



west virginia department of environmental protection

Office of Oil and Gas
601 57th Street, S.E.
Charleston, WV 25304
(304) 926-0450
fax: (304) 926-0452

Austin Caperton, Cabinet Secretary
www.dep.wv.gov

Thursday, August 30, 2018
PERMIT MODIFICATION APPROVAL
Horizontal 6A / Horizontal 6A Well - 1

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for SCHRADER UNIT 2H
47-017-06646-00-00

Limits of disturbance increased to repair a slip.

ANTERO RESOURCES CORPORATION

The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

If there are any questions, please feel free to contact me at (304) 926- 0450.

James A. Martin
Chief

A handwritten signature in blue ink, appearing to read 'James A. Martin', is positioned below the printed name and title.

Operator's Well Number: SCHRADER UNIT 2H
Farm Name: HAUG, ROBERT M. ET AL
U.S. WELL NUMBER: 47-017-06646-00-00
Horizontal 6A Horizontal 6A Well - 1
Date Modification Issued:

Promoting a healthy environment.

08/31/2018

LOCATION COORDINATES:

ACCESS ROAD ENTRANCE
LATITUDE: 39.315984 LONGITUDE: -80.708947 (NAD 83)
LATITUDE: 39.315900 LONGITUDE: -80.709123 (NAD 27)
N 4351883.05 E 525090.34 (UTM ZONE 17 METERS)

CENTROID OF WELL PAD
LATITUDE: 39.315465 LONGITUDE: -80.712241 (NAD 83)
LATITUDE: 39.315381 LONGITUDE: -80.712417 (NAD 27)
N 4351824.49 E 524806.55 (UTM ZONE 17 METERS)

GENERAL DESCRIPTION:

THE ACCESS ROAD(S) & WELL PAD HAVE BEEN CONSTRUCTED INDIVIDUAL MARCELLUS SHALE GAS WELLS.

FLOODPLAIN NOTES:

THE SITE IS LOCATED IN FLOODPLAIN ZONE "X" PER FEMA MAP NUMBER #54017C0130C.

ENVIRONMENTAL NOTES:

WETLAND DELINEATIONS WERE PERFORMED JANUARY, 2016 BY ALLSTAR ECOLOGY TO REVIEW THE SITE FOR WATERS AND WETLANDS THAT ARE MOST LIKELY WITHIN THE REGULATORY PURVIEW OF THE U.S. ARMY CORPS OF ENGINEERS (USACE) AND/OR THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (WVDEP).

GEOTECHNICAL NOTES:

A SUBSURFACE INVESTIGATION OF THE SITE WAS PERFORMED BY PENNSYLVANIA SOIL & ROCK, INC. BETWEEN JANUARY 12, 2016 & JANUARY 19, 2016. THE REPORT PREPARED BY PENNSYLVANIA SOIL & ROCK, INC., DATED FEBRUARY 16, 2016, REFLECTS THE RESULTS OF THE SUBSURFACE INVESTIGATION.

ADDITIONAL GEOTECHNICAL CONSULTATION WILL TAKE PLACE DURING SLIP REPAIR CONSTRUCTION.

PROJECT CONTACTS:

CHARLES E. COMPTON, III - SURVEYING COORDINATOR
CELL: (304) 719-6449

OPERATOR:
ANTERO RESOURCES CORPORATION
535 WHITE OAKS BLVD.
BRIDGEPORT, WV 26330
PHONE: (304) 842-4100
FAX: (304) 842-4102

PETER SCOTT - LAND AGENT
CELL: (304) 203-8012

ELI WAGONER - ENVIRONMENTAL ENGINEER
OFFICE: (304) 842-4068 CELL: (304) 476-9770

ENGINEER/SURVEYOR:
NAVITUS ENGINEERING, INC.
CYRUS S. KUMP, PE - PROJECT MANAGER/ENGINEER
OFFICE: (866) 662-4185 CELL: (540) 686-6747

JON McEVERS - OPERATIONS SUPERINTENDENT
OFFICE: (303) 357-6799 CELL: (303) 808-2423

ENVIRONMENTAL:
ALLSTAR ECOLOGY, LLC
RYAN L. WARD - ENVIRONMENTAL SCIENTIST
OFFICE: (866) 213-2666 CELL: (304) 692-7477

AARON KUNZLER - CONSTRUCTION SUPERVISOR
CELL: (405) 227-8344

GEOTECHNICAL:
PENNSYLVANIA SOIL & ROCK, INC.
CHRISTOPHER W. SAMIOS - PROJECT ENGINEER
OFFICE: (412) 372-4000 CELL: (412) 589-0662

RESTRICTIONS NOTES:

- 1. THERE ARE NO PERENNIAL STREAMS, LAKES, PONDS, OR RESERVOIRS WITHIN 100 FEET OF THE WELL PAD AND LOD. THERE ARE WETLAND IMPACTS THAT HAVE BEEN PERMITTED BY THE APPROPRIATE AGENCIES.
2. THERE ARE NO NATURALLY PRODUCING TROUT STREAMS WITHIN 300 FEET OF THE WELL PAD AND LOD.
3. THERE ARE NO GROUNDWATER INTAKE OR PUBLIC WATER SUPPLY FACILITIES WITHIN 1000 FEET OF THE WELL PAD AND LOD.
4. THERE ARE NO APPARENT EXISTING WATER WELLS OR DEVELOPED SPRINGS WITHIN 250 FEET OF THE WELL(S) BEING DRILLED.
5. THERE ARE NO OCCUPIED DWELLING STRUCTURES WITHIN 625 FEET OF THE CENTER OF THE WELL PAD.
6. THERE ARE NO AGRICULTURAL BUILDINGS LARGER THAN 2,500 SQUARE FEET WITHIN 625 FEET OF THE CENTER OF THE WELL PAD.

NOTES:

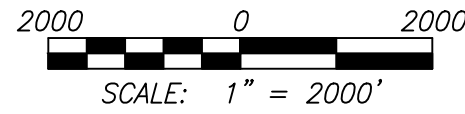
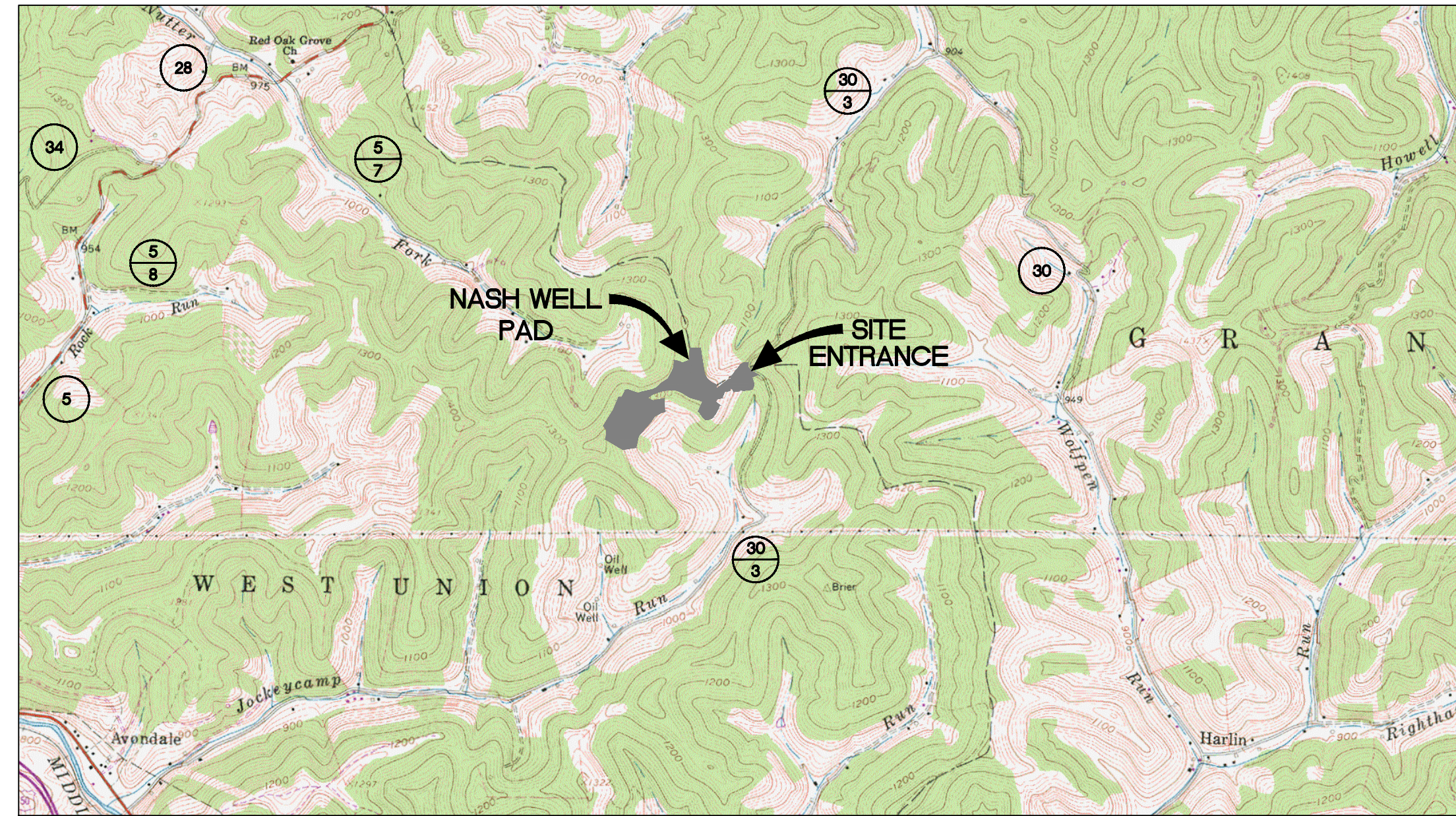
- 1. ALL BMP'S MUST REMAIN IN PLACE AND FUNCTIONAL UNTIL ALL AREAS WITHIN THE LIMIT OF DISTURBANCE ARE COMPLETE AND PERMANENTLY STABILIZED. MAINTENANCE MUST INCLUDE INSPECTION OF ALL EROSION AND SEDIMENT CONTROLS AFTER EACH RUNOFF EVENT IN EXCESS OF 0.5" AND ON A BIWEEKLY BASIS.
2. THE CONSTRUCTION SITE SHOULD BE STABILIZED AS SOON AS POSSIBLE AFTER COMPLETION. ESTABLISHMENT OF FINAL STABILIZATION MUST BE INITIATED NO LATER THAN 7 DAYS AFTER REACHING FINAL GRADE. FINAL STABILIZATION MEANS THAT ALL SOIL-DISTURBING ACTIVITIES ARE COMPLETED, AND THAT EITHER A PERMANENT VEGETATIVE COVER WITH A DENSITY OF 70% OR GREATER HAS BEEN ESTABLISHED OR THAT THE SURFACE HAS BEEN STABILIZED BY HARD COVER SUCH AS PAVEMENT OR BUILDINGS. IT SHOULD BE NOTED THAT THE 70% REQUIREMENT REFERS TO THE TOTAL AREA VEGETATED AND NOT JUST A PERCENT OF THE SITE.
3. ALL PERMANENT SEDIMENT CONTROL MEASURES CAN BE REMOVED AFTER THE SITE IS PERMANENTLY STABILIZED AND APPROVAL IS RECEIVED FROM THE WVDEP.
4. ANY AREAS DISTURBED BY REMOVAL OF CONTROLS SHALL BE REPAIRED, STABILIZED, AND PERMANENTLY SEEDED.
5. THE AS-BUILT INFORMATION SHOWN HEREON REFLECTS FIELD DATA COLLECTED RELATING TO THE FINAL GRADING OF THE DISTURBED AREA AS OF DECEMBER 19, 2016. THE AS-BUILT INFORMATION SHOWN HEREON REFLECTS FIELD DATA COLLECTED RELATING TO THE SLIDES OF THE WELL PAD AREA AND STOCKPILES AS OF APRIL 27, 2018. NAVITUS ENGINEERING IS NOT RESPONSIBLE FOR ANY CHANGES MADE TO THE SITE AFTER THE ABOVE MENTIONED DATE.
6. THE EXISTING CONTAINMENT BERM AROUND THE WELL PAD SHALL BE REPAIRED AS NECESSARY TO ENSURE 100% CONTAINMENT OF ALL FLUIDS PRIOR TO DRILLING OPERATIONS
7. THE EXISTING EGRESSES TO THE WELL PAD SHALL HAVE THE MOUNTABLE BERMS REPAIRED AS NECESSARY TO ENSURE 100% CONTAINMENT OF ALL FLUIDS PRIOR TO DRILLING OPERATIONS.



NASH WELL PAD
AS-BUILT AND EROSION & SEDIMENT
CONTROL IMPROVEMENT PLAN

WEST UNION & GRANT DISTRICTS, DODDRIDGE COUNTY, WEST VIRGINIA
FLINT RUN & NUTTER FORK - MIDDLE ISLAND CREEK WATERSHEDS

USGS 7.5 SMITHBURG QUAD MAP



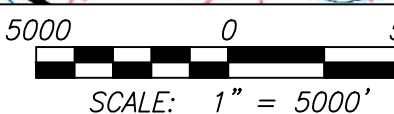
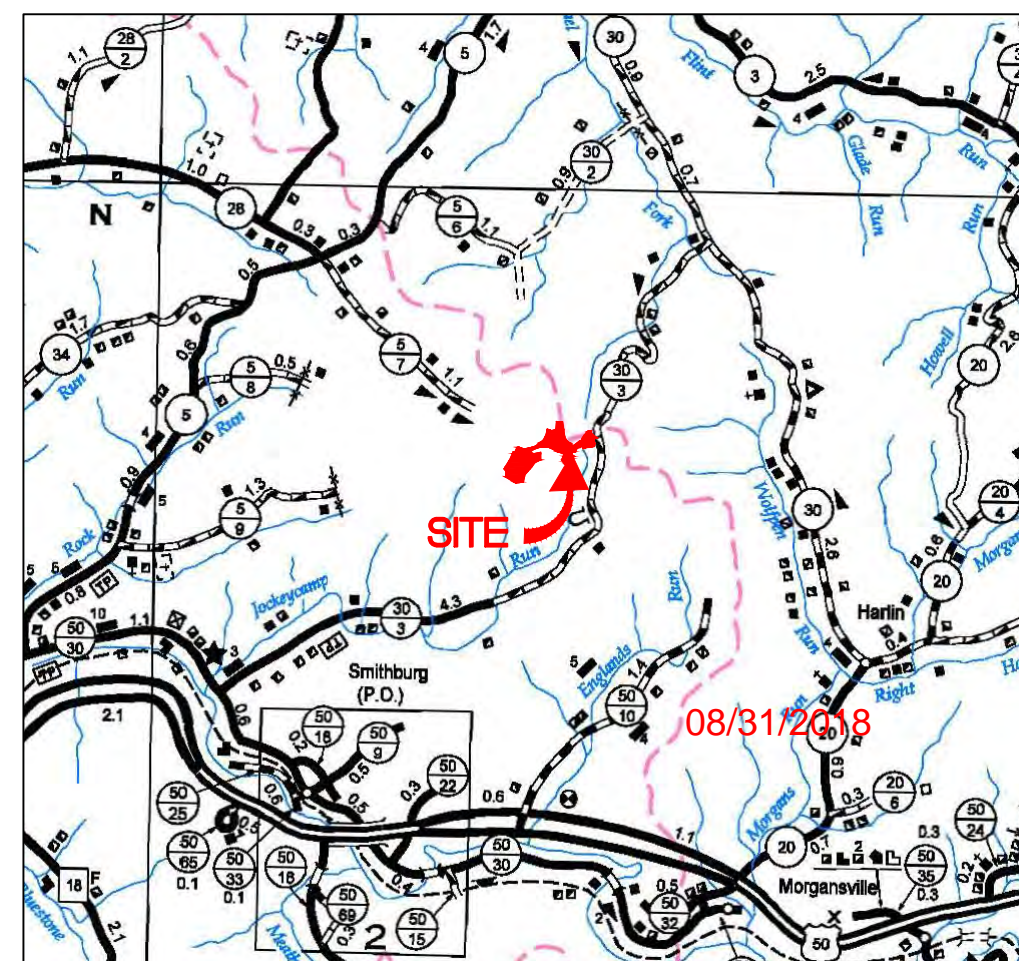
WEST VIRGINIA STATE PLANE COORDINATE SYSTEM
NORTH ZONE, NAD83
ELEVATION BASED ON NAVD83
ESTABLISHED BY SURVEY GRADE GPS & OPUS
POST-PROCESSING

WEST VIRGINIA COUNTY MAP



(NOT TO SCALE)

WVDOH COUNTY ROAD MAP



NASH WETLAND IMPACT (SQUARE FEET) table with columns: Wetland and Impact Cause, Fill (SF), Total Impact (SF), Total Impact (AC)

NASH EPHEMERAL STREAM IMPACT (LINEAR FEET) table with columns: Stream and Impact Cause, Culvert / Fill (LF), Inlets/Outlets Structures (LF), Cofferdam/ E&S Controls (LF), Temp. Disturb. Distance to L.O.D. (LF), Total Disturbance (LF)

SHEET INDEX:

- 1 - COVER SHEET
2 - LEGEND
3 - OVERALL PLAN SHEET INDEX
4 - ACCESS ROAD AS-BUILT PLAN
5 - ACCESS ROAD & WELL PAD AS-BUILT PLAN
6 - STOCKPILE AS-BUILT PLAN
7 - ACCESS ROAD PROFILES
8 - SLIDE REPAIR SECTIONS
9 - WELL PAD AS-BUILT SECTIONS
10-16 - CONSTRUCTION DETAILS

NASH LIMITS OF DISTURBANCE AREA (AC) table with columns: Total Site, Permitted, Modification, Total. Includes sub-tables for impacts to Douglas R. & Susan A. Miller TM 9-3, 9-1, 8-39, 8-12 and Dwight E. & Tina M. Moore TM 9-2.

Table listing well names (e.g., Heflin Unit 1H, McConnell Unit 1H) with coordinates and elevations.

Table listing well names (e.g., Heflin Unit 1H, McConnell Unit 1H) with coordinates and elevations, similar to the previous table but with different data points.

REPRODUCTION NOTE

THESE PLANS WERE CREATED TO BE PLOTTED ON 22"x34" (ANSI D) PAPER. HALF SCALE DRAWINGS ARE ON 11"x17" (ANSI B) PAPER.

THESE PLANS WERE CREATED FOR COLOR PLOTTING AND ANY REPRODUCTIONS IN GRAY SCALE OR COLOR MAY RESULT IN A LOSS OF INFORMATION AND SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

MISS Utility of West Virginia
1-800-245-4848
West Virginia State Law (Section XIV: Chapter 24-C)
Requires that you call two business days before you dig in the state of West Virginia.
IT'S THE LAW!!

AS-BUILT CERTIFICATION:
THE DRAWINGS, CONSTRUCTION NOTES, AND REFERENCE DIAGRAMS ATTACHED HERETO HAVE BEEN PREPARED IN ACCORDANCE WITH THE WEST VIRGINIA CODE OF STATE RULES, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS CRS 35-8. THE WELL PAD AND ACCESS ROAD WERE CONSTRUCTED IN NEAR CONFORMITY TO THE CONSTRUCTION PLANS.

