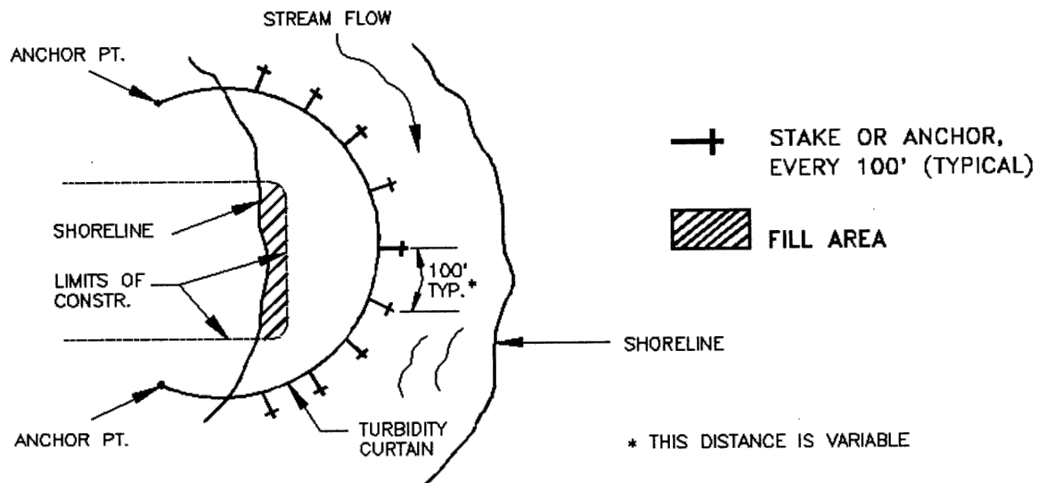


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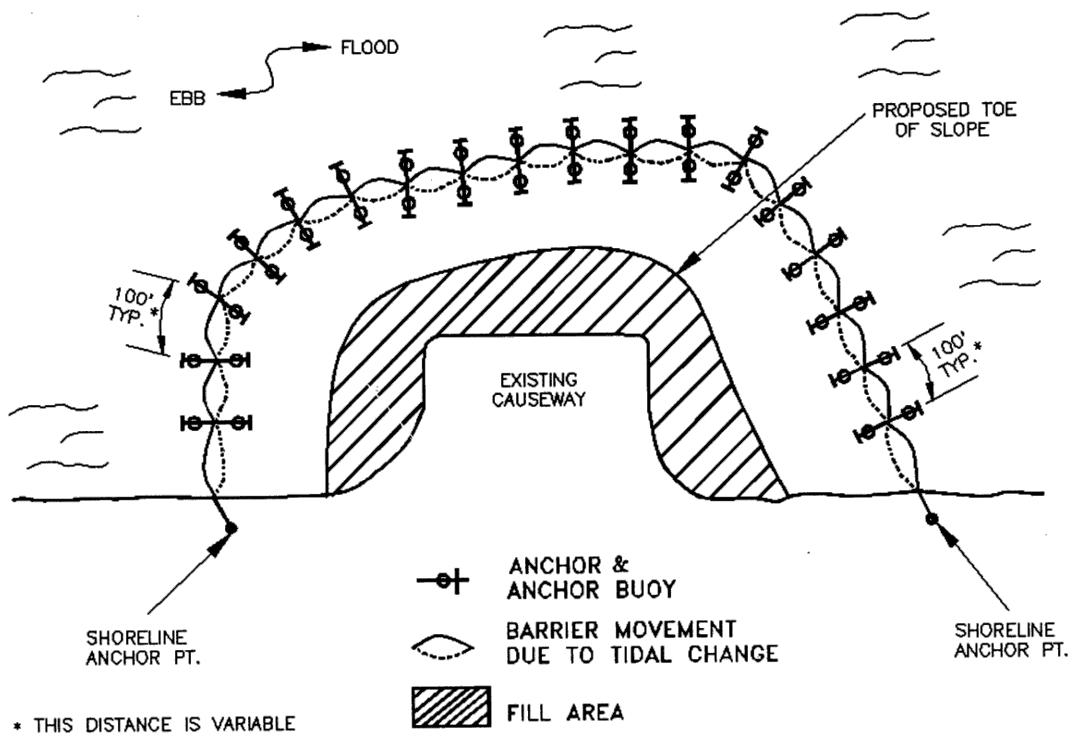
1. SUMP FILTER MAY BE USED IN CONJUNCTION WITH WATERBAR (AS DIRECTED BY OWNER REPRESENTATIVE).
2. SUMP FILTER SHALL BE LOCATED ENTIRELY WITHIN PROPOSED RIGHT OF WAY.
3. BMP SHOULD BE CHECKED WEEKLY AND AFTER EACH STORMWATER EVENT FOR SEDIMENT ACCUMULATION, PROPER OPERATION, AND COMPOST FILTER SOCK INTEGRITY.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

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		TYPICAL SUMP FILTER	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO.	
JOB NO.			REV.	
PROJECT ID:			MVP-ES42	P
PXXXX				

TYPICAL LAYOUTS: STREAMS, PONDS & LAKES (PROTECTED & NON-TIDAL)



TIDAL WATERS AND/OR HEAVY WIND & WAVE ACTION



DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

Mountain Valley
PIPELINE
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

TURBIDITY CURTAIN DETAIL

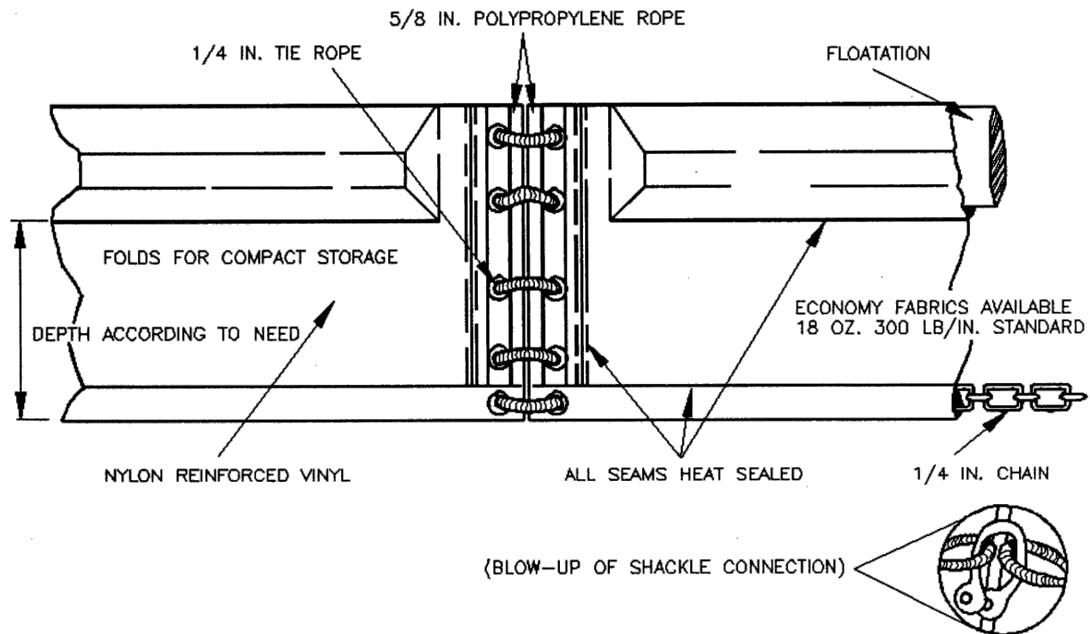
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MVP-ES43

REV.

P

TYPE I



DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

 **Mountain**
Valley
PIPELINE

DESIGN ENGINEERING

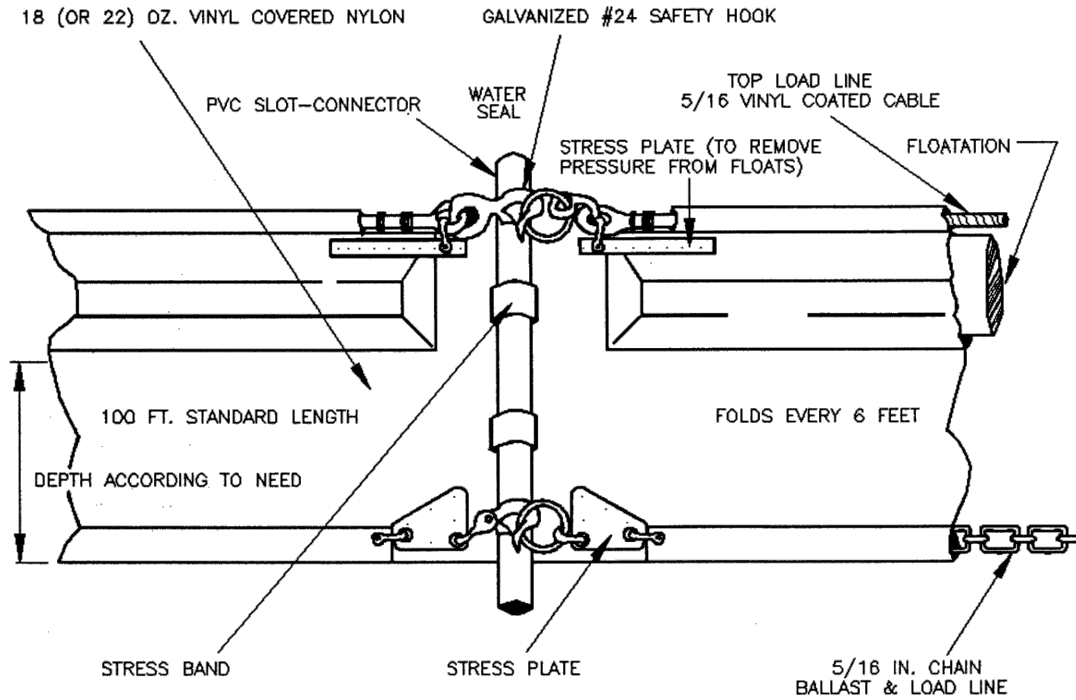
ENVIRONMENTAL DETAIL

TURBIDITY CURTAIN DETAIL

DRAWING NO.
MVP-ES43.1

REV.
P

TYPE II



DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


**Mountain
Valley**
PIPELINE
DESIGN ENGINEERING

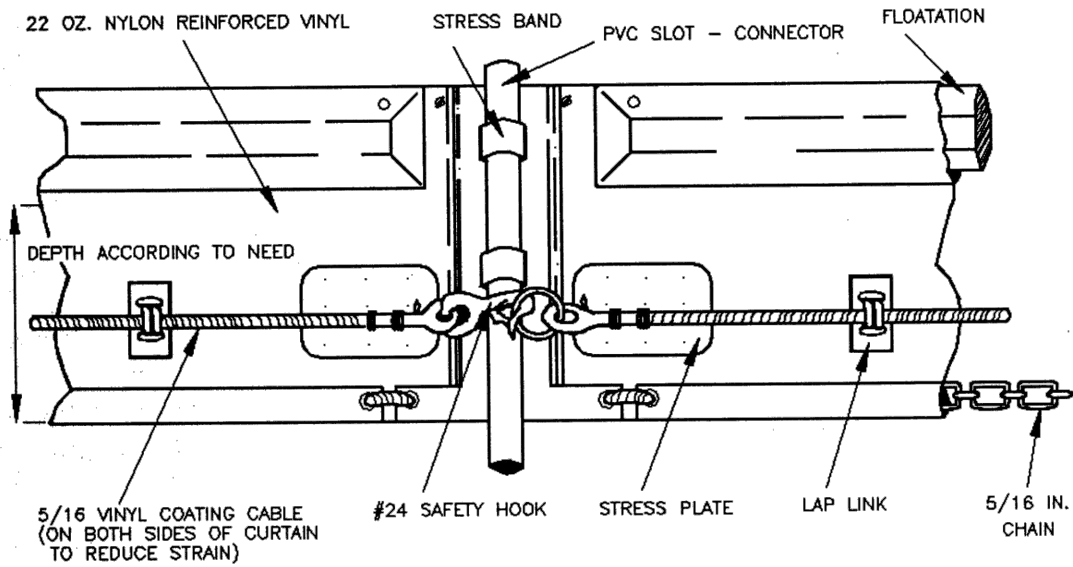
ENVIRONMENTAL DETAIL

TURBIDITY CURTAIN DETAIL

DRAWING NO.
MVP-ES43.2

REV.
P

TYPE III



DRAWN	DATE
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APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


Mountain
Valley
 PIPELINE
 DESIGN ENGINEERING

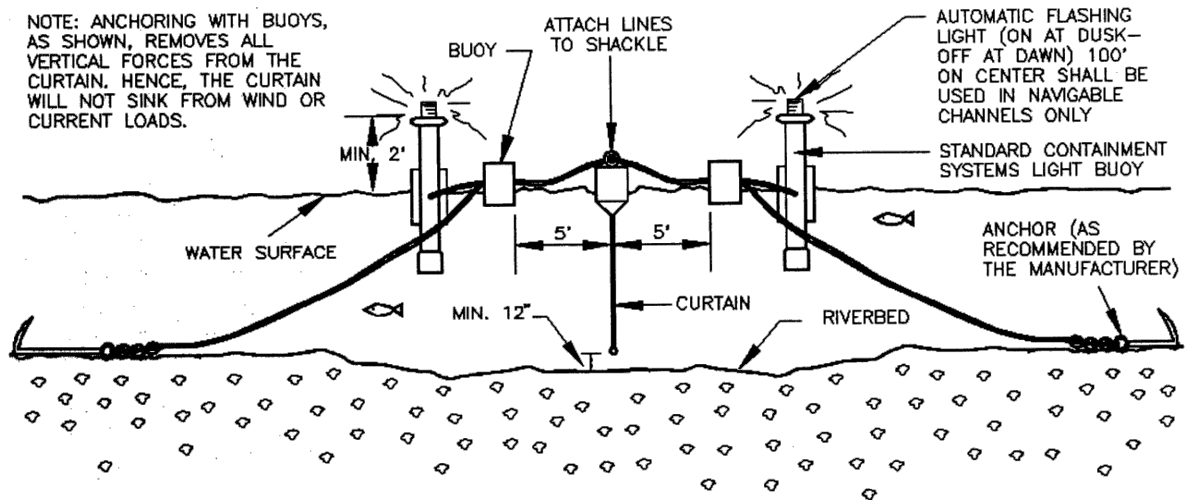
ENVIRONMENTAL DETAIL

TURBIDITY CURTAIN DETAIL

DRAWING NO.
MVP-ES43.3

REV.
P

ORIENTATION WHEN INSTALLED (TIDAL SITUATION – TYPE III)



DRAWN	DATE
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SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


**Mountain
Valley**
PIPELINE
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

TURBIDITY CURTAIN DETAIL

DRAWING NO.
MVP-ES43.4

REV.
P

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	 Mountain Valley PIPELINE DESIGN ENGINEERING	ENVIRONMENTAL DETAIL			
CHECKED	DATE		POST CONSTRUCTION STREAM CROSSING STABILIZATION			
APP'D	DATE					
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JOB NO.						
PROJECT ID: PXXXX			DRAWING NO. MVP-ES44	REV. P		

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,

$$Q = \text{Discharge over weir (ft}^3/\text{sec)}$$


$$C_d = \text{Weir Coefficient}$$

$$L = \text{Length of weir crest (ft)}$$

$$H = \text{Overtopping depth (ft)}$$

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

$$v = Q/A$$

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JOB NO.				
PROJECT ID: PXXXX			DRAWING NO. MVP-ES44.1	REV. P

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:


1. Calculate the discharge:

$$Q = CiA = 0.9 * 4.07 \text{ inches/hour} * 1 \text{ acre} = 3.66 \text{ ft}^3\text{/sec}$$

2. Rearranging the weir equation to solve for overtopping depth:

$$H = (Q/(C_d * L))^{2/3} = (3.66 \text{ ft}^3\text{/sec} / (2.99 * 8 \text{ ft}))^{2/3} = 0.29 \text{ ft}$$

3. Calculate the velocity over the compost filter sock:

DRAWN	DATE	 <p>Mountain Valley PIPELINE</p> <p>DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
CHECKED	DATE		<p>POST CONSTRUCTION STREAM CROSSING STABILIZATION</p>	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX		MVP-ES44.2	P	

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

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, 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. $S_o = 1.0 \text{ ft/ft}$). 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

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

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

$$d_n = 0.37 \text{ (ft.)} \quad V_n = 6.81 \text{ (fps)}$$

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

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

VERIFY ASSUMED ROCK SIZE

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

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

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

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


For Specific Gravity = 2.65 and Stability Factor = 1.2

$$D_{50} = 0.001 * V_a^3 / (d_{avg}^{0.5} * K_1^{1.5})$$

$$D_{50} = 0.001 * 6.81^3 / (0.5^{0.5} * 0.93^{1.5}) = 0.45 \text{ ft.}$$

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

Therefore, assumed D_{50} is appropriate.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		POST CONSTRUCTION STREAM CROSSING STABILIZATION	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX		MVP-ES44.3	P	

Construction Specifications

General

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

Water Bars / Slope Breakers

1. Water bars / slope breakers shall be installed in accordance with WATER BAR, TYPICAL SLOPE BREAKER (SB), Std. & Spec. MVP-17 and MVP-18.
2. Permanent water bars are required at all stream, river and other waterbody crossings, as well as upslope from roadway and roadbed cut slopes.
3. 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.
4. Water bar closest to stream top of bank shall be located twenty-five (25) feet maximum upslope from top of bank.
5. Water bars shall have a slope of one to four percent.
6. Water bars on retired roadways, skidtrails, and right-of-ways shall be left in place after permanent stabilization has been achieved.

Compost Filter Socks


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

Sump Filters

1. Sump filters to be installed at end of water bars. Refer to sump filter detail on Plate 2.
2. Sump filter shall be located entirely within the permanent right-of-way.
3. 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.


1. On-site salvaged rock and/or riprap, if on-site rock is not salvageable, shall be installed in accordance with RIPRAP, Std. & Spec. 3.19.
2. 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.

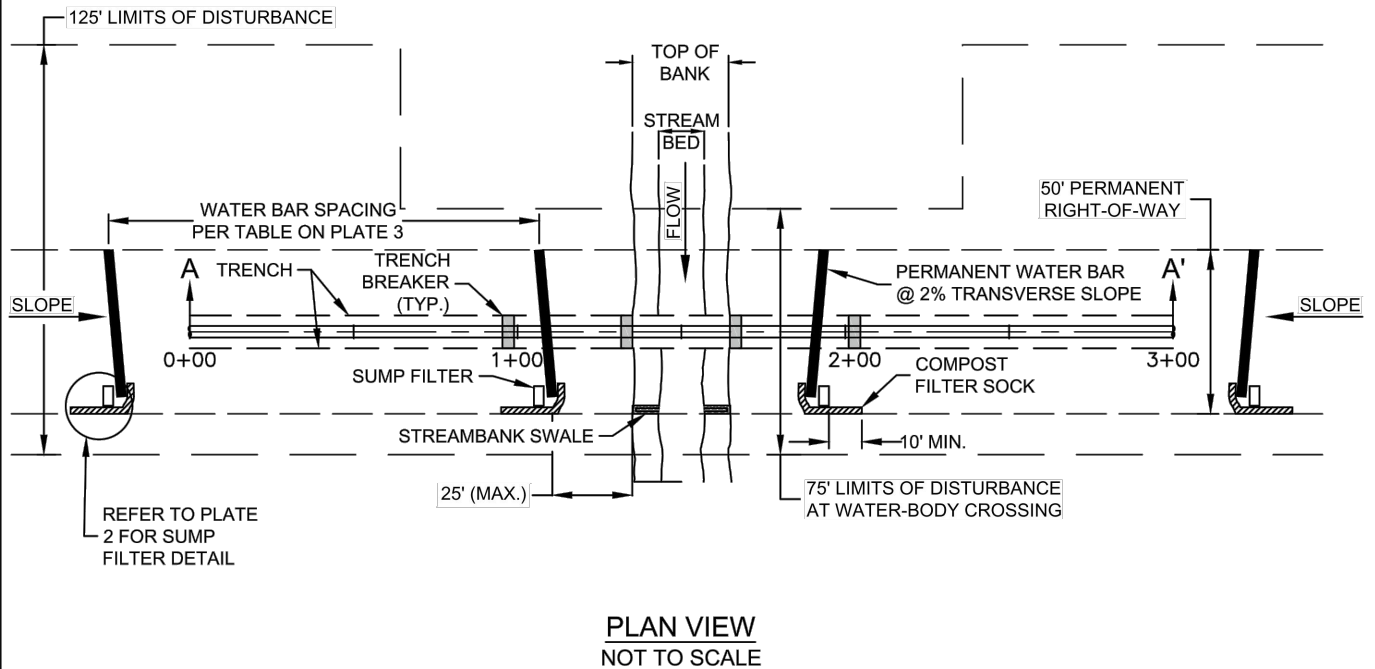
Inspections and Maintenance

1. 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.
2. Damaged or eroded water bars shall be restored to original dimensions within 24-hours of inspection.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.

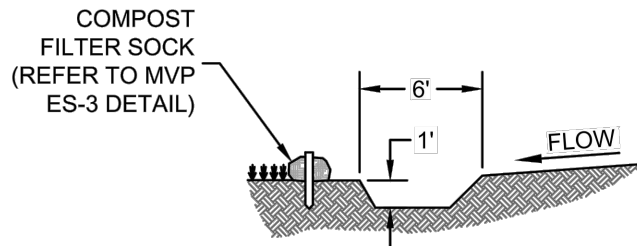
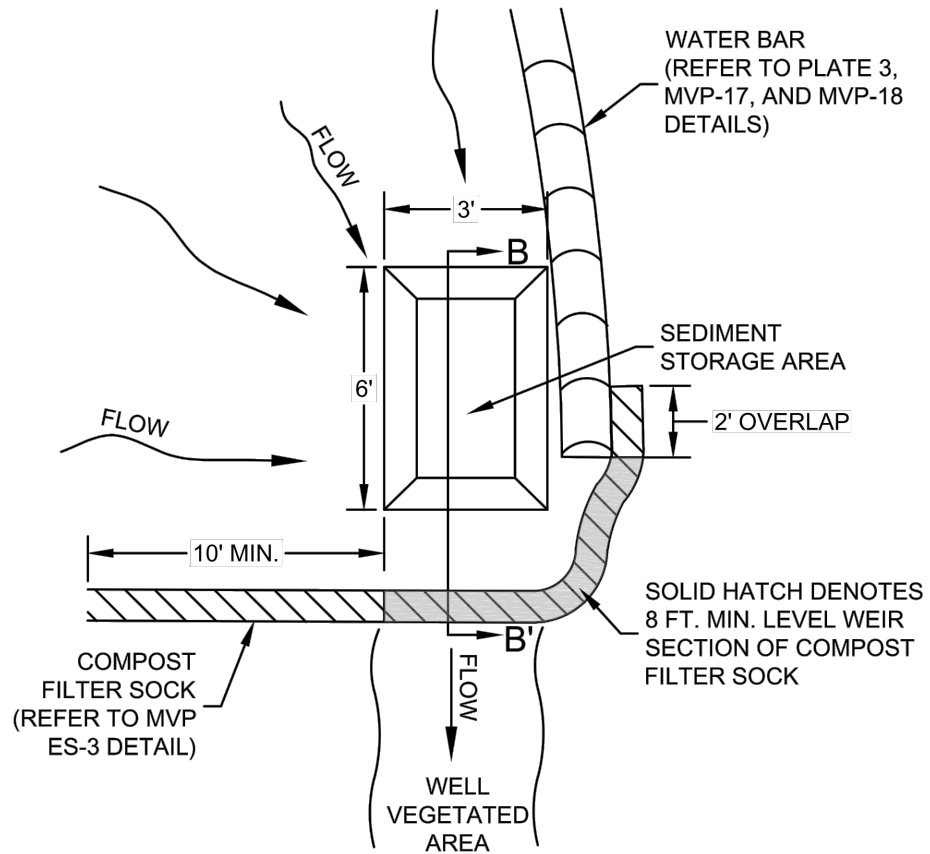
DRAWN	DATE	 <p style="font-size: 1.2em; margin: 0;">Mountain Valley</p> <p style="margin: 0;">PIPELINE</p> <p style="font-size: 1.2em; margin: 0;">DESIGN ENGINEERING</p>	ENVIRONMENTAL DETAIL	
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POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 1

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SUMP FILTER DETAIL
NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 2

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**Mountain
Valley**
PIPELINE
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

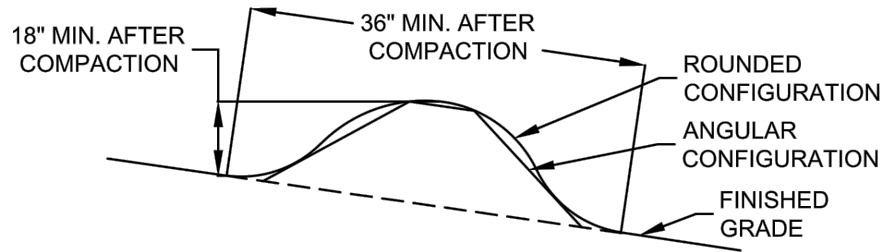
POST CONSTRUCTION STREAM
CROSSING STABILIZATION

DRAWING NO.

MVP-ES44.7

REV.

P

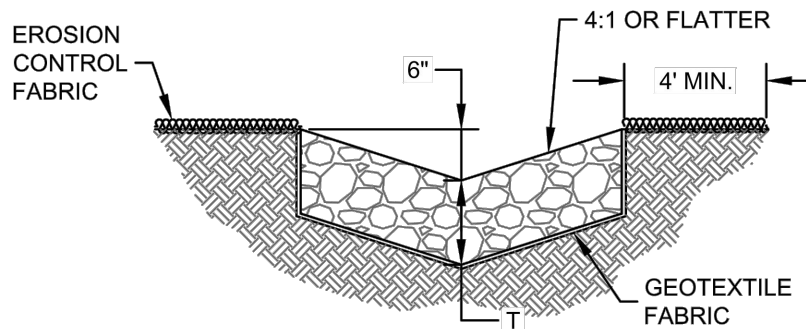


MINIMUM SPACING FOR PERMANENT WATER BARS	
PIPELINE GRADE	DISTANCE (FEET)
<2%	2,3
2-5%	400
6-15%	200
16-30%	100
>31%	50 ⁴

NOTES:

1. REFER TO MVP-17 AND MVP-18 DETAILS (WATER BAR, TYPICAL SLOPE BREAKERS).
2. PERMANENT WATER BARS WILL BE INSTALLED AS NEEDED BASED ON FIELD CONDITIONS.
3. PERMANENT WATER BARS WILL BE INSTALLED 25 FEET FROM EACH WATERBODY BOUNDARY REGARDLESS OF SLOPE CONDITIONS.
4. SLOPES GREATER THAN 65% MAY REQUIRE SITE SPECIFIC STABILIZATION MEASURES BASED ON FIELD CONDITIONS AS APPROVED BY MVP DESIGN ENGINEERING AND MVP ENVIRONMENTAL INSPECTOR.

PERMANENT WATER BAR DETAIL
NOT TO SCALE



NOTES:

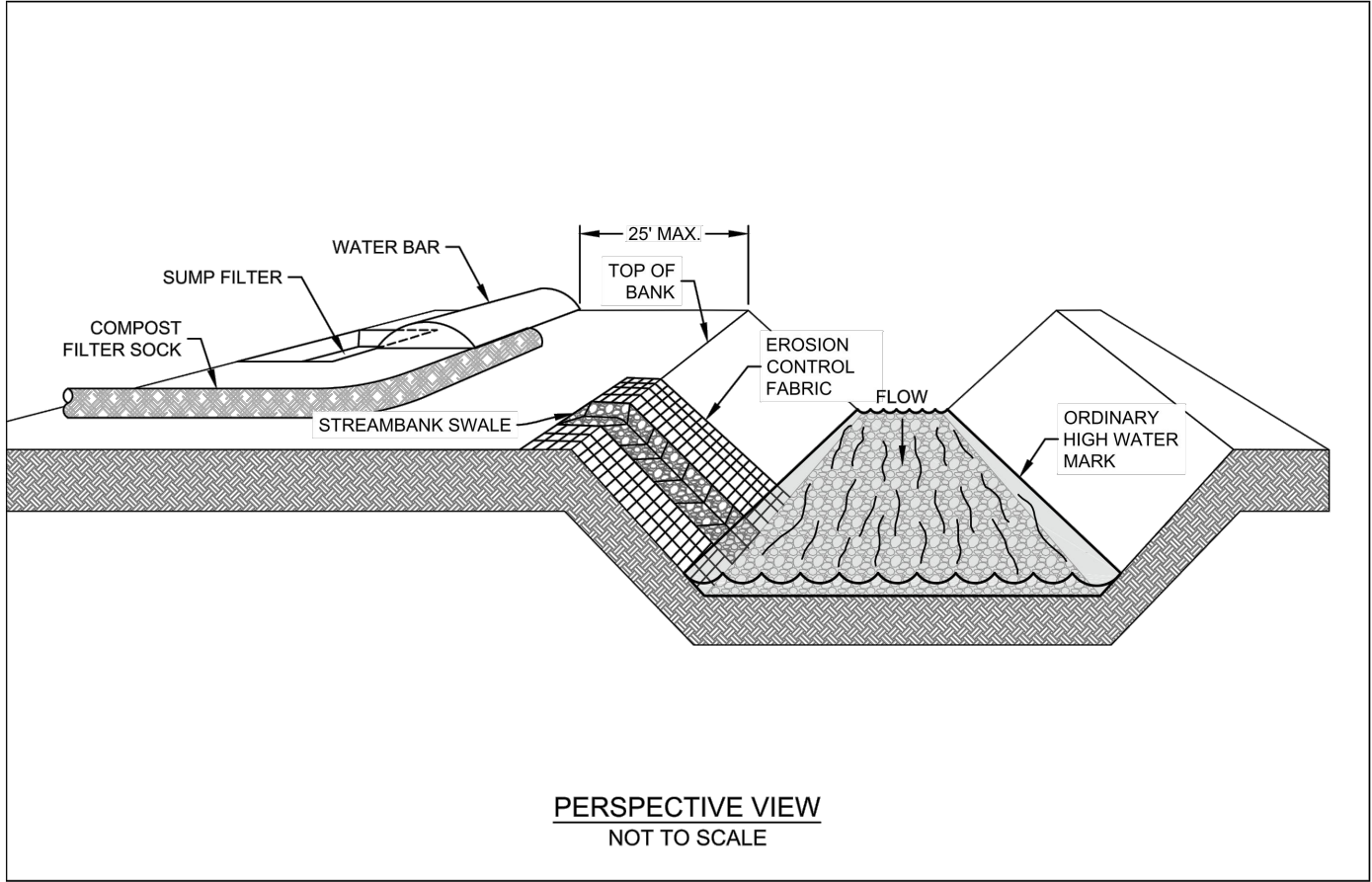
1. IF THE CONTRIBUTING DRAINAGE AREA IS GREATER THAN 1 ACRE OR IF THE SWALE IS STEEPER THAN 1:1 (1.0 FT/FT), THE PLANS SHALL PROVIDE CALCULATIONS TO DETERMINE AN APPROPRIATE SIZE STONE, MINIMUM THICKNESS, AND CHANNEL SIZE.
2. MINIMUM THICKNESS, T, SHALL BE TWO TIMES THE D50.
3. FOR DRAINAGE AREAS 1 ACRE OR LESS, D50 = 6 INCHES AND T = 12 INCHES.
4. SWALE SIDE SLOPES SHALL BE 4:1 OR FLATTER.

STREAMBANK SWALE TYPICAL CROSS SECTION
NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL


PLATE 3

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POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 4

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MULCHING

Definition

Application of plant residues or other suitable materials to the soil surface.

Purposes

1. To prevent erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow.
2. To foster the growth of vegetation by increasing available moisture and providing insulation against extreme heat and cold.

Conditions Where Practice Applies


1. Areas which have been permanently seeded (see Appendix B – Typical Construction Details MVP-ES11.1 through ES12.3) should be mulched immediately following seeding.
2. Areas which cannot be seeded because of the season should be mulched to provide some protection to the soil surface. An organic mulch should be used, and the area then seeded as soon weather or seasonal conditions permit. It is not recommended that fiber mulch be used alone for this practice; at normal application rates it just simply does not provide the protection that is achieved using other types of mulch.
3. Mulch may be used together with plantings of trees, shrubs, or certain ground covers which do not provide adequate soil stabilization by themselves.
4. Mulch shall be used in conjunction with temporary seeding operations as specified in TEMPORARY SEEDING, Std. & Spec. 3.31

Planning Considerations

Mulches are applied to the soil surface to conserve a desirable soil property or to promote plant growth. A surface mulch is one of the most effective means of controlling runoff and erosion on disturbed land.

Mulches can increase the infiltration rate of the soil, reduce soil moisture loss by evaporation, prevent crusting and sealing of the soil surface, modify soil temperatures, and provide a suitable microclimate for seed germination.

Organic mulch materials, such as straw, wood chips, bark, and fiber mulch have been found to be the most effective.

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Chemical soil stabilizers or soil binders should not be used alone for mulch. These materials are useful to bind organic mulches together to prevent displacement.

A variety of manufactured SOIL STABILIZATION BLANKETS AND MATTING (see Std. & Spec. 3.36) have been developed for erosion control in recent years. Some of these products can be used as mulches, particularly in critical areas such as waterways. They also may be used to hold other mulches to the soil surface.

The choice of materials for mulching will be based on the type of soil to be protected, site conditions, season and economics. It is especially important to mulch liberally in mid-summer and prior to winter, and on cut slopes and southern slope exposures.

Organic Mulches

Straw - The mulch most commonly used in conjunction with seeding. The straw should come from wheat or oats (free of troublesome weed seeds) and may be spread by hand or machine. Straw can be windblown and must be anchored down by an acceptable method.

Hay - Hay shall not be used as mulch for Project activities.

Com Stalks - These should be shredded into 4- to 6-inch lengths. Stalks decompose slowly and are resistant to displacement.

Wood Chips - Suitable for areas that will not be closely mowed, and around ornamental plantings. Chips decompose slowly and do not require tacking. They must be treated with 12 pounds of nitrogen per ton to prevent nutrient deficiency in plants; however, can be a very inexpensive mulch if chips are obtained from trees cleared on the site.


Bark Chips, Shredded Bark - These are by-products of timber processing which are used in landscaped plantings. Bark is also a suitable mulch for areas planted to grasses and not closely mowed. It may be applied by hand or mechanically and is not usually toxic to grasses or legumes; additional nitrogen fertilizer is not required.

Fiber Mulch - Used in hydroseeding operations and applied as part of the slurry. It creates the best seed-soil contact when applied over top of (as a separate operation) newly seeded areas. These fibers do not require tacking, although tacking agents or binders are sometimes used in conjunction with the application of fiber mulch. This form of mulch does not provide sufficient protection to highly erodible soils. Additionally, fiber mulch will not be considered adequate mulch when used during the dry summer months or when used for late fall mulch cover. Use straw mulch during these periods. Fiber mulch may be used to tack (anchor) straw mulch. This treatment is well suited for steep slopes, critical areas, and areas susceptible to displacement.

There are other organic materials which make excellent mulches but are only available locally or seasonally. Creative use of these materials can reduce costs.

Chemical Mulches and Soil Binders

A wide range of synthetic, spray-on materials are marketed to stabilize and protect the soil surface. These are emulsions or dispersions of vinyl compounds, rubber or other substances which are mixed with water and applied to the soil. They may be used alone in some cases as temporary stabilizers, or in conjunction with fiber mulches or straw.

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When used alone, chemical mulches do not have the capability to insulate the soil or retain soil moisture that organic mulches have. This soil protection is also easily damaged by traffic. Application of these mulches is usually more expensive than organic mulching, and the mulches decompose in 60-90 days.

Blankets and Matting

Field experience has shown that plastic netting, when used alone, does not retain soil moisture or modify soil temperature. In some cases it may stabilize the soil surface while grasses are being established, but is primarily used in grassed waterways and on slopes to hold straw or similar mulch in place.

Jute mesh and other soil stabilization blankets are good choices for mulching on difficult slopes and in minor drainage swales. Most of the soil stabilization mattings (used to create a permanent matrix for root growth within the soil) must receive mulching in order to properly stabilize an area. Notably, some manufacturers have recently developed permanent mattings which include self-contained, temporary mulching materials; however, these measures will have to meet the requirements noted in Std. & Spec. 3.36, SOIL STABILIZATION BLANKETS AND MATTING, before they can be recommended for use on steep slopes and in channel flow situations.

The most critical aspect of installing blankets and mats is obtaining firm, continuous contact between the material and the soil. Without such contact, the material may fail and thereby allow erosion to occur. It is important to use an adequate number of staples and make sure the material is installed properly in order to maximize soil protection. These products are discussed in more detail in Std. & Spec. 3.36, SOIL STABILIZATION BLANKETS & MATTING.

MVP will utilize hydraulically applied soil stabilization blankets and matting (i.e. Earthguard, Flexterra, or equivalent) as an alternate to the rolled ESC blanket material identified under STD & SPEC 3.36. Information regarding the hydraulically applied blankets is provided under Appendix B MVP-ES40 and MVP-ES40.1.

Specifications

Organic Mulches

Organic mulches may be used in any area where mulch is required, subject to the restrictions noted in Table 3.35-A.

Materials: Select mulch material based on site requirements, availability of materials, and availability of labor and equipment. Table 3.35-A lists the most commonly used organic mulches. Other materials, such as peanut hulls and cotton burs, may be used with the permission of the local Plan-Approving Authority.

Prior to mulching: Complete the required grading and install needed sediment control practices.

Lime and fertilizer should be incorporated and surface roughening accomplished as needed. Seed should be applied prior to mulching except in the following cases:

- a. Where seed is to be applied as part of a hydroseeder slurry containing fiber mulch.
- b. Where seed is to be applied following a straw mulch spread during winter months.



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TABLE 3.35-A			
ORGANIC MULCH MATERIALS AND APPLICATION RATES			
MULCHES:	RATES:		NOTES:
	Per Acre	Per 1000 sq. ft.	
Straw	1 ½ - 2 tons (Minimum 2 tons for winter cover)	70 – 90 lbs.	Free from weeds and coarse matter. Must be anchored. Spread with mulch blower or by hand.
Fiber Mulch	Minimum 1500 lbs.	35 lbs.	Do not use as mulch for winter cover or during hot, dry periods.* Apply as slurry.
Corn Stalks	4 – 6 tons	185 – 275 lbs.	Cut or shredded in 4-6" lengths. Air-dried. Do not use in fine turf areas. Apply with mulch blower or by hand.
Wood Chips	4 – 6 tons	185 – 275 lbs.	Free of coarse matter. Air-dried. Treat with 12 lbs nitrogen per ton. Do not use in fine turf areas. Apply with mulch blower, chip handler, or by hand.
Bark Chips or Shredded Bark	50 – 70 cu. yds.	1-2 cu. yds.	Free of coarse matter. Air-dried. Do not use in fine turf areas. Apply with mulch blower, chip handler, or by hand.
* When fiber mulch is the only available mulch during periods when straw should be used, apply at a minimum rate of 2000 lbs./ac. Or 45 lbs./1000 sq. ft.			

Source: Va. DSWC

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Application: Mulch materials shall be spread uniformly, by hand or machine.

When spreading straw mulch by hand, divide the area to be mulched into approximately 1,000 sq. ft. sections and place 70-90 lbs. (n to 2 bales) of straw in each section to facilitate uniform distribution.

Mulch Anchoring: Straw mulch must be anchored immediately after spreading to prevent displacement. Other organic mulches listed in Table 3.35-A do not require anchoring. The following methods of anchoring straw may be used:

1. Mulch anchoring tool (often referred to as a Krimper or Krimper Tool): This is a tractor-drawn implement designed to punch mulch into the soil surface. This method provides good erosion control with straw. It is limited to use on slopes no steeper than 3:1, where equipment can operate safely. Machinery shall be operated on the contour.
2. Fiber Mulch: A very common practice with widespread use today. Apply fiber mulch by means of a hydroseeder at a rate of 500-750 lbs./acre over top of straw mulch or hay. It has an added benefit of providing additional mulch to the newly seeded area.
3. Liquid mulch binders: Application of liquid mulch binders and tackifiers should be heaviest at edges of areas and at crests of ridges and banks, to prevent displacement. The remainder of the area should have binder applied uniformly. Binders may be applied after mulch is spread or may be sprayed into the mulch as it is being blown onto the soil.


The following types of binders may be used:

- a. Synthetic binders - Formulated binders or organically formulated products may be used as recommended by the manufacturer to anchor mulch.
- b. *Asphalt - Any type of asphalt thin enough to be blown from spray equipment is satisfactory. Recommended for use are rapid curing (RC-70, RC-250, RC-800), medium curing (MC-250, MC-800) and emulsified asphalt (SS-1, CSS-1, CMS-2, MS-2, RS-1, RS-2, CRS-1, and CRS-2).

Apply asphalt at 0.10 gallon per square yard (10 gal./1000 sq. ft. or 430 gal./acre). Do not use heavier applications as it may cause the straw to "perch" over rills. All asphalt designations are from the Asphalt Institute Specifications.

*Note: This particular method is not used as commonly today as it once was in the past. The development of hydraulic seeding equipment promoted the industry to turn to synthetic or organically based binders and tackifiers. When this method is used, environmental concerns should be addressed to ensure that petroleum-based products do not enter valuable water supplies. Avoid applications into waterways or channels.

4. Mulch nettings: Lightweight plastic, cotton, or paper nets may be stapled over the mulch according to manufacturer's recommendations.
5. Peg and twine: Because it is labor-intensive, this method is feasible only in small areas where other methods cannot be used. Drive 8- to 10-inch wooden pegs to within 3 inches of the soil surface, every 4 feet in all directions. Stakes may be driven before or after straw is spread. Secure mulch by stretching twine between pegs in a criss-cross-within-a square pattern. Turn twine 2 or more times around each peg.

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Chemical Mulches


Chemical mulches* may be used alone only in the following situations:

- a. Where no other mulching material is available.
- b. In conjunction with temporary seeding during the times when mulch is not required for that practice.
- c. From March 15 to May 1 and August 15 to September 30, provided that they are used on areas with slopes no steeper than 4:1, which have been roughened in accordance with SURFACE ROUGHENING, Std. & Spec. 3.29. If rill erosion occurs, another mulch material shall be applied immediately.

*Note: Chemical mulches may be used to bind other mulches or with fiber mulch in a hydroseeded slurry at any time. Manufacturer's recommendations for application of chemical mulches shall be followed.

Maintenance

All mulches and soil coverings should be inspected periodically (particularly after rainstorms) to check for erosion. Where erosion is observed in mulched areas, additional mulch should be applied. Nets and mats should be inspected after rainstorms for dislocation or failure. If washouts or breakage occur, re-install netting or matting as necessary after repairing damage to the slope or ditch. Inspections should take place up until grasses are firmly established. Where mulch is used in conjunction with ornamental plantings, inspect periodically throughout the year to determine if mulch is maintaining coverage of the soil surface; repair as needed.

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TOPSOILING & SOIL HANDLING FOR M.V.P.

Definition

Methods of preserving and using the surface layer of undisturbed soil, often enriched in organic matter, in order to obtain a more desirable planting and growth medium.

Purposes

To provide a suitable growth medium for final site stabilization with vegetation and promote successful reforestation.

Conditions Where Practice Applies

1. Where the preservation or importation of topsoil is determined to be the most effective method of providing a suitable growth medium.
2. Where the subsoil or existing soil presents the following problems:
 - a. The texture, pH, or nutrient balance of the available soil cannot be modified by reasonable means to provide an adequate growth medium.
 - b. The soil material is too shallow to provide an adequate root zone and to supply necessary moisture and nutrients for plant growth.
 - c. The soil contains substances potentially toxic to plant growth.
3. Only on slopes that are 2:1 or flatter unless other measures are taken to prevent erosion and sloughing.


Planning Considerations

Topsoil is the surface layer of the soil profile, generally characterized as being darker than the subsoil due to the presence of organic matter. It is the major zone of root development, carrying much of the nutrients available to plants, and supplying a large share of the water used by plants.

Although topsoil provides an excellent growth medium, there are disadvantages to its use. Stripping, stockpiling, and reapplying topsoil, or importing topsoil, may not always be cost-effective. Topsoiling can delay seeding or sodding operations, increasing the exposure time of denuded areas. Most topsoil contains weed seeds, and weeds may compete with desirable species.

Advantages of topsoil include its high organic matter content and friable consistence, water-holding capacity, and nutrient content.

In site planning, the option of topsoiling should be compared with that of preparing a seedbed in subsoil. The clay content of subsoils does provide high moisture availability and deter leaching of nutrients and, when properly limed and fertilized, subsoils may provide a good growth medium which is generally free

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of weed seeds. In many cases topsoiling may not be required for the establishment of less demanding, lower maintenance plant material. Topsoiling is strongly recommended where ornamental plants or high-maintenance turf will be grown. Topsoiling is a required procedure when establishing vegetation on shallow soils, soils containing potentially toxic materials, and soils of critically low pH (high acid) levels.

If topsoiling is to be done, the following items should be considered:

1. Whether an adequate volume of topsoil exists on the site. Topsoil will be spread at a compacted depth of 2 to 4 inches (depths closer to 4 inches are preferred).
2. Location of the topsoil stockpile so that it meets specifications and does not interfere with work on the site.
3. Allow sufficient time in scheduling for topsoil to be spread and bonded prior to seeding or planting.
4. Care must be taken not to apply topsoil to subsoil if the two soils have contrasting textures. Clayey topsoil over sandy subsoil is a particularly poor combination, as water may creep along the junction between the soil layers, causing the topsoil to slough. Sandy topsoil over a clay subsoil is equally as likely to fail.
5. If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. Topsoiling of steep slopes should be discouraged unless good bonding of soils can be achieved.

Specifications

Materials

Field exploration of the site shall be made to determine if there is sufficient surface soil of good quality to justify stripping. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam). It shall be free of debris, trash, stumps, rocks, roots, and noxious weeds, and shall give evidence of being able to support healthy vegetation. It shall contain no substance that is potentially toxic to plant growth.


In areas where revegetation is of concern based on existing soil conditions and determined by the MVP Environmental Inspector (EI), topsoil samples shall be taken for analysis. Samples will be collected by the MVP EI and sent to a recognized laboratory for analysis of the following criteria:

Organic matter content shall be not less than 1.5% by weight.

pH range shall be from 6.0-7.5. If pH is less than 6.0, lime shall be added in accordance with soil test results or in accordance with the recommendations of the vegetative establishment practice being used.

Soluble salts shall not exceed 500 ppm.

Soil samples collected and sent for analysis will be identified by the MVP Constructions Spread # and pipeline station from which the sample was obtained. Areas that fail to revegetate following restoration will be sampled and analyzed based on the above parameters.

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Topsoil Importing

Topsoil would be imported as needed in residential areas only. If additional off-site topsoil is needed, it must meet the standards stated above.

Stripping

Topsoil operations should not be performed when the soil is wet or frozen. Stripping shall be confined to the immediate construction area. A 4-to 6-inch stripping depth is common, but depth may vary depending on the particular soil. All perimeter dikes, basins, and other sediment controls shall be in place prior to stripping.

Stockpiling

Topsoil shall be stockpiled in such a manner that natural drainage is not obstructed and no off-site sediment damage shall result. Stabilize or protect stockpiles in accordance with MS #2.

Excavated subsoil shall be stockpiled separately from topsoil.

Side slopes of the stockpile shall not exceed 2:1.

Perimeter controls must be placed around the stockpile immediately; seeding of stockpiles shall be completed within 7 days of the formation of the stockpile, in accordance with Std. & Spec. 3.31, TEMPORARY SEEDING if it is to remain dormant for longer than 14 days (refer to MS #1 and MS #2).

Site Preparation Prior to and Maintenance During Topsoiling and Excavation

Before topsoiling or excavation, establish needed erosion and sediment control practices such as diversions, grade stabilization structures, berms, dikes, level spreaders, waterways, sediment basins, etc. These practices must be maintained during topsoiling and excavation.


Grading: Previously established grades on the areas to be topsoiled shall be maintained according to the approved plan.

Liming: Where the pH of the subsoil is 6.0 or less, or the soil is composed of heavy clays, agricultural limestone shall be spread in accordance with the soil test or the vegetative establishment practice being used.

Bonding: After the areas to be topsoiled have been brought to grade, and immediately prior to dumping and spreading the topsoil, the subgrade shall be loosened by disking or scarifying to a depth of at least 4-6 inches to ensure bonding of the topsoil and subsoil. Refer to 2.8.3 Soil Compaction Mitigation within the Project Standards and Specifications for additional information.

Applying Topsoil

Topsoil shall not be placed while in a frozen or muddy condition, when topsoil or subgrade is excessively wet, or in a condition that may otherwise be detrimental to proper grading or seeding. The topsoil shall be uniformly distributed to a minimum compacted depth of 2 inches on 3:1 or steeper slopes and 4 inches on flatter slopes or to mimic existing conditions present in the adjacent undisturbed areas. (See Table 3.30-A to determine volume of topsoil required for application to various depths). Any irregularities in the surface, resulting from topsoiling or other operations, shall be corrected in order to prevent the formation of depressions or water pockets.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		TOPSOILING & SOIL HANDLING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID: PXXXX			DRAWING NO. MVP-ES46.2	REV. P

Once the topsoil has been applied to the subgrade the topsoil should be disked and raked. Excess rock will be removed from at least the top 12 inches of soil to the extent practicable in all cultivated or rotated cropland, managed pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area shall be similar to adjacent areas not disturbed by construction. The landowner or land management agency may approve other provisions in writing. Refer to Standards and Specifications Section 2.8 Final Grading for additional information.

TABLE 3.30-A		
CUBIC YARDS OF TOPSOIL REQUIRED FOR APPLICATION TO VARIOUS DEPTHS		
DEPTH (INCHES)	PER 1,000 (SQUARE FEET)	PER ACRE
1	3.1	134
2	6.2	268
3	9.3	403
4	12.4	537
5	15.5	672
6	18.6	806

SOURCE: Va. DSWC


Soil Sterilants

No seed shall be placed on soil which has been treated with soil sterilants until sufficient time has elapsed to permit dissipation of toxic materials.

Special Soil Related Requirements for Working in Wetlands

Norfolk District 2017 Nationwide Permit Regional Conditions, dated March 20, 2017 (subject to revision in Spring of 2017), NWP 12 – Utility Line Activities items 3.b.iii, 5.a, and 5.b require the following:

1. Minimizing clearing of wetlands. Grubbing shall be limited to the permanent easement for underground utility lines. Outside of the permanent easement, wetland vegetation shall only be removed at or above the ground surface unless written justification is provided and the impacts are reviewed and approved by the Corps.
2. Whenever practicable, excavated material shall be placed on a Corps confirmed upland site. However, when this is not practicable, temporary stockpiling is hereby authorized provided that:
 - a. All excavated material stockpiled in a vegetated wetland area is placed on filter cloth, mats, or some other semi-permeable surface. The material will be stabilized with straw bales, filter cloth, etc. to prevent reentry into any waterway.
 - b. All excavated material must be placed back into the trench to the original contour and all excess excavated material must be completely removed from the wetlands within 30 days after the pipeline has been laid through the wetland areas. Permission must be granted by the District Commander or his authorized representatives if the material is to be stockpiled longer than 30 days.

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		TOPSOILING & SOIL HANDLING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID:		MVP-ES46.3	P	
PXXXX				

BARE ROOT SAPLING AND SHRUB PLANTING

Definition

The establishment of riparian buffer areas and forested or scrub-shrub wetland areas using bare root seedling plantings to supplement the permanent riparian seed mix.

Purposes

To establish target native tree species comparable to the region, site characteristics (e.g., topography; soil characteristics; adjacent vegetation), and adjacent forest composition in order to encourage the timely reestablishment of habitat removed during Project construction in select areas of the Project. Tree and shrub species intended for use in bare root plantings are identified in Appendix B – MVP-ES11.6 and MVP-ES11.7.

Conditions Where Practice Applies

Specific areas disturbed by Project activities along pipeline corridor. Locations where bare root plantings will be implemented at waterbody crossings are identified in Appendix B – MVP-ES11.8 and 11.9.

Planning Considerations

Storage


Ideally bare root seedlings should be planted immediately upon delivery. Keep seedlings in original sack or box from the nursery to preserve moisture within the package. Seedlings shall be stored in a cool, damp, and shady location that will not receive direct sunlight and is sheltered from the wind. Refrigerated trailer storage is preferred. Leave air gaps between boxes or sacks when stacking seedlings and only stack up to 3 high.

Handling

It is important to handle bare root seedlings with care due to the fragile nature of the exposed roots and stems. Do not plant any seedling that has been damaged.

Carefully examine each seedling prior to planting and discard if any of the following are present:

- Broken stems or main root
- Mold or mildew
- Stems that are without bark
- Desiccated roots
- A root system less than 5 inches long

DRAWN	DATE	 DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BARE ROOT SAPLING AND SHRUB PLANTING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.			DRAWING NO.	REV.
PROJECT ID: PXXXX		MVP-ES47	P	

Specifications


Planting

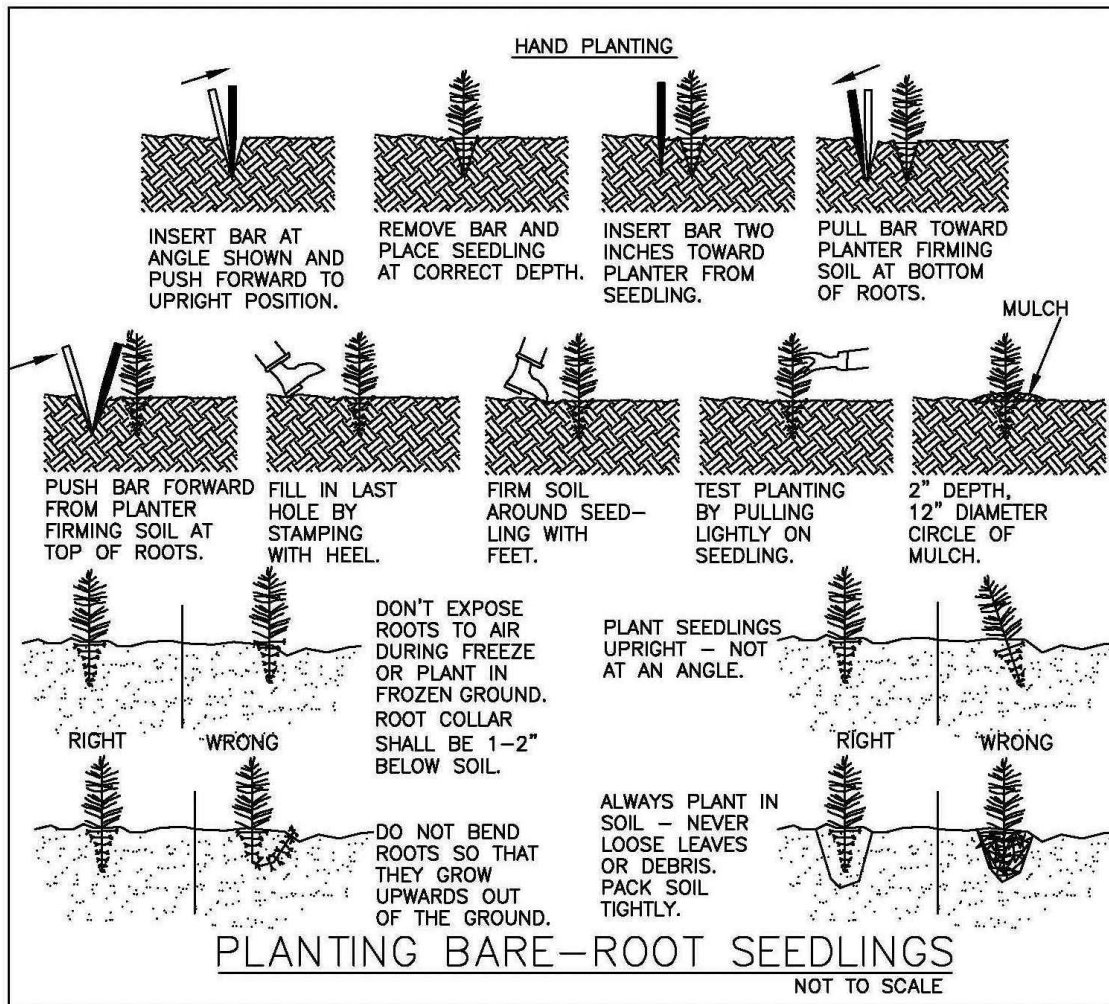
- Planting of bare root seedlings shall only take place between October 1st and April 30th.
- Planting shall take place after seeding application.
- A spade, planting bar, or shovel shall be used to plant all bare root seedlings.

Steps for Planting Bare Root Seedling

1. The planting hole shall be dug 8-10 inches deep and 4-5 inches wide. The hole shall be deep enough to fit the entire bare root system without bending.
2. All bare root seedlings shall be treated with root dip absorbent polymers and mycorrhizal root dip inoculates in accordance with manufacturer's recommendations.
3. Carefully separate the seedlings and place one seedling per planting hole. Discard any that have any of the defects outlined above.
4. For seedling with root systems longer than the depth of the planting hole, prune roots back to a length of 8-10 inches below root collar. Bare root pruning shall take place in a cool, shaded location out of the wind. After bare root pruning, re-moisten the seedling before planting. If not planting the seedling immediately, re-moisten and store appropriately in original packaging.
5. Insert the roots of the seedling to the bottom of the planting hole and lift upward slightly so that the root collar is at or slightly below finished grade. This will ensure that the root system is planted without bending.
6. Fertilize each bare root seedling with a 5 gram tablet of controlled release fertilizer.
7. The seedling shall be maintained in an upright position when filling the planting hole. To fill the planting hole insert the spade, planting bar, or shovel behind the planting hole and tilt back to close the bottom of the planting hole. Next tilt the tool forward to close the top of the hole. Gently pack soil to fill any remaining void space in the planting hole.

If a definite browse line exists in the adjacent forest all bare root seedlings shall be planted in tree tubes tall enough to protect the seedlings from deer browse (a minimum of 5' tall).

DRAWN	DATE	 Mountain Valley PIPELINE DESIGN ENGINEERING	ENVIRONMENTAL DETAIL	
CHECKED	DATE		BARE ROOT SAPLING AND SHRUB PLANTING	
APP'D	DATE			
SCALE N.T.S.	SHEET 1 OF 1			
JOB NO.				
PROJECT ID: PXXXX			DRAWING NO. MVP-ES47.1	REV. P



DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX


Mountain
Valley
 PIPELINE
 DESIGN ENGINEERING

ENVIRONMENTAL DETAIL

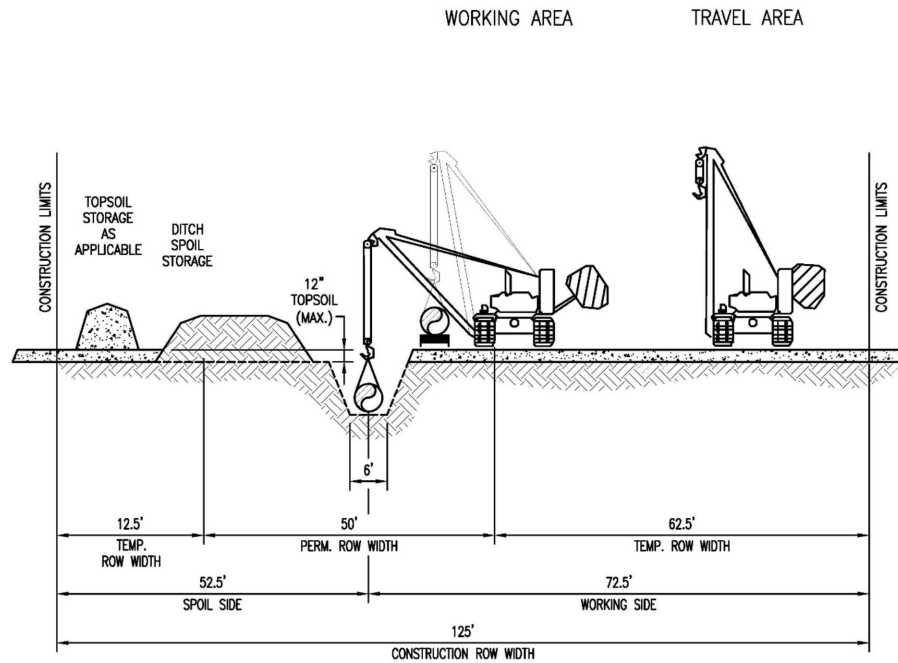
BARE ROOT SAPLING
AND SHRUB PLANTING

DRAWING NO.

MVP-ES47.2

REV.

P



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	10/6/2016
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



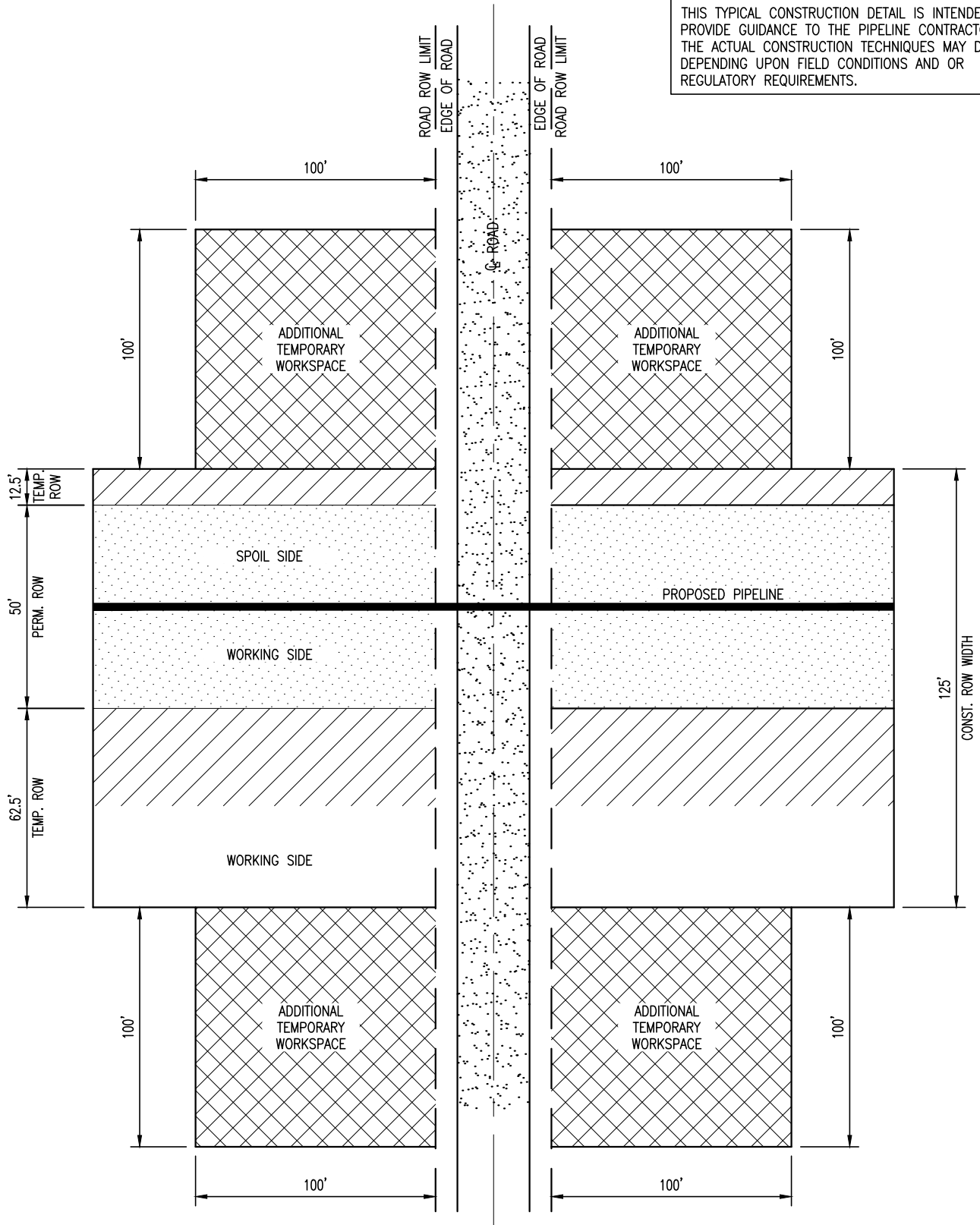
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
NON-PARALLEL CONSTRUCTION WITH
TOPSOIL SEGREGATION

DRAWING NO.	REV.
MVP-2	0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



DRAWN	JDM	DATE	11/14/14
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
ROAD CROSSING BORED
TYPICAL

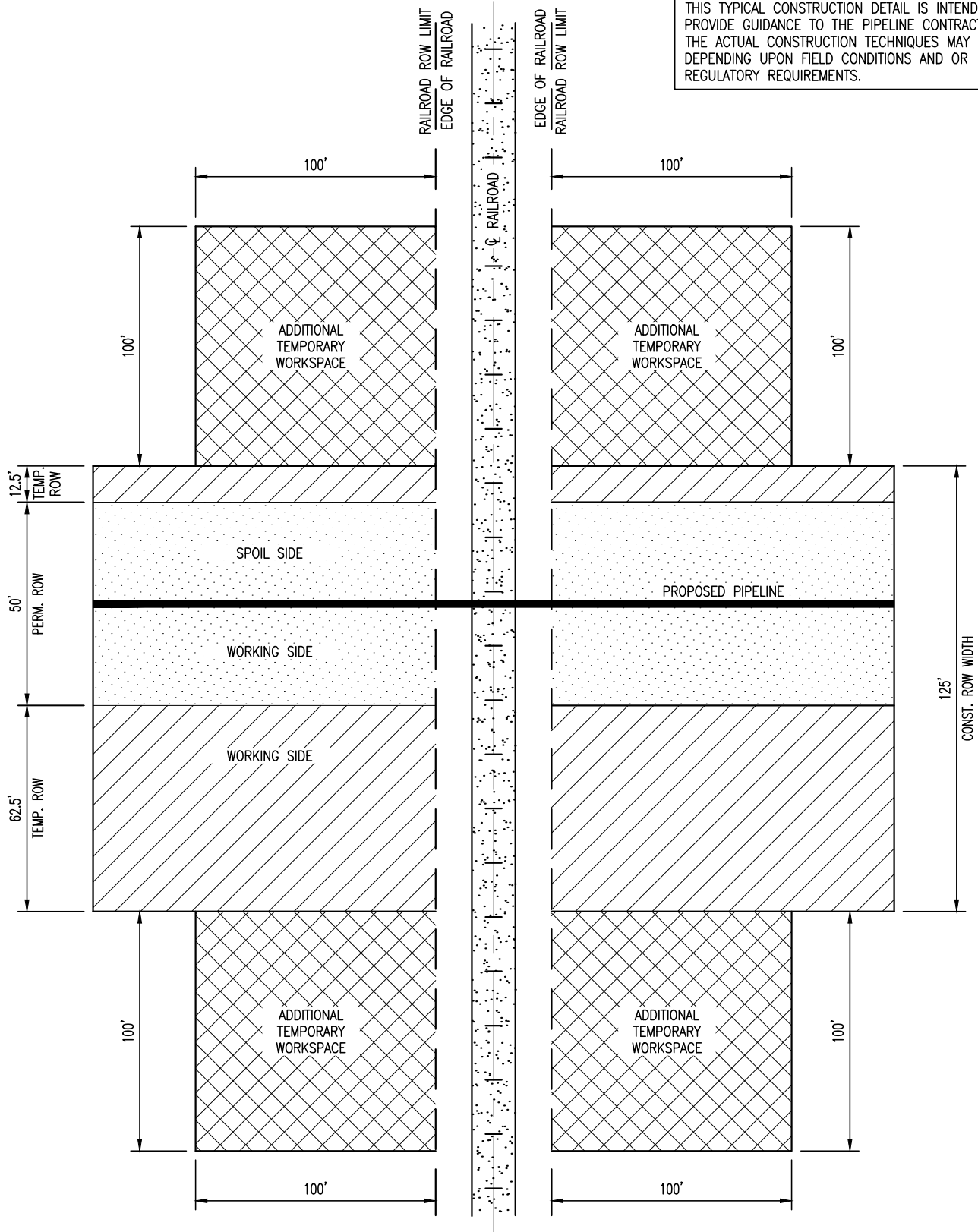
DRAWING NO.

MVP-4

REV.