NAVITUS ENERGY ENGINEERING logo and contact information (Telephone: (866) 662-4185 | www.NavitusEng.com). Includes revision table, project title (NASH WELL PAD WEST UNION & GRANT DISTRICTS, DODDRIDGE COUNTY, WEST VIRGINIA), date (06/22/2018), scale (AS SHOWN), and sheet number (SHEET 1 OF 16).

LEGEND

APPROVED
WVDEP OOG
Modification
WJS 8/30/2018

LEGEND			
EX. INDEX CONTOUR & CONTOUR LABEL		PR. INDEX CONTOUR (10' INTERVAL) & CONTOUR LABEL	
EX. INTERMEDIATE CONTOUR		PR. INTERMEDIATE CONTOUR (2' INTERVAL)	
EX. PROPERTY LINE		PR. INTERMEDIATE CONTOUR (1' INTERVAL)	
EX. TOP OF BERM		PR. INDEX ROAD CONTOUR (10' INTERVAL) & CONTOUR LABEL	
EX. ROAD EDGE OF GRAVEL/DIRT		PR. INTERMEDIATE ROAD CONTOUR (2' INTERVAL)	
EX. ROAD EDGE OF PAVEMENT		PR. PADS/STOCKPILE TOPO LIMITS	
EX. ROAD CENTERLINE		PERMITTED LIMITS OF DISTURBANCE	
EX. GUARDRAIL		MODIFICATION LIMITS OF DISTURBANCE	
EX. BRIDGE		PR. ROAD/IMPOUNDMENT EDGE OF GRAVEL	
EX. DITCHLINE/DRAINAGE FEATURE		PR. ROAD CENTERLINE	
EX. RIP-RAP		PR. GUARDRAIL	
EX. CULVERT		PR. ROCK CONSTRUCTION ENTRANCE	
EX. TREELINE		PR. AIR BRIDGE	
EX. BUILDING		PR. CULVERT	
EX. MISCELLANEOUS FEATURE		PR. DITCH	
EX. 100 YR FEMA FLOODPLAIN		PR. RIP-RAP TRAPEZOIDAL DITCH	
EX. DELINEATED STREAM		PR. OUTLET PROTECTION	
EX. DELINEATED WETLAND/POND		PR. DIVERSION	
100' WETLAND/STREAM BUFFER		PR. ROCK LEVEL SPREADER	
STREAM/WETLAND DELINEATION STUDY AREA		PR. COMPOST FILTER SOCK	
EX. FENCELINE		PR. SUPER SILT FENCE	
EX. GATE		PR. WELL HEAD	
EX. PERIMETER SAFETY FENCE		PR. PAD DEWATERING SYSTEM	
EX. ACCESS GATE WITH EMERGENCY LIFELINE		PR. TOP OF PAD CONTAINMENT BERM	
EX. WELL HEAD ON DESIGNED PAD		PR. 220' X 320' PAD FOOTPRINT	
EX. GAS WELL		PR. SPOT SHOT	
EX. PIPELINE		PR. PERIMETER SAFETY FENCE	
EX. PIPELINE R/W		PR. ACCESS GATE WITH EMERGENCY LIFELINE	
EX. PIPELINE METER		PR. PIPELINE	
EX. PIPELINE VALVE		PR. PIPELINE R/W	
EX. PIT		PR. OVERHEAD UTILITY	
EX. OVERHEAD UTILITY		PR. POWER POLE/GUY WIRE	
EX. POWER POLE/GUY WIRE		PR. OVERHEAD UTILITY R/W	
EX. UNDERGROUND ELECTRIC		PR. WATERLINE	
EX. UNDERGROUND TELEPHONE		BORING LOCATION	
EX. UNDERGROUND FIBER OPTIC		X-SECTION/PROFILE GRID INDEX	
EX. UTILITY R/W		X-SECTION/PROFILE GRID INTERMEDIATE	
EX. WATERLINE		X-SECTION/PROFILE PROPOSED GRADE	
EX. WATER WELL/EX. SPRING		X-SECTION/PROFILE EXISTING GRADE	
EX. COMPOST SOCK		X-SECTION/PROFILE WATER SURFACE	
EX. SUPER SILT FENCE		X-SECTION/PROFILE CULVERT	
EX. SILT FENCE		MATCHLINE	
APPROX. LOCATION OF SLIDE AREA		EX. METER	
APPROX. LOCATION OF BORROW/ SPOIL AREA		EX. TANK	
PR. TOE BENCH		EX. COMBUSTOR	
EX. APPROX. SURFACE & SUB-SURFACE ELECTRIC LINE AREA		EX. GPU	
EX. APPROX. SURFACE & SUB-SURFACE DUMP LINE AREA		EX. SEPARATOR	
EX. APPROX. SURFACE & SUB-SURFACE WELL LINE AREA		EX. VRT	
EX. APPROX. SURFACE & SUB-SURFACE SALES LINE AREA		EX. KNOCK-OUT VESSEL	
		EX. STAIRS/CATWALK	
		EX. DEWATERING SYSTEM	
		EX. PIG LAUNCHER	
		EX. SECONDARY CONTAINMENT	
		EX. ABOVE-GND VAPOR LINE	
		EX. ESD	
		EX. MAILBOX	
		EX. CONTROL PT.	
		EX. MUSTER AREA	

NAVITUS
ENERGY ENGINEERING
Telephone: (868) 662-4165 | www.NavitusEng.com

DATE	REVISION
05/26/2016	REVISED PER LOD COMMENTS
12/21/2016	REVISED PER SLIDE REPAIR
03/16/2017	REVISED PER SLIDE AREAS #1, #2, & #3
05/03/2017	REVISED LOD MODIFICATION
06/14/2017	REVISED PER LANDOWNER CHANGE
07/27/2017	REVISED PER SITE VISIT
06/22/2018	REVISED PER SLIDE AREAS #9, #11, & #12

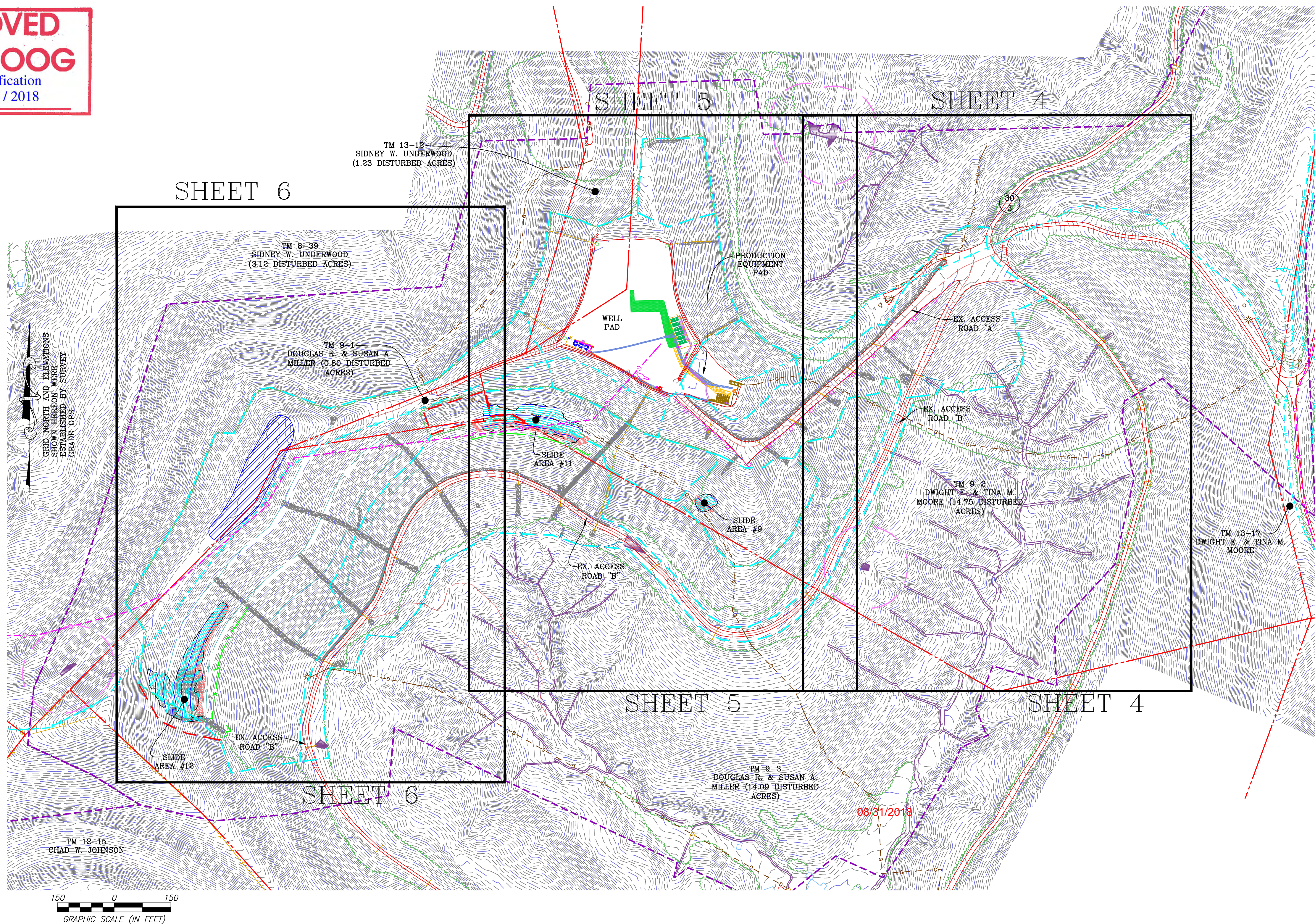
Antero Resources
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

LEGEND
NASH
WELL PAD
WEST UNION & GRANT DISTRICTS
DODDRIDGE COUNTY, WEST VIRGINIA



OVERALL PLAN SHEET INDEX

APPROVED
WVDEP OOG
 Modification
 8/30/2018



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OVERALL PLAN SHEET INDEX
NASH
 WELL PAD
 WEST UNION & GRANT DISTRICTS
 DODDRIDGE COUNTY, WEST VIRGINIA

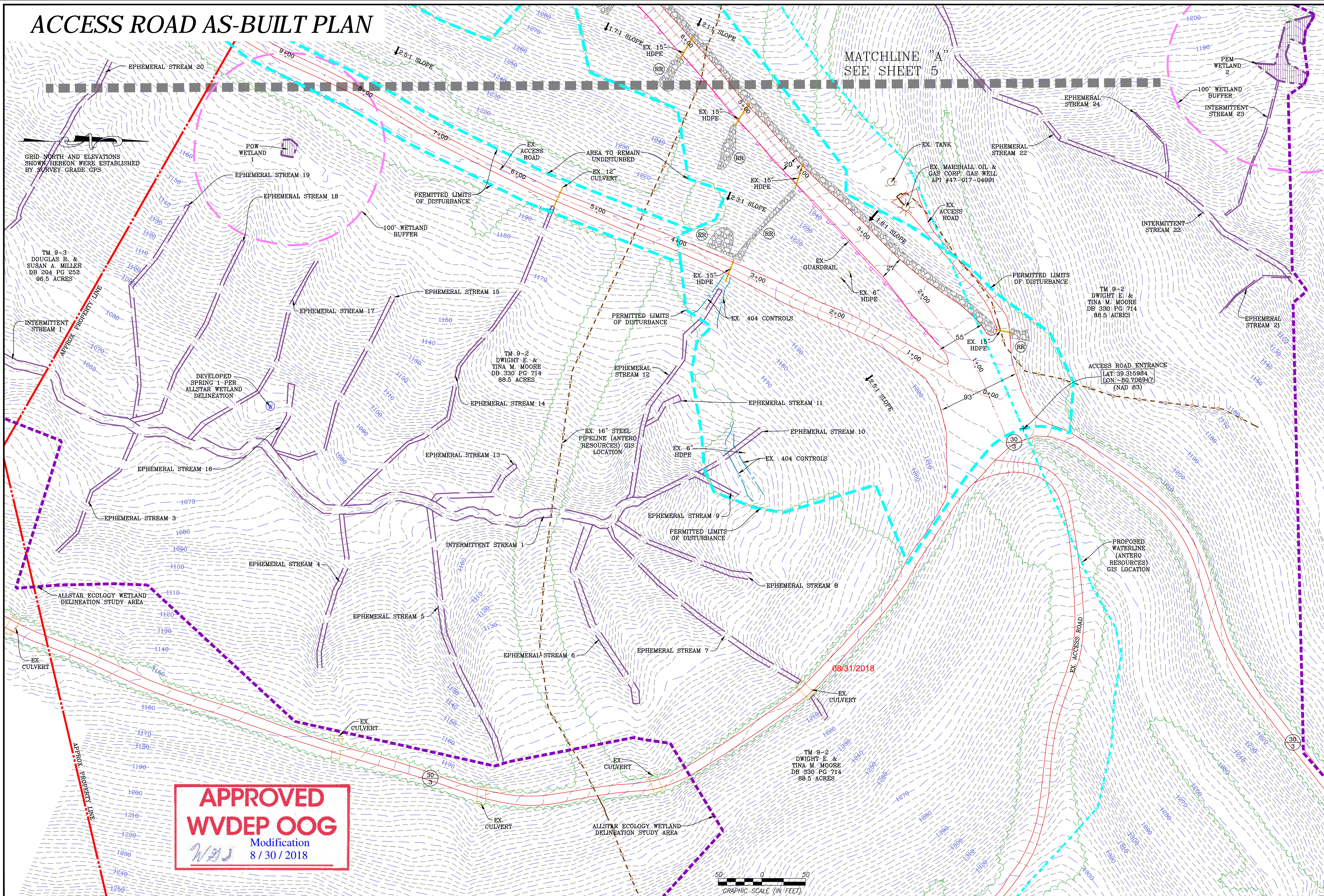


DATE: 02/22/2016
 SCALE: 1" = 150'
 SHEET 3 OF 16

GENERAL NOTES:

- THE PRE-CONSTRUCTION TOPOGRAPHIC INFORMATION SHOWN HEREON IS BASED ON MARCH 22, 2012 AERIAL PHOTOGRAPHY COMPILED FEBRUARY, 2013 BY BLUE MOUNTAIN AERIAL MAPPING, BURTON, WEST VIRGINIA.
- AS-BUILT INFORMATION SHOWN HEREON IS BASED ON FIELD SURVEY PERFORMED BY NAVITUS ENGINEERING, INC. BETWEEN MAY 15, 2015 & APRIL 27, 2018.
- THE PROPERTY LINES SHOWN HEREON DO NOT REPRESENT A BOUNDARY SURVEY ON ANY OF THE PARCELS SHOWN. PROPERTY CORNERS AND LINES PERTINENT TO WELL LOCATION ARE BASED ON A FIELD SURVEY. THE REMAINDER OF THE PROPERTY LINES ARE BASED ON COUNTY REAL ESTATE TAX MAPS, GIS INFORMATION AND DEEDS OF RECORD.
- UTILITIES AND THEIR LOCATIONS AS SHOWN HEREON ARE BASED ON: A) OBSERVABLE EVIDENCE OF THOSE VISIBLE, ABOVE-GROUND FACILITIES, FEATURES, AND MARKERS WHICH WERE FOUND ON THE SUBJECT PROPERTY AT THE TIME OF SURVEY PERFORMED BY NAVITUS ENGINEERING AND B) FIELD MARKINGS PLACED BY UTILITY COMPANIES IN RESPONSE TO THE WV 811 TICKET SUBMITTED BY NAVITUS ENGINEERING. NAVITUS ENGINEERING CANNOT GUARANTEE THE ACCURACY OF THE UTILITY MARKINGS PERFORMED BY OTHERS OR THAT ALL UTILITIES EXISTING WITHIN THE LIMITS OF THIS PLAN ARE SHOWN. ANY UTILITIES ENCOUNTERED SUBSEQUENT TO PLAN APPROVAL OR DURING CONSTRUCTION THAT ARE NOT SHOWN ON THE PLAN SHOULD BE REPORTED TO NAVITUS ENGINEERING AND ANTERO RESOURCES CORPORATION.

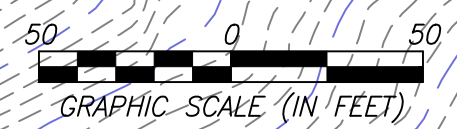
ACCESS ROAD AS-BUILT PLAN



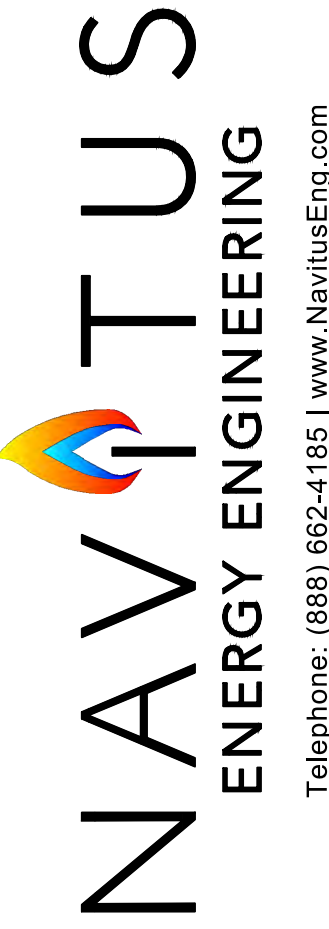
GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS

TM 9-3 DOUGLAS R. & SUSAN A. MILLER DB 204 PG 252 96.5 ACRES

APPROVED WVDEP OOG
 Modification
 8/30/2018
WJS




MATCHLINE "A" SEE SHEET 5




Telephone: (866) 662-4165 | www.NavitusEng.com

DATE	REVISION
05/28/2016	REVISED PER LOD COMMENTS
12/21/2016	REVISED PER SLIDE REPAIR
03/16/2017	REVISED PER SLIDE AREAS #1, #2, & #3
05/03/2017	REVISED LOD MODIFICATION
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 ANTERO RESOURCES CORPORATION