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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



DRAWN	JDM	DATE	11/14/14
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
RAILROAD CROSSING BORED

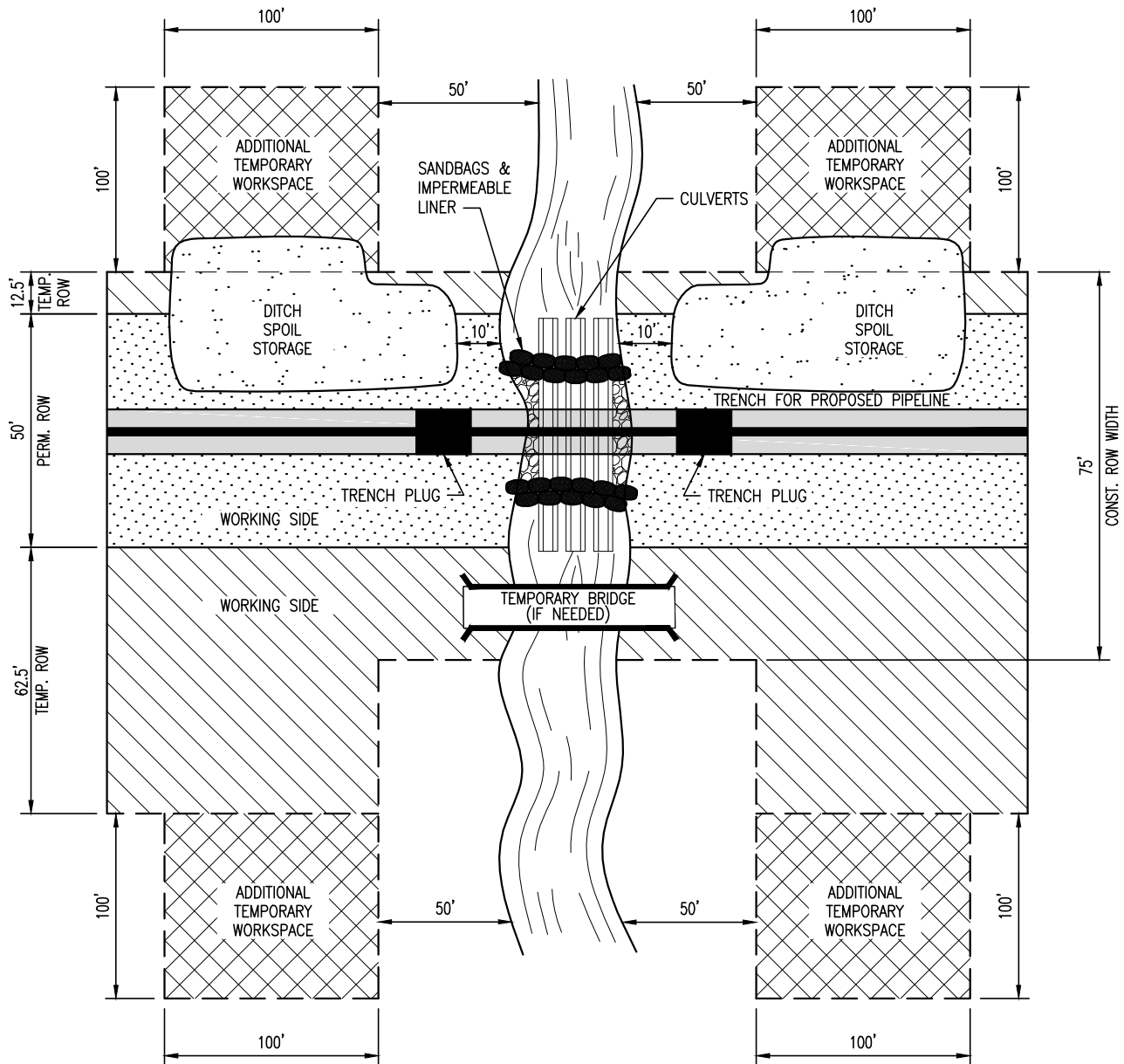
DRAWING NO.

MVP-5

REV.

0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



DRAWN	JDM	DATE	11/17/14
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
WATERBODY CROSSING
OPEN CUT – FLUME

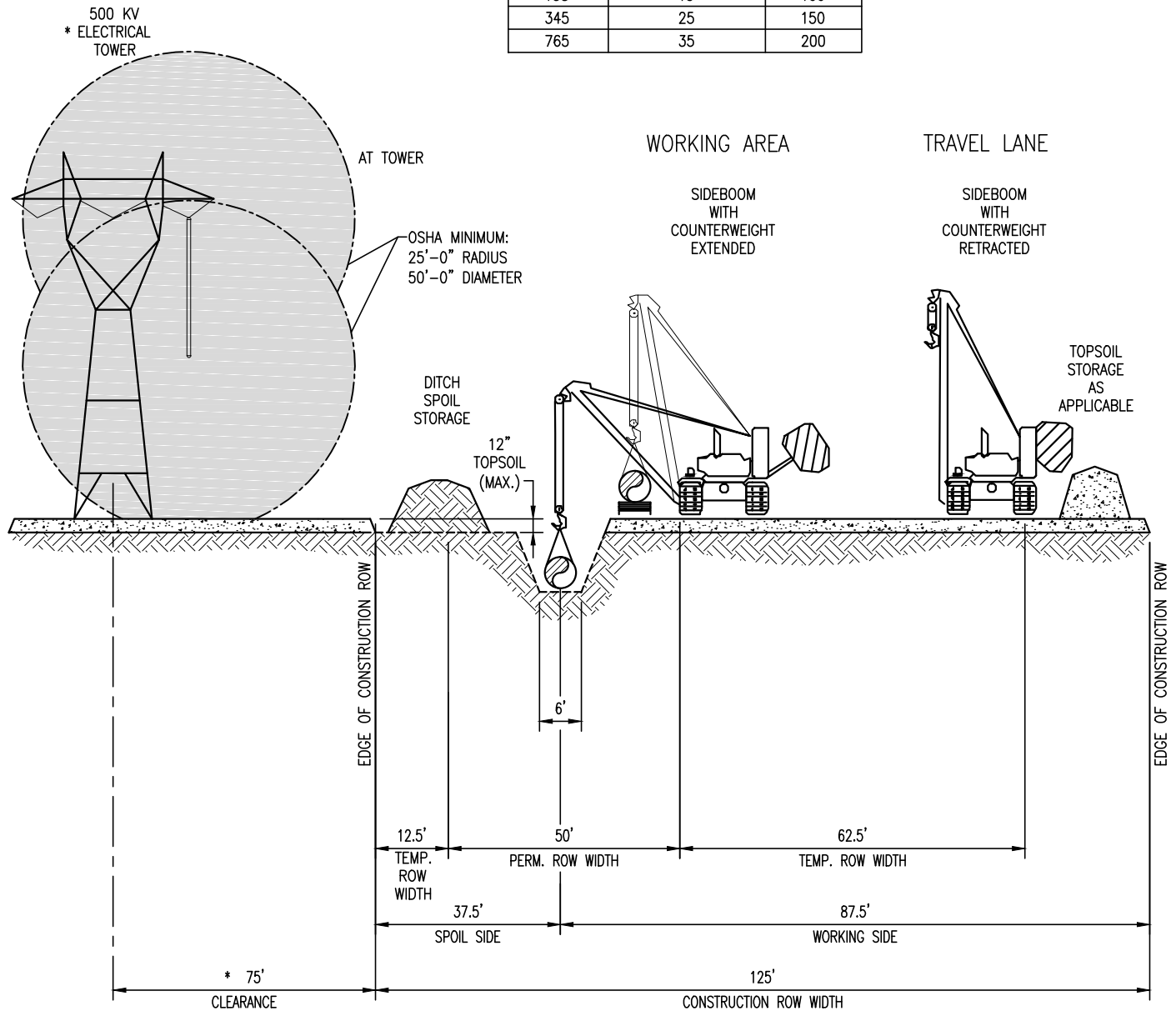
DRAWING NO.

MVP-6

REV.

0

POWER LINE VOLTAGE KV	MINIMUM ALLOWABLE APPROACH DISTANCE FEET	TYPICAL ROW WIDTH FEET
34	10	50
69	12	70
138	15	100
345	25	150
765	35	200



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

* SEE TABLE AT TOP OF PAGE

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

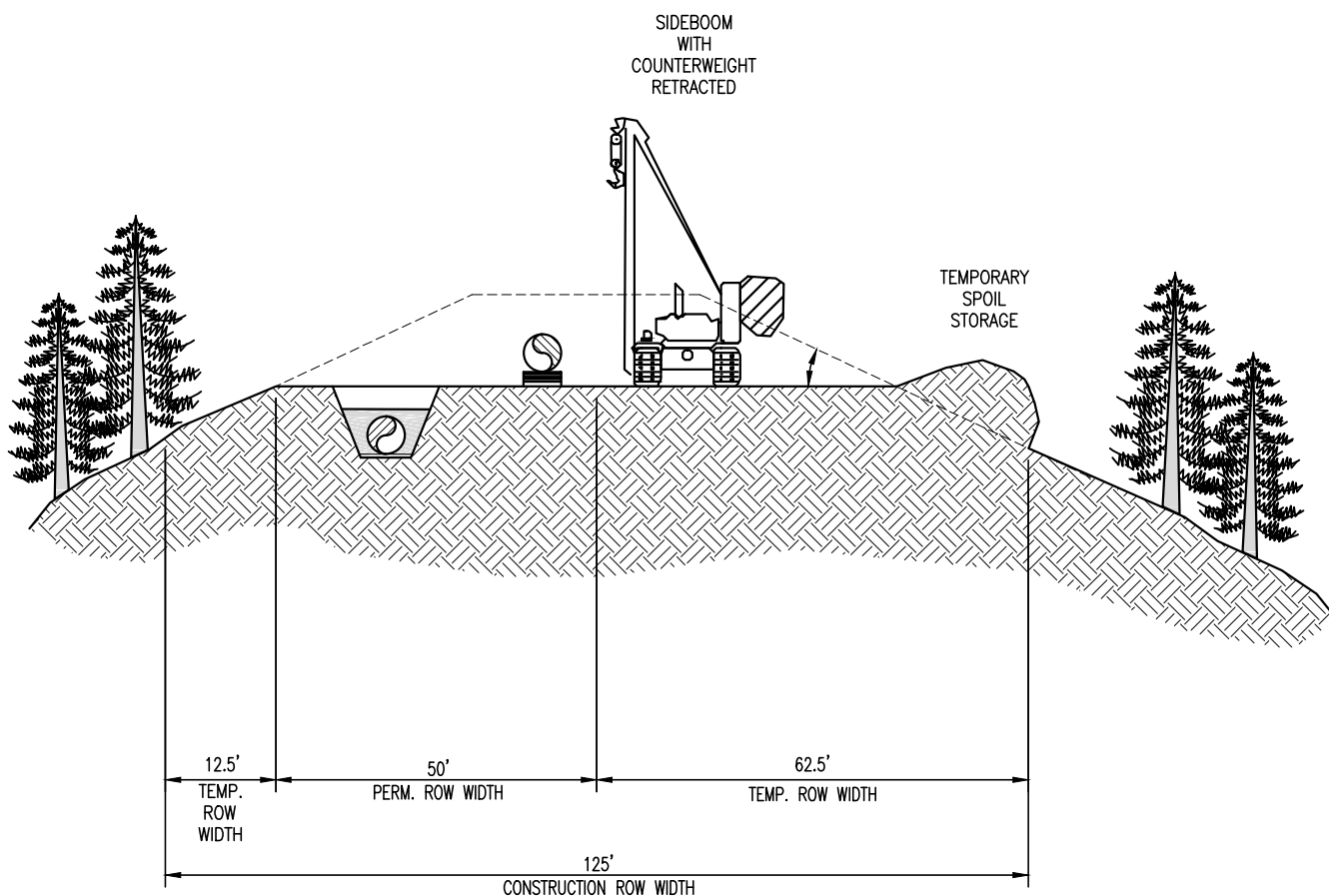
MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES
RIGHT-OF-WAY

DRAWING NO.

MVP-7

REV.

0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
TYPICAL CROSS SECTION
FOR LARGE DIAMETER PIPE
RIDGE

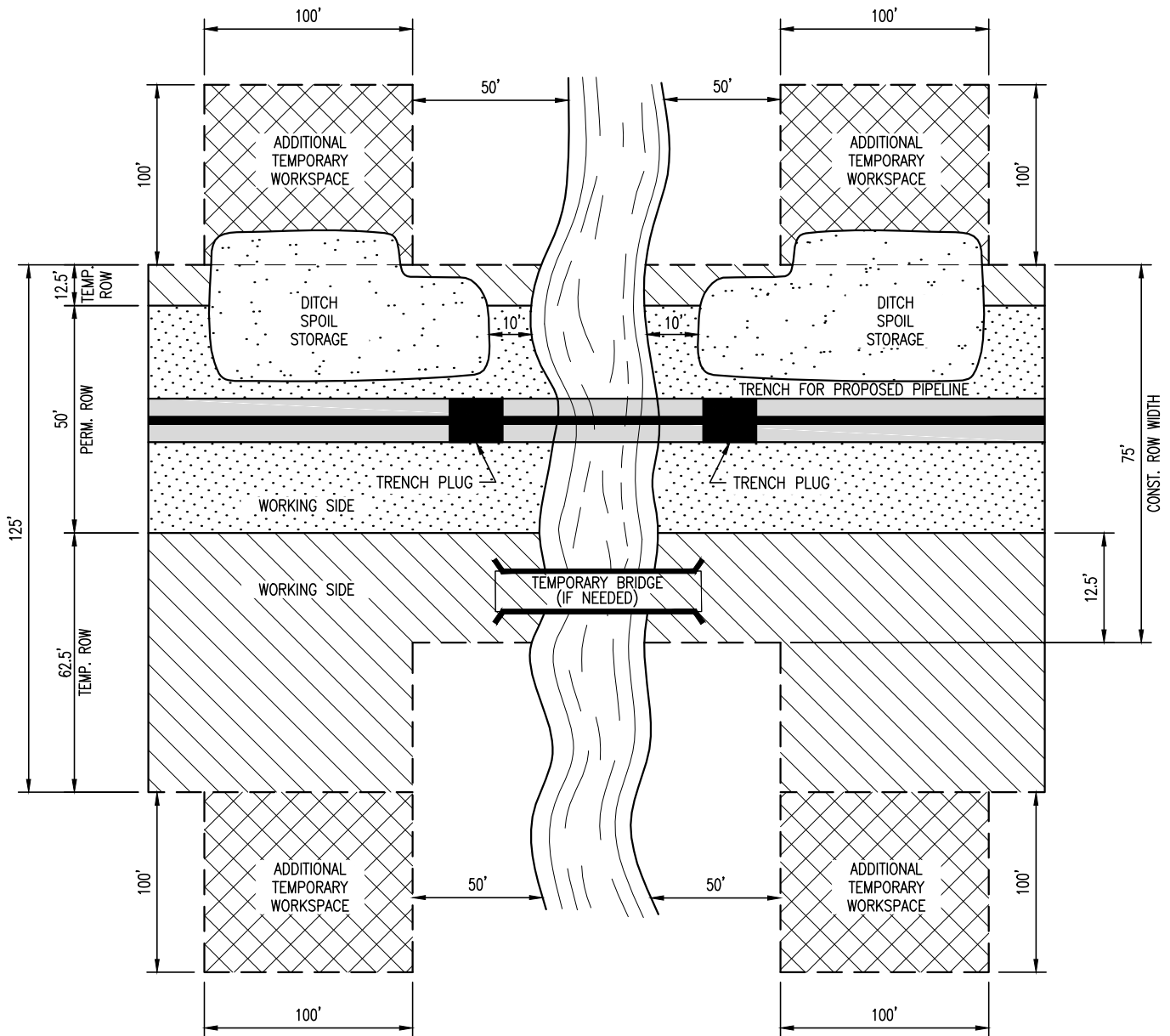
DRAWING NO.

MVP-8

REV.

0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

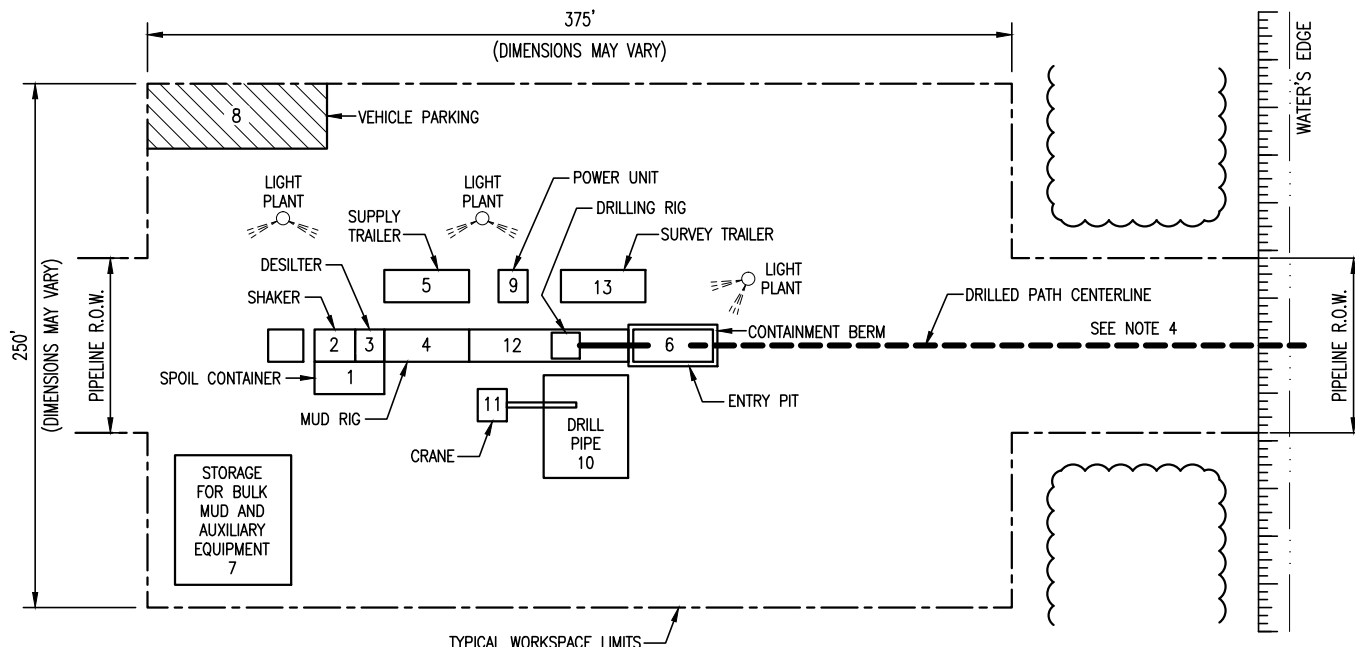
MAINLINE CONSTRUCTION
WATERBODY CROSSING
OPEN CUT – WET DITCH
RIGHT-OF-WAY

DRAWING NO.

MVP-9

REV.

0



EQUIPMENT:

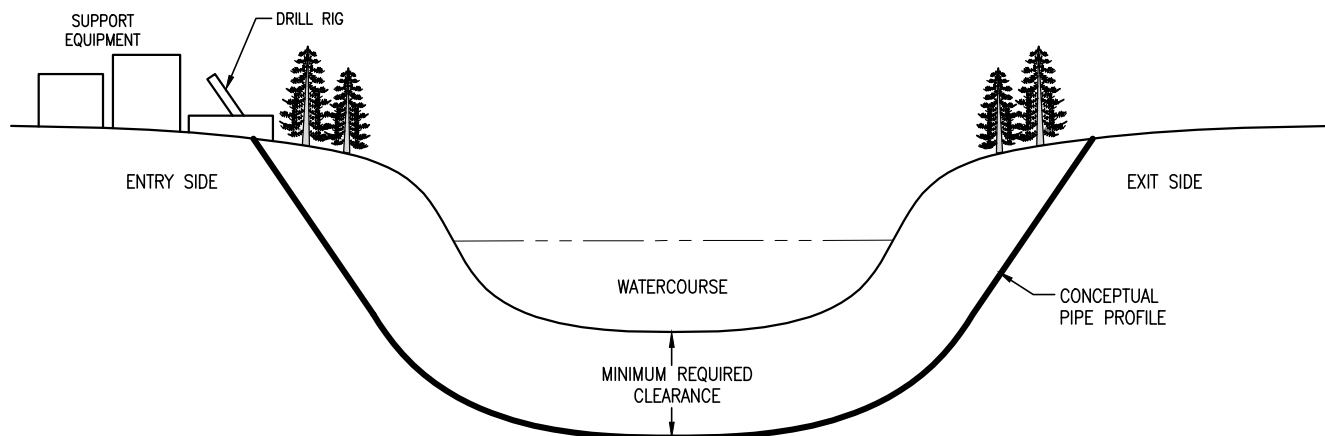
1. SPOIL CONTAINER: 8' X 20'
2. SHAKER: 8' X 12'
3. DESILTER: 8' X 8'
4. MUD RIG: 8' X 25'
5. SUPPLY TRAILER: 8' X 25'
6. ENTRY PIT: 8' X 20'
7. STORAGE: 30' X 30'
8. VEHICLE PARKING: 15' X 50'
9. POWER UNIT: 8' X 10'
10. DRILL PIPE: 30' X 30'
11. CRANE: 8' X 8'
12. DRILLING RIG: 8' X 45'
13. SURVEY TRAILER: 8' X 25'

NOTES:

1. EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.
2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.
4. HAND CLEARED ACCESS PATH WILL BE USED TO OBTAIN WATER FROM SOURCE WHERE PERMITTED.

ENTRY SITE PLAN

SCALE: N.T.S.



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

PROFILE

SCALE: N.T.S.

GENERAL NOTES:

1. PIPE DEPTHS MAY VARY.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/18/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

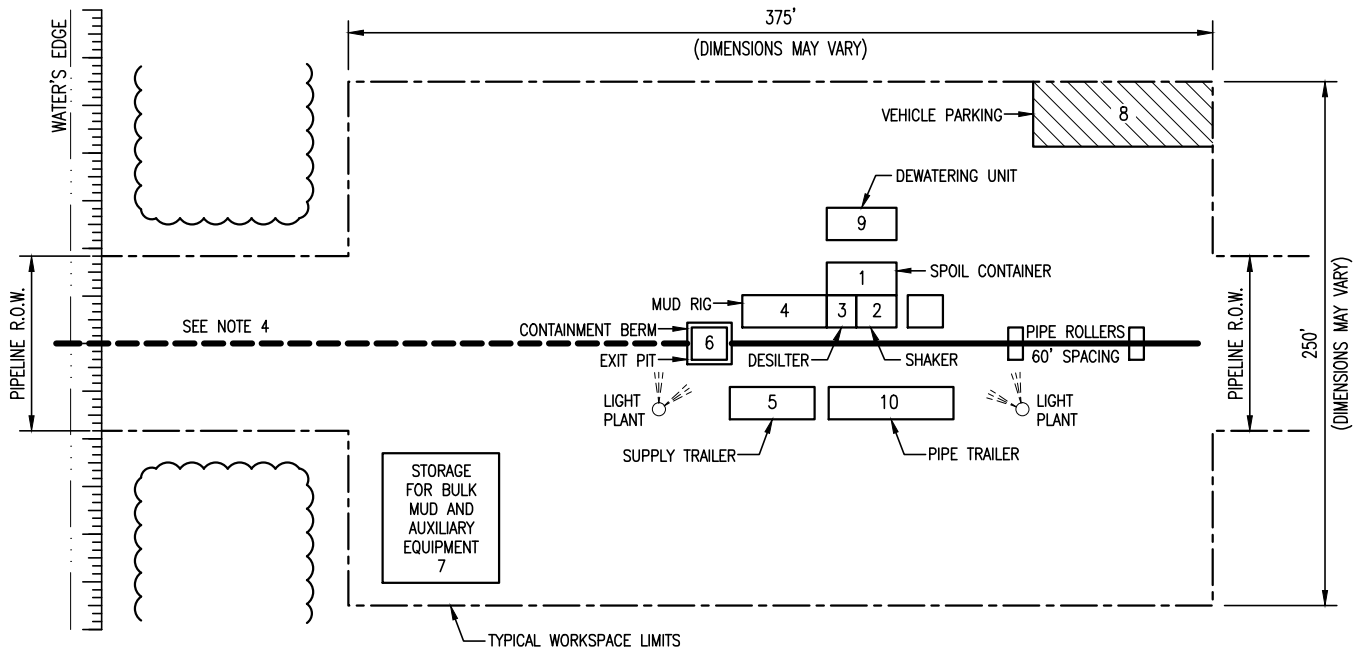
MAINLINE CONSTRUCTION
TYPICAL DIRECTIONAL DRILL
ENTRY SITE PLAN & PROFILE

DRAWING NO.

MVP-10

REV.

0



EQUIPMENT:

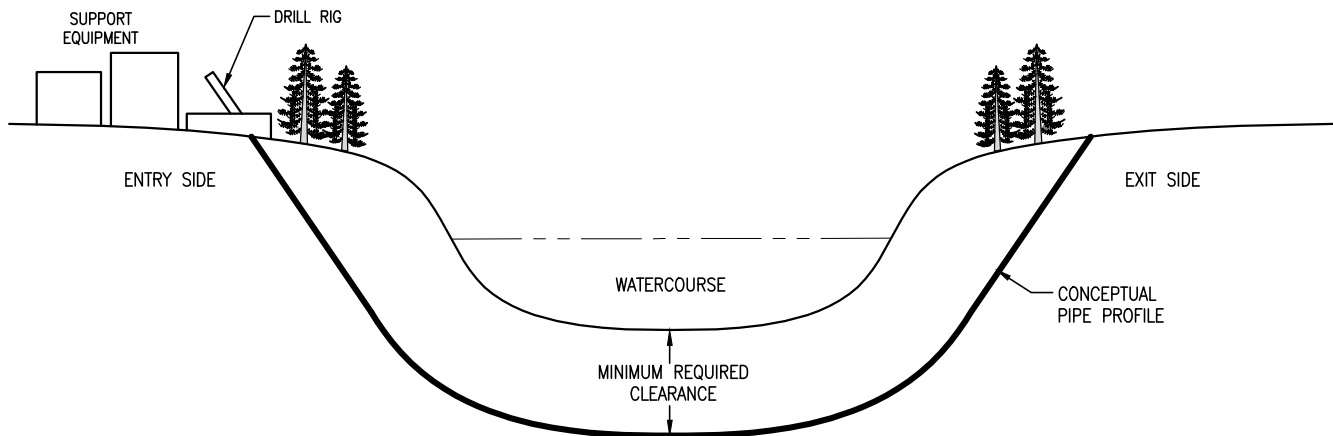
1. SPOIL CONTAINER: 8' X 20'
2. SHAKER: 8' X 12'
3. DESILTER: 8' X 8'
4. MUD RIG: 8' X 25'
5. SUPPLY TRAILER: 8' X 25'
6. EXIT PIT: 8' X 10'
7. STORAGE: 30' X 30'
8. VEHICLE PARKING: 15' X 50'
9. DEWATERING UNIT: 8' X 20'
10. PIPE TRAILER: 8' X 40'

NOTES:

1. EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.
2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.
4. HAND CLEARED ACCESS PATH WILL BE USED TO OBTAIN WATER FROM SOURCE WHERE PERMITTED.

EXIT SITE PLAN

SCALE: N.T.S.



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PROFILE

SCALE: N.T.S.

GENERAL NOTES:

1. PIPE DEPTHS MAY VARY.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/18/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
TYPICAL DIRECTIONAL DRILL
EXIT SITE PLAN & PROFILE

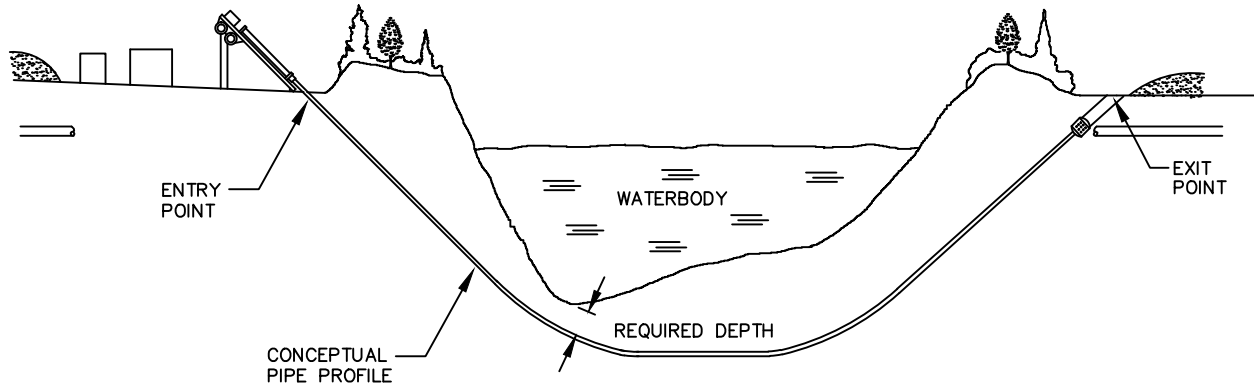
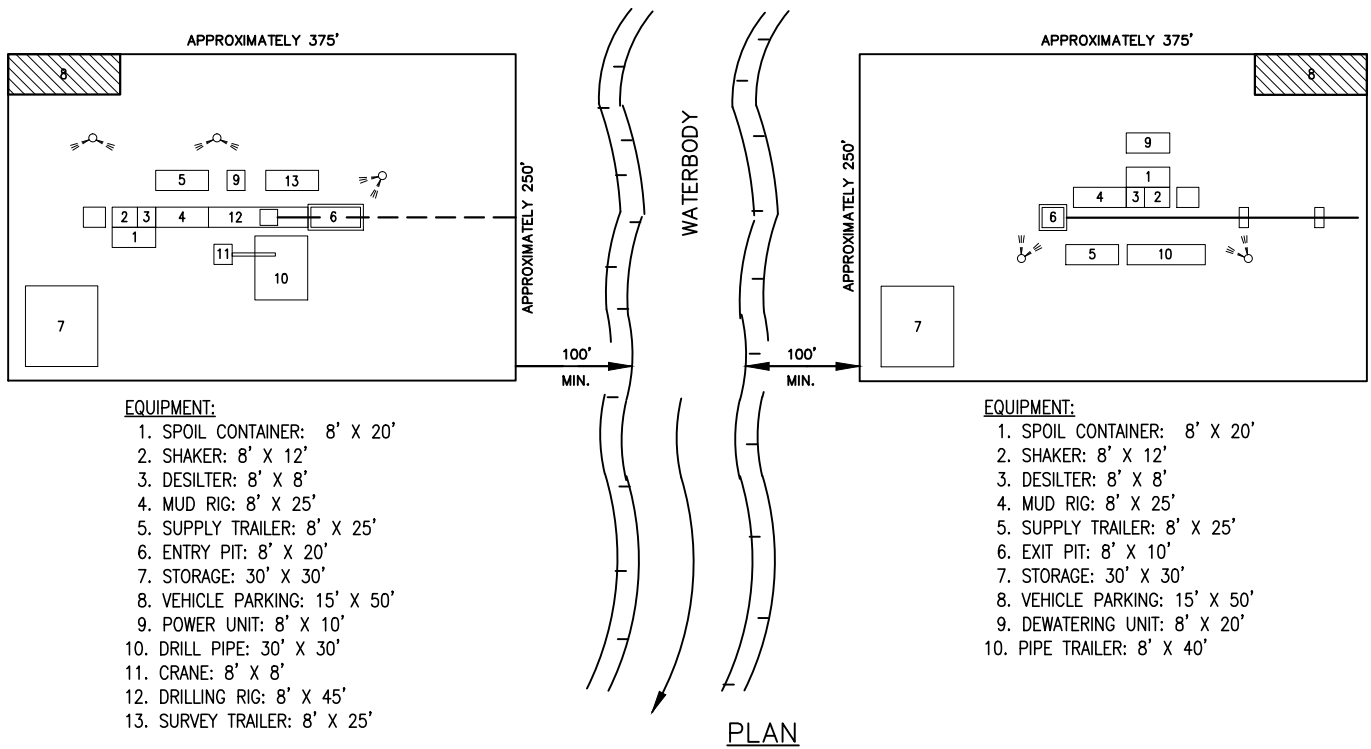
DRAWING NO.

MVP-11

REV.

0

HORIZONTAL DIRECTIONAL DRILL METHOD 7



NOTES:

1. SET UP DRILLING EQUIPMENT A MINIMUM OF 100 FEET FROM THE EDGE OF THE WATERCOURSE. DO NOT CLEAR OR GRADE WITHIN THE 100 FOOT ZONE.
2. ENSURE THAT ONLY BENTONITE BASED DRILLING MUD IS USED. DO NOT ALLOW THE USE OF ANY ADDITIVES TO THE DRILLING MUD WITHOUT THE APPROVAL OF COMPANY INSPECTOR.
3. INSTALL SUITABLE DRILLING MUD TANKS OR SUMPS TO PREVENT CONTAMINATION OF WATERCOURSE.
4. INSTALL BERMS DOWNSLOPE FROM THE DRILL ENTRY AND ANTICIPATED EXIT POINTS TO CONTAIN ANY RELEASE OF DRILLING MUD.
5. DISPOSE OF DRILLING MUD IN ACCORDANCE WITH THE APPROPRIATE REGULATORY AUTHORITY REQUIREMENTS.
6. A SEDIMENT BARRIER SHALL BE PLACED ON THE DOWN SLOPE SIDE OF RIGHT-OF-WAY, PER THE PROJECT NARRATIVE.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	3/18/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

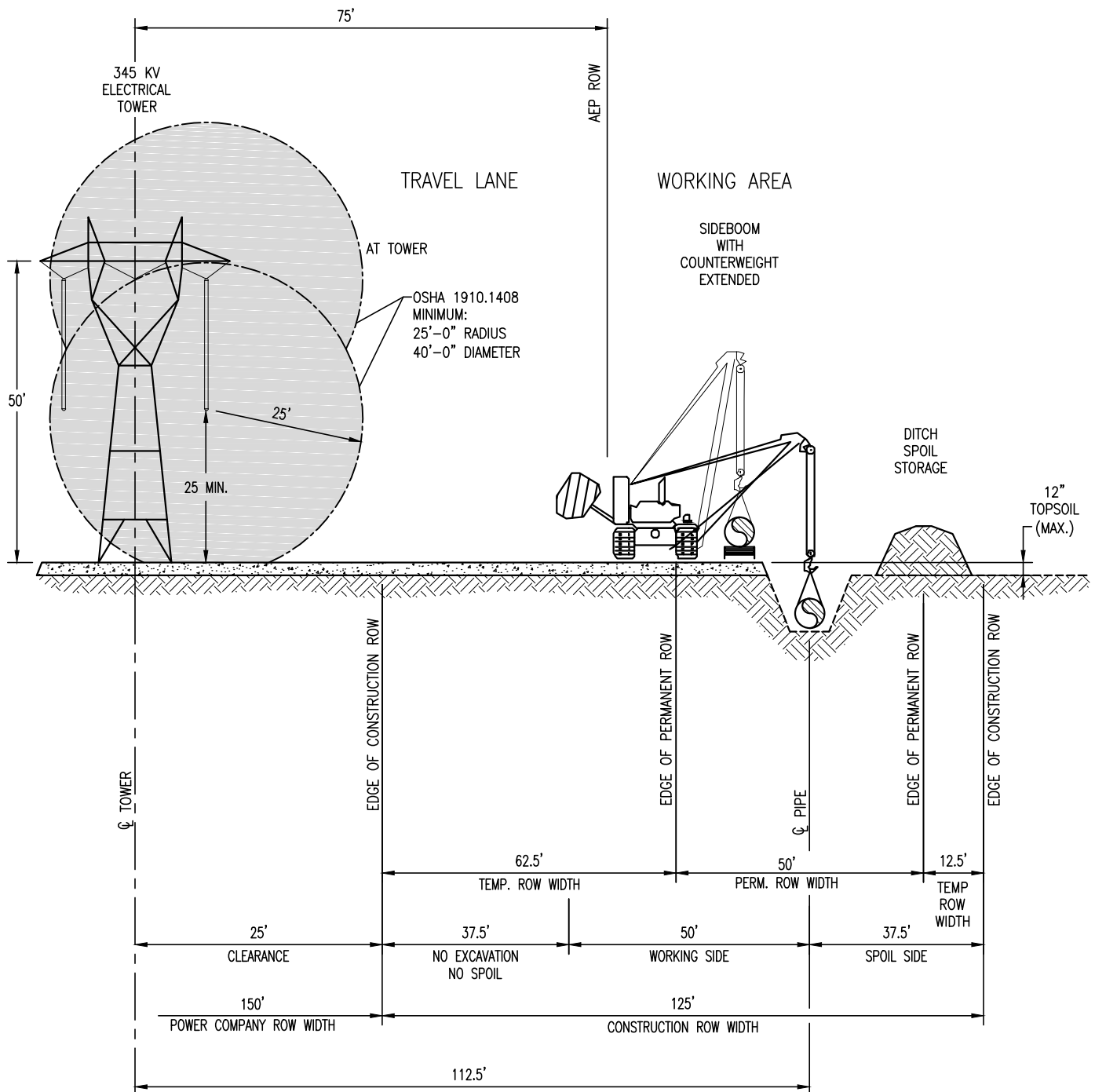
HORIZONTAL DIRECTIONAL DRILL (HDD)

DRAWING NO.

MVP-12

REV.

0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	5/27/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

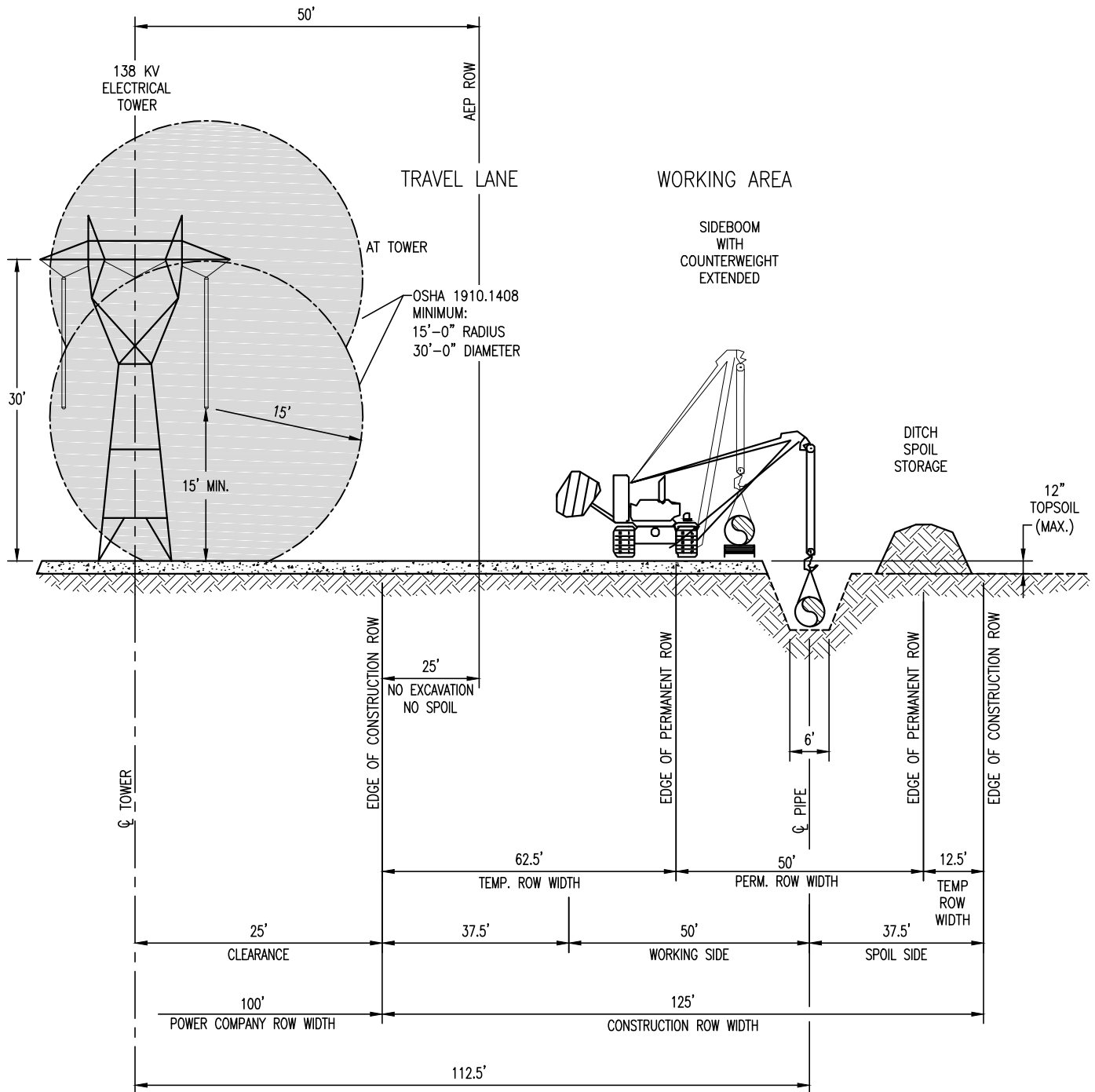
MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES - 345KV
RIGHT-OF-WAY

DRAWING NO.

MVP-13

REV.

0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	5/27/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

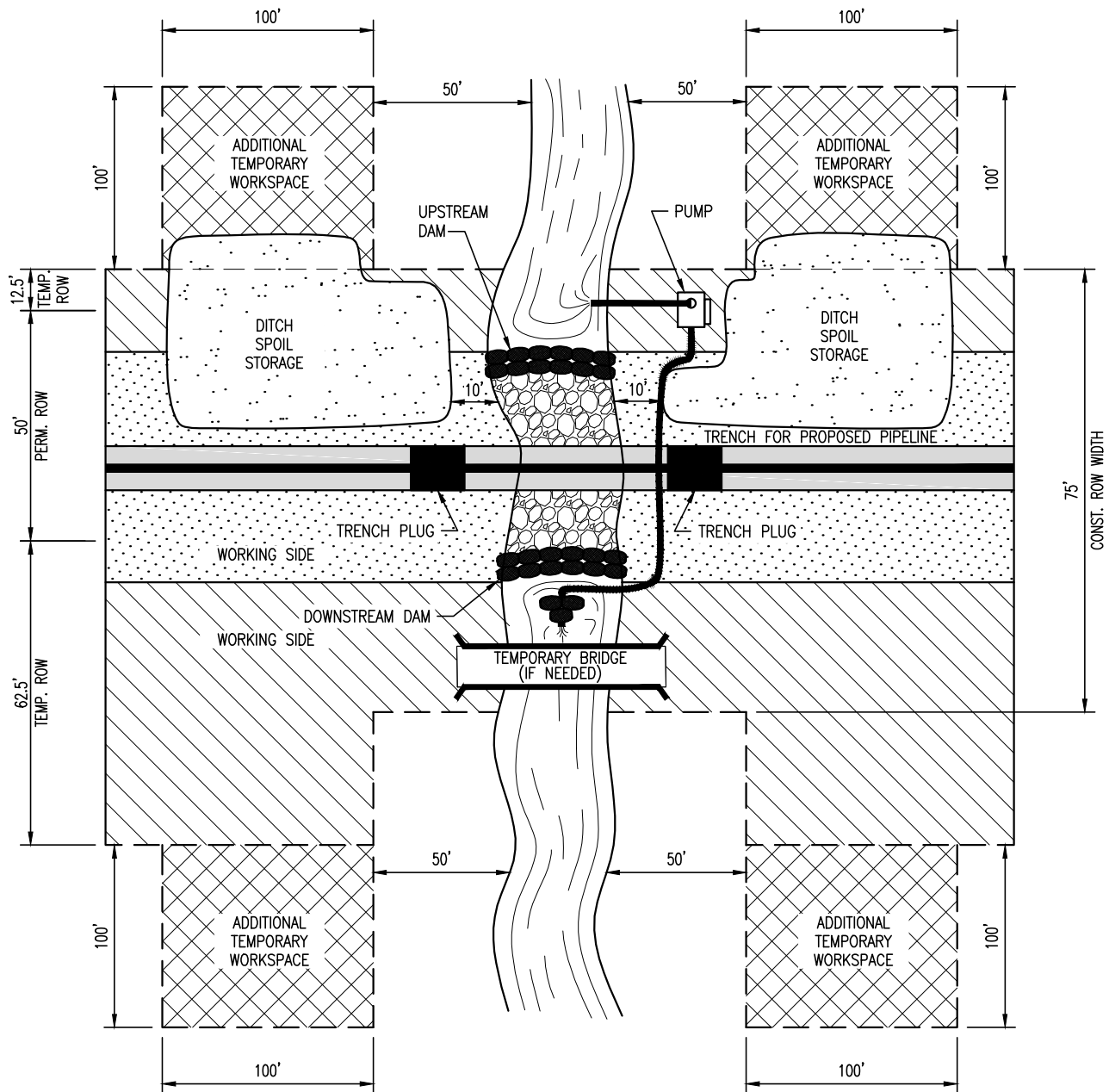


DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES - 138KV
RIGHT-OF-WAY

DRAWING NO.	REV.
MVP-14	0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	08/20/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1

JOB NO.
PROJECT ID:
PXXXX



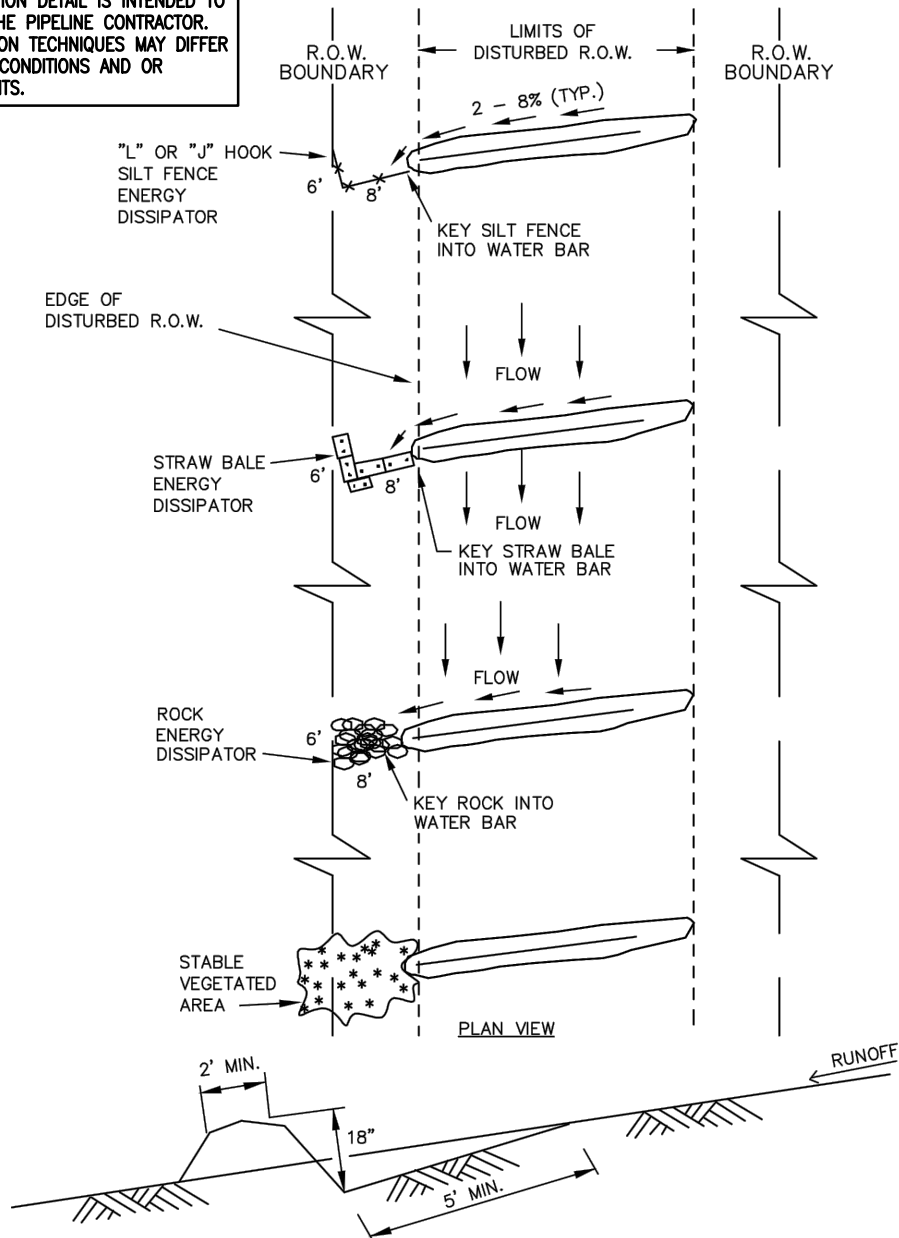
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
WATERBODY CROSSING
OPEN CUT – DRY/DAM AND PUMP
RIGHT-OF-WAY

DRAWING NO.	REV.
MVP-15	0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



NOTES:

1. SLOPE BREAKERS SHALL BE CONSTRUCTED OF COMPACTED NATIVE SOIL AND INSTALLED AT LOCATIONS AS SHOWN ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE COMPANY'S INSPECTOR.
2. SLOPE BREAKERS SHALL BE ORIENTED AS SHOWN OR OTHER PATTERN AS DIRECTED BY THE COMPANY'S INSPECTOR TO DIRECT THE WATER OFF THE R.O.W.
3. SLOPE BREAKERS SHALL BE CONSTRUCTED AT A 2-8% GRADIENT ACROSS THE SLOPE.
4. THE SLOPE BREAKERS SHALL BE 18" DEEP (AS MEASURED FROM THE TROUGH TO THE TOP OF THE SLOPE BREAKER). THE TROUGH WILL BE A MINIMUM OF 5' WIDE ACROSS THE WIDTH OF THE RIGHT-OF-WAY.
5. THE OUTLET OF THE SLOPE BREAKER MUST FREELY DISCHARGE RUNOFF OFF FROM THE DISTURBED RIGHT-OF-WAY INTO A STABLE, WELL VEGETATED AREA OR INTO AN ENERGY DISSIPATER.
6. WHERE SLOPE BREAKERS EXTEND BEYOND THE EDGE OF THE CONSTRUCTION R.O.W. DIRECT RUNOFF INTO STABLE, WELL VEGETATED AREAS, THESE LOCATIONS MUST BE APPROVED BY THE COMPANY'S INSPECTOR.

DRAWN	JL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	10/6/2016
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

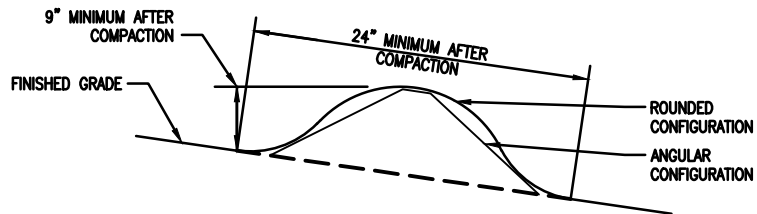


DESIGN ENGINEERING

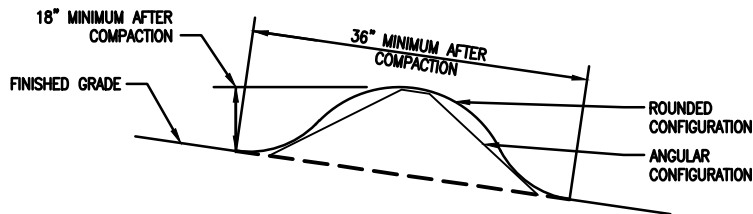
TYPICAL CONSTRUCTION DETAIL

SLOPE BREAKER/RIGHT-OF-WAY
DIVERSION/WATERBAR

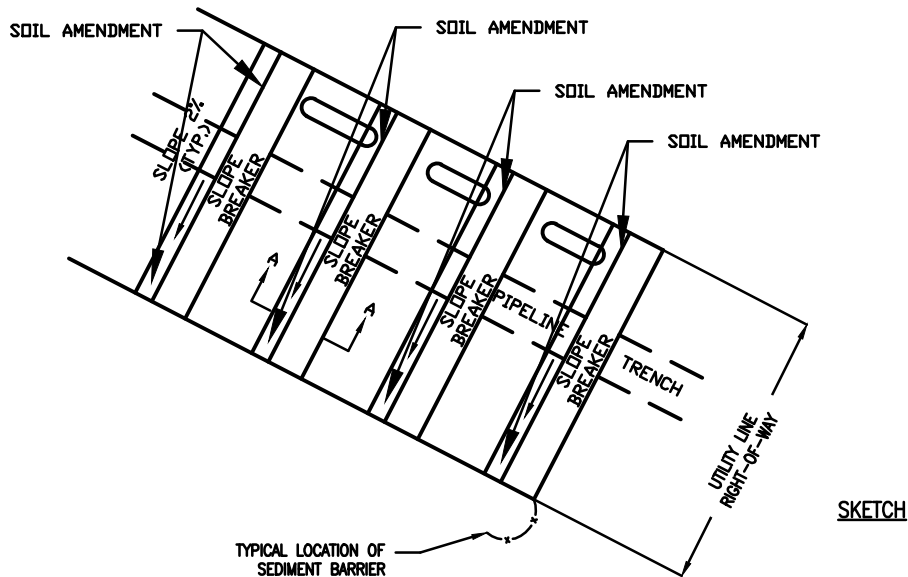
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MVP-17	0



SECTION A-A
(TEMPORARY INSTALLATION)



SECTION A-A
(PERMANENT INSTALLATION)



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

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TYPICAL CONSTRUCTION DETAIL

SLOPE BREAKER/RIGHT-OF-WAY
DIVERSION/WATERBAR

DRAWING NO.

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RECOMMENDED MAXIMUM SPACING FOR PERMANENT SLOPE BREAKERS	
PIPELINE GRADE	DISTANCE (FEET)
<2%	- 1, 2
2-5%	400
6-15%	200
16-30%	100
>31%	50 ³

¹ PERMANENT SLOPE BREAKERS WILL BE INSTALLED AS NEEDED BASED ON FIELD CONDITIONS.

² PERMANENT SLOPE BREAKERS WILL BE INSTALLED 25 FEET FROM EACH WATERBODY BOUNDARY REGARDLESS OF SLOPE CONDITIONS.

³ SLOPES GREATER THAN 65% MAY REQUIRE SITE SPECIFIC STABILIZATION MEASURES BASED ON FIELD CONDITIONS AS APPROVED BY MVP DESIGN ENGINEERING AND MVP ENVIRONMENTAL INSPECTOR.

NOTES:

WATERBARS SHALL BE INSPECTED WEEKLY (DAILY ON ACTIVE ROADS) AND AFTER EACH RUNOFF EVENT. DAMAGED OR ERODED WATERBARS SHALL BE RESTORED TO ORIGINAL DIMENSIONS WITHIN 24 HOURS OF INSPECTION

MAINTENANCE OF WATERBARS SHALL BE PROVIDED UNTIL ROADWAY, SKIDTRAIL, OR RIGHT-OF-WAY HAS ACHIEVED PERMANENT STABILIZATION

WATERBARS ON RETIRED ROADWAYS, SKIDTRAILS, AND RIGHT-OF-WAYS SHALL BE LEFT IN PLACE AFTER PERMANENT STABILIZATION HAS BEEN ACHIEVED

SUMP FILTERS TO BE INSTALLED AT END OF WATERBARS. REFER TO SUMP FILTER DETAIL ON SHEET 0.09 FOR MORE DETAIL.

OUTLET PROTECTION/COMPOST FILTER SOCK SHOULD BE INSTALLED AT THE OUTLET OF ALL WATERBARS.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

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CHECKED MMF	DATE 10/6/2016			
APP'D XXX	DATE 10/6/2016		SLOPE BREAKER/RIGHT-OF-WAY DIVERSION/WATERBAR	
SCALE N.T.S.	SHEET 1 OF 1			
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STRAW MULCH

1. STRAW MULCH SHALL BE INSTALLED AT LOCATIONS IDENTIFIED ON THE CONSTRUCTION DRAWING AND/OR AS DIRECTED BY THE COMPANY'S INSPECTOR TO PROTECT SOIL FROM EROSION. AREAS TARGETED FOR STRAW MULCH INCLUDE THE FOLLOWING:
 - 10-40% SLOPES WITH LESS THAN 40% SURFACE COVER.
 - 0-10% SLOPES WITH SOILS RATED BY APPLICABLE COUNTY AS HIGH IN WIND ERODIBILITY AND LESS THAN 40% SURFACE COVER AND IF DIRECTED BY COMPANY'S INSPECTOR.
2. WHEAT, OAT, BARLEY, RYE OR FLAX STRAW WILL BE USED, WHERE APPROPRIATE, DEPENDING UPON AVAILABILITY.
3. ONLY CERTIFIED "NOXIOUS WEED-FREE" STRAW MULCH SHALL BE APPLIED AT A RATE OF:
 - 1,780 TO 2,225 LB/AC WHEAT, OAT, BARLEY OR RYE STRAW
 - 2,670 TO 3,560 LB/AC FLAX STRAW
4. AREAS WHERE RESPREAD TOPSOIL EXHIBITS AN ADEQUATE COVER FROM RESPREAD OF PLANT DEBRIS AND COARSE FRAGMENTS, MULCH RATES MAY BE REDUCED OR ELIMINATED BY THE COMPANY'S INSPECTOR.

STRAW CRIMPING

1. STRAW CRIMPING WILL BE UTILIZED ON NONCULTIVATED, WIND EROSION PRONE SOILS, AND ON CULTIVATED, WATER EROSION PRONE SOILS AS IDENTIFIED ON THE ALIGNMENT SHEETS, UNLESS OTHERWISE DIRECTED BY THE COMPANY'S INSPECTOR. STRAW CRIMPING AT ADDITIONAL LOCATIONS IDENTIFIED BY THE COMPANY'S INSPECTOR MAY BE REQUIRED.
 2. EQUIPMENT SPECIFICALLY DESIGNED TO CRIMP STRAW (SUCH AS A STRAW MULCH CRIMPER MANUFACTURED BY FINN CORPORATION OR AN APPROVED EQUIVALENT) SHALL BE USED TO CRIMP STRAW FIBERS TO A DEPTH OF TWO TO THREE INCHES. STEEP SLOPES INACCESSIBLE WITH A CRIMPER SHALL BE CRIMPED BY TRACKING WITH A CRAWLER RUNNING PERPENDICULAR TO THE SLOPE. DISCS SHALL NOT BE ALLOWED FOR CRIMPING EXCEPT AS STATED IN NOTE 3.
- WHERE EXCESSIVE STONINESS IS ENCOUNTERED TO THE EXTENT THAT THE SPECIALIZED CRIMPING EQUIPMENT IS NOT
3. USEABLE, ATTEMPT TO ANCHOR THE STRAW BY INCORPORATION WITH AN AGRICULTURAL DISC OR CULTIVATOR. WHERE FROZEN GROUND CONDITIONS ARE ENCOUNTERED TO THE EXTENT THAT THE CRIMPING OPERATION IS NOT FEASIBLE, SPREAD STRAW AT DOUBLE THE NORMAL RATE.
- CRIMP OR ANCHOR STRAW INTO THE SOIL TO AN APPROXIMATE DEPTH OF 2". STRAW SHOULD STAND
4. VERTICALLY 2" TO 8" OUT OF THE GROUND IN ROWS SPACED APPROXIMATELY 6" APART.
- IN HIGHLY ERODIBLE SANDY LOCATIONS, WHERE DIRECTED BY THE COMPANY'S INSPECTOR, DOUBLE THE STRAW
5. APPLICATION RATE AND MAKE TWO PASSES TO ANCHOR THE STRAW, ONE PASS PERPENDICULAR TO THE OTHER OR CRISS-CROSSED.
- STRAW FOR CRIMPING WILL BE APPROVED BY COMPANY AND THE LANDOWNERS AND OCCUPANTS OR APPROPRIATE
6. REGULATORY AUTHORITIES WHERE APPLICABLE. CRITERIA FOR THE SELECTION OF STRAW IS AS FOLLOWS:
 - FOR EACH LOT OF BALES, TO THE EXTENT FEASIBLE, THE FIELD WHERE THE BALES WERE OBTAINED WILL BE INSPECTED BEFORE IT IS HARVESTED, OR THE STUBBLE WILL BE INSPECTED IMMEDIATELY AFTER HARVEST AND A SAMPLE OF GRAIN WILL BE INSPECTED FOR WEED SEEDS.
 - THE STRAW MUST HAVE BEEN HARVESTED WITH A CONVENTIONAL COMBINE, NOT A ROTARY COMBINE.
 - THE STRAW MUST HAVE A MINIMUM FIBRE LENGTH OF 8", 12" IS PREFERRED.
 - THE STRAW MUST BE FREE OF NOXIOUS OR RESTRICTED WEEDS AND UNDESIRABLE SPECIES WHICH WOULD HAMPER RECLAMATION EFFORTS.
 - TO THE EXTENT FEASIBLE, BALES OBTAINED FROM LOW LYING WEEDY AREAS WILL BE IDENTIFIED AND AVOIDED.

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DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

EROSION CONTROL
STRAW MULCH
(STM)

DRAWING NO.

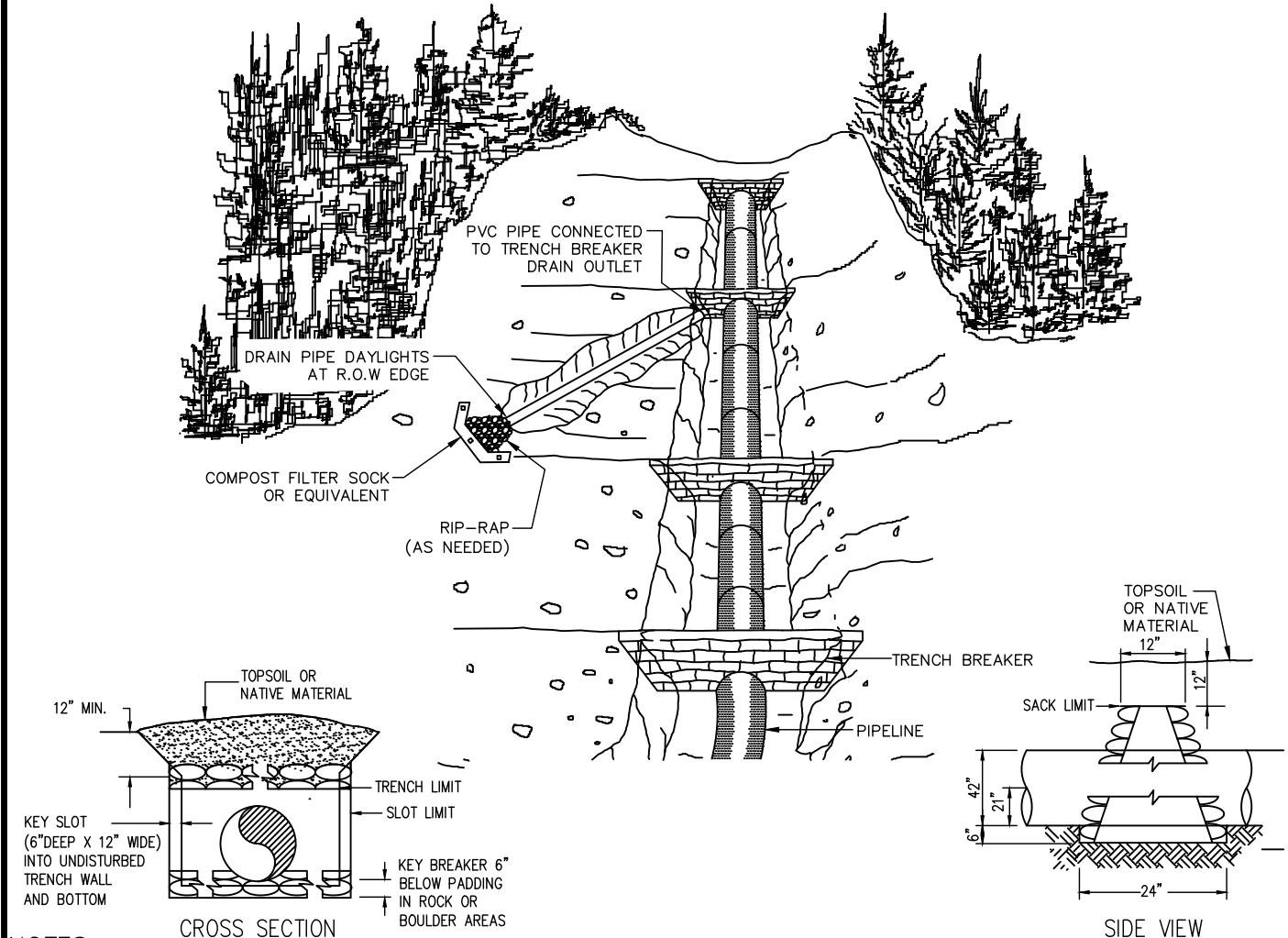
MVP-19

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SLOPE %	DISTANCE	PLUG MATERIAL
0% - 5%	SEE NOTE 6	CONCRETE FILLED SACKS
5% - 15%	500 FT	SANDBAGS OR CONCRETE FILLED SACKS
15% - 25%	300 FT	SANDBAGS OR CONCRETE FILLED SACKS
25% - 35%	200 FT	SANDBAGS OR CONCRETE FILLED SACKS
35% - 100%	100 FT	SANDBAGS OR CONCRETE FILLED SACKS
> 100%	50 FT	CONCRETE FILLED BAGS (WETTED)

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NOTES:

- TRENCH BREAKERS SHALL BE INSTALLED:
 - ON SLOPES ALONG THE TRENCH LINE WHERE THE NATURAL DRAINAGE PATTERN, PROFILE, AND TYPE OF BACKFILL MATERIAL MAY RESULT IN LOSS OF BACKFILL MATERIAL OR ALTERATION OF THE NATURAL PATTERN;
 - AT THE BASE OF SLOPES ADJACENT TO WATERBODIES AND WETLANDS;
 - WHERE NEEDED TO AVOID DRAINING A WETLAND;
 - ON UPLAND SLOPES, AT THE SAME SPACING AS SLOPE BREAKERS AND UP SLOPE OF SLOPE BREAKERS;
 - IN CULTIVATED LAND AND RESIDENTIAL AREAS WHERE PERMANENT SLOPE BREAKERS ARE NOT TYPICALLY INSTALLED, AT THE SAME SPACING AS IF PERMANENT SLOPE BREAKERS WERE REQUIRED.
- MATERIALS APPROPRIATE FOR USE AS PERMANENT TRENCH BREAKERS INCLUDE SANDBAGS OR CONCRETE FILLED SACKS. TOPSOIL SHALL NOT BE USED FOR TRENCH BREAKERS.
- TRENCH BREAKERS INSTALLED AT WATERBODY AND WETLAND CROSSINGS SHALL BE CONSTRUCTED OF IMPERVIOUS MATERIALS (CONCRETE FILLED SACKS).
- BREAKER SPACING AND CONFIGURATION MAY BE CHANGED AS DIRECTED BY MVP. DEPTH OF DITCH MAY VARY WITH SITE CONDITIONS.
- ALL MATERIALS SHALL BE SUPPLIED BY CONTRACTOR.
- TRENCH BREAKERS ARE REQUIRED AT ALL WATERBODY CROSSINGS REGARDLESS OF TRENCH SLOPE. OTHERWISE NOTE REQUIRED AT SLOPES < 5%.
- SINGLE TRENCH BREAKERS WILL BE A MINIMUM WIDTH OF 24" AND DOUBLE TRENCH BREAKERS WILL BE A MINIMUM WIDTH OF 36".
- FOR SUBSURFACE AND TRENCH BREAKER DRAINAGE DETAILS INCLUDING THOSE FOR STEEP SLOPES, SEE LANDSLIDE MITIGATION TYPICAL DETAILS.
- FOR SLOPES EXCEEDING 50%, CONCRETE FILLED SACKS ARE REQUIRED UNLESS OTHERWISE APPROVED BY MVP.