NASH
 WELL PAD
 WEST UNION & GRANT DISTRICTS
 DODDRIDGE COUNTY, WEST VIRGINIA



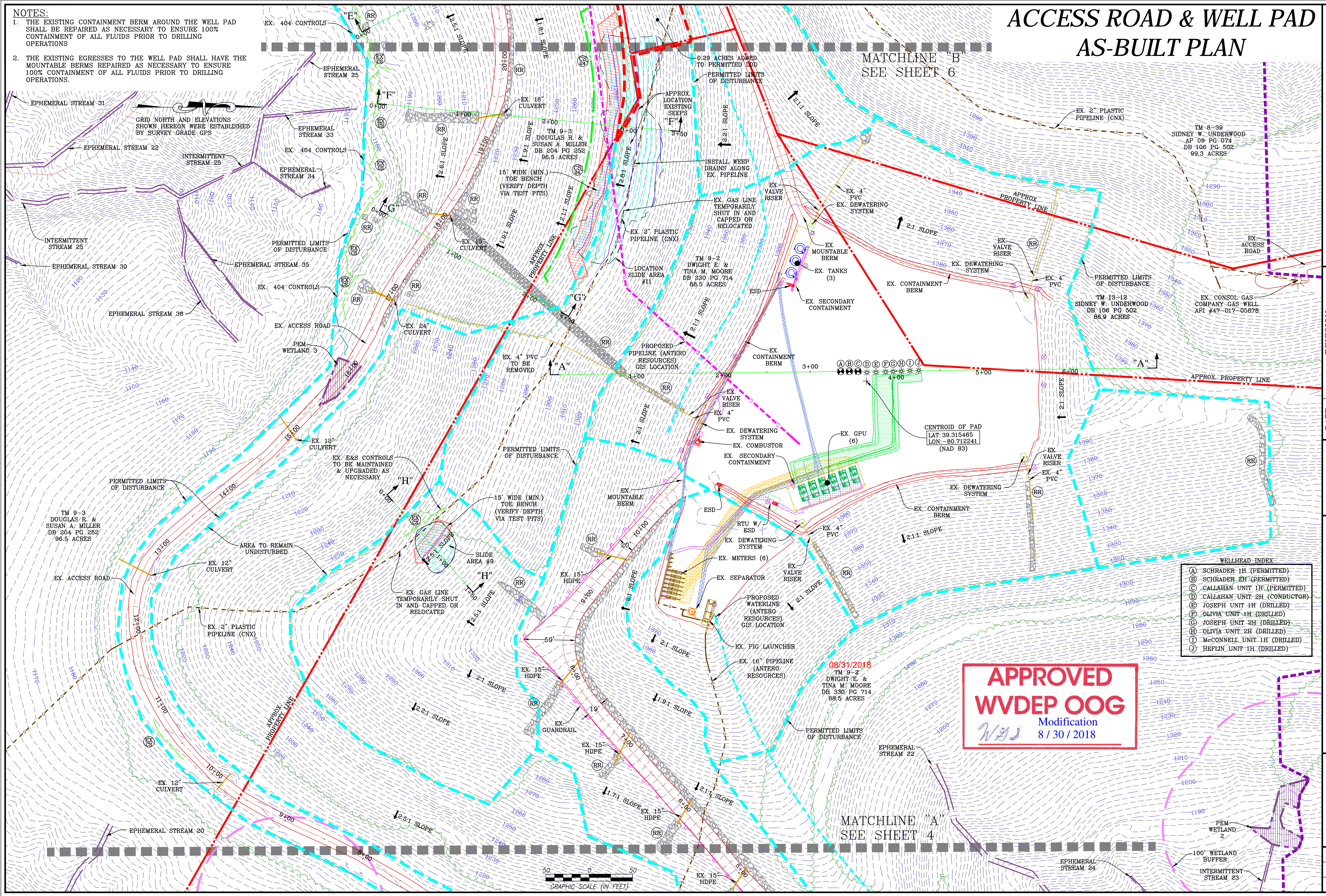
06/22/2018

DATE: 02/22/2016
 SCALE: 1" = 50'
 SHEET 4 OF 16

NOTES:
 1. THE EXISTING CONTAINMENT BERM AROUND THE WELL PAD SHALL BE REPAIRED AS NECESSARY TO ENSURE 100% CONTAINMENT OF ALL FLUIDS PRIOR TO DRILLING OPERATIONS
 2. THE EXISTING EGRESSSES TO THE WELL PAD SHALL HAVE THE MOUNTABLE BERMS REPAIRED AS NECESSARY TO ENSURE 100% CONTAINMENT OF ALL FLUIDS PRIOR TO DRILLING OPERATIONS.

ACCESS ROAD & WELL PAD AS-BUILT PLAN

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ENERGY ENGINEERING
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Antero Resources
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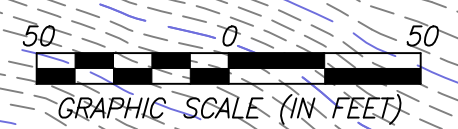
WELLHEAD INDEX

(A)	SCHRADER 1H (PERMITTED)
(B)	SCHRADER 2H (PERMITTED)
(C)	CALLAHAN UNIT 1H (PERMITTED)
(D)	CALLAHAN UNIT 2H (CONDUCTOR)
(E)	JOSEPH UNIT 1H (DRILLED)
(F)	OLVIA UNIT 1H (DRILLED)
(G)	JOSEPH UNIT 2H (DRILLED)
(H)	OLVIA UNIT 2H (DRILLED)
(I)	McCONNELL UNIT 1H (DRILLED)
(J)	HEFLIN UNIT 1H (DRILLED)

NASH
WELL PAD
WEST UNION & GRANT DISTRICTS
DODDRIDGE COUNTY, WEST VIRGINIA



DATE: 02/22/2016
 SCALE: 1" = 50'
 SHEET 5 OF 16

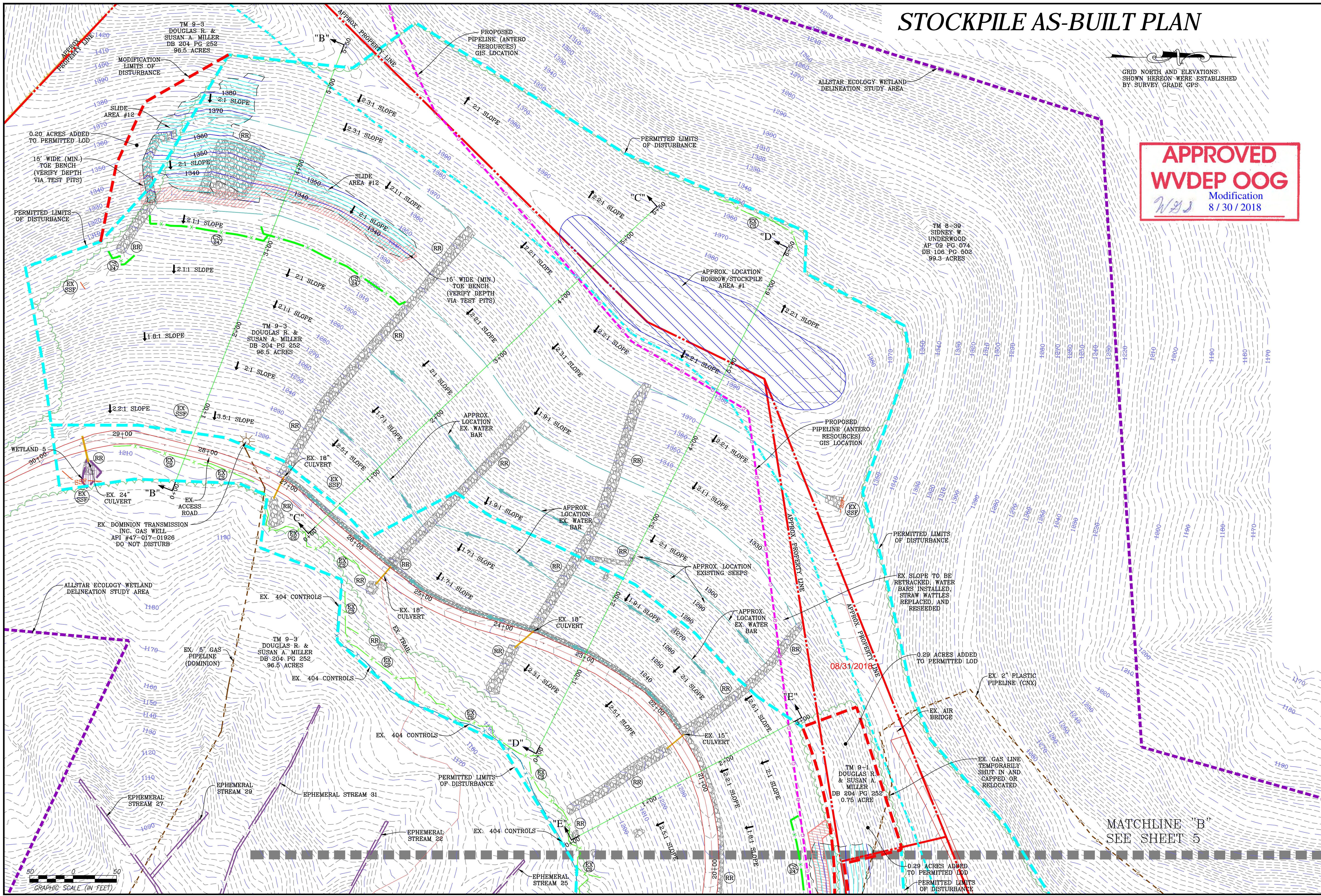


STOCKPILE AS-BUILT PLAN

GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS.

APPROVED
WVDEP OOG
Modification
8/30/2018

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ENERGY ENGINEERING
Telephone: (866) 662-4165 | www.NavitusEng.com



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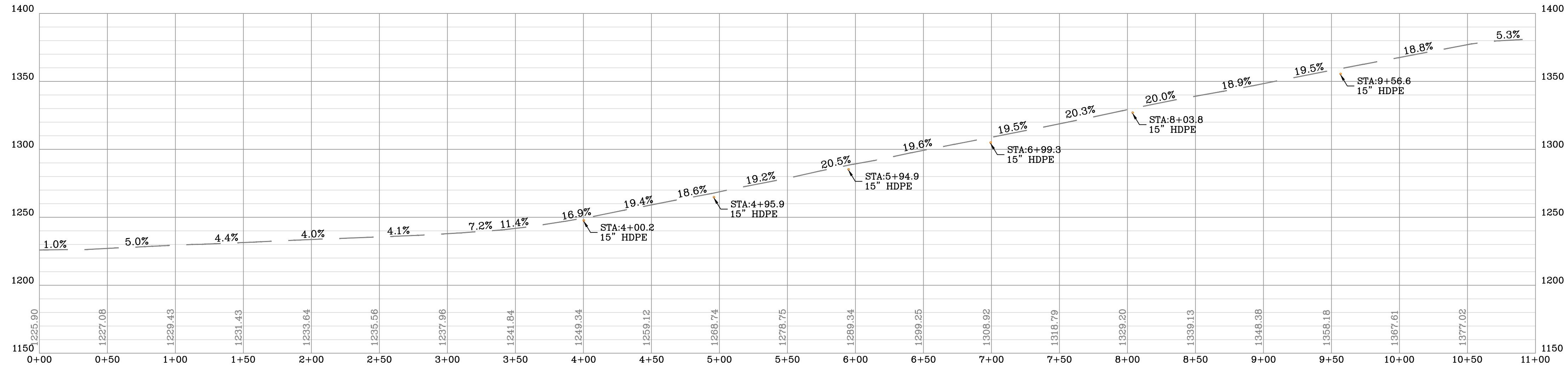
Antero
Resources
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STOCKPILE AS-BUILT PLAN
NASH
WELL PAD
WEST UNION & GRANT DISTRICTS
DODDRIDGE COUNTY, WEST VIRGINIA



DATE: 02/22/2016
SCALE: 1" = 50'
SHEET 6 OF 16

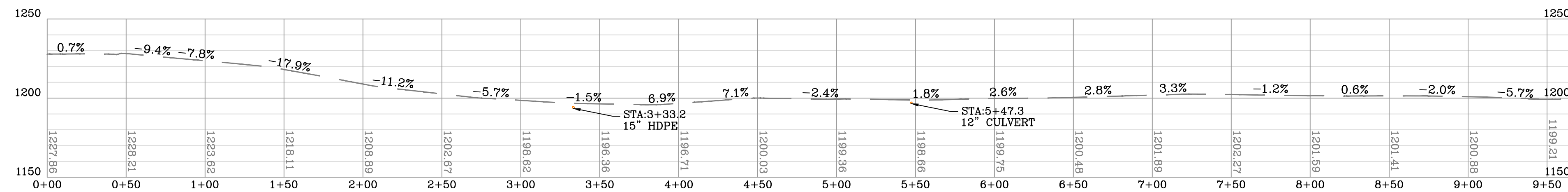
ACCESS ROAD PROFILES



ACCESS ROAD "A" AS-BUILT PROFILE

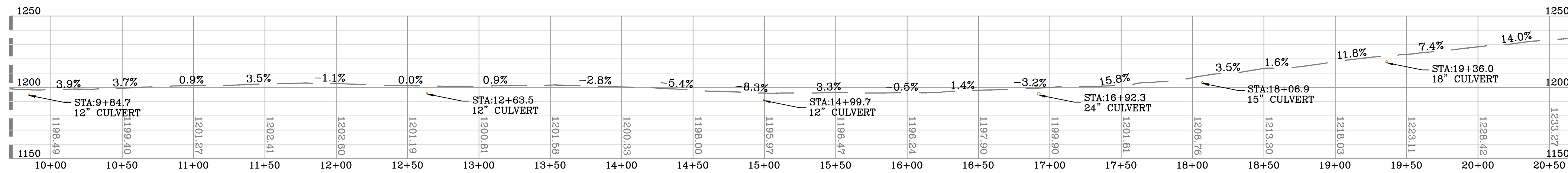
SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

APPROVED
WVDEP OOG
Modification
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WJS



ACCESS ROAD "B" AS-BUILT PROFILE

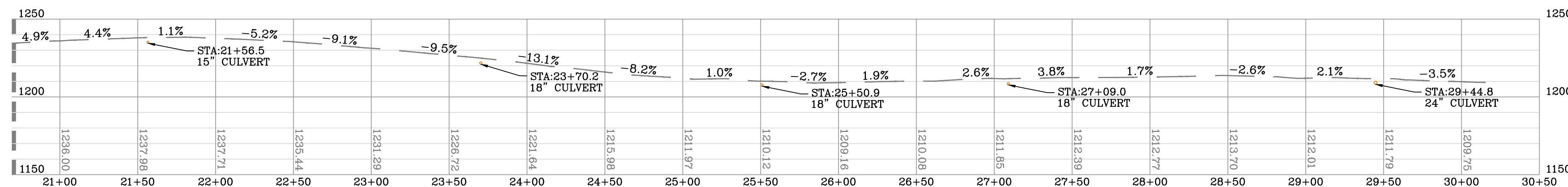
SCALE: HORIZ. 1" = 50' VERT. 1" = 50'



ACCESS ROAD "B" AS-BUILT PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

08/31/2018



ACCESS ROAD "B" AS-BUILT PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

DATE	REVISION
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06/22/2018	REVISED PER SLIDE AREAS #9, #11, & #12