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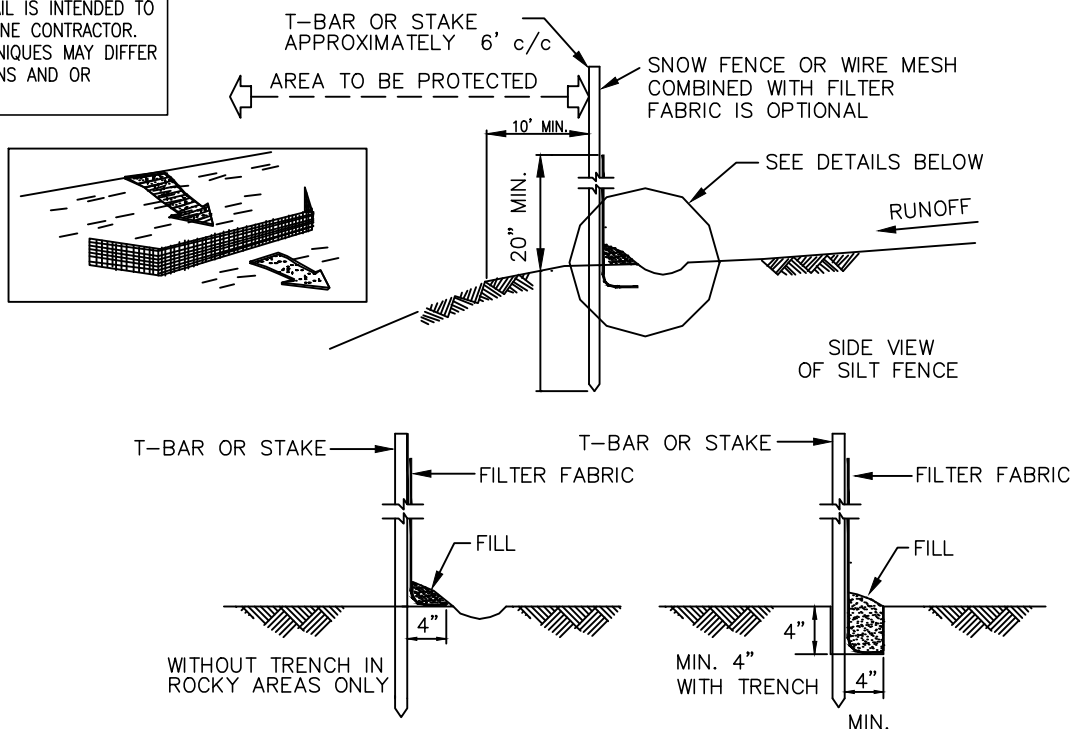
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

TYPICAL TRENCH BREAKER REQUIREMENTS

DRAWING NO.	REV.
MVP-20	0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



NOTE:

1. GENERALLY WHEN A LONG SEDIMENT BARRIER IS REQUIRED, SILT FENCE WILL BE UTILIZED RATHER THAN STRAW BALES AT:
 - THE BASE OF ALL SLOPES ABOVE ROADS, SPRINGS, WETLANDS, IMPOUNDMENTS AND PERENNIAL AND INTERMITTENT STREAMS.
 - THE DOWN SLOPE RIGHT-OF-WAY EDGE WHERE ANY OF THE ABOVE MENTIONED LOCATIONS ARE ADJACENT TO THE RIGHT-OF-WAY.
 - BETWEEN TOPSOIL/SPOIL STOCKPILES AND PERENNIAL OR INTERMITTENT STREAMS OR WETLANDS WHERE BUFFER ZONE REQUIREMENTS CANNOT BE MET.
 - ALONG R.O.W. BOUNDARIES OF WETLAND CONSTRUCTION.
 - AS SPECIFIED IN THE SPILL PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN.
 - AS DIRECTED BY THE COMPANY'S INSPECTOR.
2. THE SILT FENCE SHALL BE CONSTRUCTED AS FOLLOWS:
 - FABRIC USED FOR THE SILT FENCE SHALL BE A "STANDARD STRENGTH" GEOTEXTILE, SUCH AS MIRAFI 100X OR AN APPROVED EQUIVALENT.
 - THE FABRIC SHALL BE CUT FROM A CONTINUOUS FABRIC ROLL.
 - THE HEIGHT OF THE FENCE SHALL NOT EXCEED 24".
 - SPLICES SHALL ONLY BE DONE AT POSTS AND SHALL CONSIST OF A MINIMUM OF 6" OF OVERLAP WITH BOTH ENDS SECURED TO THE POST.
 - POSTS SHALL BE POSITIONED A MAXIMUM OF 6' APART.
 - POSTS SHALL CONSIST OF 2"x2" WOODEN STAKES OF SUFFICIENT LENGTH TO EXTEND A MINIMUM OF 12" INTO THE GROUND.
 - FABRIC SHALL BE STAPLED OR WIRED TO POSTS A MAXIMUM OF EVERY 9".
3. THE SILT FENCE SHALL BE INSTALLED AS SPECIFIED BY THE MANUFACTURER OR AS FOLLOWS:
 - A TRENCH, 4" WIDE AND 4" DEEP, SHALL BE EXCAVATED ALONG THE CONTOUR. THE POST SHALL BE DRIVEN INTO THE BOTTOM OF THE TRENCH ON THE DOWNSTREAM SIDE OF THE FILTER FABRIC. THE TRENCH SHALL BE BACK FILLED AND COMPACTED, ENSURING 4" OF FENCE IS BURIED WITHIN THE TRENCH.
 - IN AREAS WHERE THE TERRAIN IS TOO ROCKY FOR TRENCHING, A 4" GROUND FLAP WITH ROCK FILL TO HOLD IT IN PLACE SHALL BE USED.

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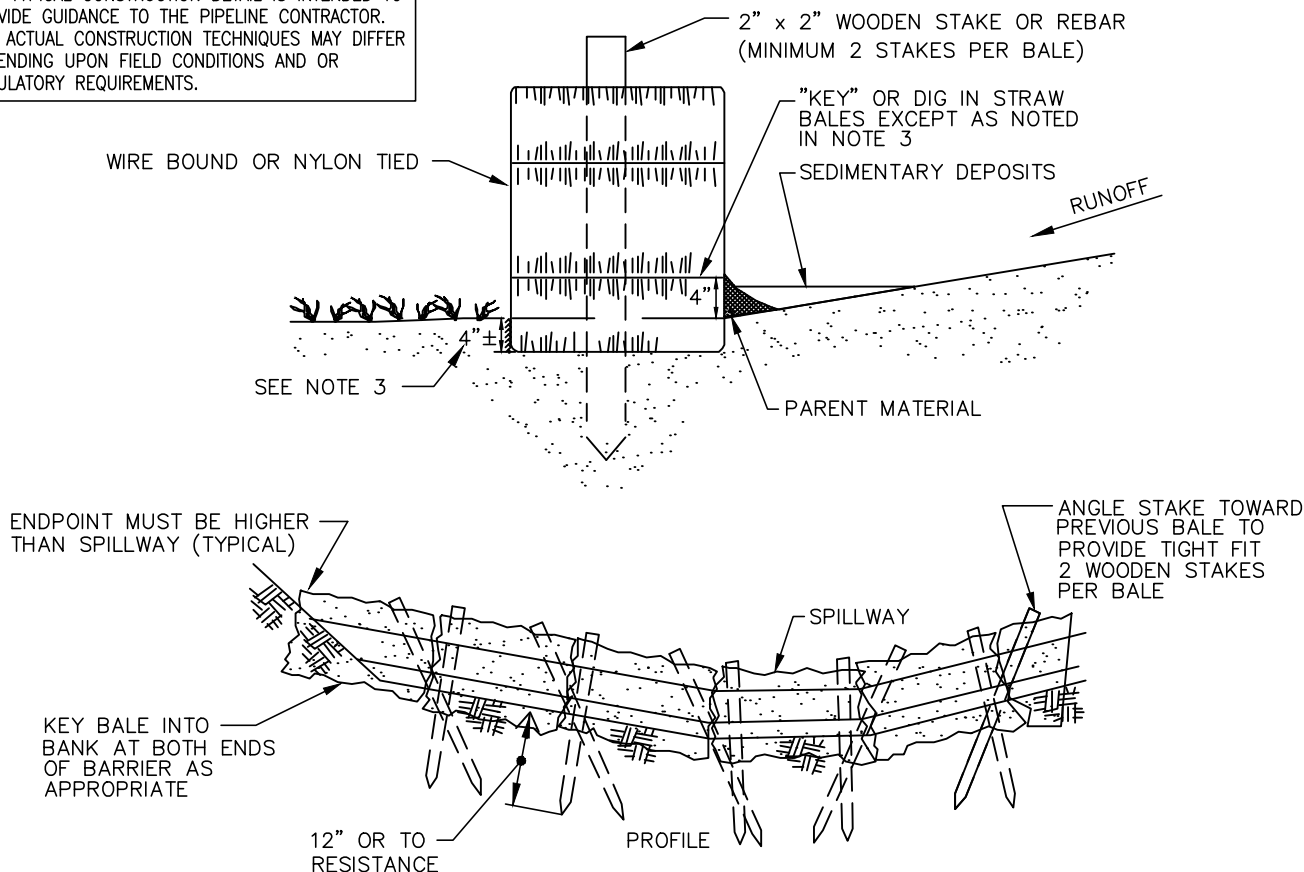
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

EROSION CONTROL
SILT FENCE SEDIMENT BARRIER
(SFB)

DRAWING NO.	REV.
MVP-21	0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



NOTES:

- STRAW BALE SEDIMENT BARRIERS SHALL BE INSTALLED AT THE FOLLOWING LOCATIONS:
 - THE BASE OF ALL SLOPES ABOVE ROADS, SPRINGS, WETLANDS, IMPOUNDMENTS AND FLOWING STREAMS.
 - THE DOWNSLOPE RIGHT-OF-WAY EDGE WHERE ANY OF THE ABOVE-MENTIONED LOCATIONS ARE ADJACENT TO THE RIGHT-OF-WAY.
 - BETWEEN TOPSOIL/SPOIL STOCKPILES AND STREAMS OR WETLANDS AS NEEDED.
 - ALONG R.O.W. BOUNDARIES IN WETLAND CONSTRUCTION.
 - AS SPECIFIED IN THE SPILL PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN.
 - AS DIRECTED BY THE COMPANY'S INSPECTOR.
- STRAW BALE SEDIMENT BARRIERS SHALL CONSIST OF A ROW OF STRAW BALES, PLACED ON THE FIBER-CUT EDGE (TIES NOT IN CONTACT WITH THE GROUND). BALES SHALL BE TIGHTLY ABUTTED TO ONE ANOTHER. THE BARRIER SHALL BE ONE BALE HIGH. ONLY CERTIFIED "NOXIOUS WEED-FREE" STRAW SHALL BE USED WHENEVER POSSIBLE.
- ENTRENCH ("KEY") STRAW BALES INTO THE GROUND TO A DEPTH OF 4" EXCEPT IN FROZEN, SATURATED, OR EXTREMELY ROCKY SOILS. PLACE PARENT MATERIAL ON UPSTREAM SIDE OF STRAW BALES TO PREVENT UNDERMINING.
- WALK ON STRAW BALES TO INSURE ADEQUATE BALE-TO-SOIL CONTACT.
- ANCHOR STRAW BALES SECURELY IN PLACE WITH TWO WOODEN OR STEEL REBAR STAKES DRIVEN THROUGH THE TOPS OF THE BALES. THE STAKES SHALL PENETRATE THE GROUND A DISTANCE OF 12" UNLESS ROCK OR AN IMPERMEABLE LAYER IS ENCOUNTERED:
 - THE FIRST, CENTER AND END BALES OF THE BARRIER SHALL HAVE STAKES DRIVEN VERTICALLY THROUGH THE BALE.
 - BALES, OTHER THAN THOSE LOCATED AT THE ENDS OR CENTER OF THE BARRIER, SHALL HAVE THE FIRST STAKE DRIVEN THROUGH THE TOP OF THE BALE AT AN ANGLE SO THAT THE STAKE PASSES THROUGH THE PREVIOUSLY PLACED BALE, IN ORDER TO PROVIDE TIGHT CONTACT BETWEEN BALES. THE SECOND STAKE SHALL BE DRIVEN VERTICALLY THROUGH THE TOP OF THE BALE.

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DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

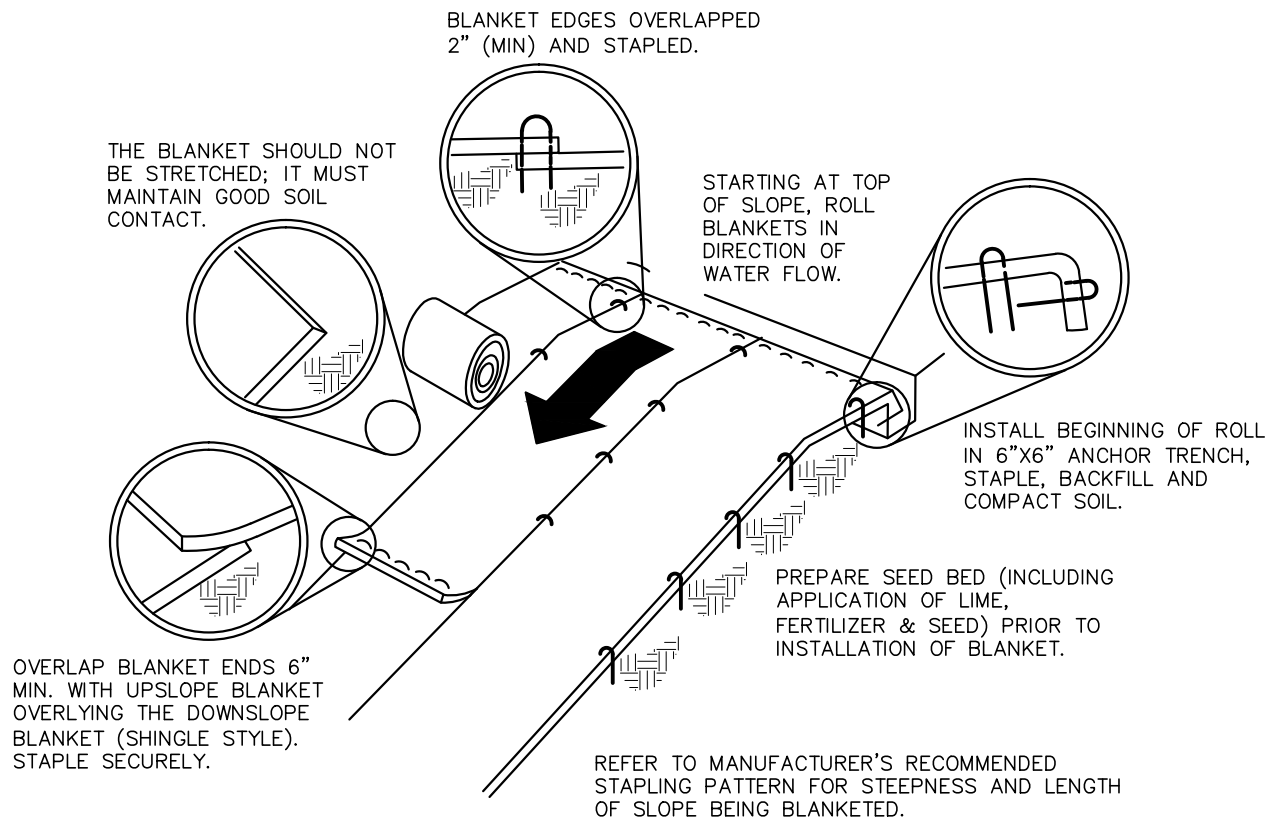
EROSION CONTROL
STRAW BALE SEDIMENT BARRIER
(SBB)

DRAWING NO.

MVP-22

REV.

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SEED AND SOIL AMENDMENTS SHALL BE APPLIED ACCORDING TO RATES IN THE PLAN DRAWINGS PRIOR TO INSTALLING THE BLANKET.

PROVIDE ANCHOR TRENCH AT TOE OF SLOPE IN SIMILAR FASHION AT THE TOP OF SLOPE.

SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS.

BLANKET SHALL HAVE GOOD CONTINUOUS CONTACT AND UNDERLYING SOIL THROUGHOUT ENTIRE LENGTH. LAY BLANKET LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH SOIL. DO NOT STRETCH BLANKET.

BLANKET SHALL BE STAPLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

BLANKET AREAS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT UNTIL PERENNIAL VEGETATION IS ESTABLISHED TO A MINIMUM UNIFORM 70% COVERAGE THROUGHOUT THE BLANKETED AREA. DAMAGED OR DISPLACED BLANKETS SHALL BE RESTORED OR REPLACED WITHIN 4 CALENDAR DAYS.

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TYPICAL CONSTRUCTION DETAIL

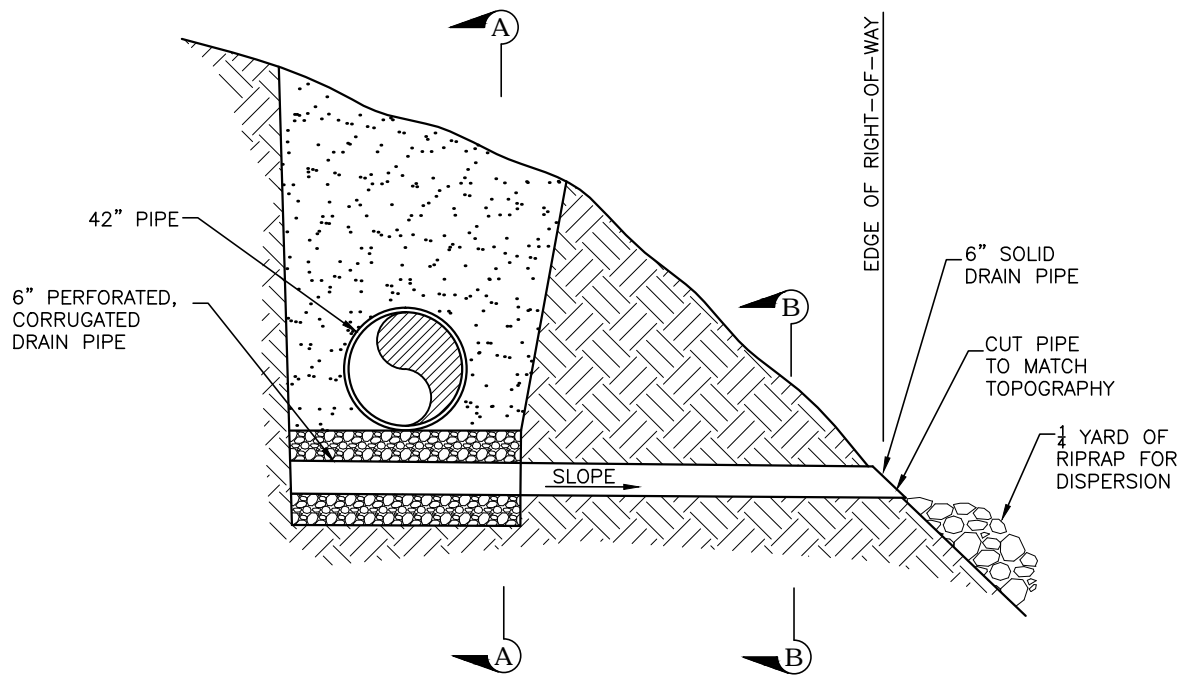
SLOPE INSTALLATION

DRAWING NO.

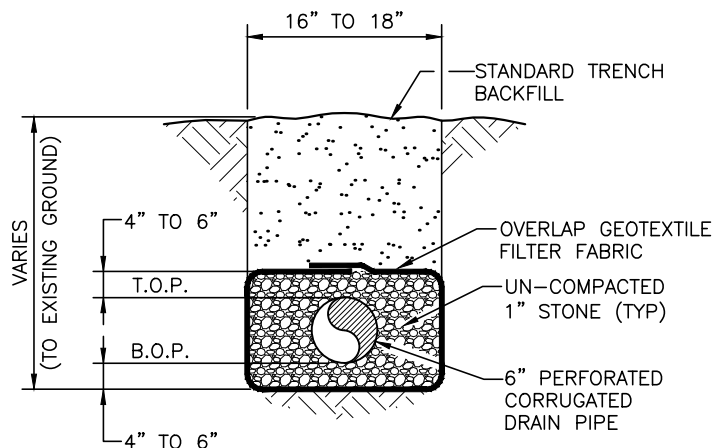
MVP-23

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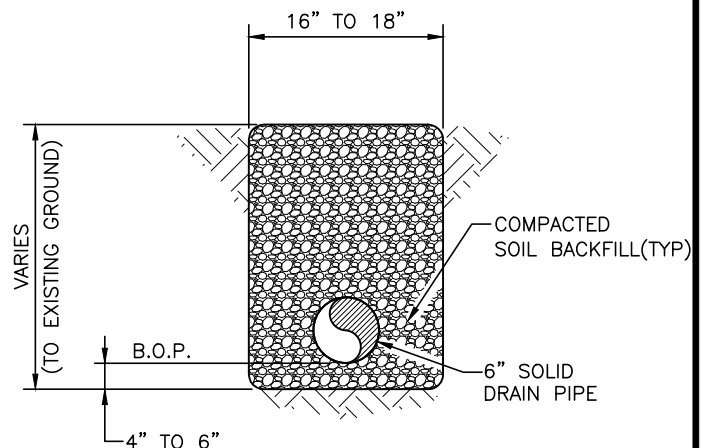
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MAINLINE CROSS SECTION



SECTION A-A



SECTION B-B

NOTES

1. LOW POINT DITCH DRAINS SHALL BE INSTALLED AT LOCATIONS SPECIFIED IN THE APPROVED EROSION & SEDIMENTATION CONTROL PLAN, AND AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
2. FILL STONE SHOULD BE 1" AGGREGATE WITHOUT FINES, CRUSHER RUN WITHOUT FINES, OR EQUIVALENT.
3. DRAIN PIPE TO BE CONNECTED USING STANDARD PIPE COLLARS.

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TYPICAL CONSTRUCTION DETAIL

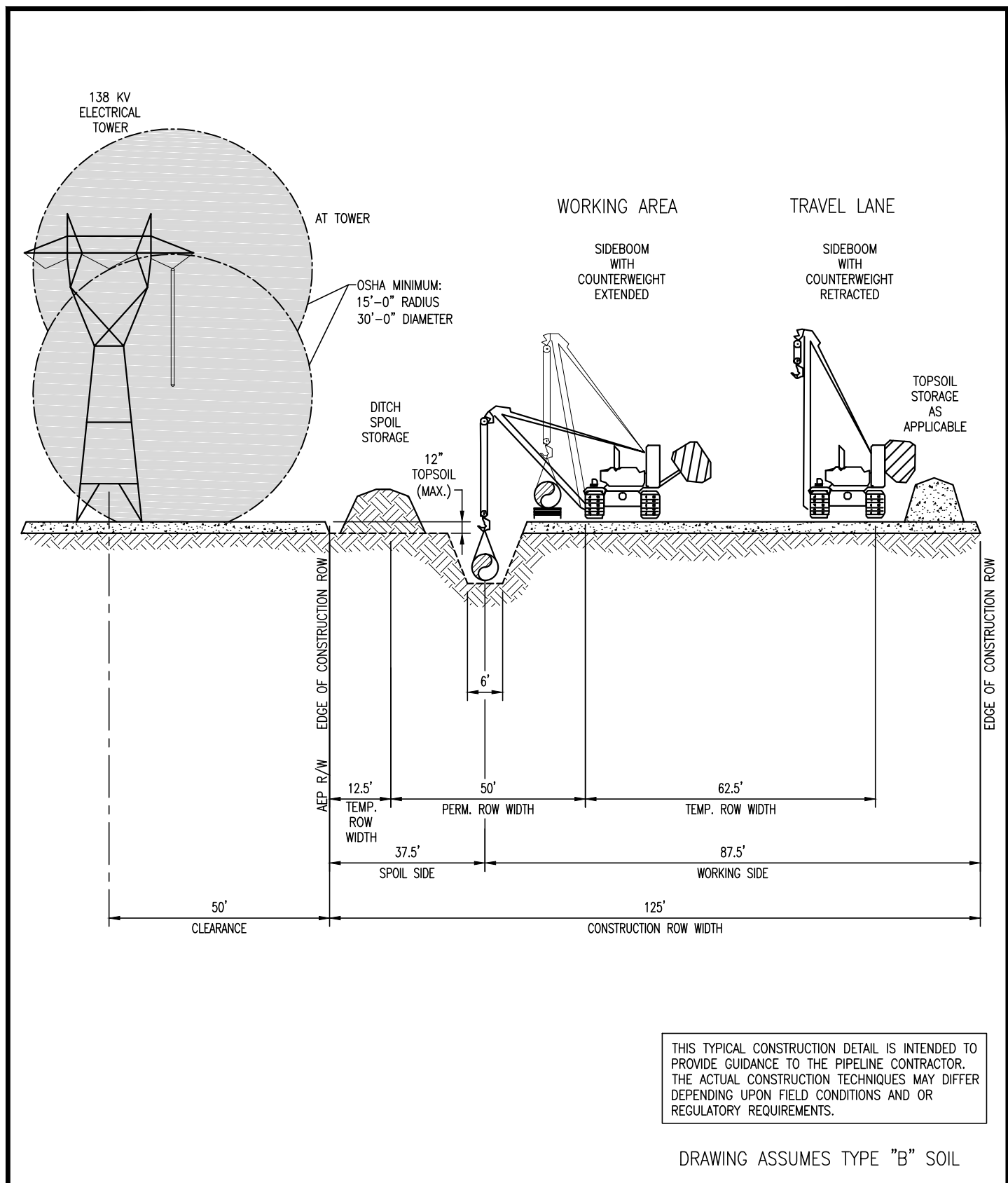
SIDEHILL LOW-POINT DRAIN
TYPICAL

DRAWING NO.

MVP-24

REV.

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TYPICAL CONSTRUCTION DETAIL

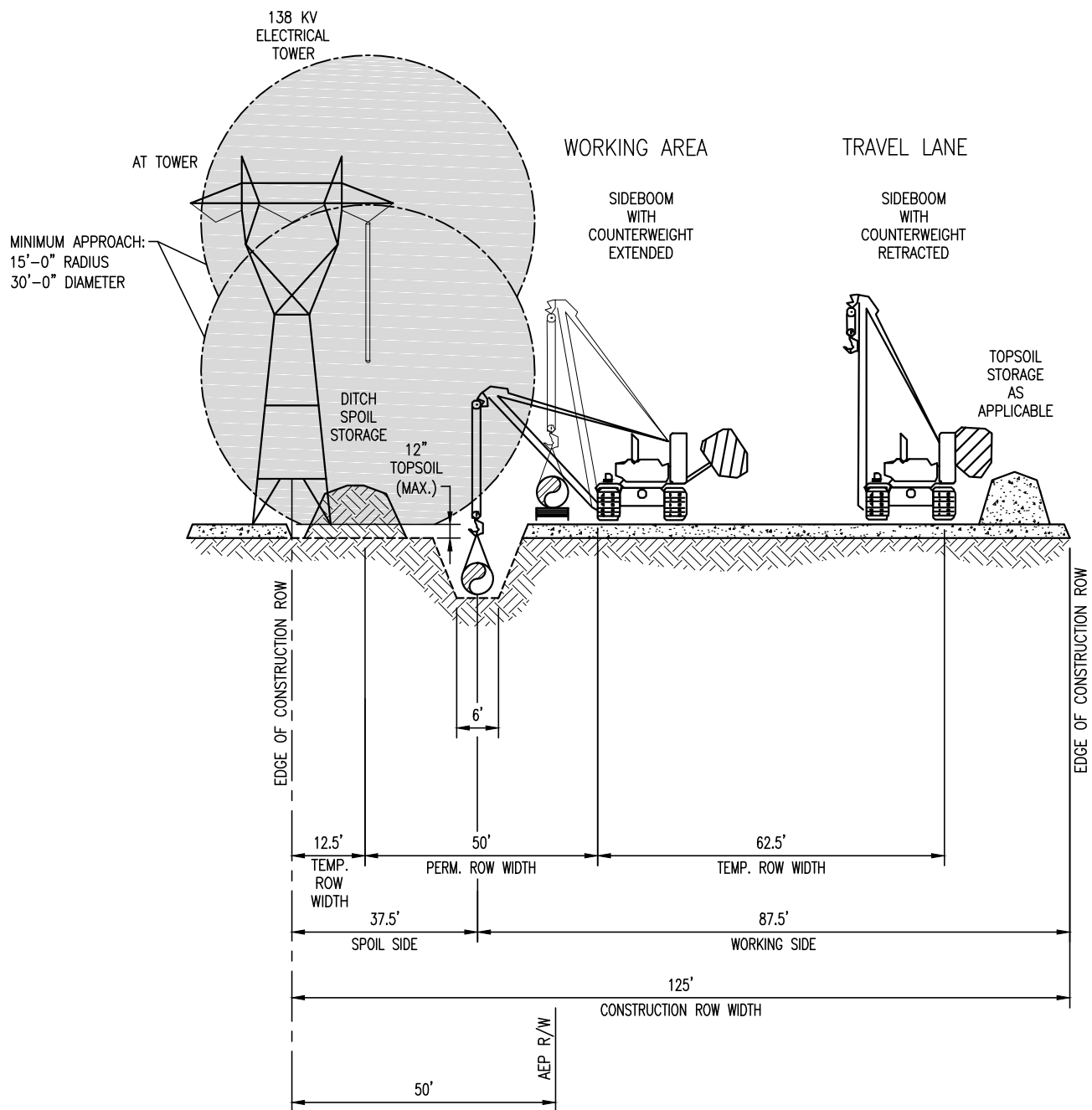
MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES
RIGHT-OF-WAY

DRAWING NO.

MVP-25

REV.

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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

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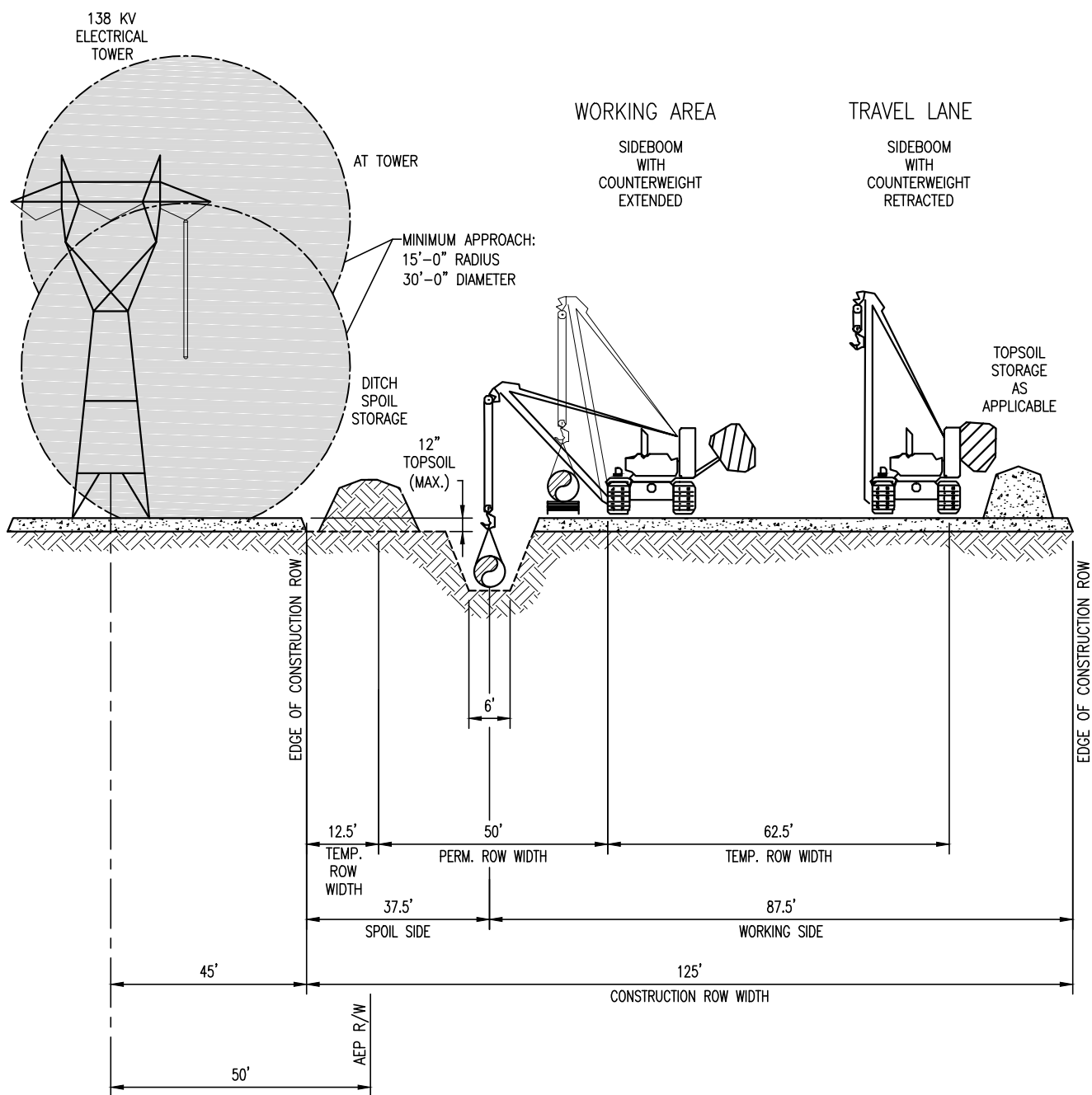


DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES
RIGHT-OF-WAY

DRAWING NO.	REV.
MVP-26	0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

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TYPICAL CONSTRUCTION DETAIL

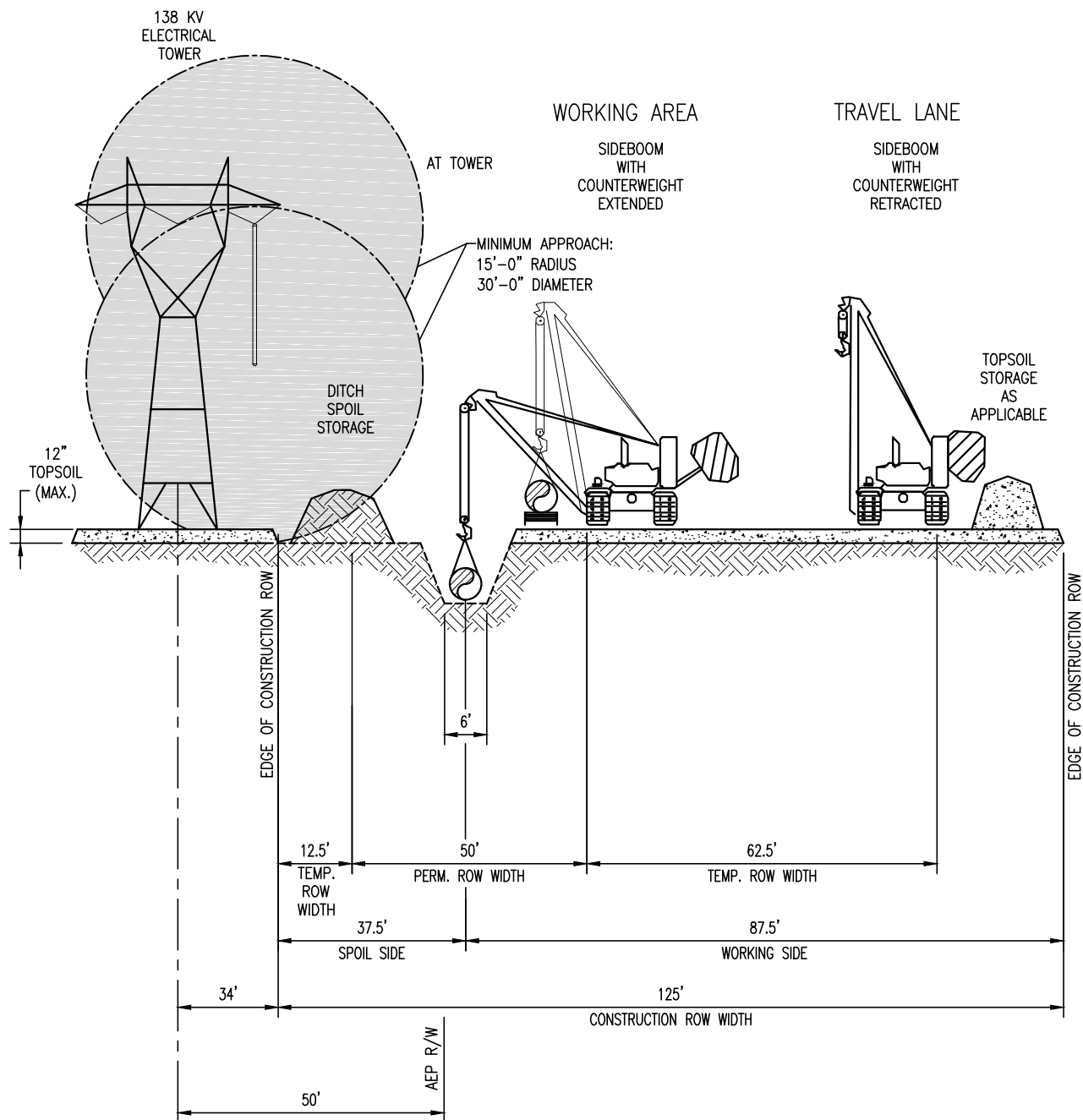
MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES
RIGHT-OF-WAY

DRAWING NO.

MVP-27

REV.

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DRAWING ASSUMES TYPE "B" SOIL

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DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

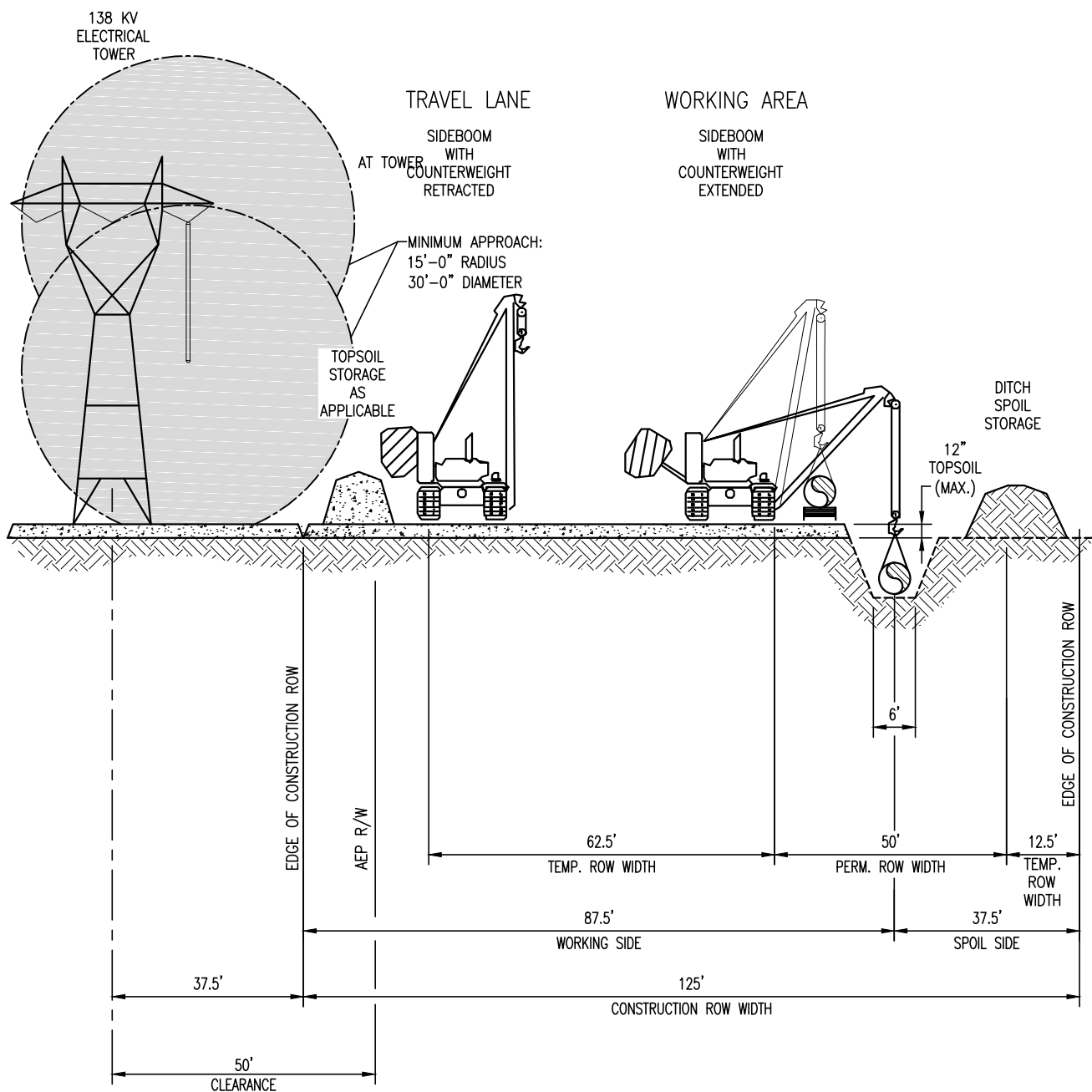
MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES
RIGHT-OF-WAY

DRAWING NO.

MVP-28

REV.

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DRAWING ASSUMES TYPE "B" SOIL

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DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

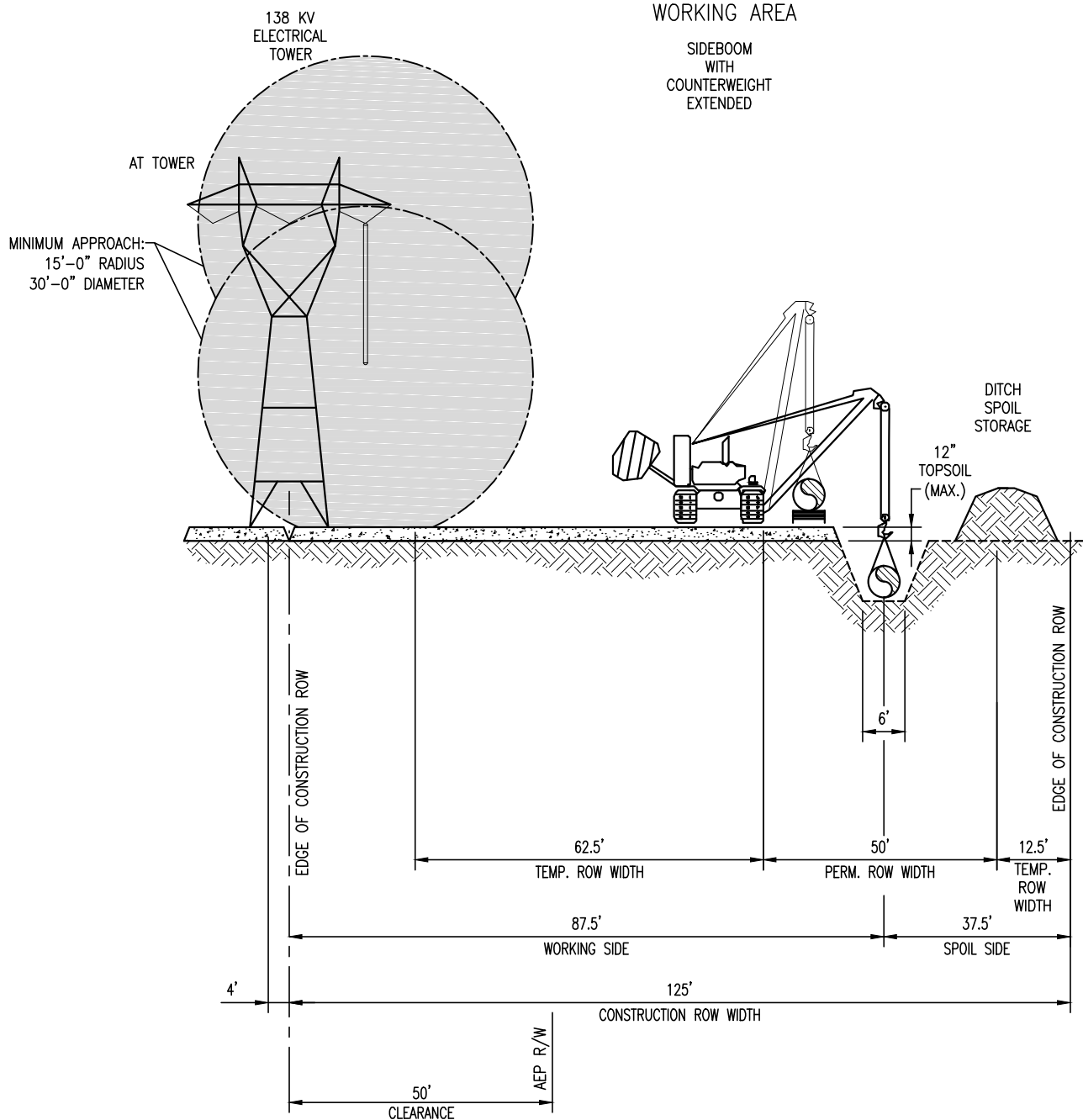
MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES
RIGHT-OF-WAY

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REV.

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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

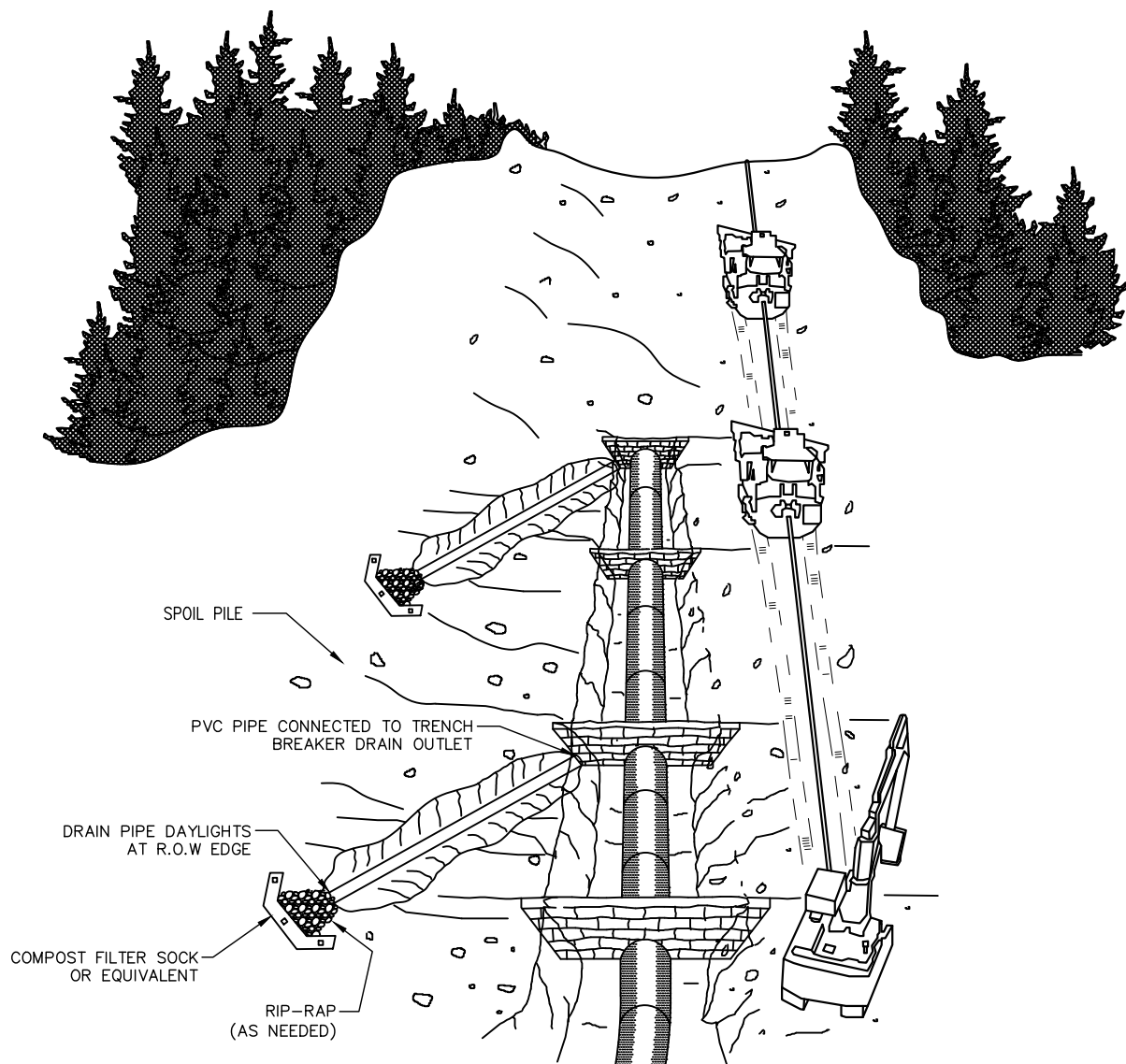


DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
PARALLEL TO POWER LINES
RIGHT-OF-WAY

DRAWING NO.	REV.
MVP-30	0



NOTES:

1. WINCHES MAY BE REQUIRED FOR MOVING EQUIPMENT AND MATERIAL, AND DURING CONSTRUCTION ON STEEP LONGITUDINAL SLOPES.
2. WINCHES WILL EITHER BE FIXED WINCHES OR TRACKED EQUIPMENT WITH WINCHES.
3. WINCHES WILL TYPICALLY BE REQUIRED FOR SLOPES OF 30% (17") AND UP.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	03/28/16
CHECKED	RRR	DATE	04/06/16
APP'D	RLM	DATE	04/06/16
SCALE	N.T.S.	SHEET	1 OF 1

JOB NO.
PROJECT ID:
PXXXX

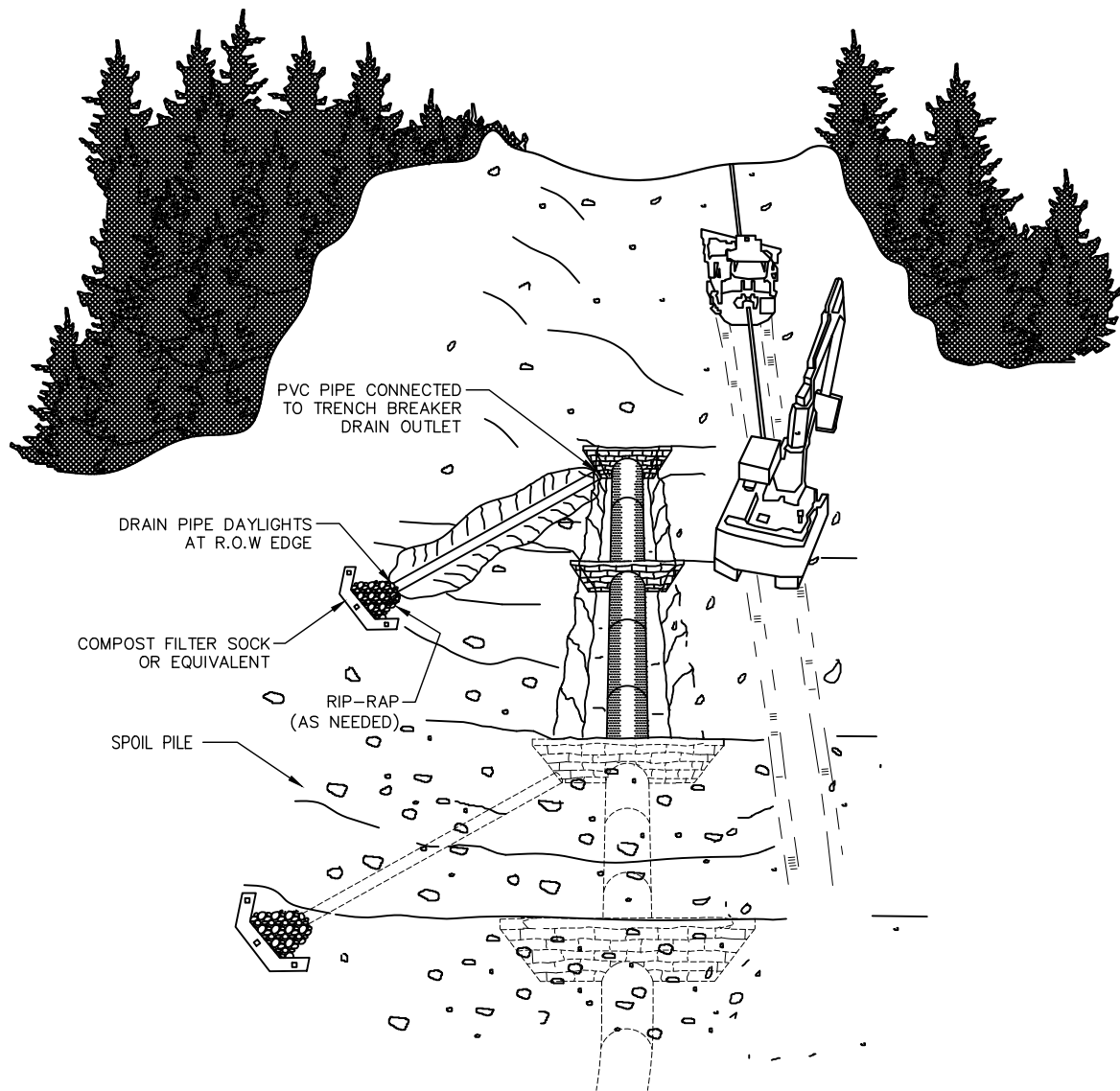


DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
STEEP HILL PARALLEL CONSTRUCTION
NO TOP SOIL SEGREGATION

DRAWING NO.	REV.
MVP-31	0



NOTES:

1. WINCHES MAY BE REQUIRED FOR MOVING EQUIPMENT AND MATERIAL, AND DURING CONSTRUCTION ON STEEP LONGITUDINAL SLOPES.
2. WINCHES WILL EITHER BE FIXED WINCHES OR TRACKED EQUIPMENT WITH WINCHES.
3. WINCHES WILL TYPICALLY BE REQUIRED FOR SLOPES OF 30% (17") AND UP.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JIL	DATE	06/23/16
CHECKED	RRR	DATE	06/23/16
APP'D	RLM	DATE	06/23/16
SCALE	N.T.S.	SHEET	1 OF 1

JOB NO.
PROJECT ID:
PXXXX

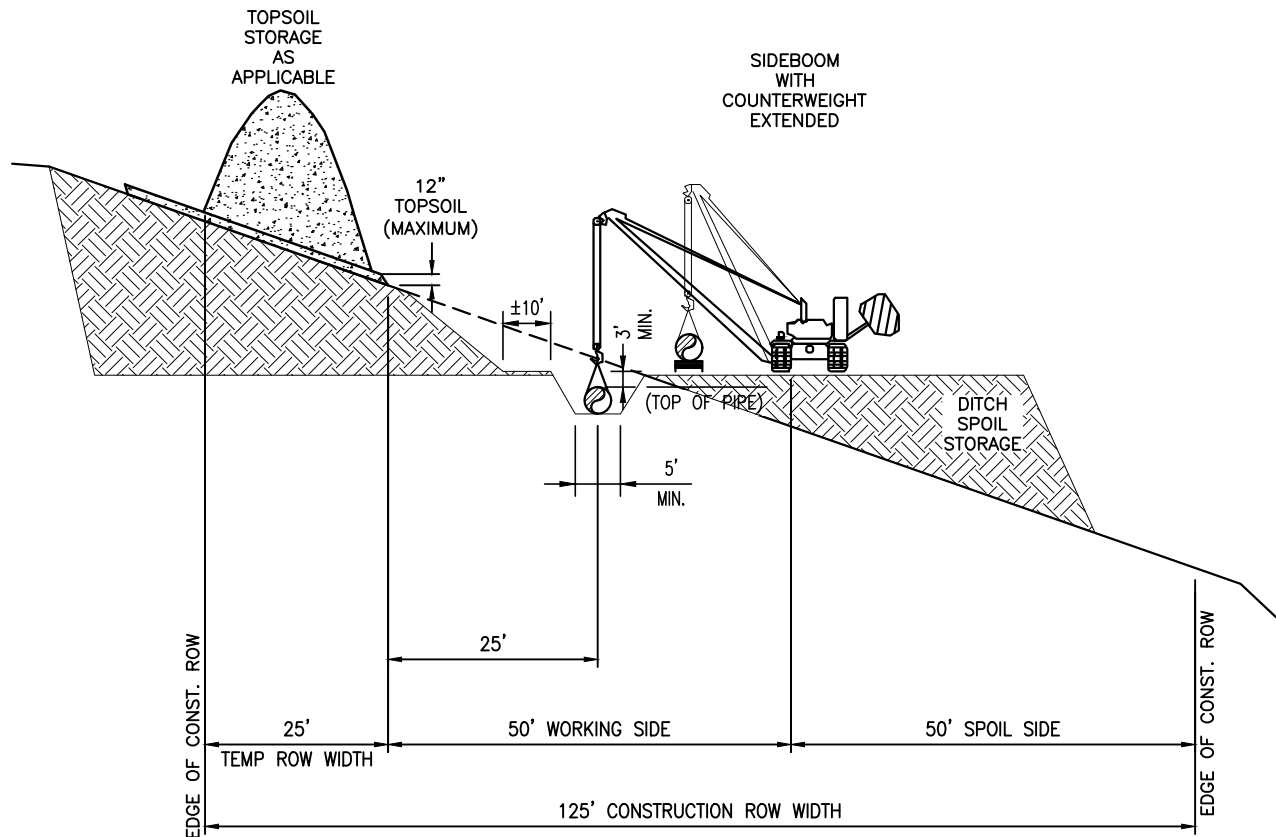


DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
STEEP HILL STOVE PIPE CONSTRUCTION
JEFFERSON NATIONAL FOREST
NO TOP SOIL SEGREGATION

DRAWING NO.	REV.
MVP-32	0



NOTES:

1. SEEPS OR SPRINGS ENCOUNTERED IN THE EXCAVATION SHALL BE INTERCEPTED BY TRANSVERSE TRENCH DRAINS, CUTOFF DRAINS, OR SIMILAR, AND DIRECTED OUT OF THE PIPELINE DITCH TO AN ENERGY DISSIPATING STRUCTURE (SUCH AS A RIPRAP APRON).
2. BACKFILL MATERIAL SHALL EXCLUDE ORGANIC MATERIAL, VEGETATION, STUMPS, ROOT SYSTEMS, FROZEN MATERIAL, AND ROCKS LARGER THAN THREE INCHES IN DIAMETER.
3. BACKFILL OPERATIONS SHALL BE PERFORMED WHEN SOIL MOISTURE CONTENT IS SUITABLE FOR COMPACTION, AT OR NEAR OPTIMUM MOISTURE CONTENT (I.E., NOT IMMEDIATELY FOLLOWING A LARGE PRECIPITATION EVENT OR WHEN SOIL IS EXCESSIVELY DRY).
4. BACKFILL MATERIAL SHALL BE PLACED IN COMPACTED LIFTS NO GREATER THAN 12 INCHES THICK.
5. BACKFILL COMPACTION SHALL BE ACCOMPLISHED USING THE BACK OF AN EXCAVATOR BUCKET, SHEEP'S FOOT ROLLER, OR SIMILAR.
6. WHERE A TEMPORARY CUT AND FILL SURFACE IS REQUIRED, ANY GROUND FRACTURES FORMING NEAR THE CUT/FILL LINE OR THE PIPELINE DITCH SHALL BE REPAIRED TO PREVENT WATER INFILTRATION.
7. ALL STREAMS, GULLIES, NATURAL DRAINS, FIELD ROADS OR TRAILS, AND OTHER WATER CONVEYING FEATURES SHALL BE PROPERLY RECONTOURED SUCH THAT THE PERMANENT RIGHT-OF-WAY IS PROTECTED FROM PREFERENTIAL WATER ACCUMULATION AND INFILTRATION.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	EPG	DATE	10/06/16
CHECKED	MMF	DATE	10/06/16
APP'D	RLM	DATE	10/06/16
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

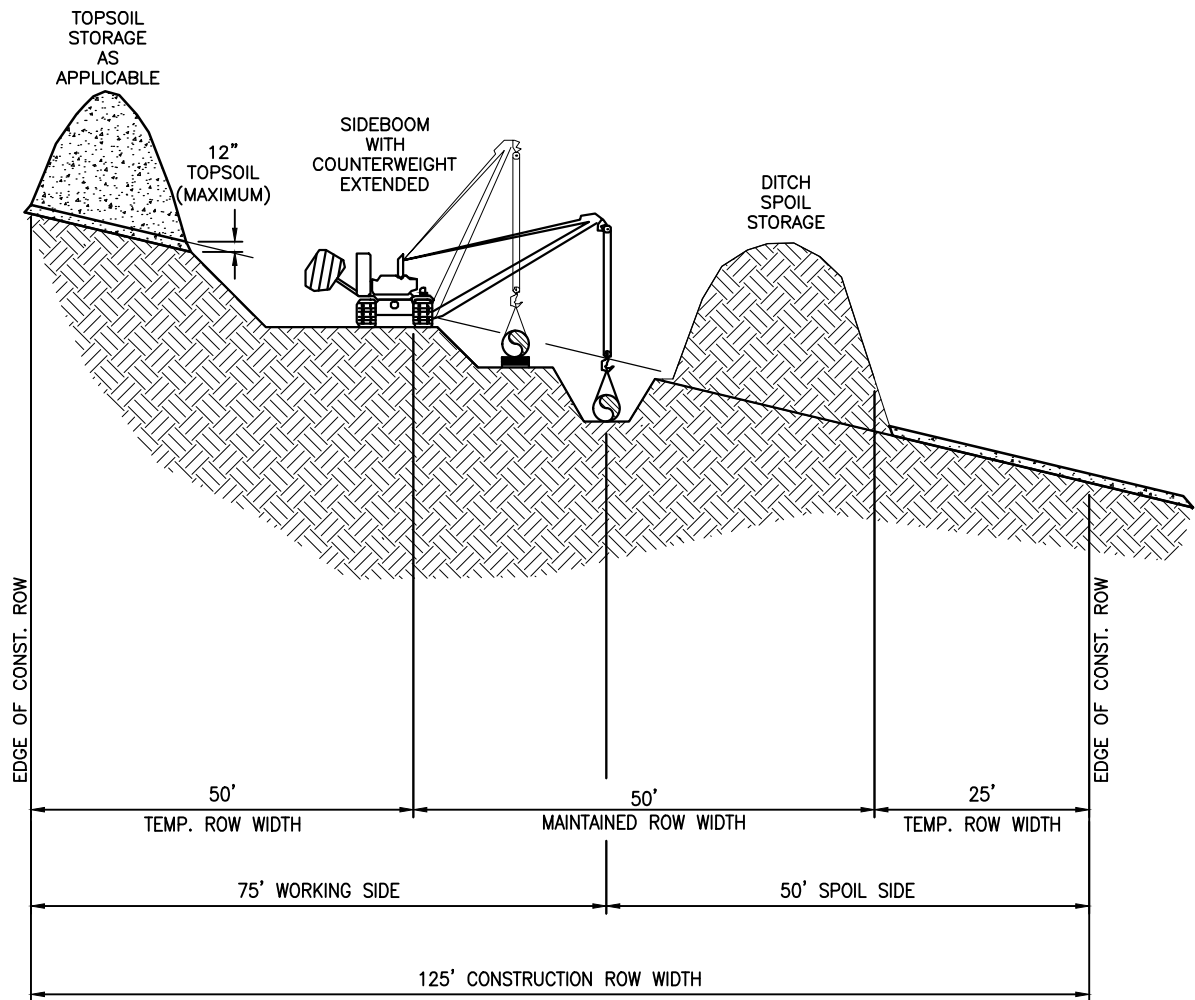
MAINLINE CONSTRUCTION
SIDE HILL CONSTRUCTION
RIGHT OF WAY

DRAWING NO.

MVP-33

REV.

0



NOTES:

1. SEEPS OR SPRINGS ENCOUNTERED IN THE EXCAVATION SHALL BE INTERCEPTED BY TRANSVERSE TRENCH DRAINS, CUTOFF DRAINS, OR SIMILAR, AND DIRECTED OUT OF THE PIPELINE DITCH TO AN ENERGY DISSIPATING STRUCTURE (SUCH AS A RIPRAP APRON).
2. BACKFILL MATERIAL SHALL EXCLUDE ORGANIC MATERIAL, VEGETATION, STUMPS, ROOT SYSTEMS, FROZEN MATERIAL, AND ROCKS LARGER THAN THREE INCHES IN DIAMETER.
3. BACKFILL OPERATIONS SHALL BE PERFORMED WHEN SOIL MOISTURE CONTENT IS SUITABLE FOR COMPACTION, AT OR NEAR OPTIMUM MOISTURE CONTENT (I.E., NOT IMMEDIATELY FOLLOWING A LARGE PRECIPITATION EVENT OR WHEN SOIL IS EXCESSIVELY DRY).
4. BACKFILL MATERIAL SHALL BE PLACED IN COMPACTED LIFTS NO GREATER THAN 12 INCHES THICK.
5. BACKFILL COMPACTION SHALL BE ACCOMPLISHED USING THE BACK OF AN EXCAVATOR BUCKET, SHEEP'S FOOT ROLLER, OR SIMILAR.
6. WHERE A TEMPORARY CUT AND FILL SURFACE IS REQUIRED, ANY GROUND FRACTURES FORMING NEAR THE CUT/FILL LINE OR THE PIPELINE DITCH SHALL BE REPAIRED TO PREVENT WATER INFILTRATION.
7. ALL STREAMS, GULLIES, NATURAL DRAINS, FIELD ROADS OR TRAILS, AND OTHER WATER CONVEYING FEATURES SHALL BE PROPERLY RECONTOURED SUCH THAT THE PERMANENT RIGHT-OF-WAY IS PROTECTED FROM PREFERENTIAL WATER ACCUMULATION AND INFILTRATION.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	EPG	DATE	10/06/16
CHECKED	MMF	DATE	10/06/16
APP'D	RLM	DATE	10/06/16
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

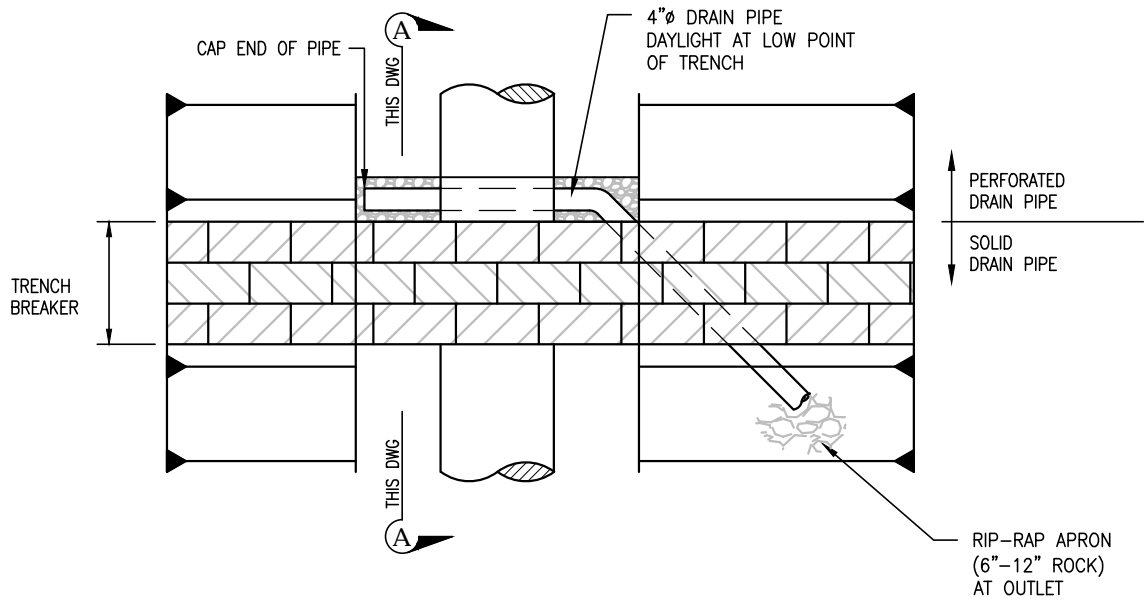
MAINLINE CONSTRUCTION
TWO TONE METHOD
RIGHT OF WAY

DRAWING NO.

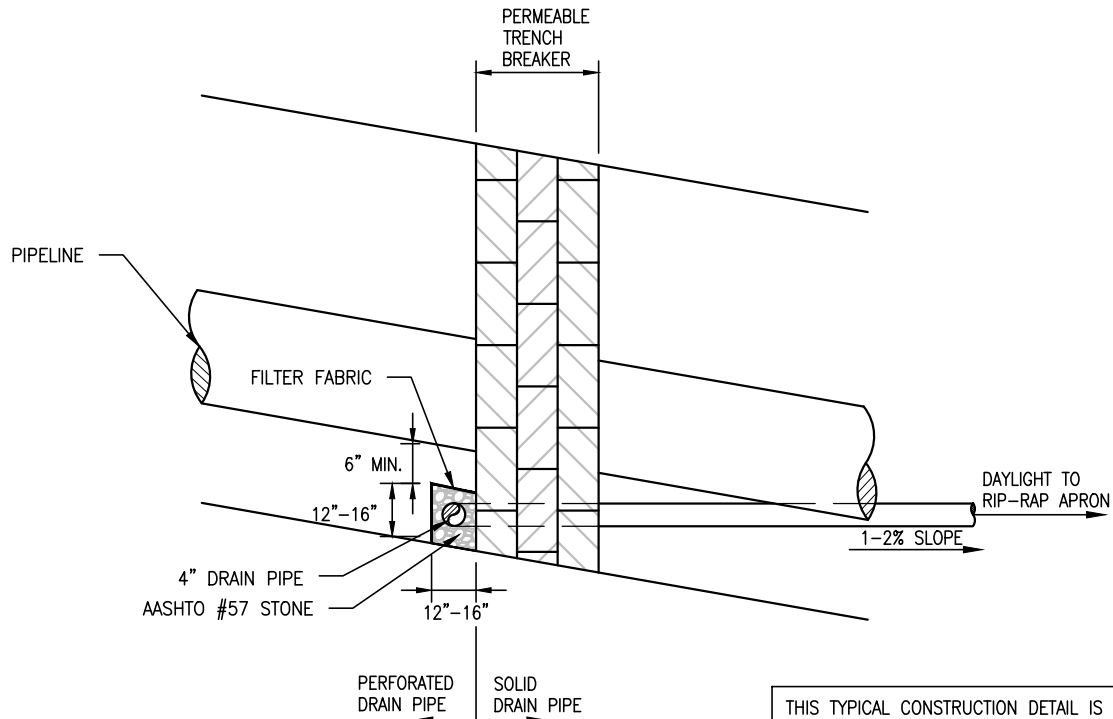
MVP-34

REV.