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CORPORATION

ACCESS ROAD PROFILES

NASH
WELL PAD

WEST UNION & GRANT DISTRICTS
DODDRIDGE COUNTY, WEST VIRGINIA



06/22/2018

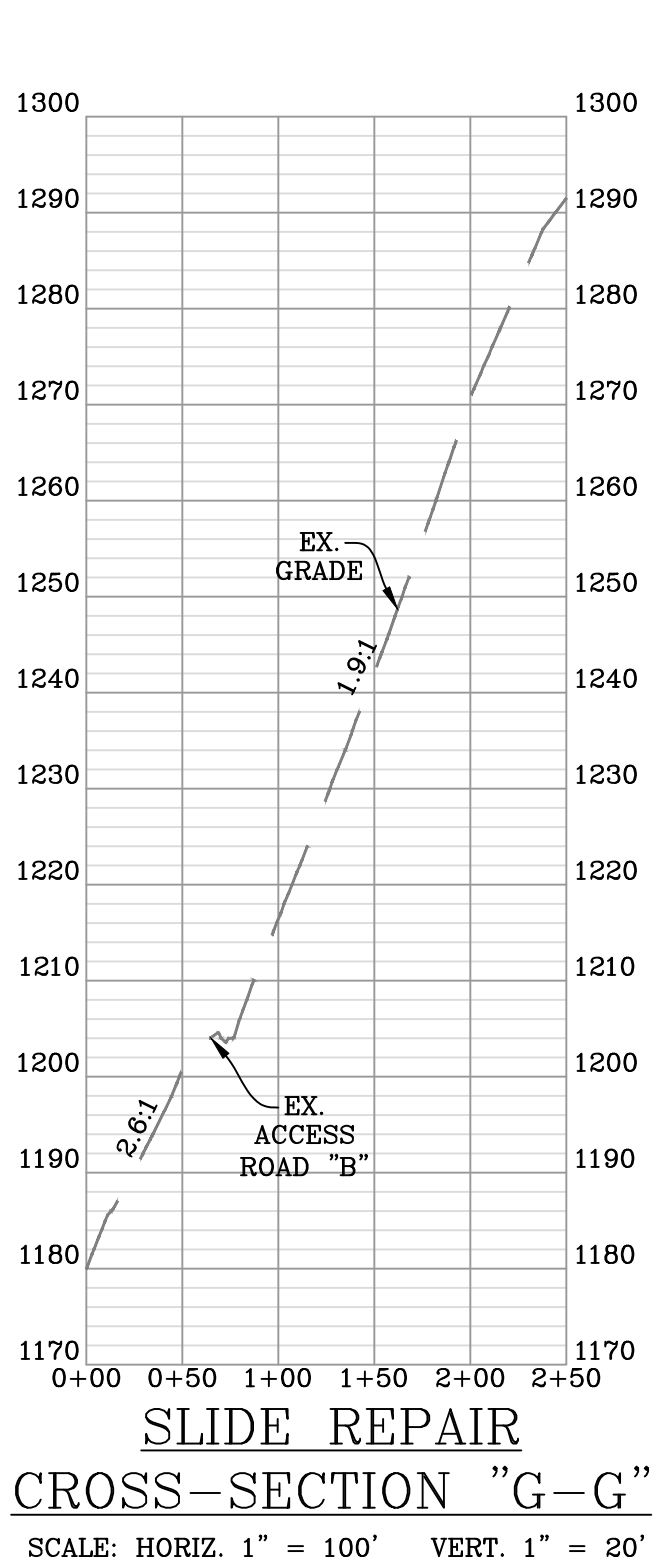
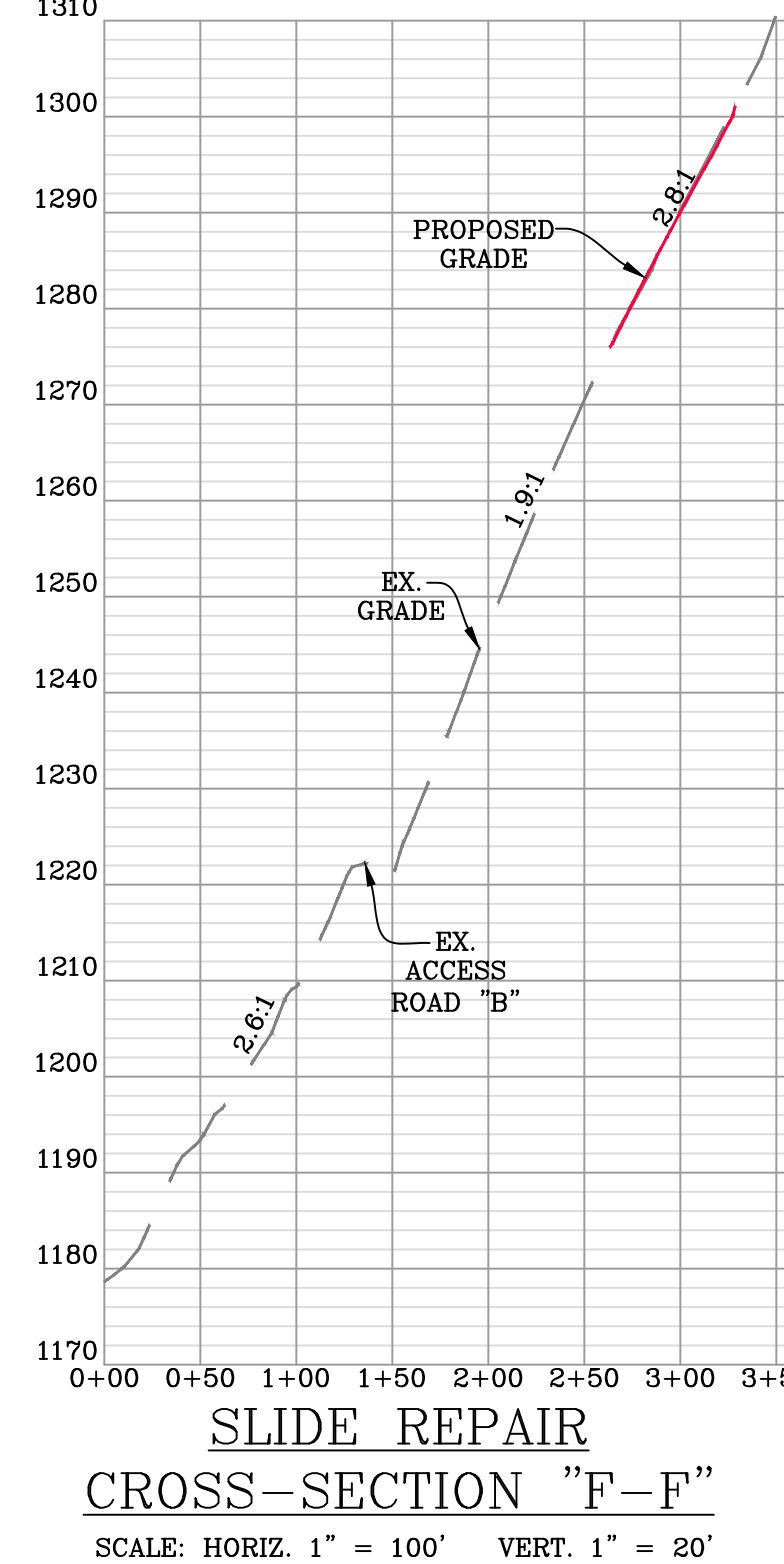
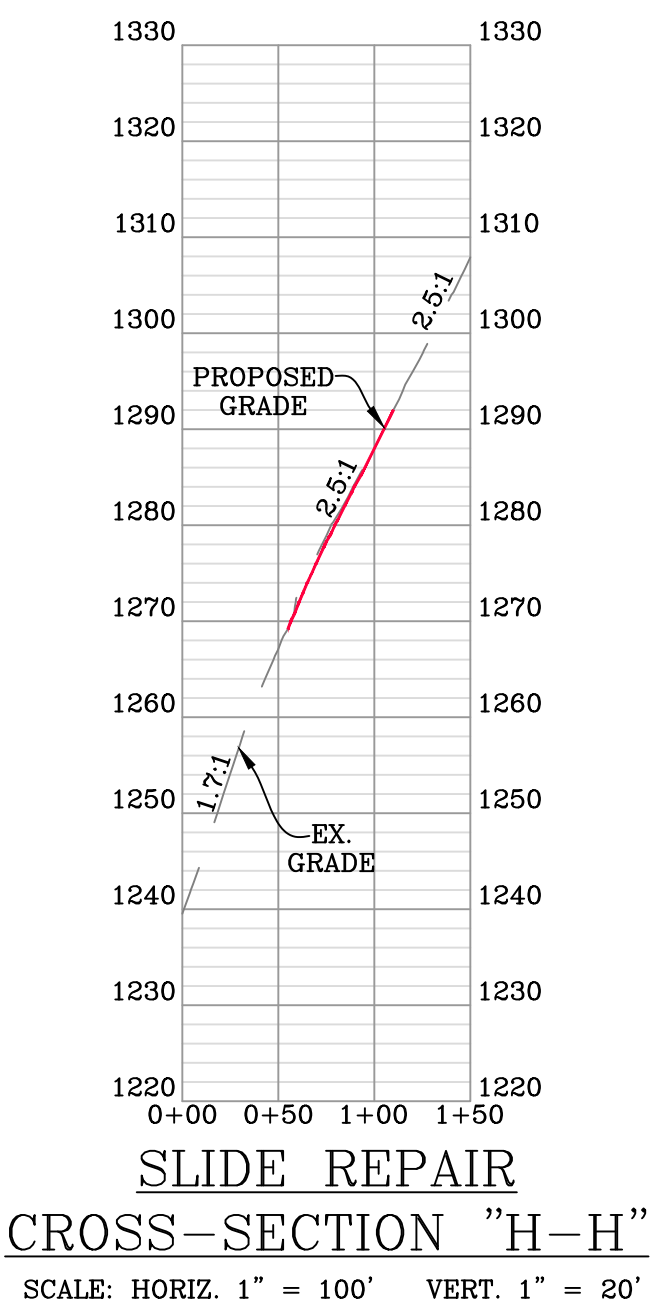
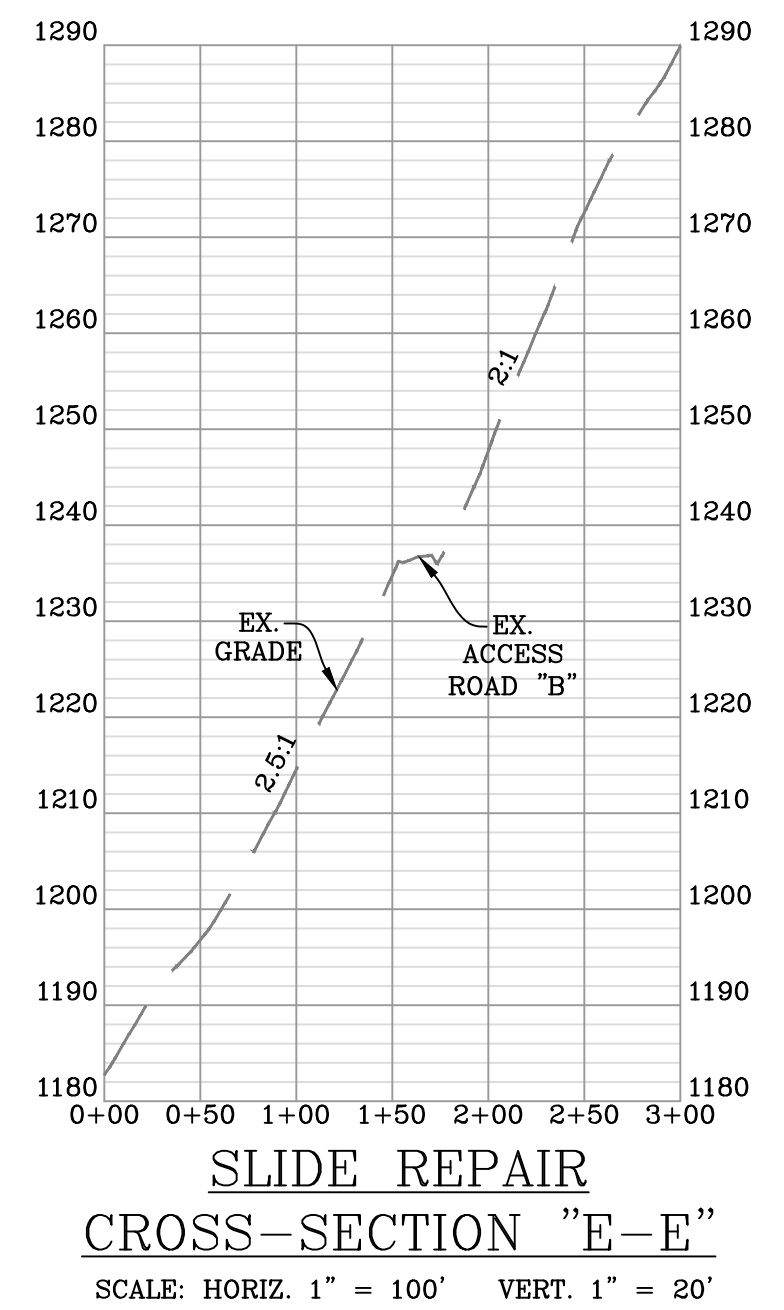
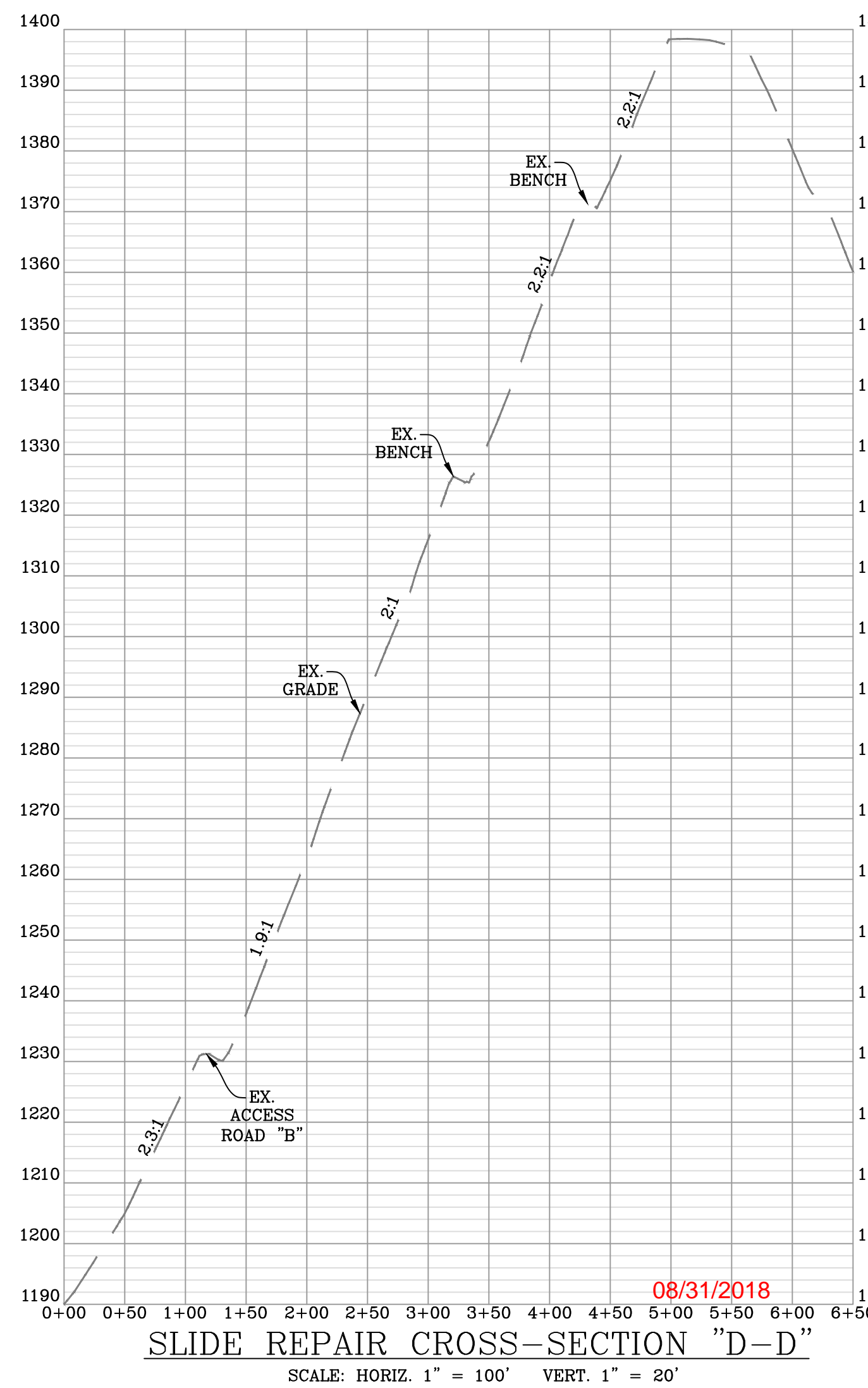
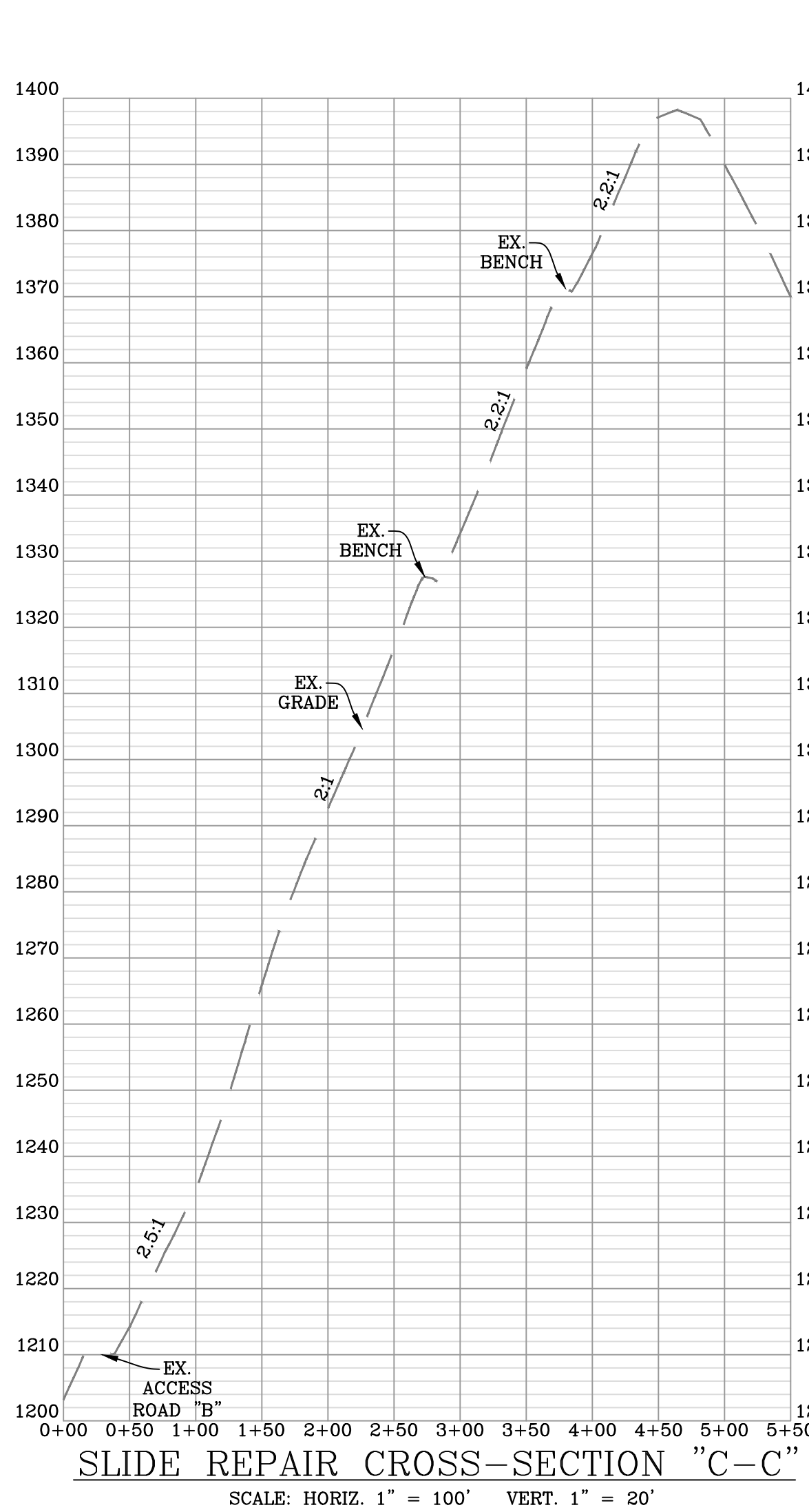
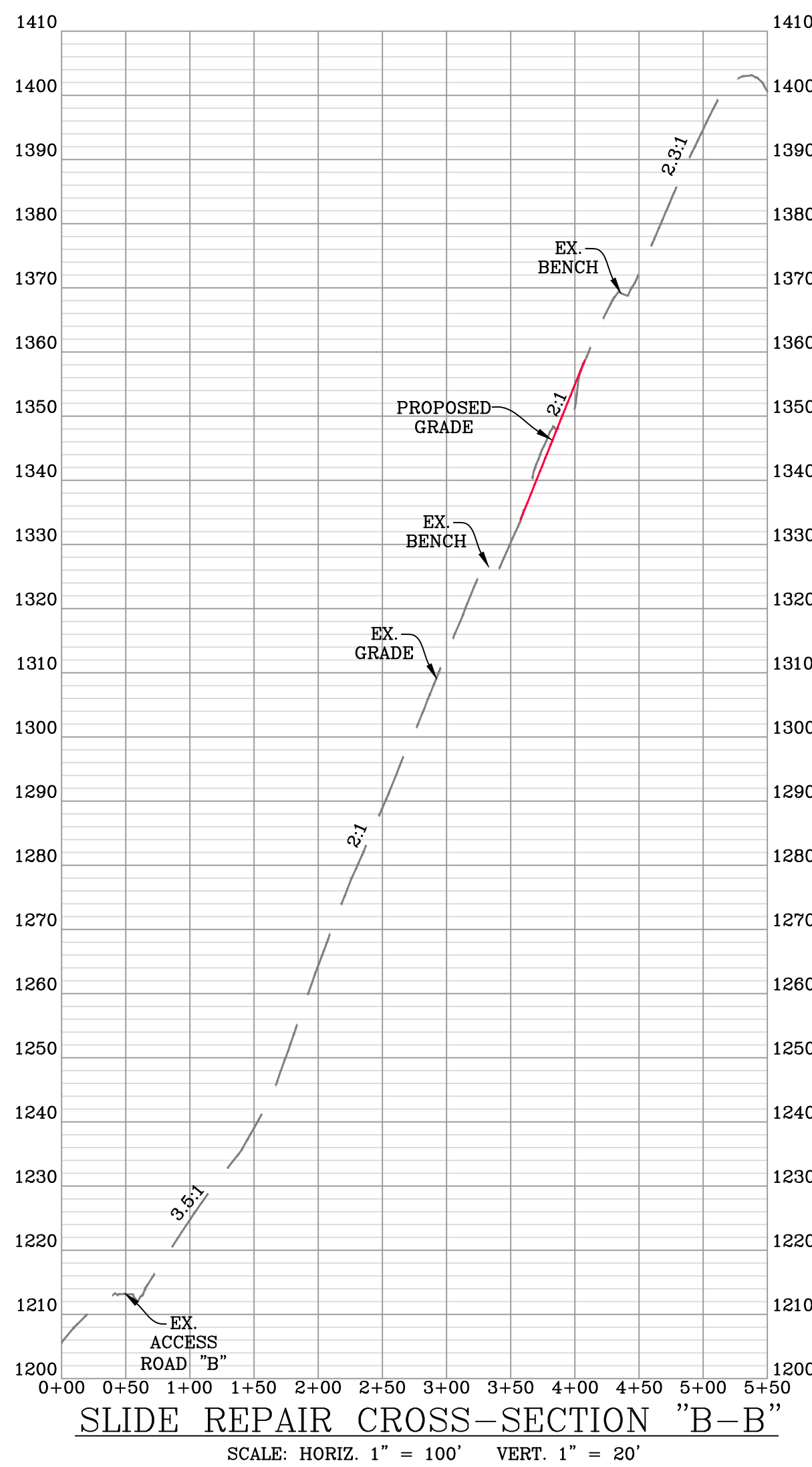
DATE: 02/22/2016

SCALE: AS SHOWN


SHEET 7 OF 16

SLIDE REPAIR SECTIONS

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WJS Modification
 8/30/2018



DATE	REVISION
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SLIDE REPAIR SECTIONS
NASH
WELL PAD
 WEST UNION & GRANT DISTRICTS
 DODDRIDGE COUNTY, WEST VIRGINIA

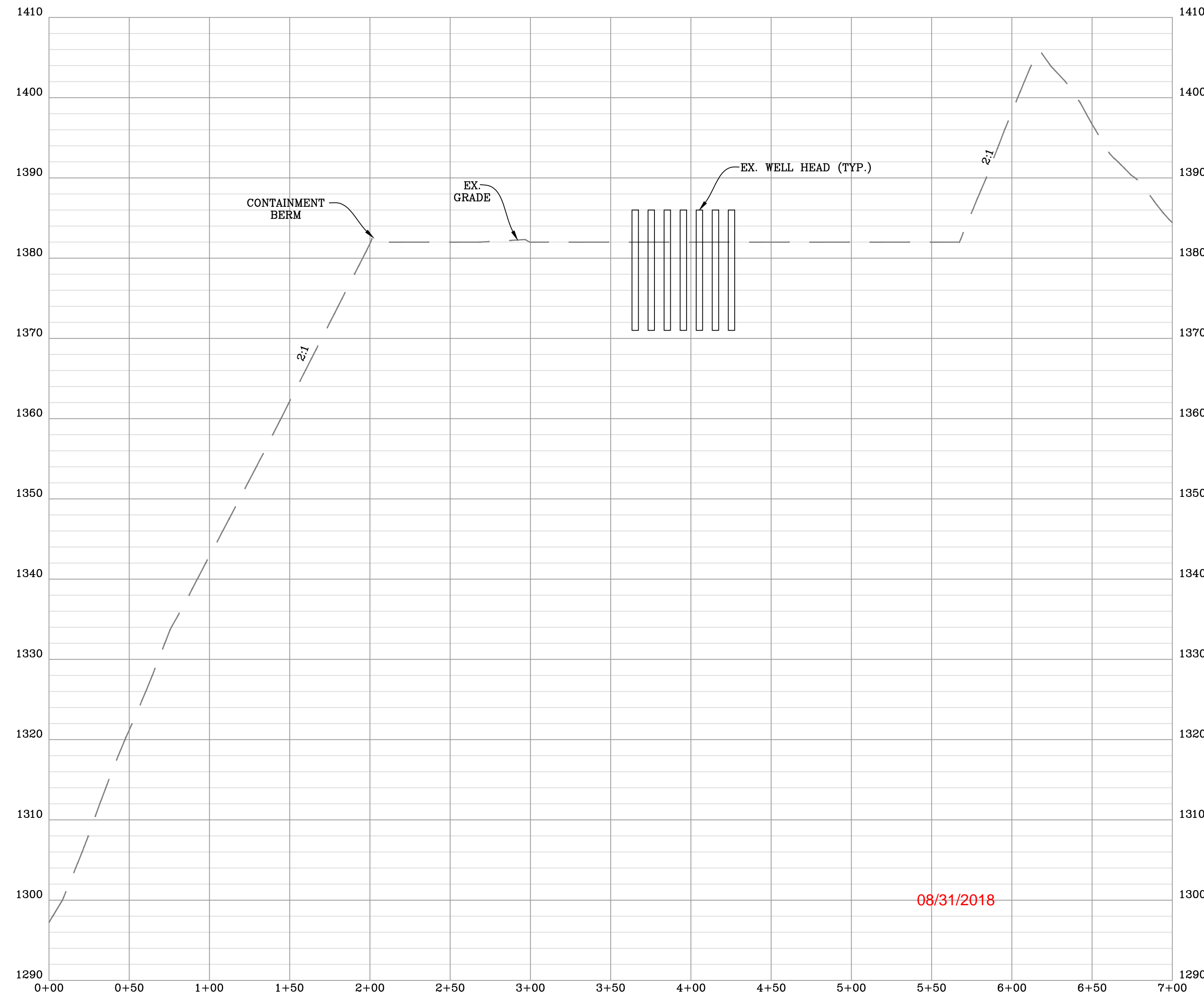


WELL PAD AS-BUILT SECTIONS

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Modification
8/30/2018

WJS



WELL PAD CROSS-SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