0



PLAN
SCALE: NOT TO SCALE



SECTION A-A
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

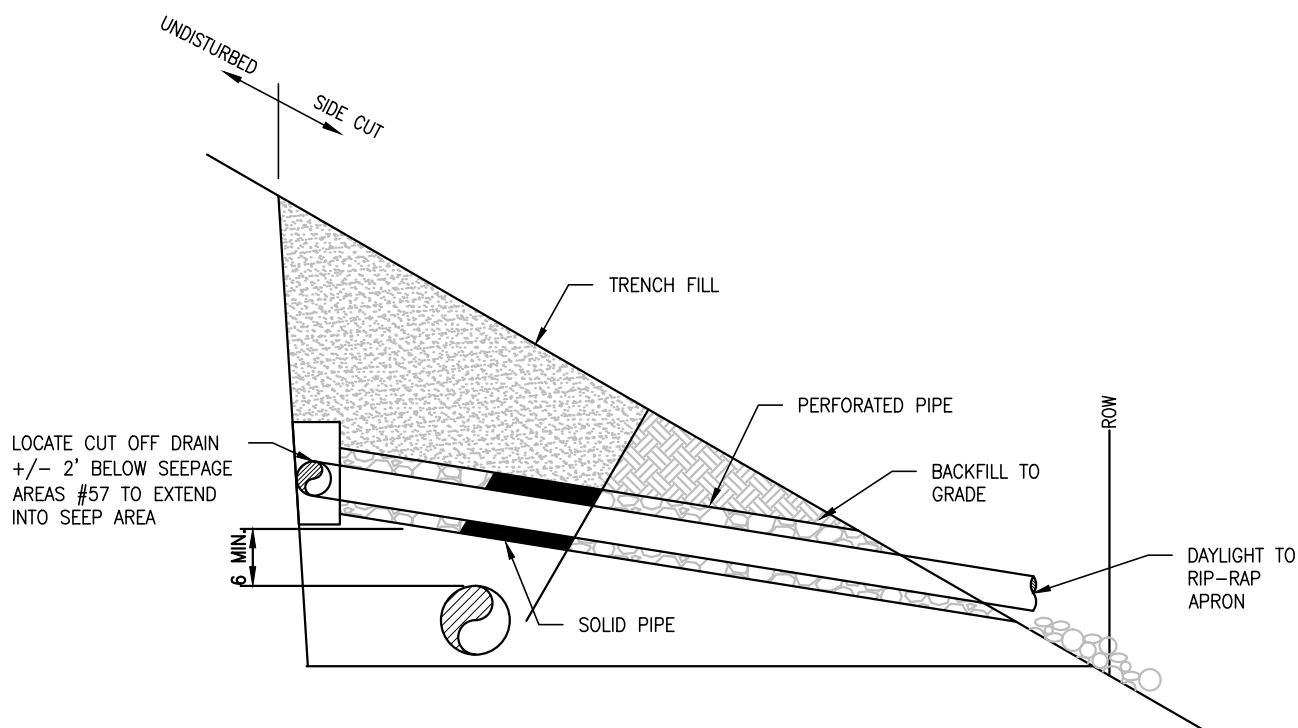
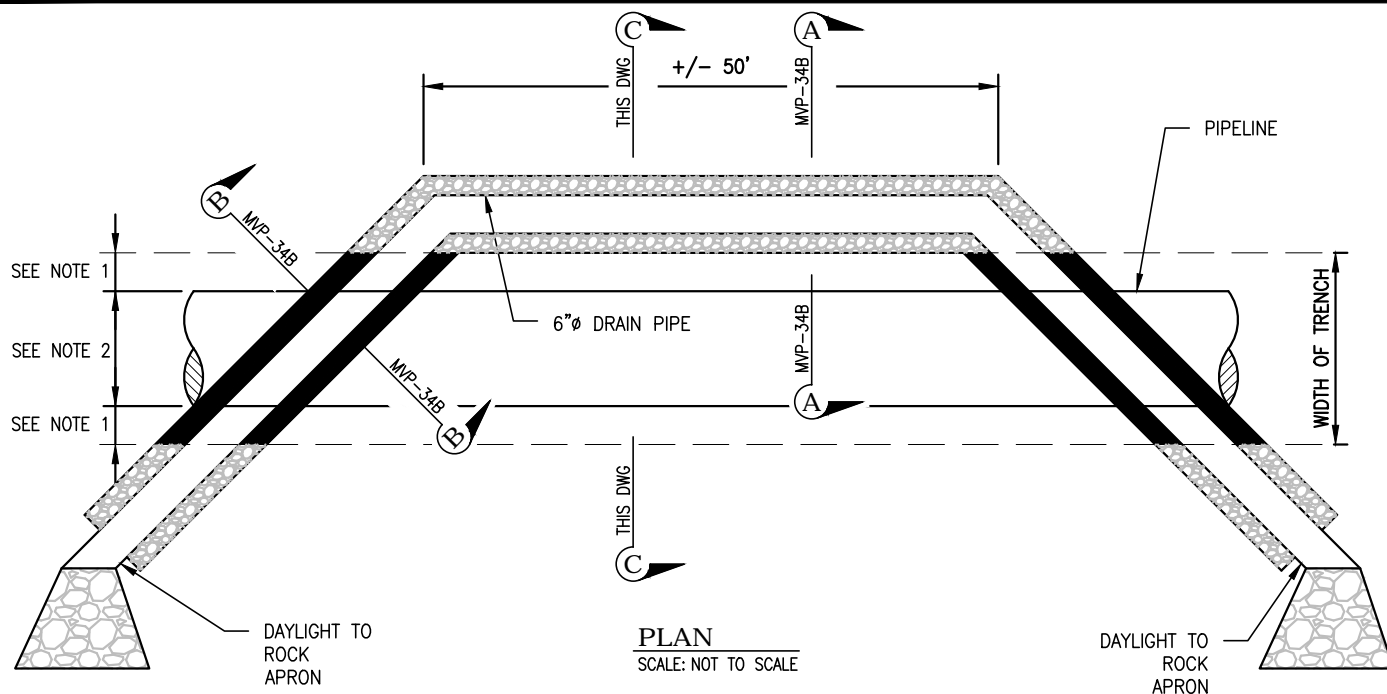
TRENCH BREAKER DAYLIGHT DRAIN

DRAWING NO.

MVP-35

REV.

0



NOTES:

1. PERFORATED PIPE SURROUNDED BY #57 STONE.
2. SOLID PIPE (IN TRENCH) SURROUNDED BY TRENCH BACKFILL.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 2
JOB NO.			
PROJECT ID:			
	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

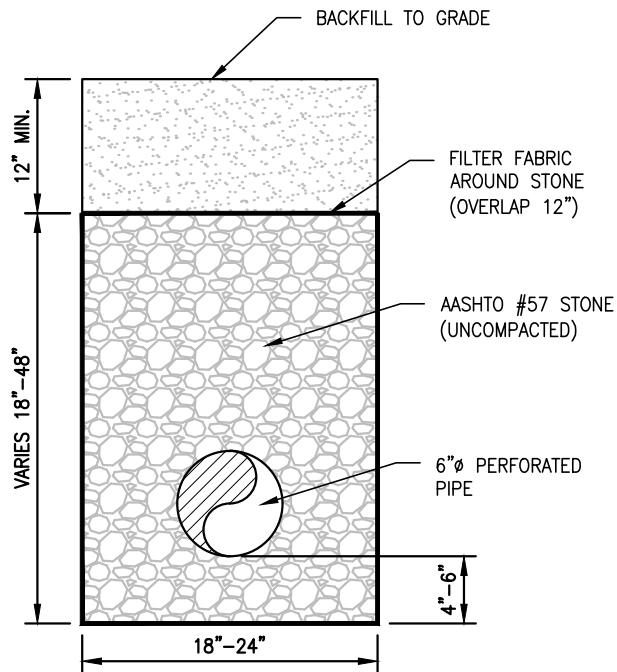
CUTOFF DRAIN-SIDEHILL

DRAWING NO.

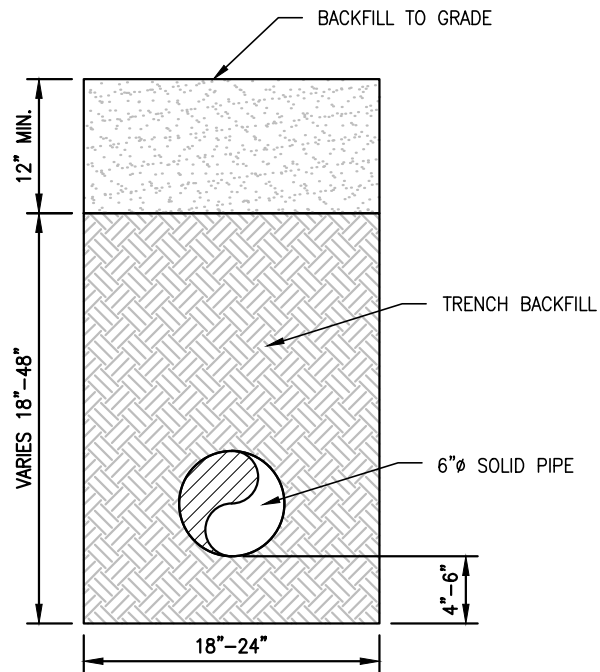
MVP-36A

REV.

0



SECTION A-A
SCALE: NOT TO SCALE
FROM MVP-34A



SECTION B-B
SCALE: NOT TO SCALE
FROM MVP-34A

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Lutz, Keith on: October 18, 2016 - 3:38 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	2 OF 2
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

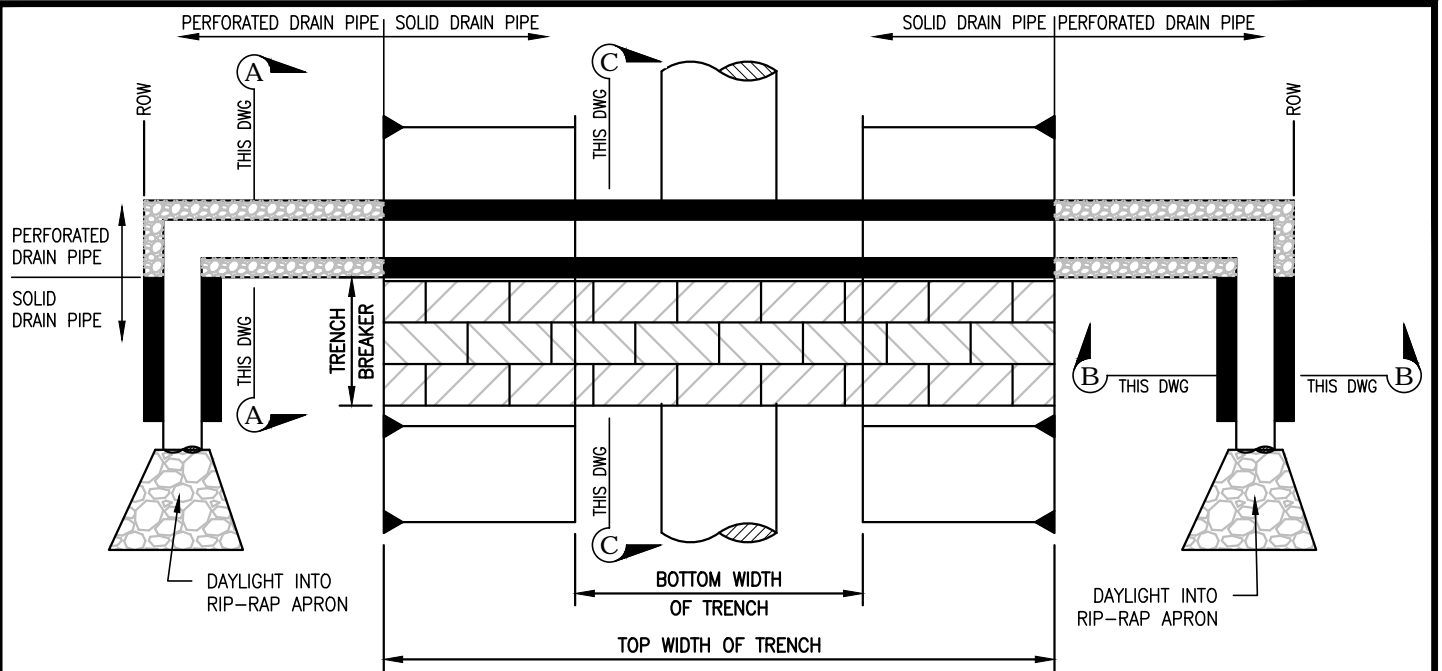
CUTOFF DRAIN-SIDEHILL

DRAWING NO.

MVP-36B

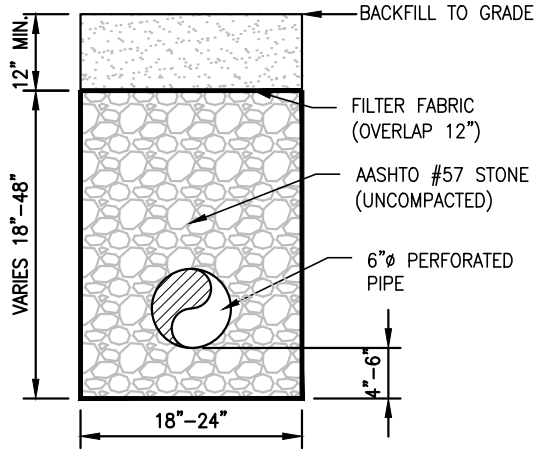
REV.

0

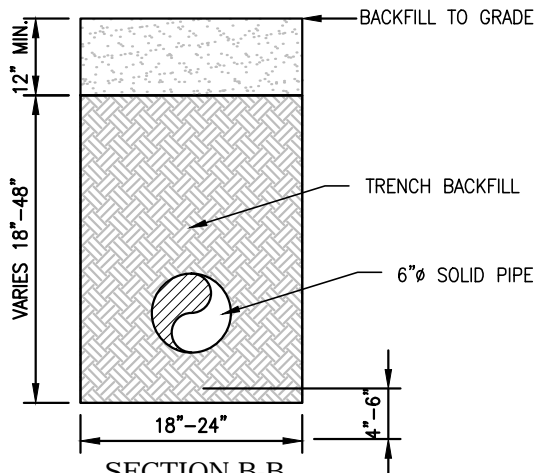


PLAN
SCALE: NOT TO SCALE

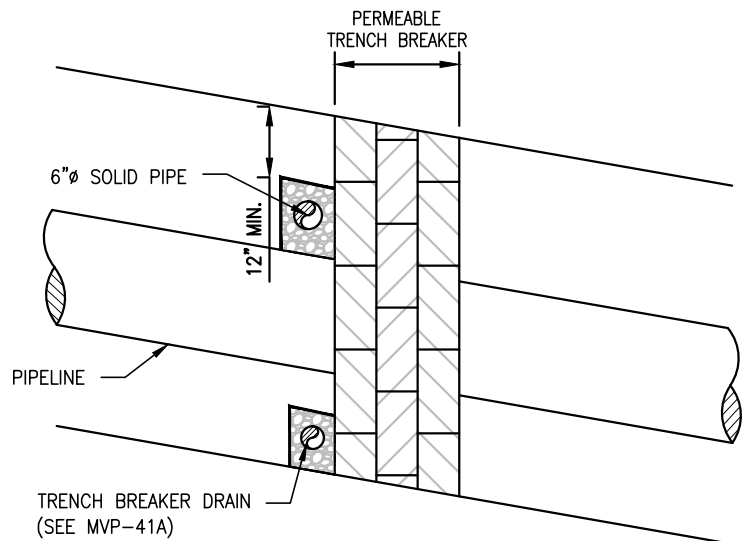
NOTES:
1. EACH CUTOFF DRAIN SHALL UTILIZE A TRENCH BREAKER DRAIN (SEE DETAIL 1) TO DRAIN THE TRENCH.



SECTION A-A
SCALE: NOT TO SCALE



SECTION B-B
SCALE: NOT TO SCALE



SECTION C-C
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Lutz, Keith on: October 18, 2016 - 3:38 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

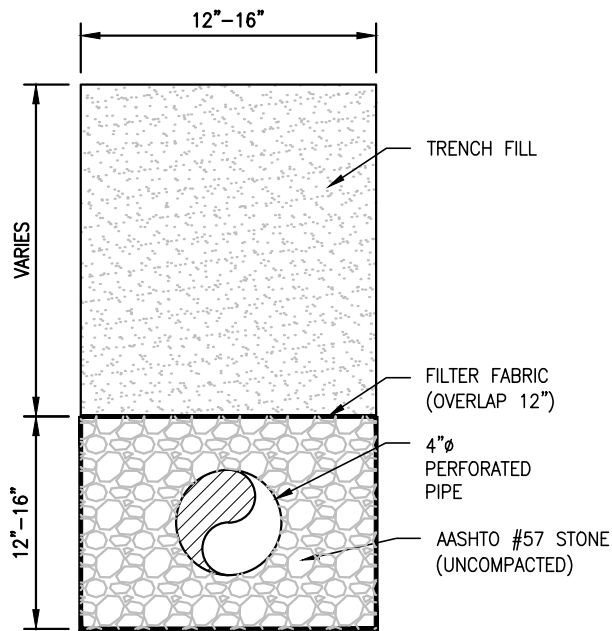
CUTOFF DRAIN-PLANAR

DRAWING NO.

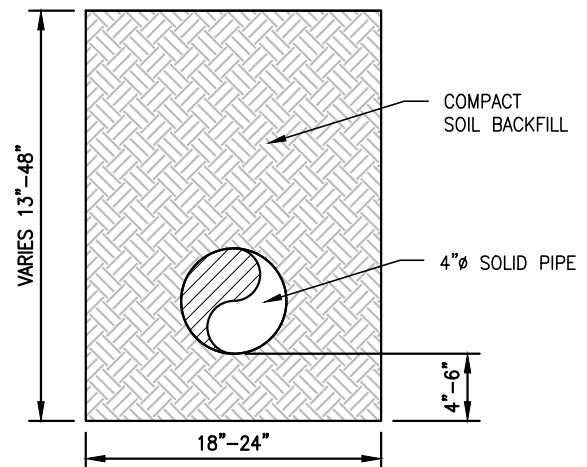
MVP-37

REV.

0



SECTION A-A
SCALE: NOT TO SCALE
FROM MVP-36A



SECTION B-B
SCALE: NOT TO SCALE
FROM MVP-36A

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	2 OF 2
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

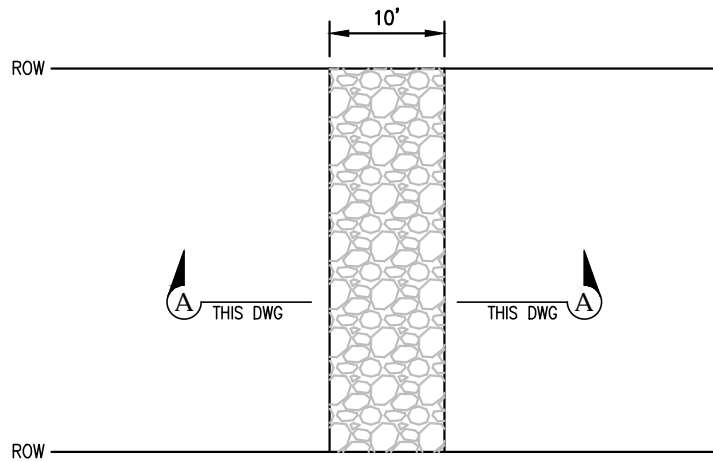
TRANSVERSE TRENCH DRAIN

DRAWING NO.

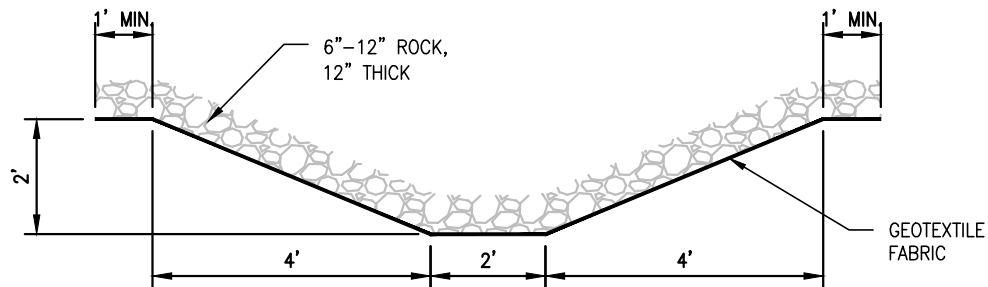
MVP-38B

REV.

0



PLAN
SCALE: NOT TO SCALE



SECTION A-A
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

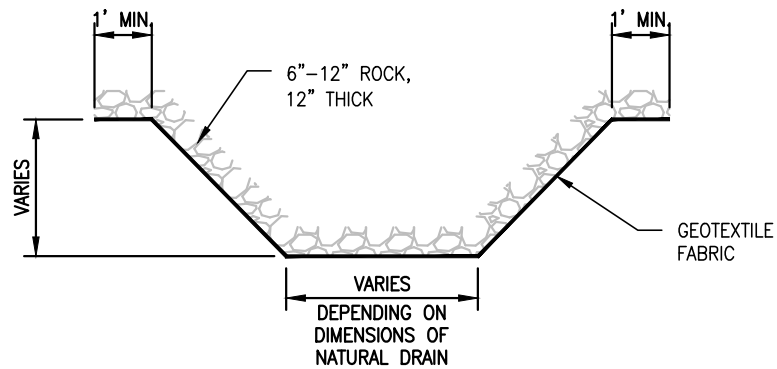
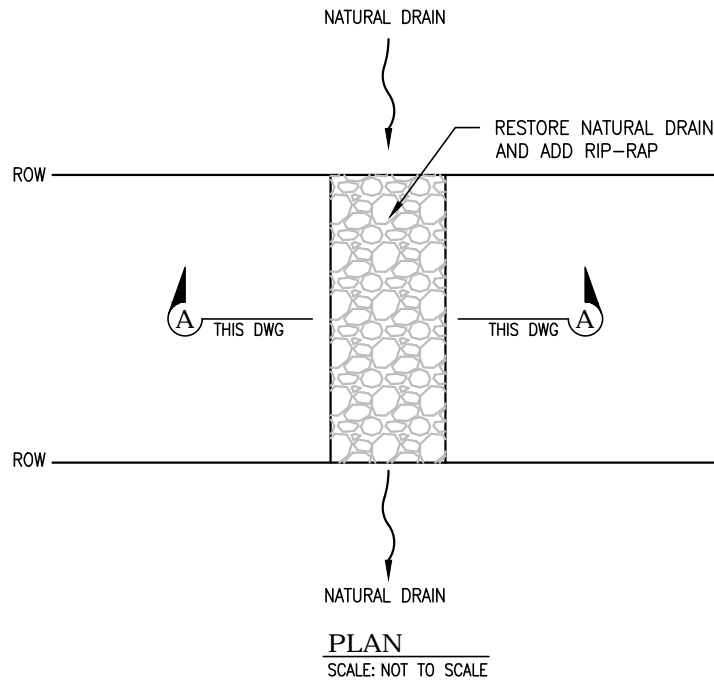
ROCK LINED SWALE

DRAWING NO.

MVP-39

REV.

0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

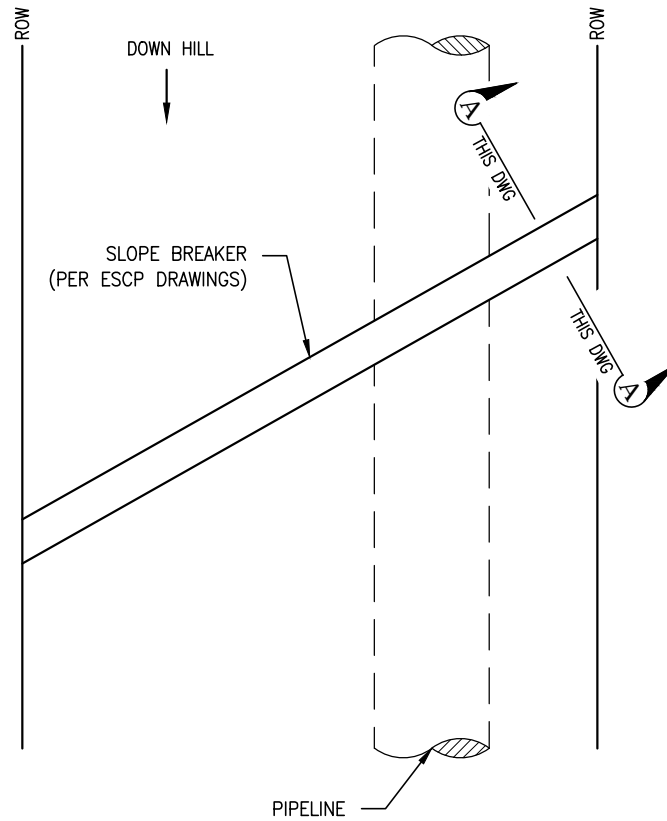
RIP-RAP NATURAL DRAIN

DRAWING NO.

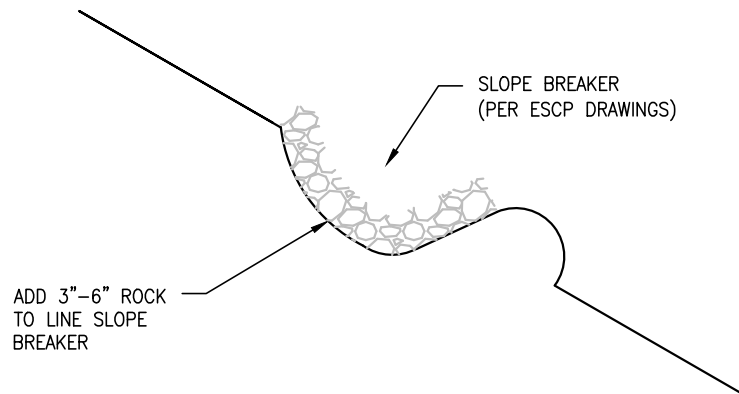
MVP-40

REV.

0



PLAN
SCALE: NOT TO SCALE



SECTION A-A
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
			PXXXX



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

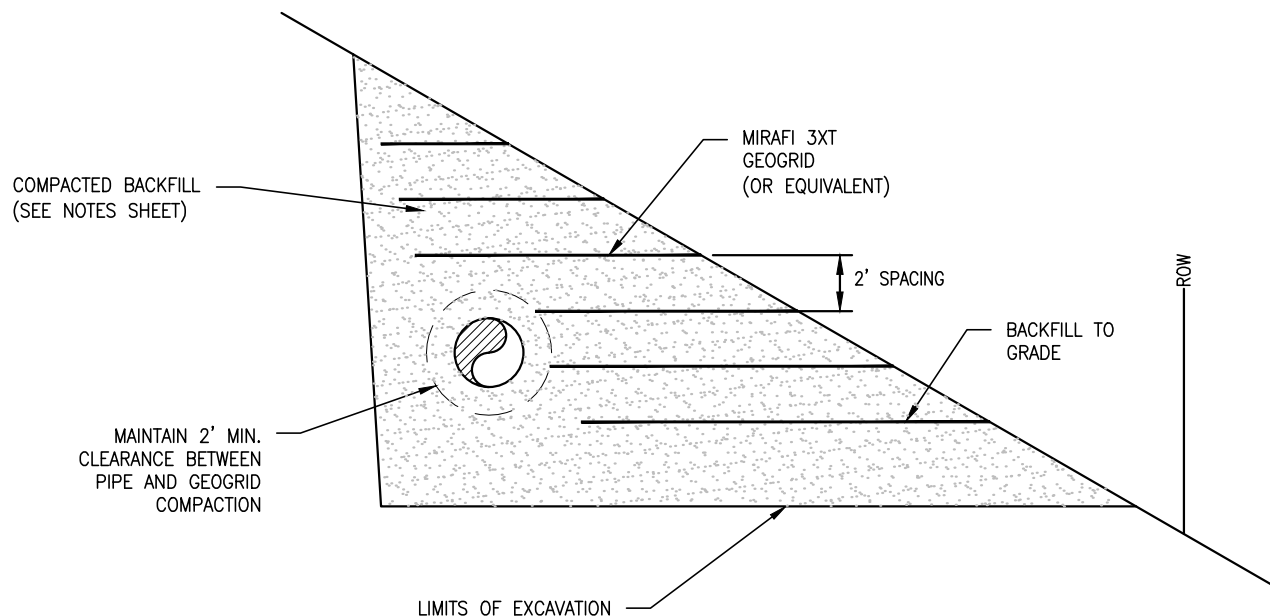
RIP-RAP SLOPE BREAKERS

DRAWING NO.

MVP-41

REV.

0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 3
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

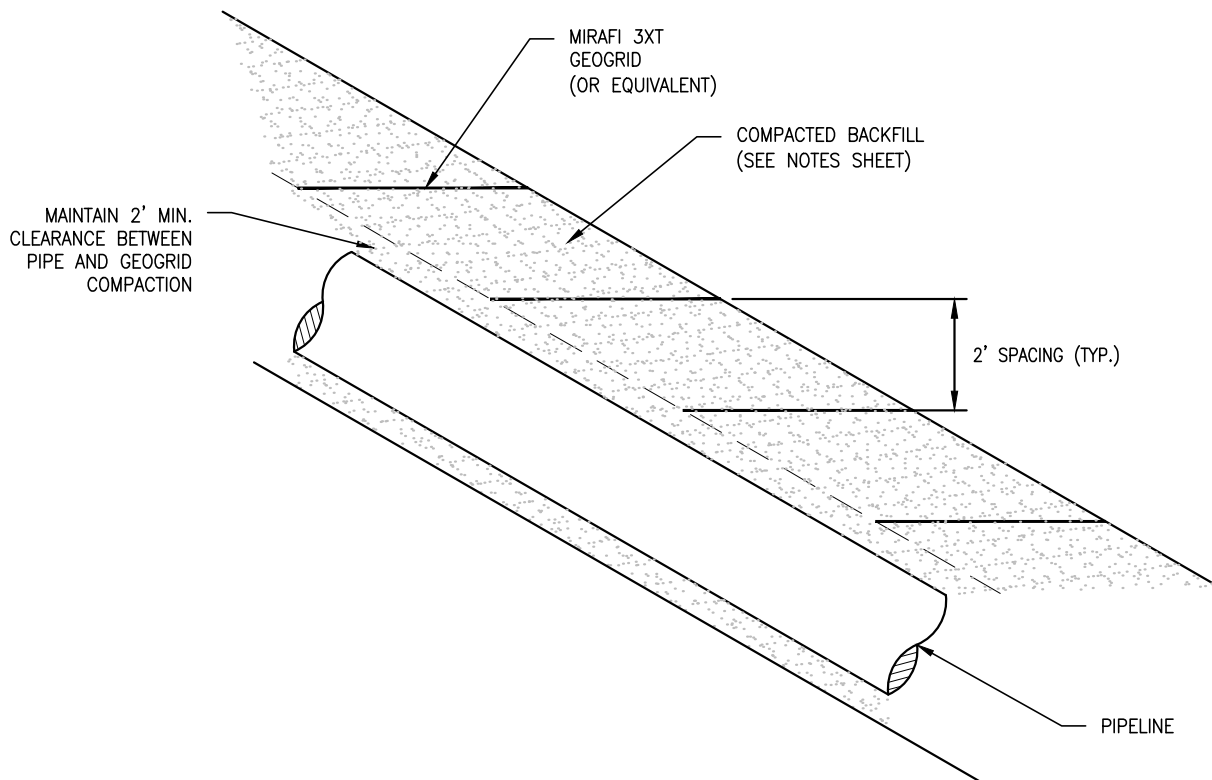
GEOGRID-SIDEHILL

DRAWING NO.

MVP-42A

REV.

0



SECTION VIEW
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	2 OF 3
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

SLIDE MITIGATION DETAIL

GEOGRID-PLANAR

DRAWING NO.

MVP-42B

REV.

0

COMPACTION NOTES

- 1) ALL ROCKS LARGER THAN 6 INCHES IN SIZE, AND MORE THAN 10 PERCENT BY VOLUME SHOULD BE REMOVED AND PROPERLY DISPOSED FROM THE BACKFILL MATERIAL.
- 2) THE SUBGRADE AT THE BASE OF THE EXCAVATION SHOULD BE PROOFROLLED WITH A PNEUMATIC TIRED ROLLER OR VEHICLE.
- 3) THE EXCAVATED AREA SHALL BE BACKFILLED WITH THE CLEANED EXCAVATED SOIL MATERIAL AND COMPACTED IN PLACE.
- 4) BACKFILL OPERATIONS SHALL BE PERFORMED WHEN SOIL IS SUITABLE FOR COMPACTION (I.E., NOT IMMEDIATELY FOLLOWING A LARGE RAIN, SNOW, OR ICE EVENT). FROZEN FILL SHALL NOT BE USED.
- 5) THE BACKFILL SHALL BE PLACED IN COMPACTED LIFTS NO GREATER THAN 12 INCHES.
- 6) MAINTAIN A MINIMUM 2FT CLEARANCE BETWEEN COMPACTION ACTIVITY AND THE GAS PIPELINE.

GRAVEL DRAIN NOTES

- 1) GEOTEXTILE FABRIC SHALL BE TENCATE MIRAFI 140N OR APPROVED EQUIVALENT.
- 2) THE GEOTEXTILE FABRIC SHALL BE STORED UNDAMAGED PURSUANT TO MANUFACTURERS RECOMMENDATIONS.
- 3) DO NOT OPERATE CONSTRUCTION EQUIPMENT DIRECTLY ON THE GEOTEXTILE FABRIC.
- 4) DRAINAGE AGGREGATE SHALL MEET THE REQUIREMENTS OF AASHTO NO. 57 STONE.
- 5) DRAINAGE AGGREGATE SHALL NOT BE COMPACTED.

GEOGRID NOTES

- 1) GEOGRID REINFORCEMENT SHALL BE TENCATE MIRAFI 3XT OR APPROVED EQUIVALENT.
- 2) THE GEOGRID MATERIAL SHALL BE STORED UNDAMAGED PURSUANT TO MANUFACTURERS RECOMMENDATIONS.
- 3) GEOGRID SHALL BE PLACED HORIZONTALLY ON THE BACKFILL WITH THE PRINCIPAL STRENGTH DIRECTION PERPENDICULAR TO THE FACE OF THE SLOPE. ADJACENT PIECES OF PRIMARY GEOGRID SHALL NOT OVERLAP BUT ARE TO BE BUTTED SIDE TO SIDE.
- 4) REMOVE ALL SLACK IN THE GEOGRID MATERIAL AND ANCHOR AS NECESSARY WITH PINS, OR BAGS TO PREVENT SLACK FROM DEVELOPMENT DURING FILL PLACEMENT AND COMPACTION.
- 5) FILL IS TO BE PLACED AND SPREAD DIRECTLY ON THE GEOGRID MATERIAL WITH RUBBER TIRED EQUIPMENT ONLY. SPEEDS ARE TO BE KEPT SLOW WITH AS FEW STOPS AND TURNS AS PRACTICAL.
- 6) DO NOT OPERATE TRACKED EQUIPMENT DIRECTLY ON THE GEOGRID MATERIAL.
- 7) MAINTAIN A MINIMUM 2FT CLEARANCE BETWEEN GEOGRID MATERIAL AND THE GAS PIPELINE.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	3 OF 3
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

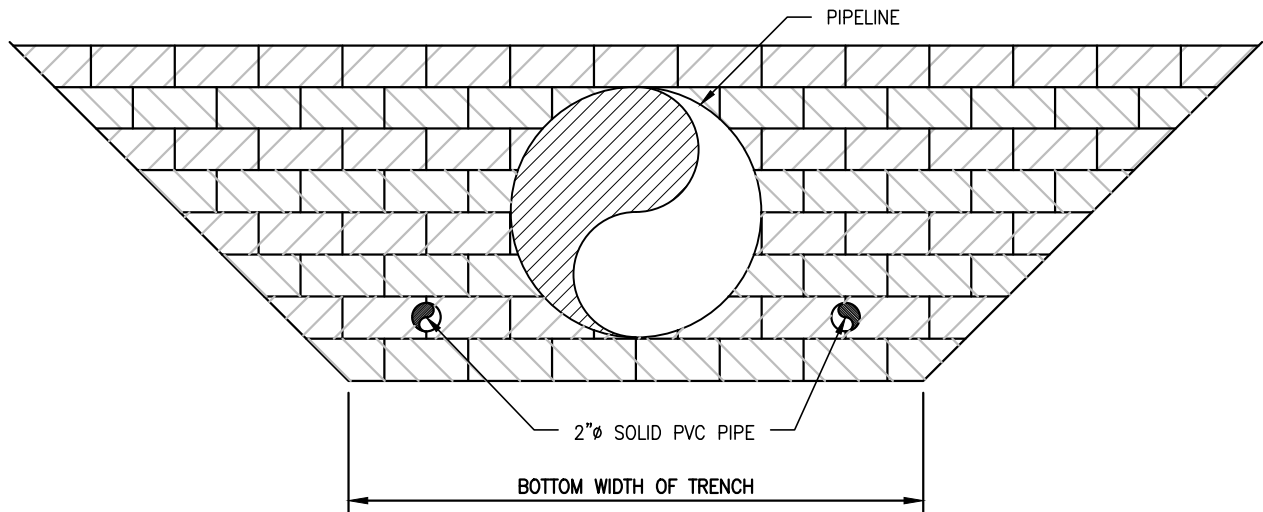
GEOGRID NOTES

DRAWING NO.

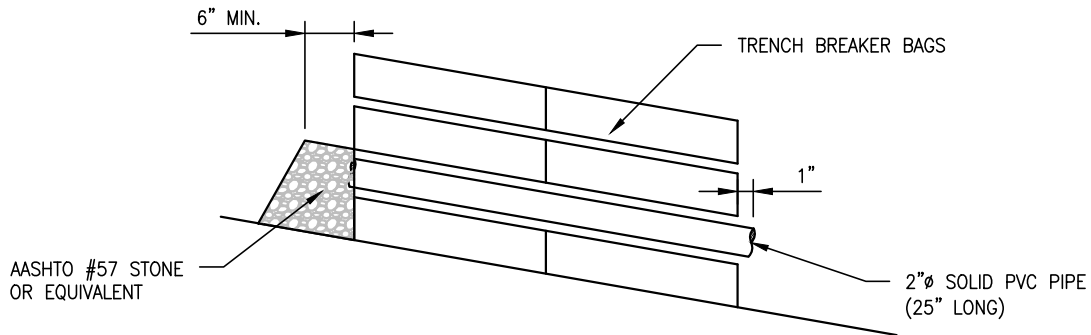
MVP-42C

REV.

0



FRONT VIEW
SCALE: NOT TO SCALE



SECTION VIEW
SCALE: NOT TO SCALE

NOTES:

1. PLACE PVC DRAIN PIPE ON FIRST LAYER OF TRENCH BREAKER BAGS.
2. PLACE PVC DRAIN PIPE EQUADISTANT FROM THE OUTSIDE EDGE OF THE 30" GAS PIPE AND THE BOTTOM LIMITS OF THE TRENCH.
3. EXTEND PVC PIPE THROUGH ENTIRE TRENCH BREAKER AND EXTEND APPROX. 1" PAST END OF BREAKER.
4. AASHTO#57 STONE SHALL BE PLACED TO A MINIMUM 6" THICKNESS UPSLOPE OF THE DRAIN PIPE.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	4/14/2016
CHECKED	MMF	DATE	4/14/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 2
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

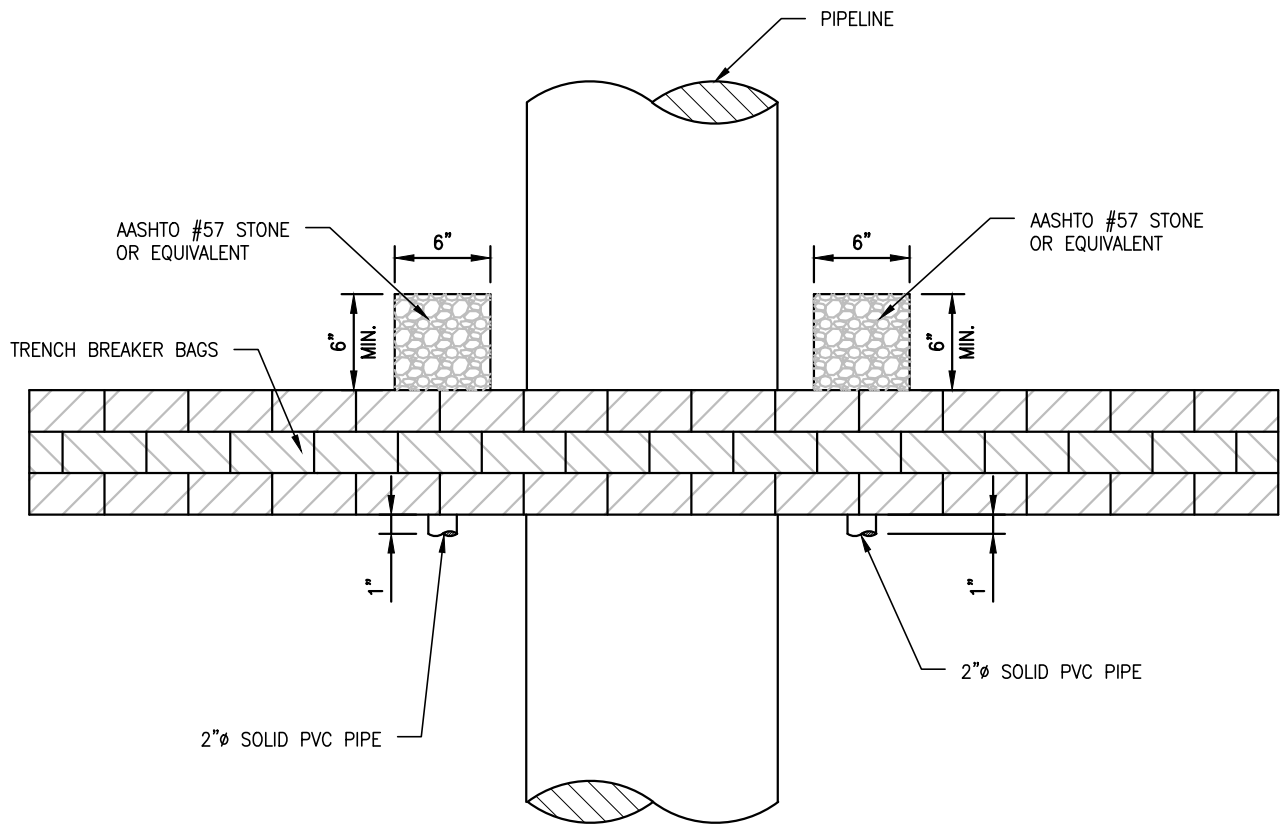
TRENCH BREAKER
PASS-THROUGH DRAIN

DRAWING NO.

MVP-43A

REV.

0



PLAN VIEW
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	4/14/2016
CHECKED	MMF	DATE	4/14/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	2 OF 2
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

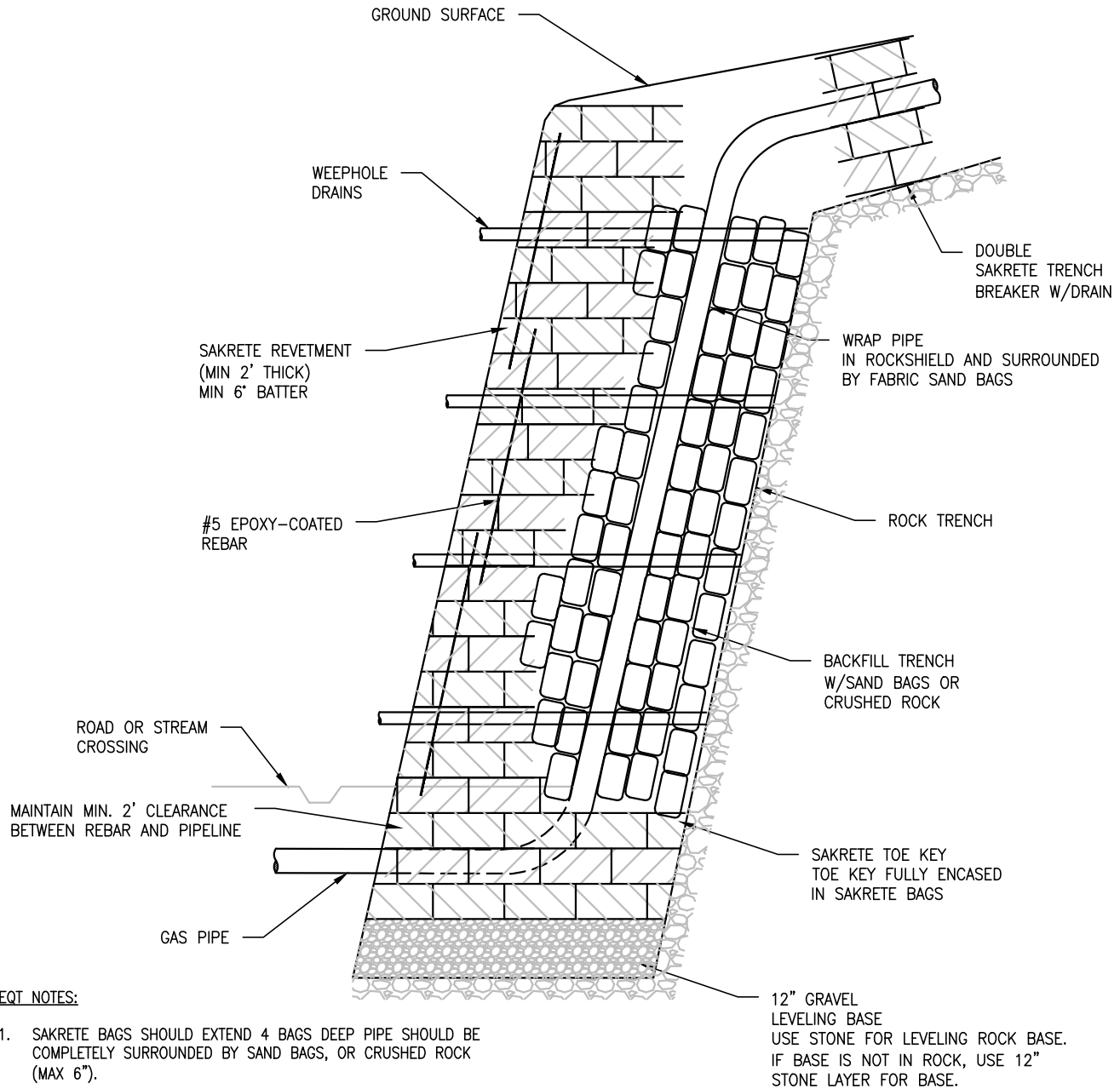
TRENCH BREAKER
PASS-ROUGH DRAIN

DRAWING NO.

MVP-43B

REV.

0



EQT NOTES:

1. SAKRETE BAGS SHOULD EXTEND 4 BAGS DEEP PIPE SHOULD BE COMPLETELY SURROUNDED BY SAND BAGS, OR CRUSHED ROCK (MAX 6").
2. SAKRETE BAGS SHOULD BE STAGGERED IN A MASONRY FASHION. THE FACE OF THE WELL SHALL BE INCLINED 6"-10" FROM VERTICAL.
3. #5 REBAR SHOULD BE DRIVEN THROUGH THE SAKRETE BAGS (SEE DETAIL 1).
4. 2"Ø PVC WEEPHOLE DRAINS SHALL BE INSTALLED EVERY 15 FT.

SIDE VIEW
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Lutz, Keith on: October 18, 2016 - 3:42 PM

DRAWN	OL	DATE	6/29/2016
CHECKED	MMF	DATE	-
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 2
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

SLIDE MITIGATION
HIGHWALL REVETMENT
SIDE VIEW

DRAWING NO.

MVP-44A

REV.

0

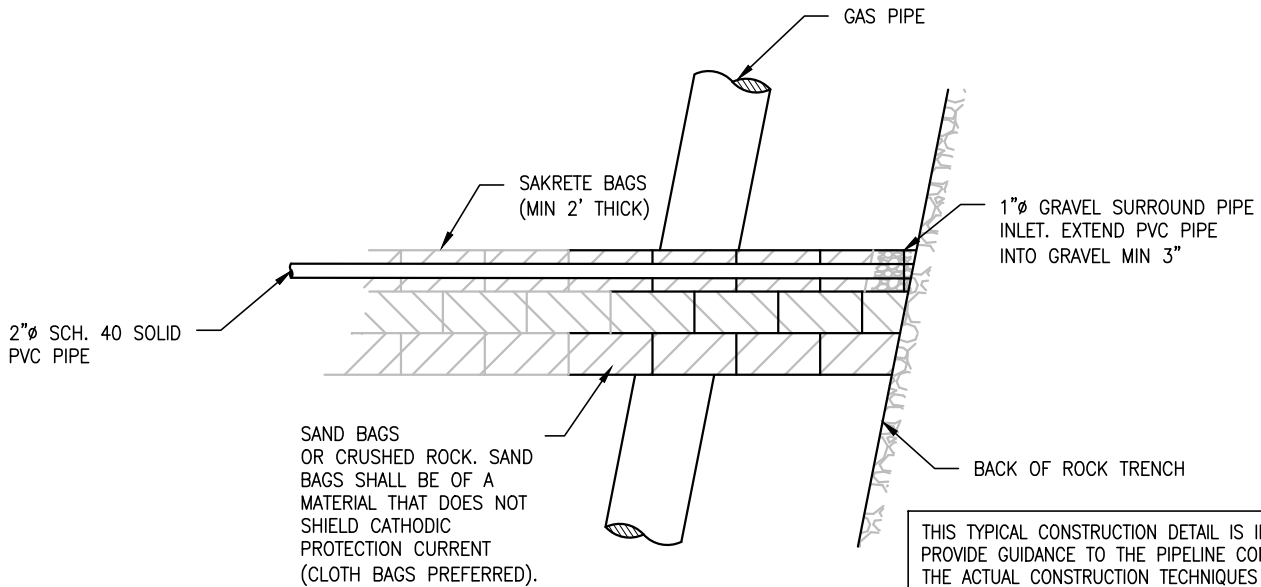
#5 EPOXY-COATED REBAR DRIVEN INTO PLACE. OVERLAP REBAR MIN. 3 BAGS. SPACE REBAR 12" HORIZONTALLY.

2"Ø PVC WEEPHOLE DRAINS (SEE DETAIL #2)

GAS PIPE (SPACE REBAR TO MAINTAIN MIN. 2' CLEARANCE FROM PIPELINE)

12" STONE LEVELING BASE

FRONT VIEW
SCALE: NOT TO SCALE



DRAIN DETAIL
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	OL	DATE	6/29/2016
CHECKED	MMF	DATE	-
APP'D		DATE	
SCALE	N.T.S.	SHEET	2 OF 2
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

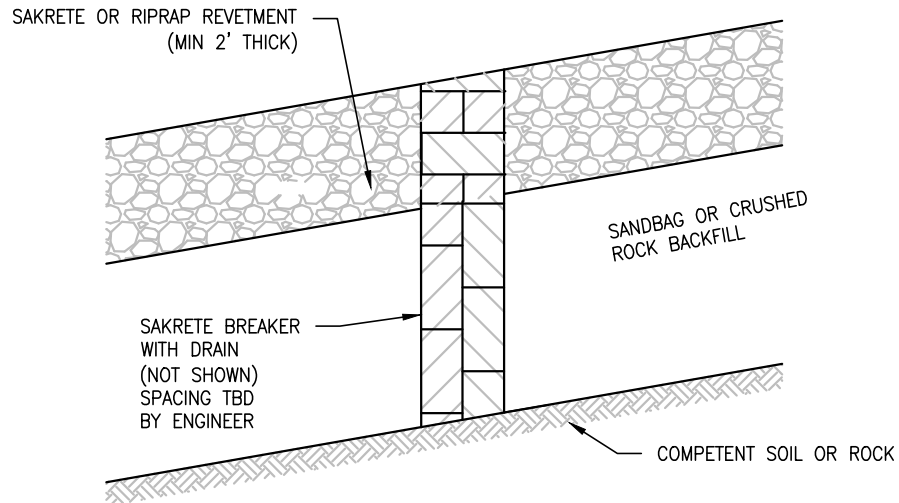
SLIDE MITIGATION
HIGHWALL REVETMENT
FRONT VIEW AND DRAIN DETAIL

DRAWING NO.

MVP-44B

REV.

0



SIDE VIEW
SCALE: NOT TO SCALE

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DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

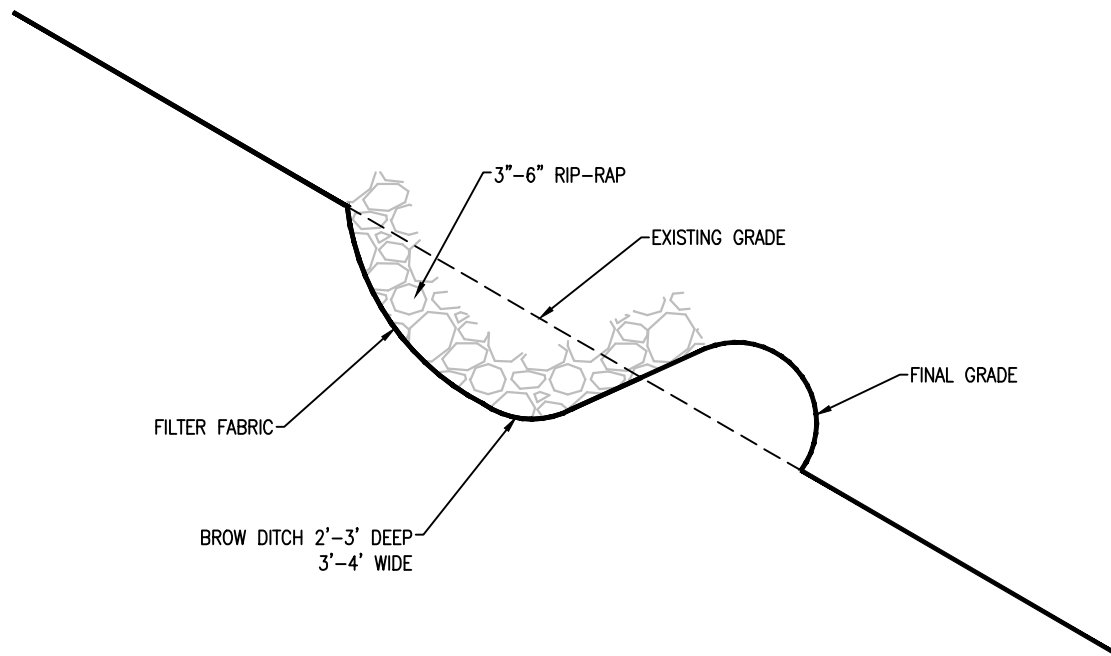
STEEP SLOPE REVETMENT

DRAWING NO.

MVP-45

REV.

0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	7/12/2016
CHECKED	MMF	DATE	7/12/2016
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

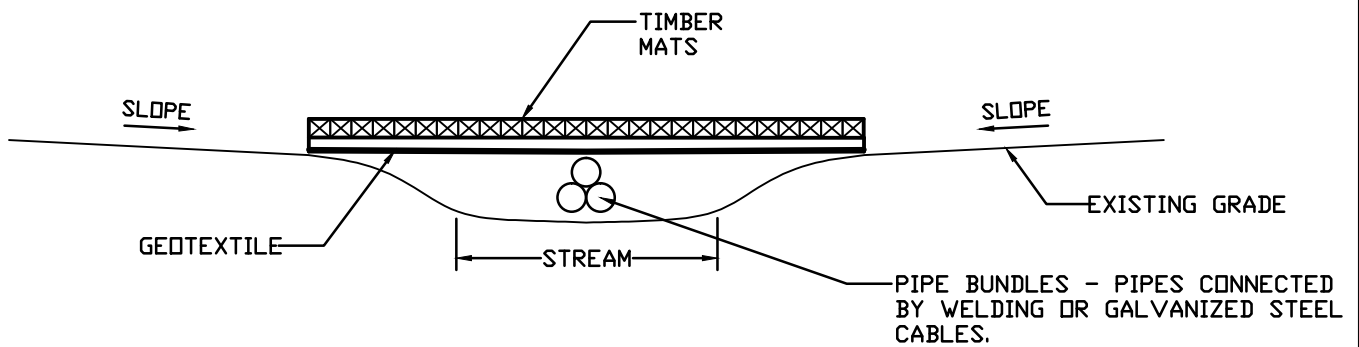
BROW DITCH DETAIL

DRAWING NO.

MVP-46

REV.

0



NOTE:

CFS TO BE INSTALLED AT THE END OF EACH WORKING DAY.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	10/6/2016
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

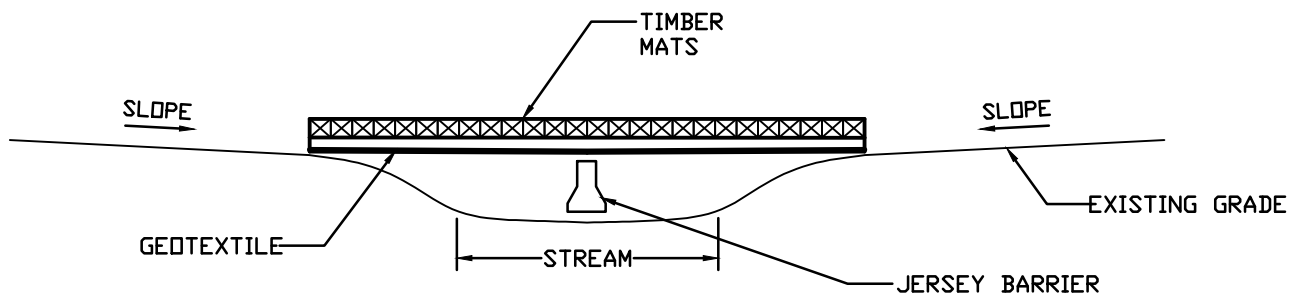


DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

TIMBER MAT AND PIPE BUNDLE
TEMPORARY STREAM CROSSING

DRAWING NO.	REV.
MVP-47	0



NOTE:

CFS TO BE INSTALLED AT THE END OF EACH WORKING DAY.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	10/6/2016
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

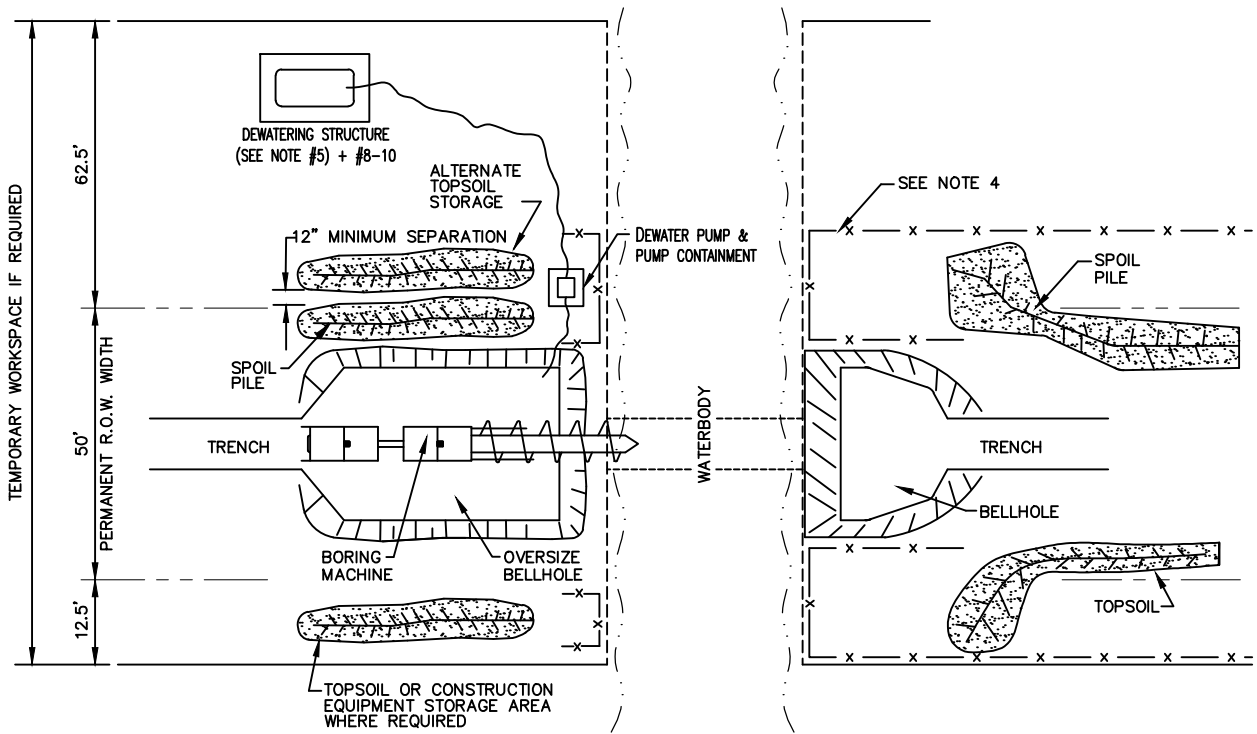


DESIGN ENGINEERING

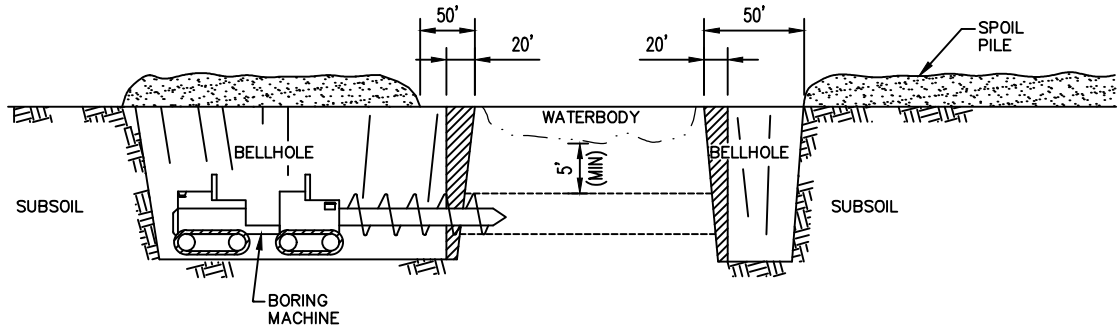
TYPICAL CONSTRUCTION DETAIL

TIMBER MAT AND JERSEY BARRIER
TEMPORARY STREAM CROSSING

DRAWING NO.	REV.
MVP-48	0



PLAN VIEW
(NOT TO SCALE)



PROFILE

NOTES:

1. STRIP TOPSOIL FROM THE BELLHOLE AREA IN UNMANAGED WOODLAND. STRIP TOPSOIL FROM THE BELLHOLE AND SPOIL STORAGE AREA.
2. EXCAVATE BELLHOLE, STORING SPOIL ON OPPOSITE SIDE OF R.O.W. FROM TOPSOIL OR ADJACENT TO TOPSOIL MAINTAINING A MINIMUM 12 INCHES OF SEPARATION TO AVOID MIXING TOPSOIL AND SPOIL.
3. THE SIDES OF THE BORE PITS SHALL BE SLOPED BACK TO STABLE CONFIGURATION UNLESS SUPPORTED BY SHEET PILING OR OTHER SHORING MEANS. INSTALL SAFETY FENCE AROUND BORE PITS AS NECESSARY.
4. INSTALL TEMPORARY EROSION CONTROL PROCEDURES AS SPECIFIED IN THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. DEWATER BORE PIT TO CONTROL SEEPAGE WATER FLOW. DEWATER INTO AN APPROPRIATE DEWATERING STRUCTURE. REFER TO TYPICAL MVP-ES2 PUMPED WATER FILTER BAG AND STD & SPEC 3.26 DEWATERING STRUCTURE.
6. UPON COMPLETION OF PIPE INSTALLATION AND TIE-INS, BACKFILL PIT SPOIL. MINIMIZE POST CONSTRUCTION SETTLEMENT BY COMPACTING BACKFILL USING STANDARD PIPELINE CONSTRUCTION EQUIPMENT AVAILABLE AT SITE. LEAVE A CROWN TO ALLOW FOR SUBSIDENCE OF THE BACKFILL. RESPREAD SALVAGED TOPSOIL AND COMPACT. NO EXCESS SPOIL WILL BE SPREAD WITHIN FLOOD PLAINS OR DELINEATED WETLANDS AREAS.
7. BORE DEPTH WILL BE DETERMINED BASED ON SCOUR ANALYSIS MINIMUM OF 5' SEPARATION BETWEEN TOP OF BORE PROFILE & BOTTOM OF WATERBODY CHANNEL.
8. DEWATERING STRUCTURE WILL BE PLACED IN A STABILIZED AREA AWAY FROM WATERBODY AND WETLANDS.
9. PUMPING RATE WILL NOT EXCEED MFG'S RECOMMENDATIONS AND WILL NOT RESULT IN INCREASED EROSION.
10. DEWATERING ACTIVITY SHALL BE MONITORED DURING OPERATION.

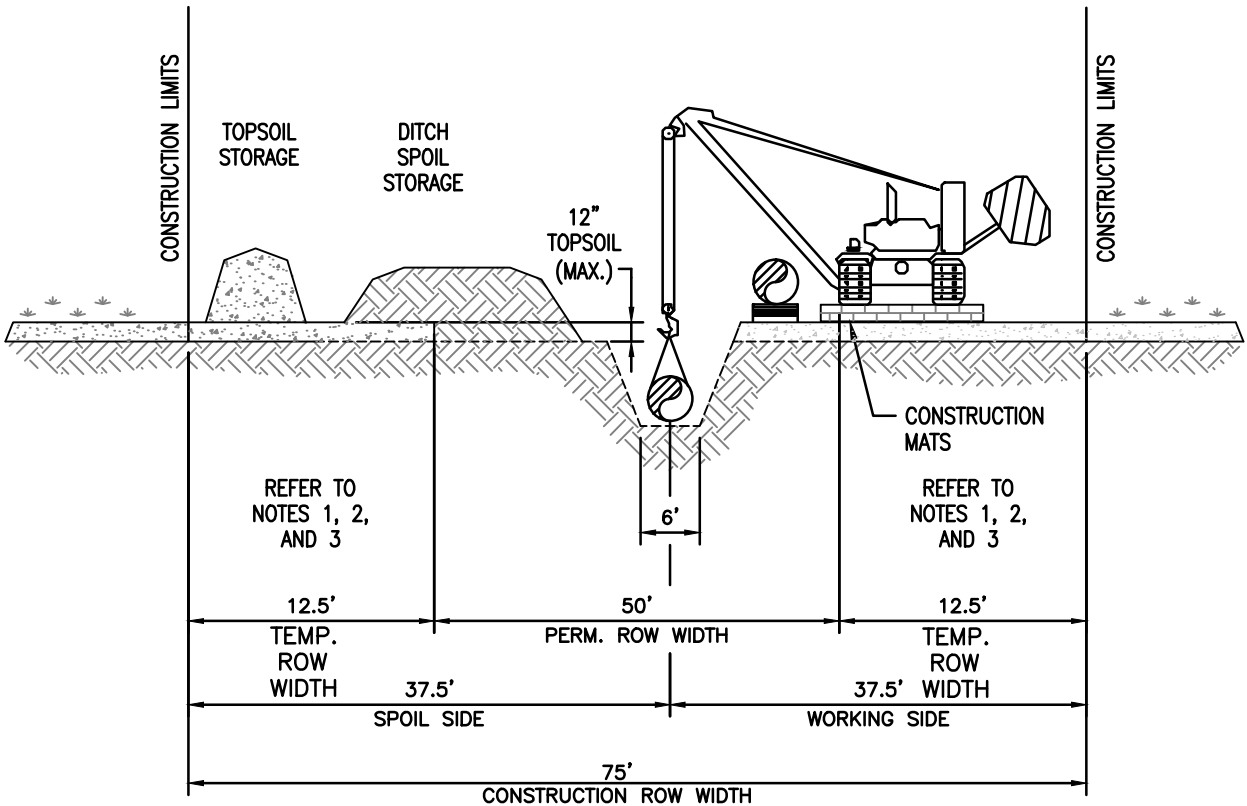
THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	EPG	DATE	01/30/2017
CHECKED	-	DATE	-
APP'D	-	DATE	-
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL	
TYPICAL WATERBODY CONVENTIONAL BORE	
DRAWING NO.	REV.
MVP-51	0



NOTES:

1. TOPSOIL SEGREGATION/REMOVAL WILL ONLY BE CONDUCTED WITHIN THE PERMANENT EASEMENT AT ALL WETLAND CROSSINGS IN VIRGINIA.
2. GRUBBING ACTIVITIES SHALL BE LIMITED TO THE PERMANENT EASEMENT AT ALL WETLAND CROSSINGS IN VIRGINIA. OUTSIDE OF THE PERMANENT EASEMENT, WETLAND VEGETATION SHALL ONLY BE REMOVED AT OR ABOVE THE GROUND SURFACE. WOODY VEGETATION WITHIN THE TEMPORARY EASEMENT SHALL BE CUT AT GROUND SURFACE WITH THE STUMPS TO REMAIN IN-PLACE.
3. WETLAND CROSSINGS IN VIRGINIA SHALL BE CONDUCTED IN ACCORDANCE WITH NWP12 GENERAL AND NORFOLK DISTRICT REGIONAL CONDITIONS.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JL	DATE
CHECKED	MMF	DATE
APP'D	XXX	DATE
SCALE	N.T.S.	SHEET OF
JOB NO.		
PROJECT ID:	PXXXX	



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

WETLAND CROSSING TYPICAL FOR
USACE NORFOLK (VA) DISTRICT

DRAWING NO.	REV.
MVP-53	0