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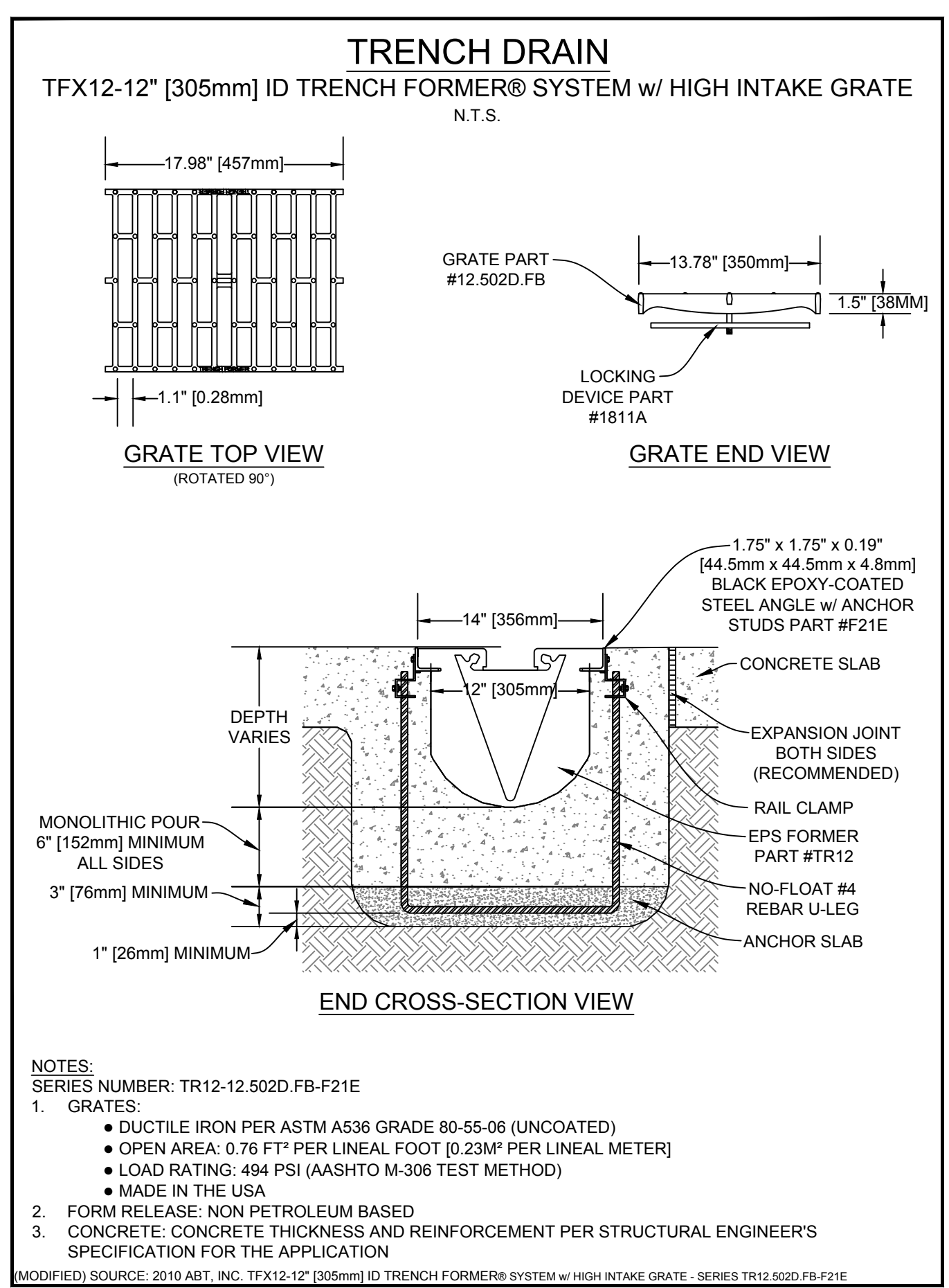
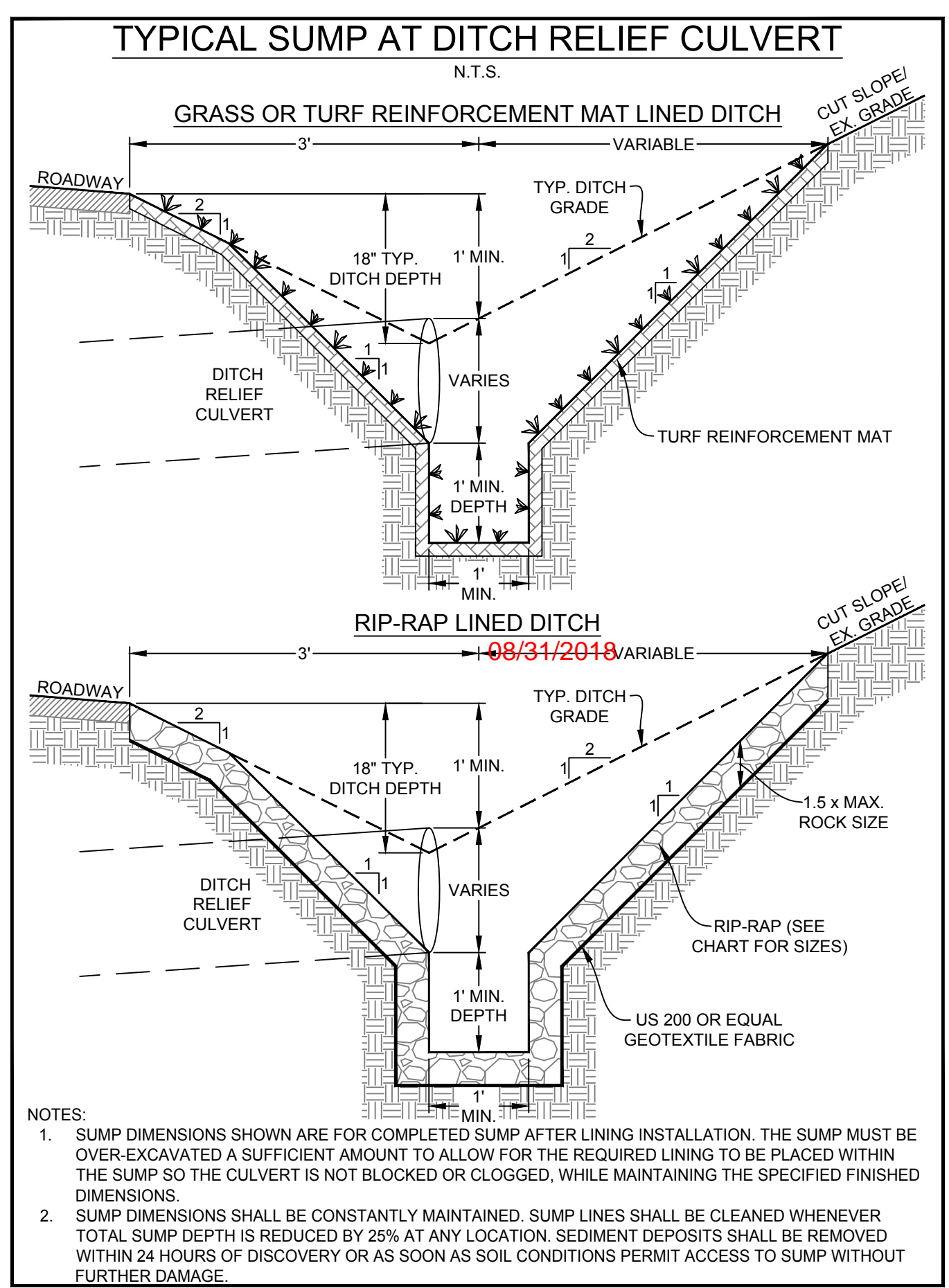
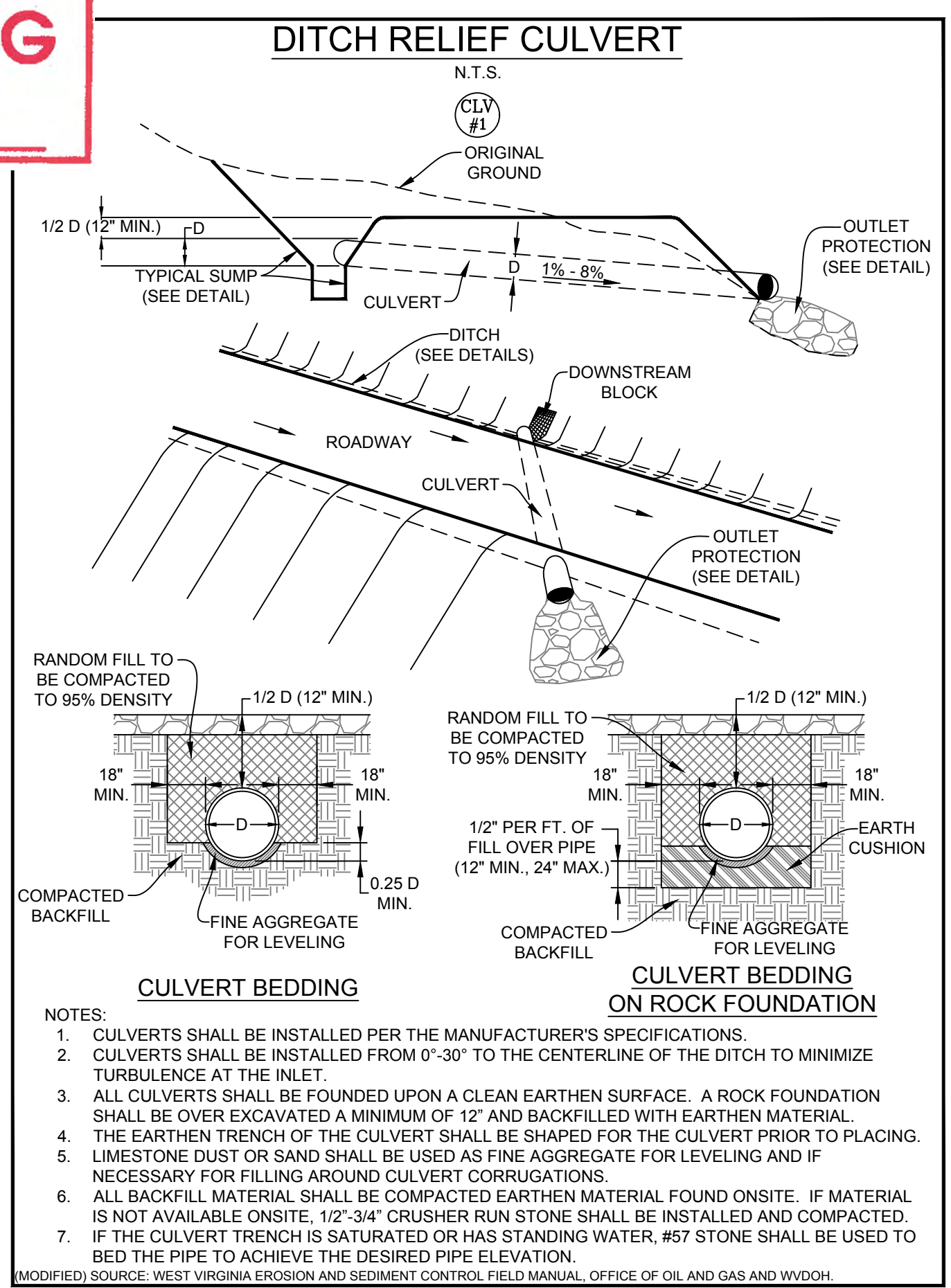
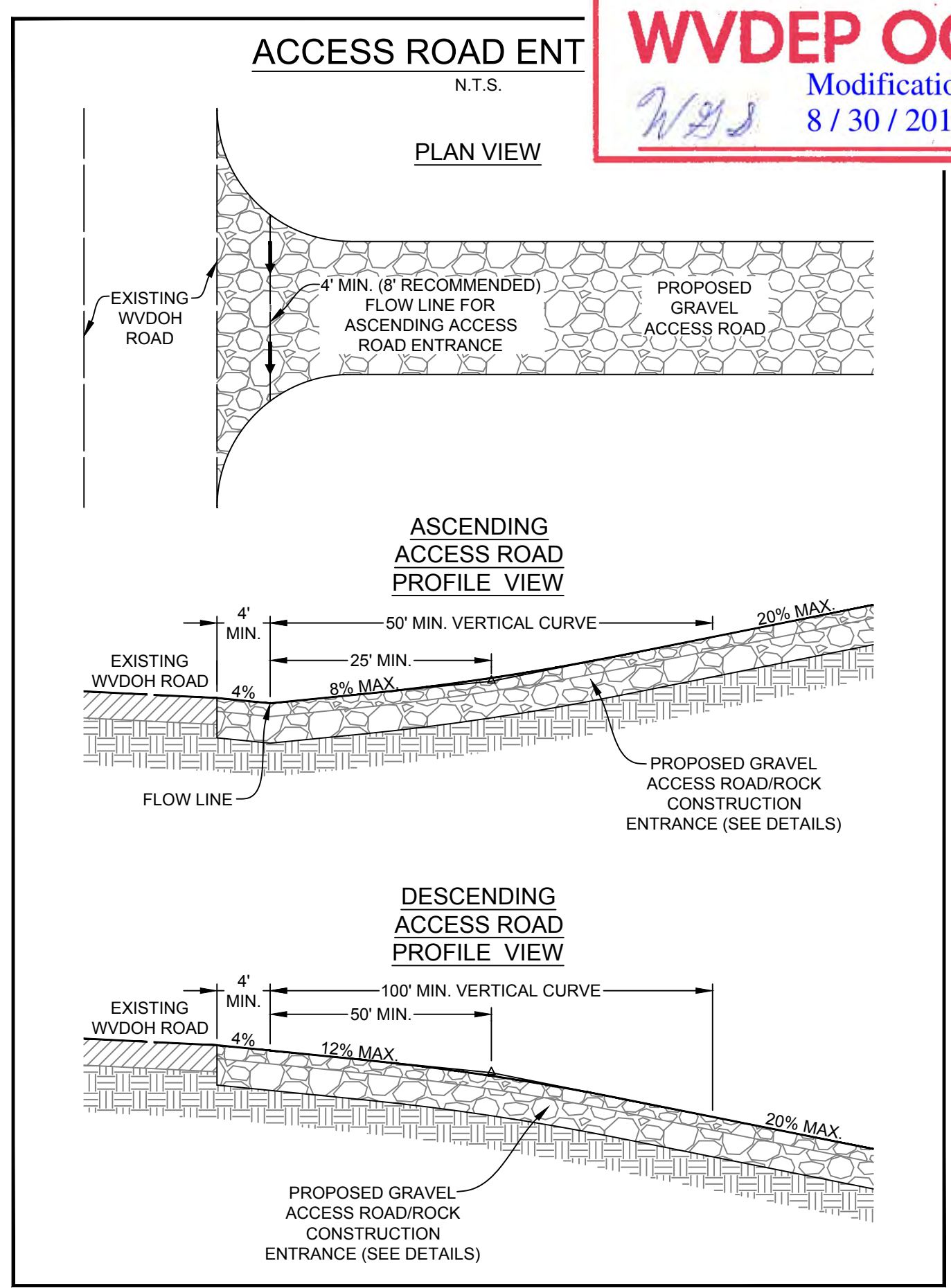
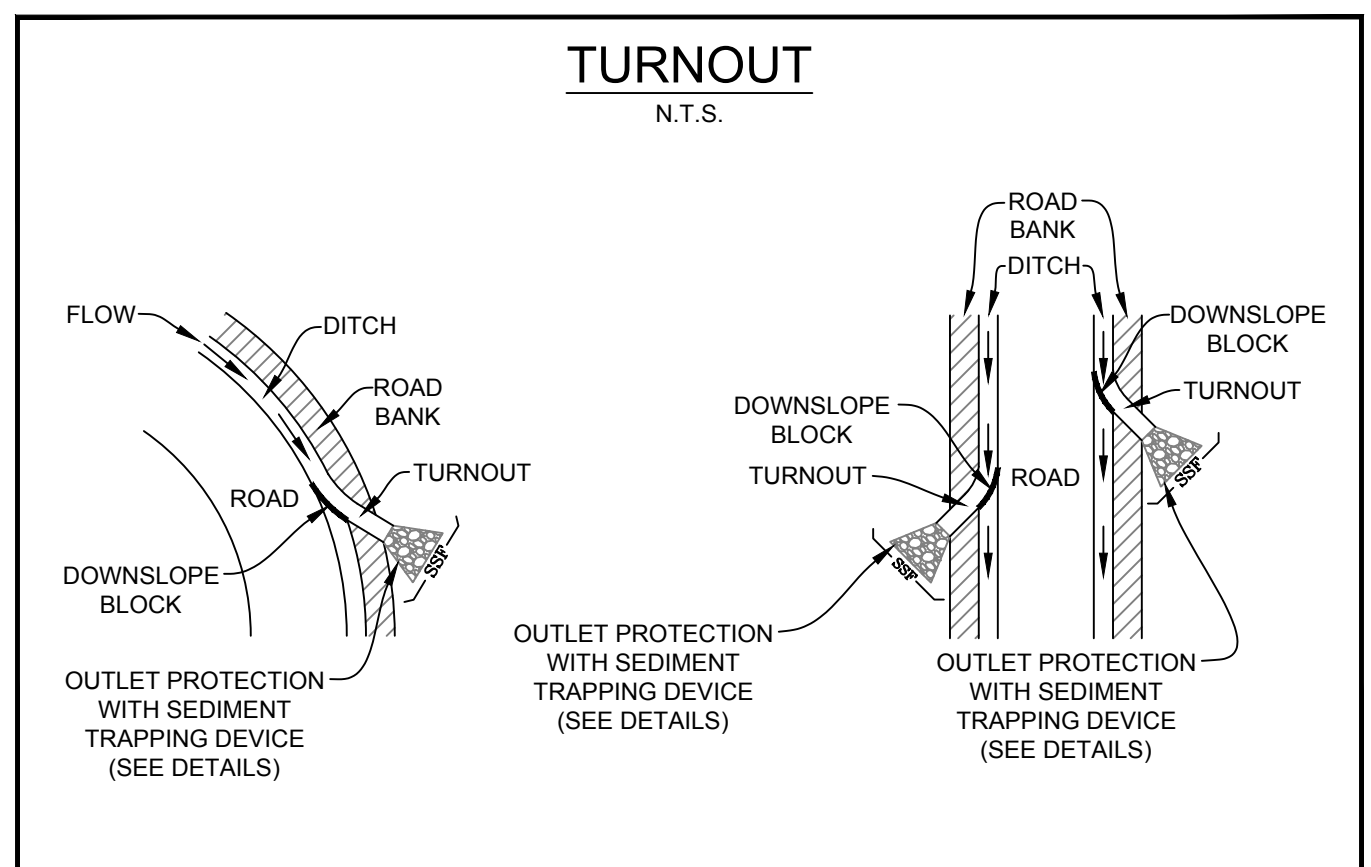
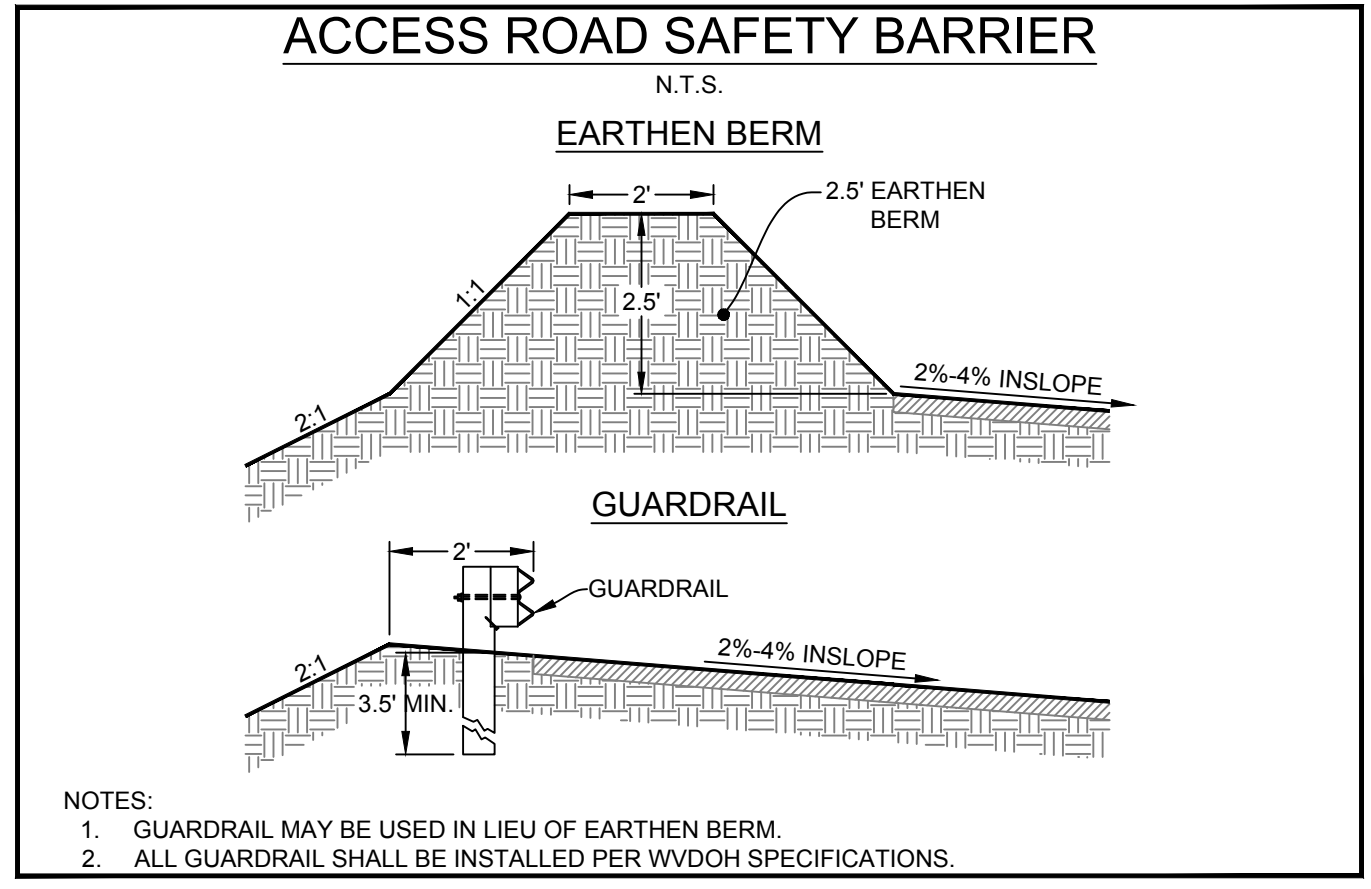
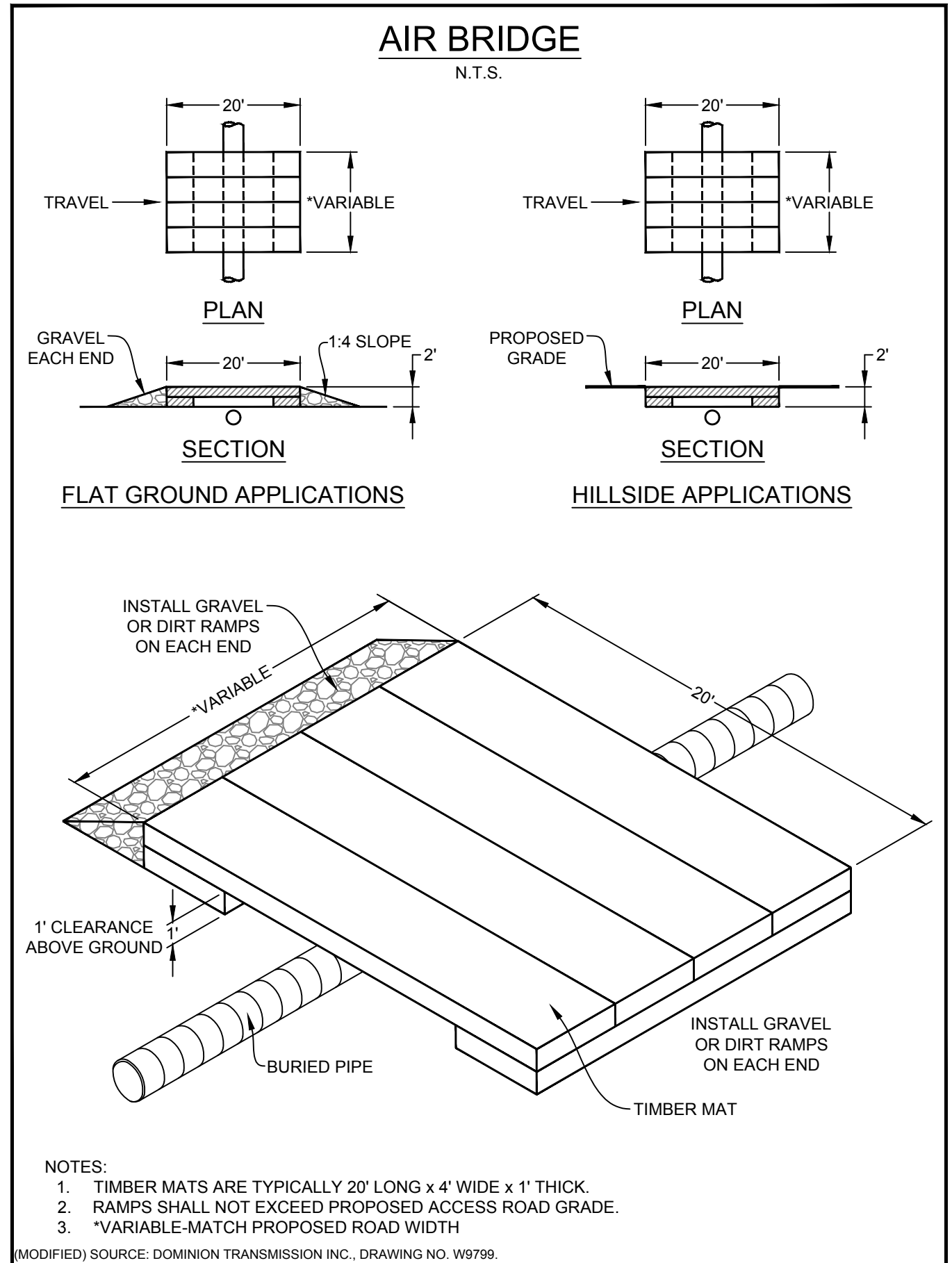
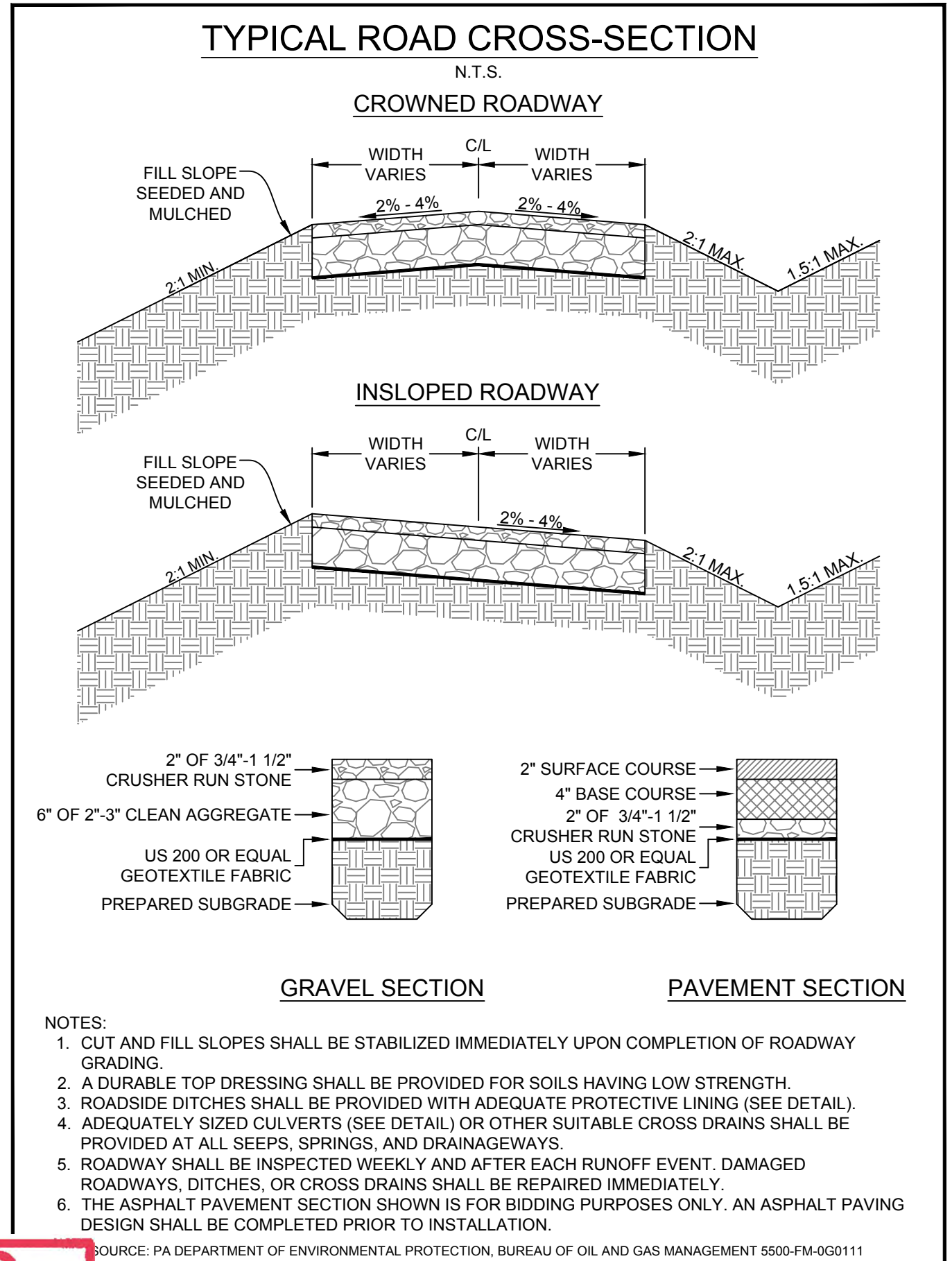
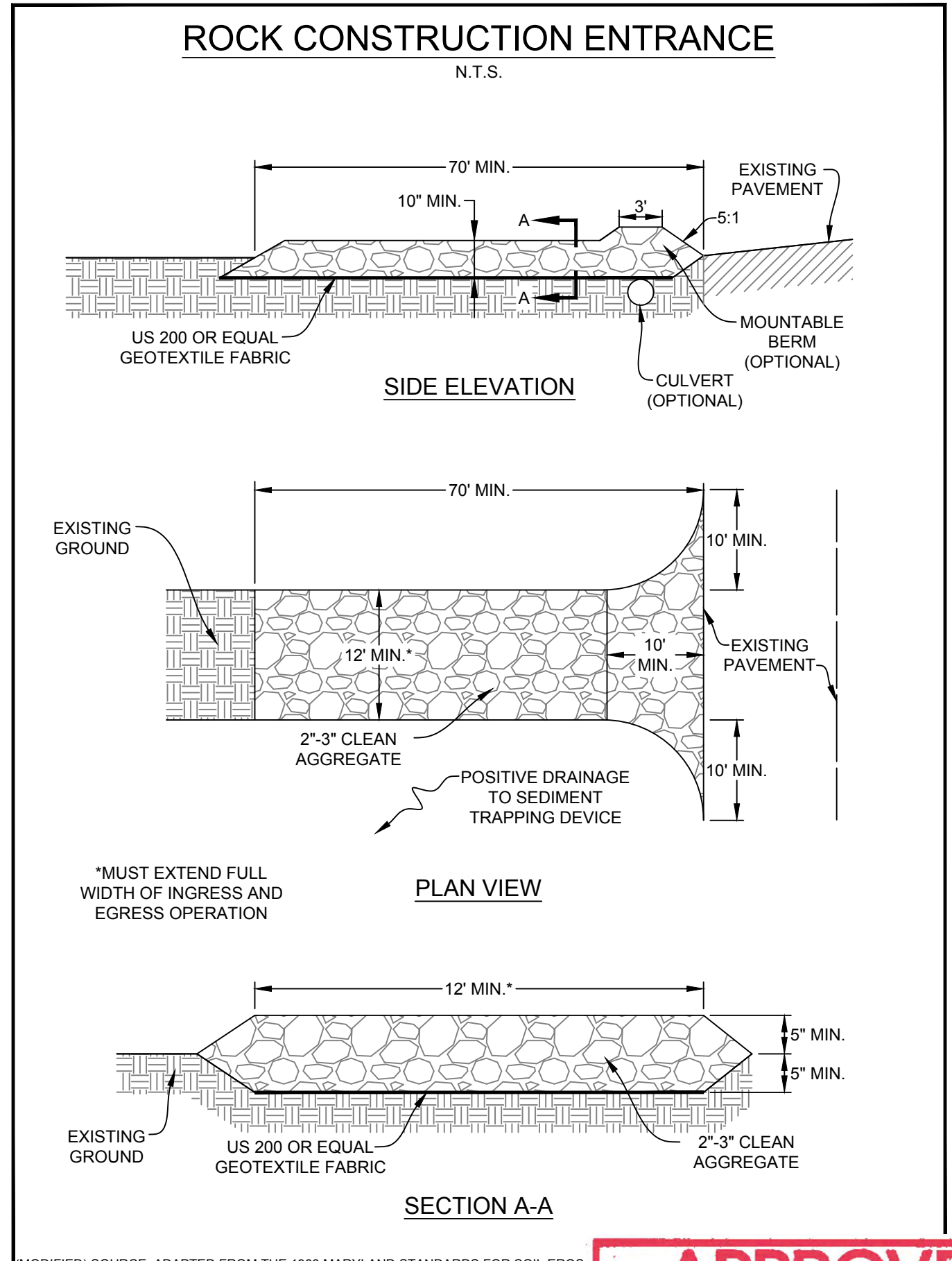
WELL PAD AS-BUILT SECTIONS

NASH

WELL PAD
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DODDRIDGE COUNTY, WEST VIRGINIA



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Antero Resources

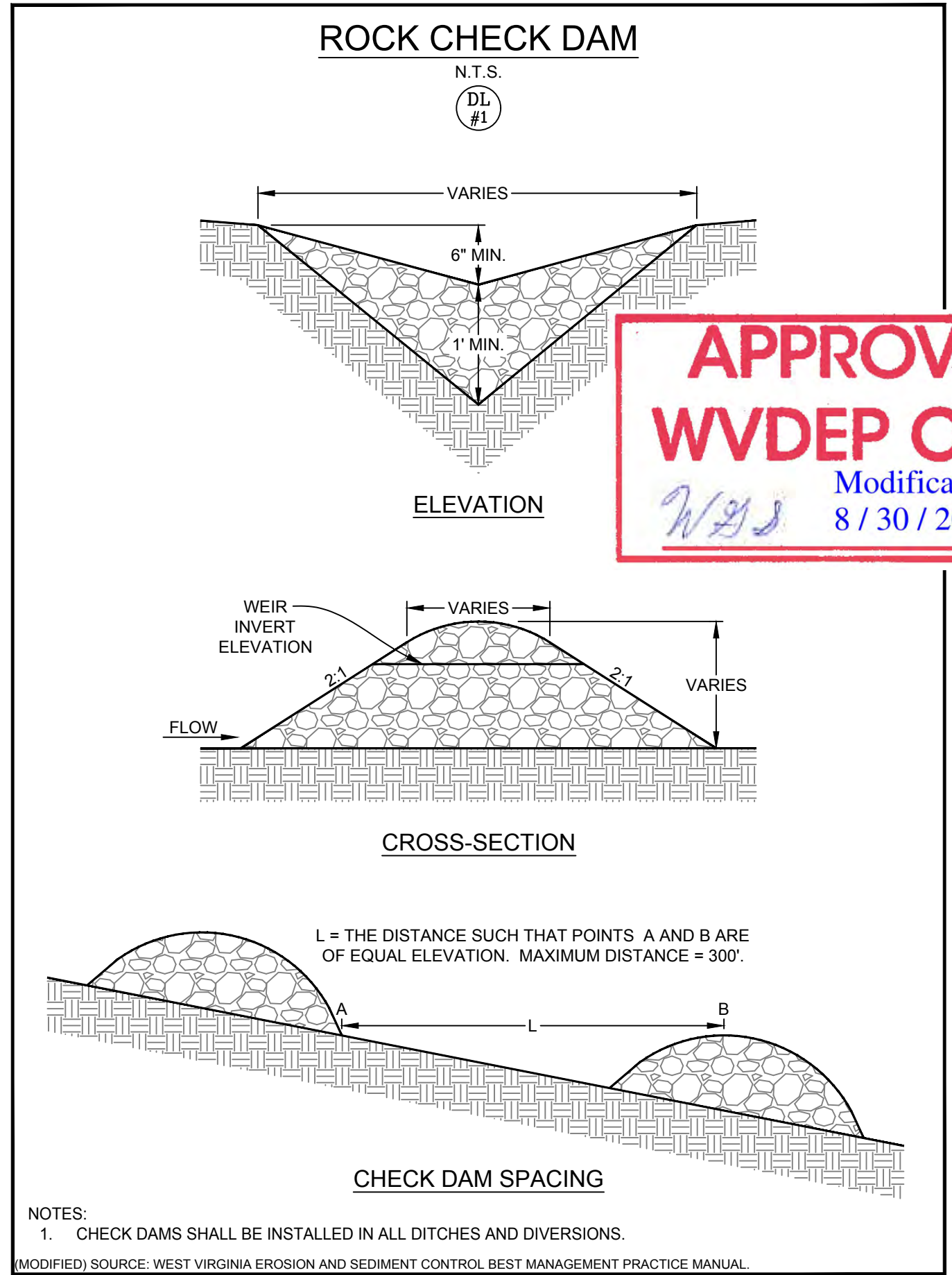
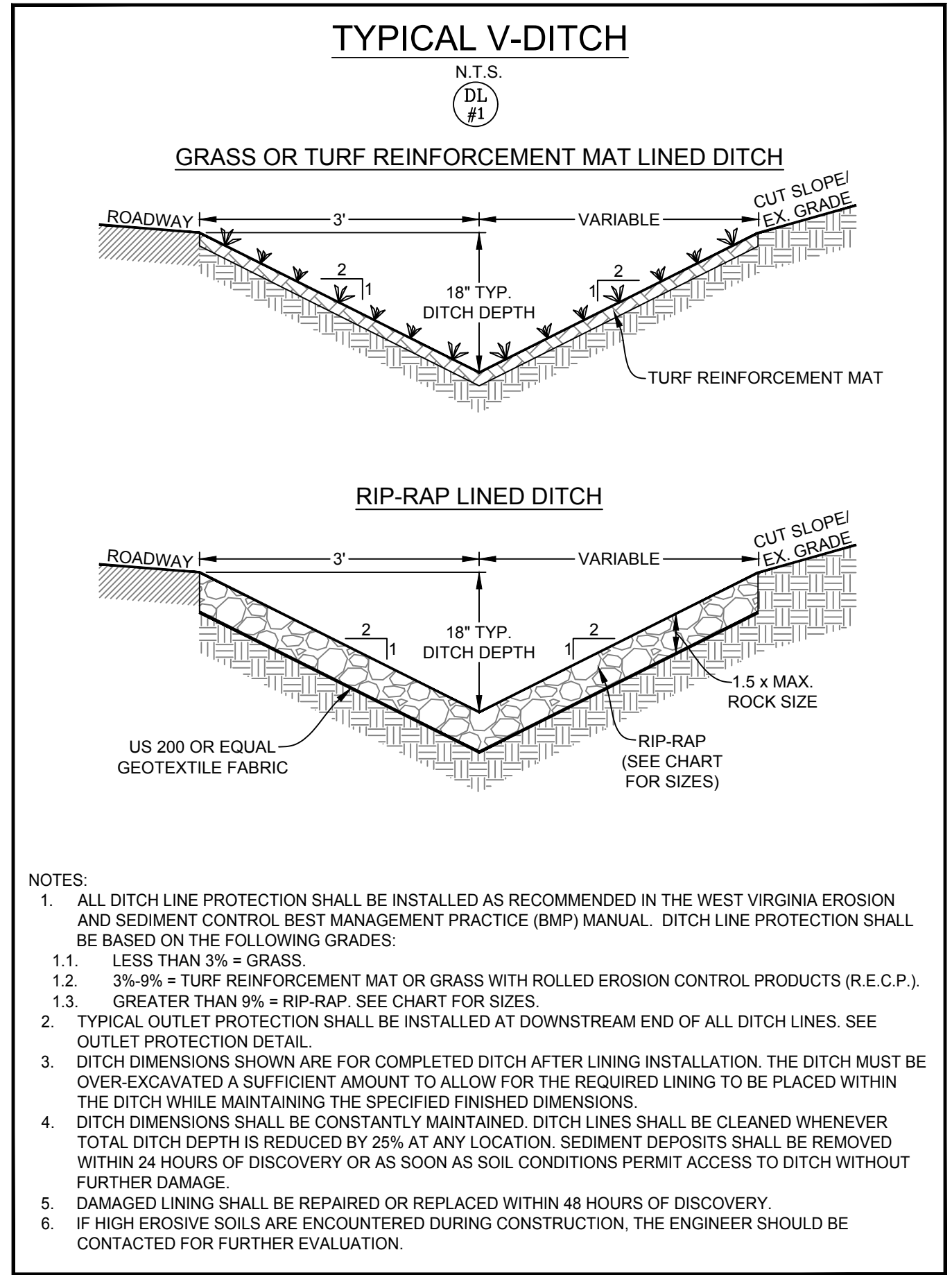
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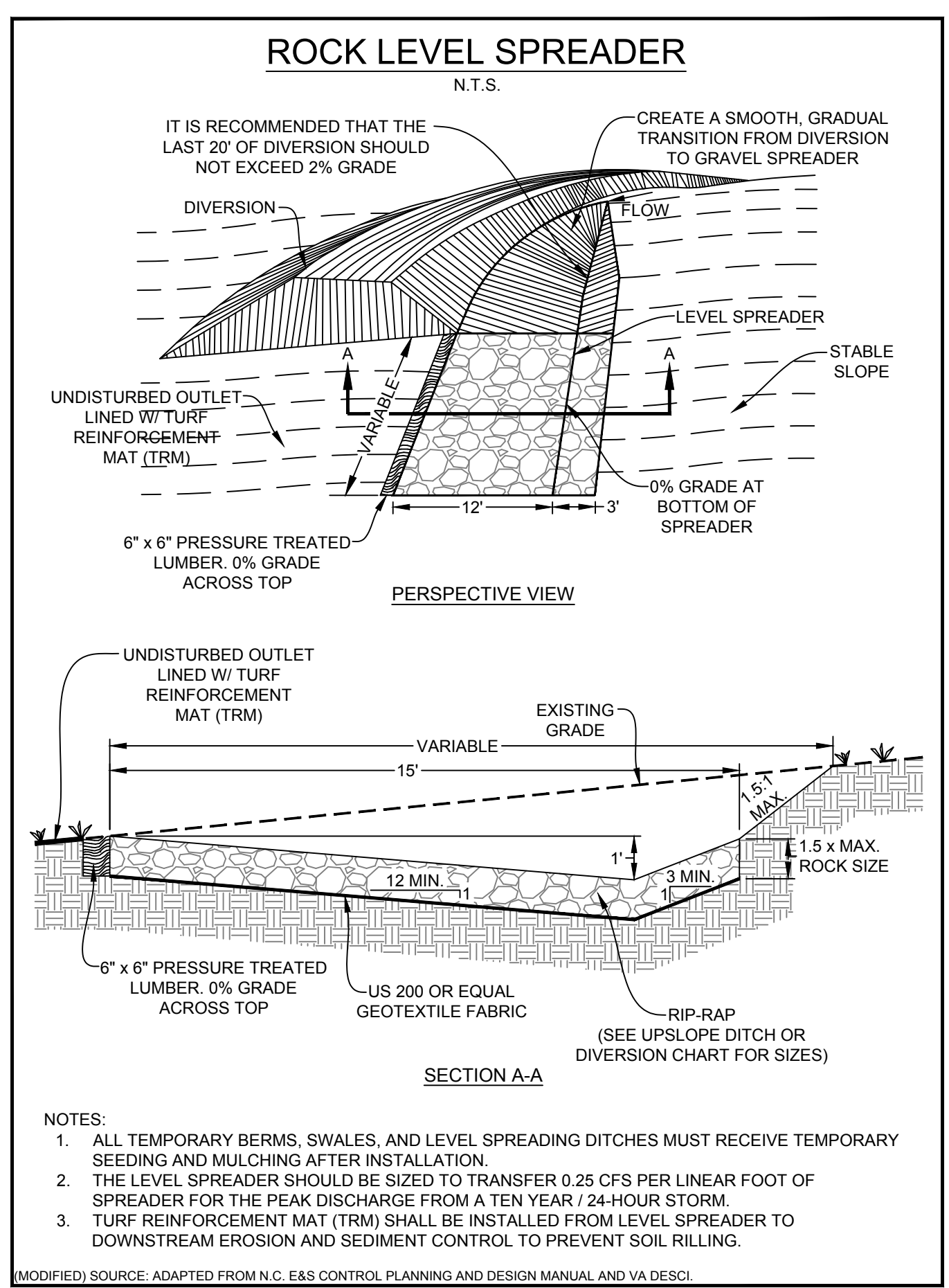
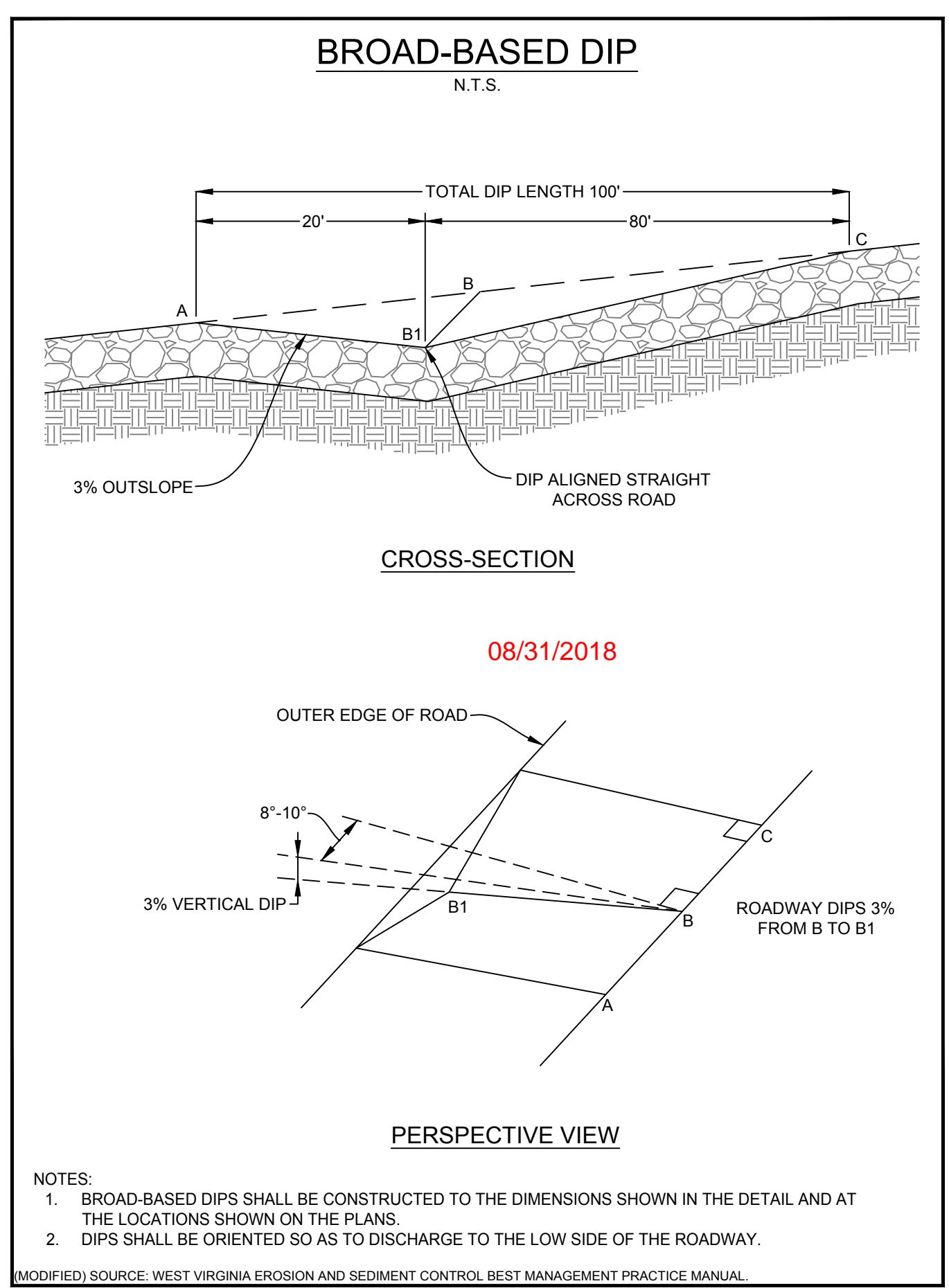
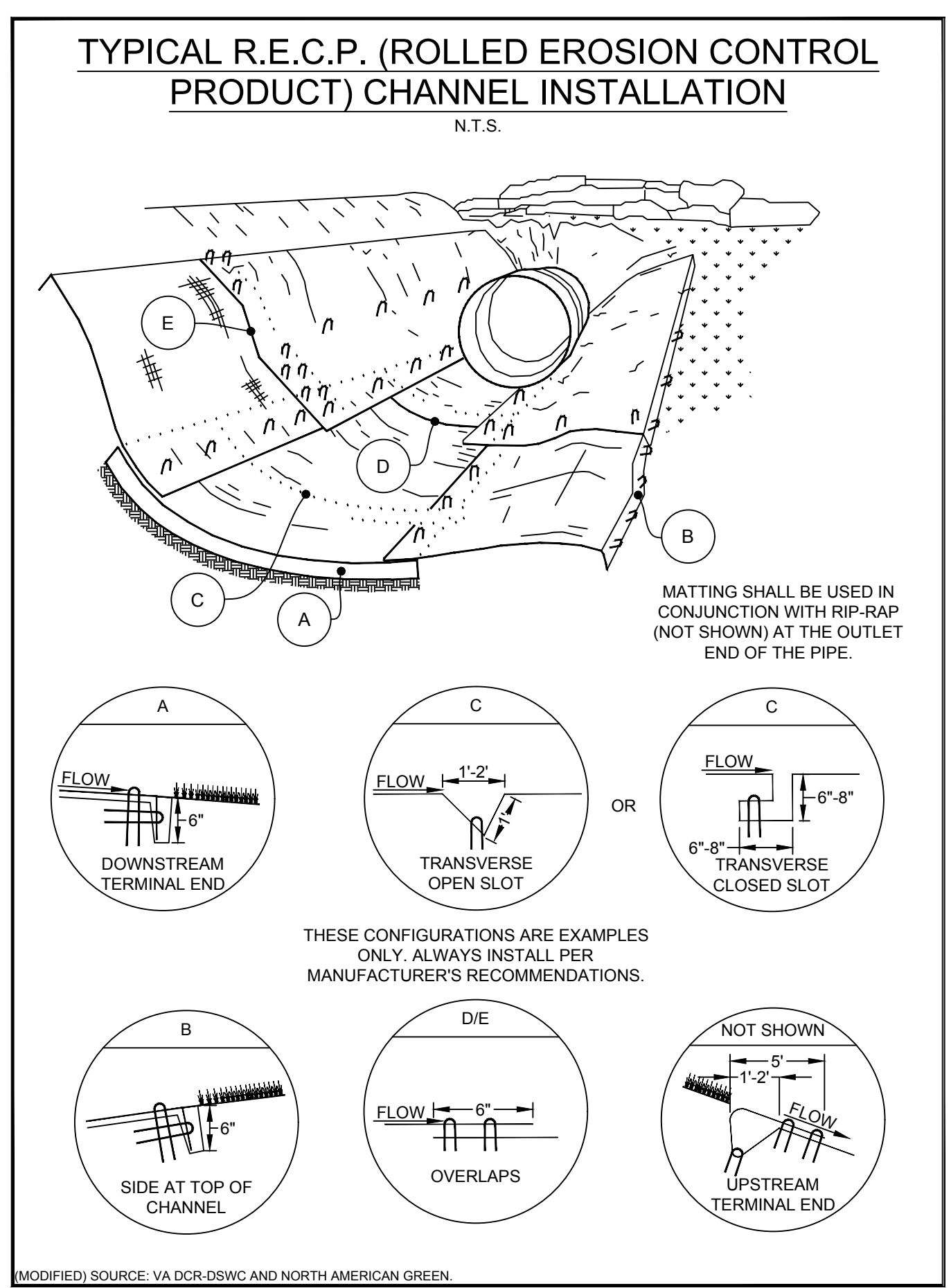
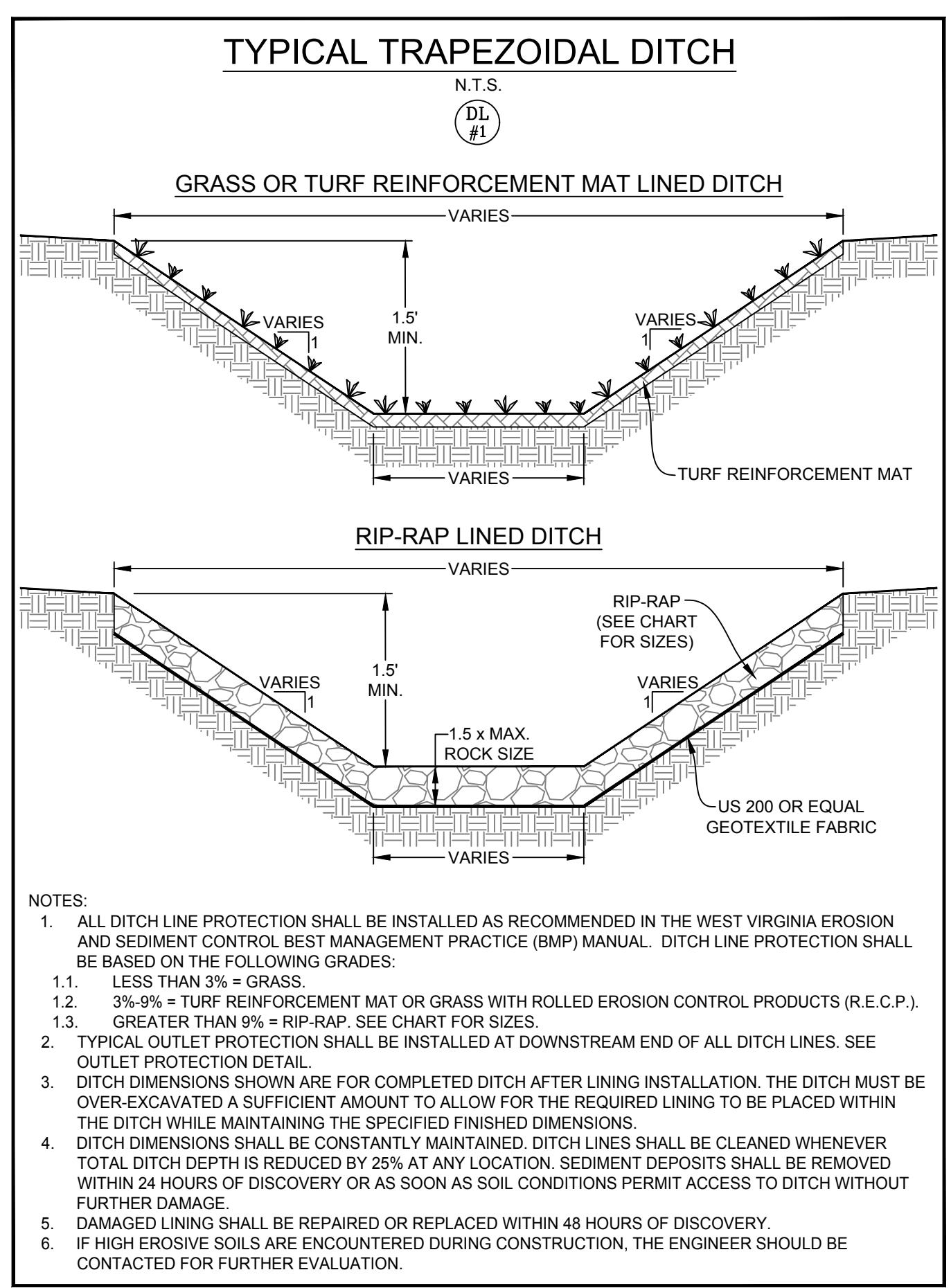
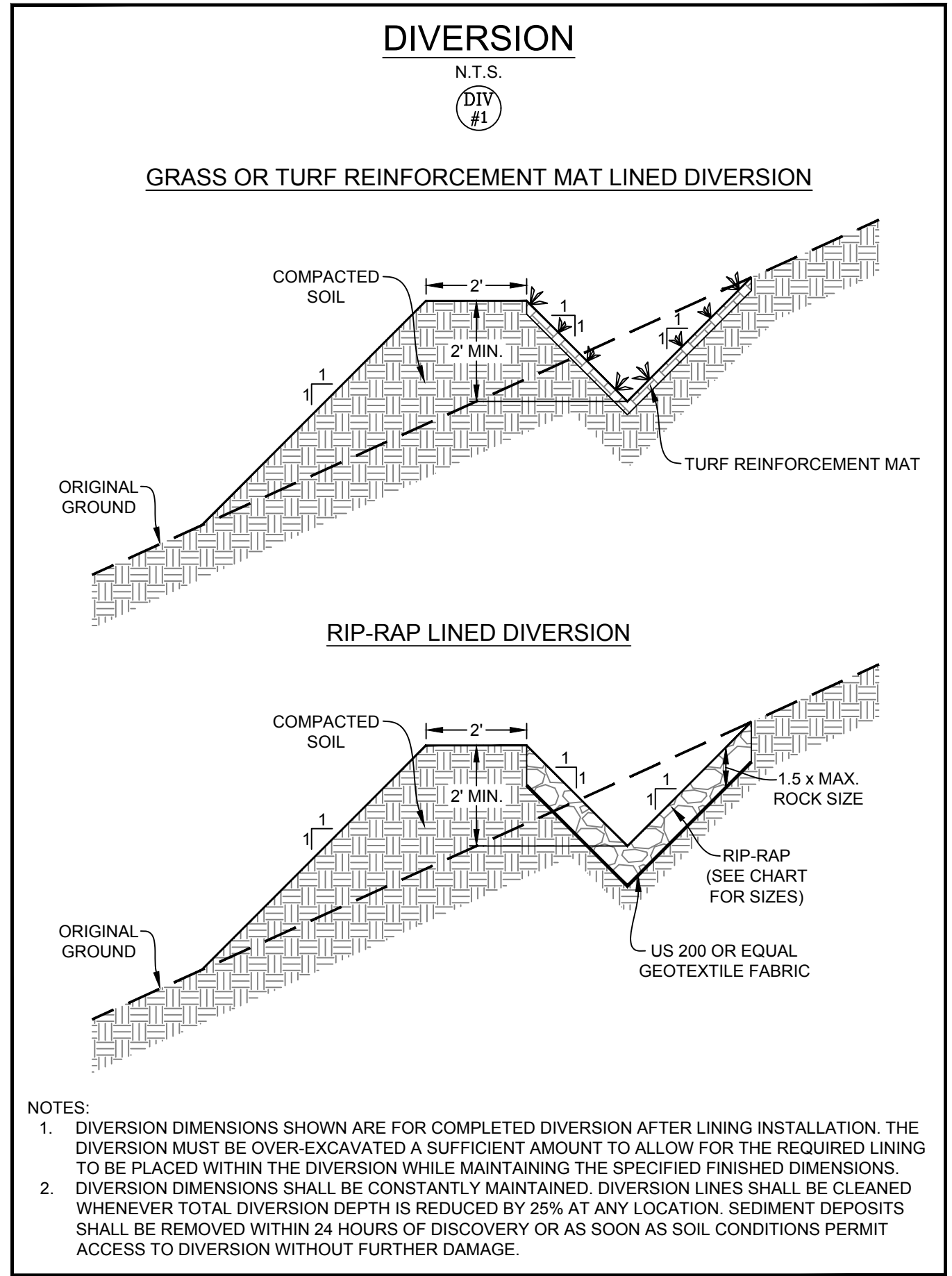
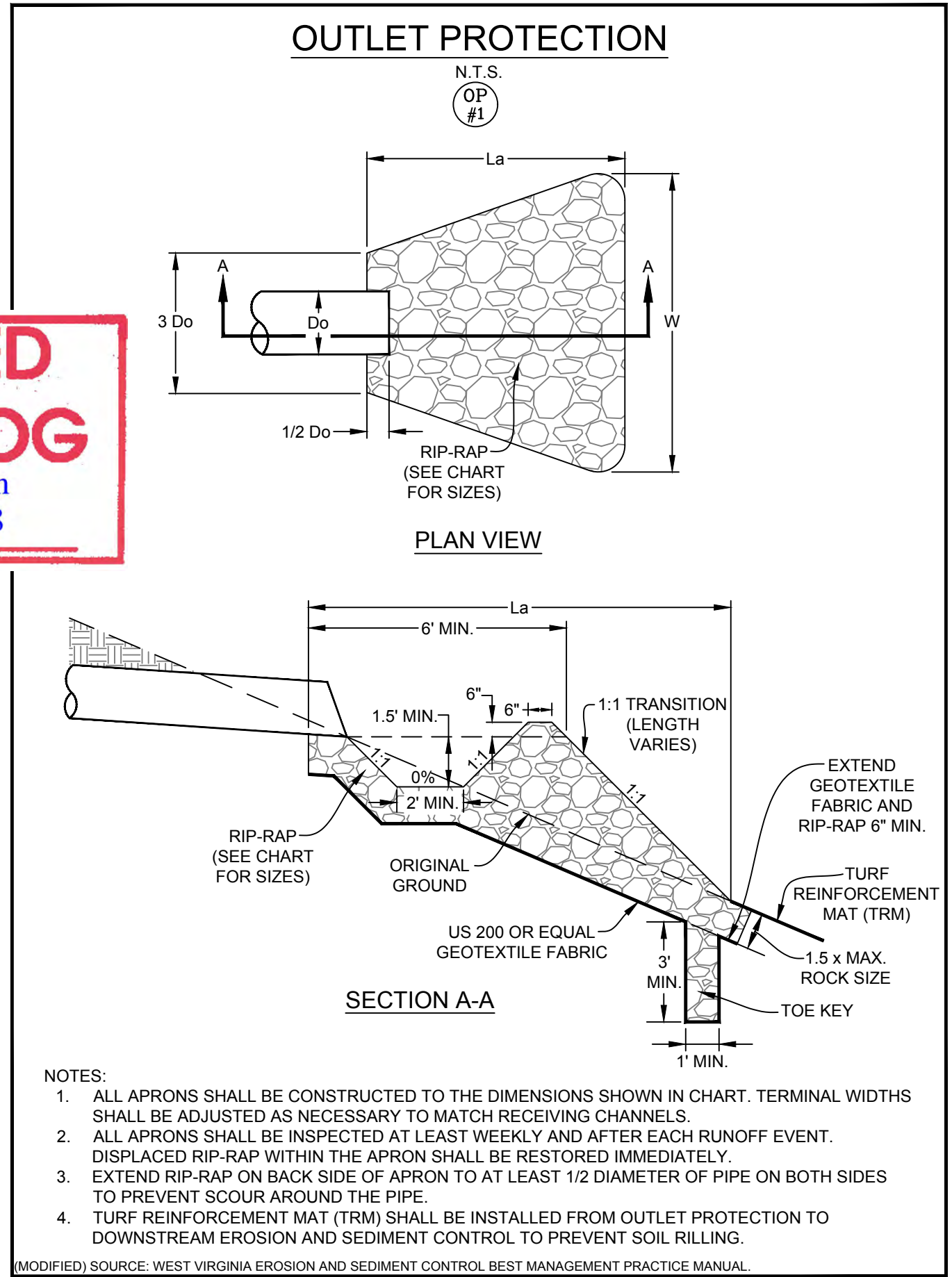
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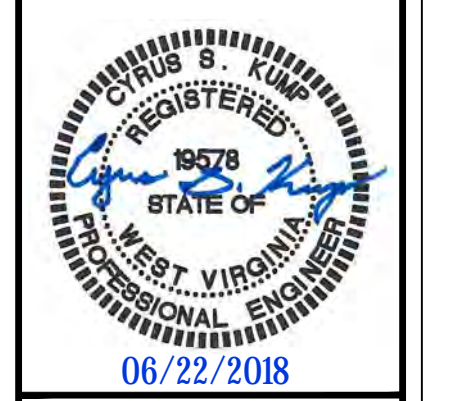
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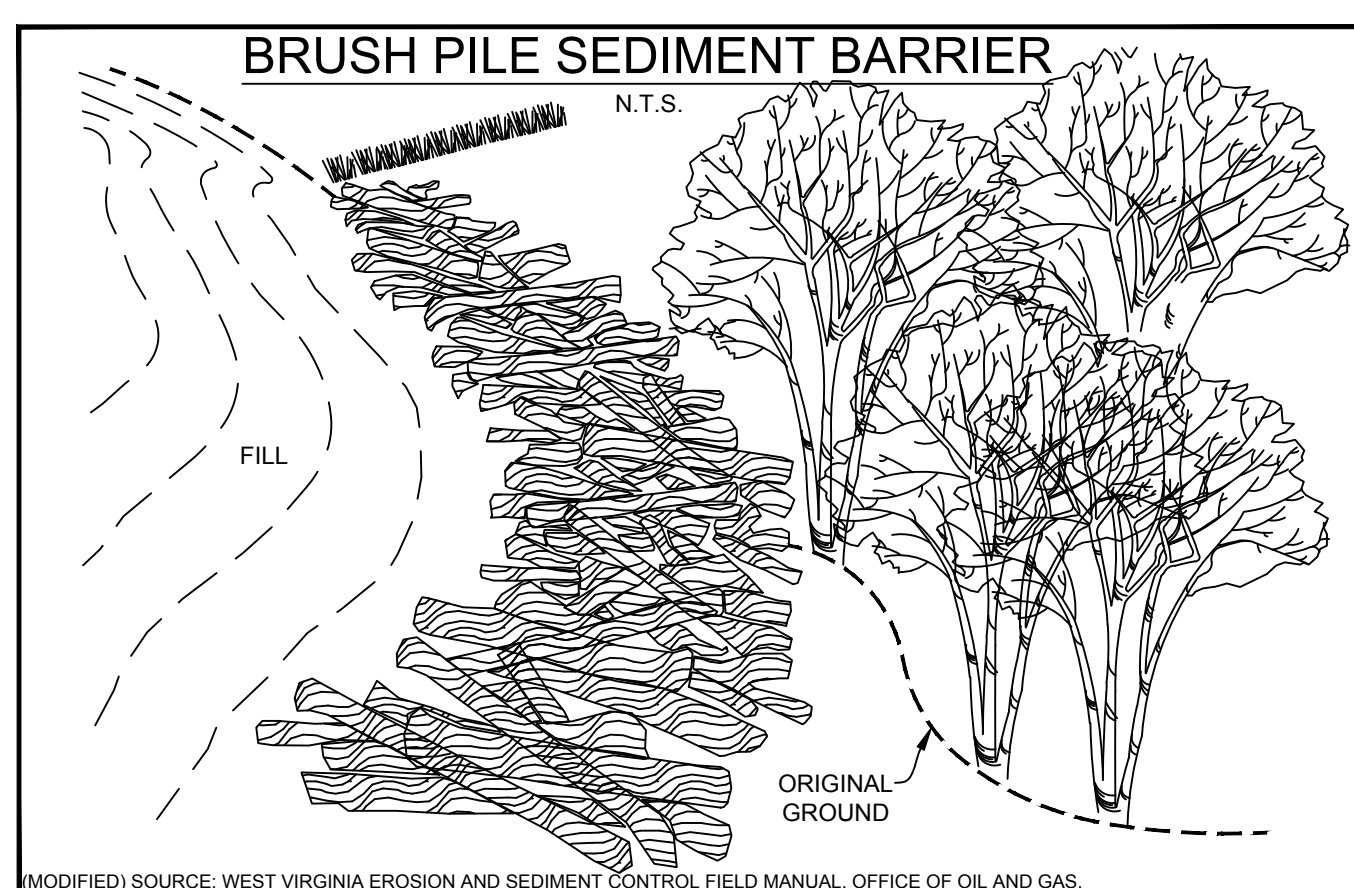
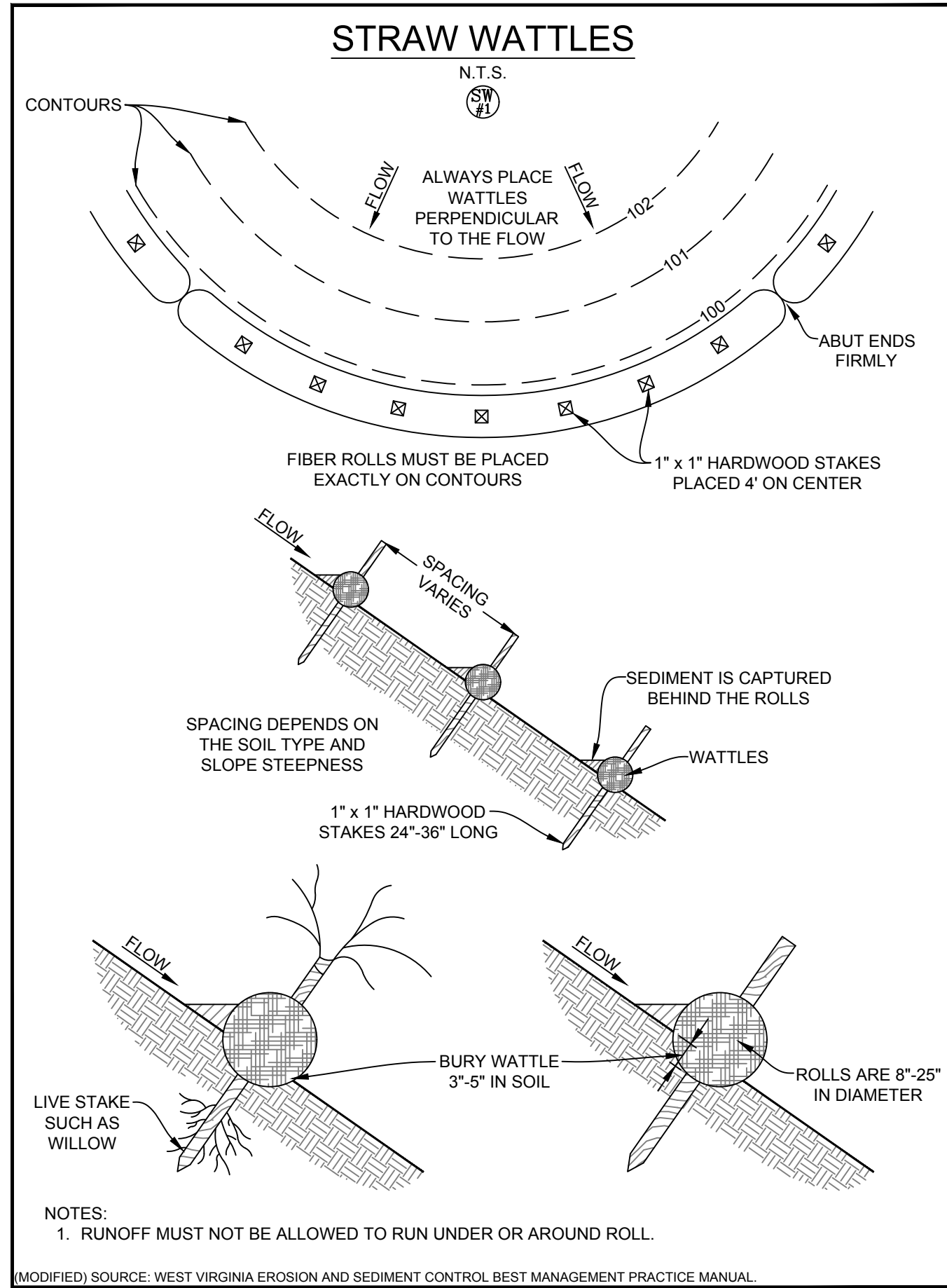
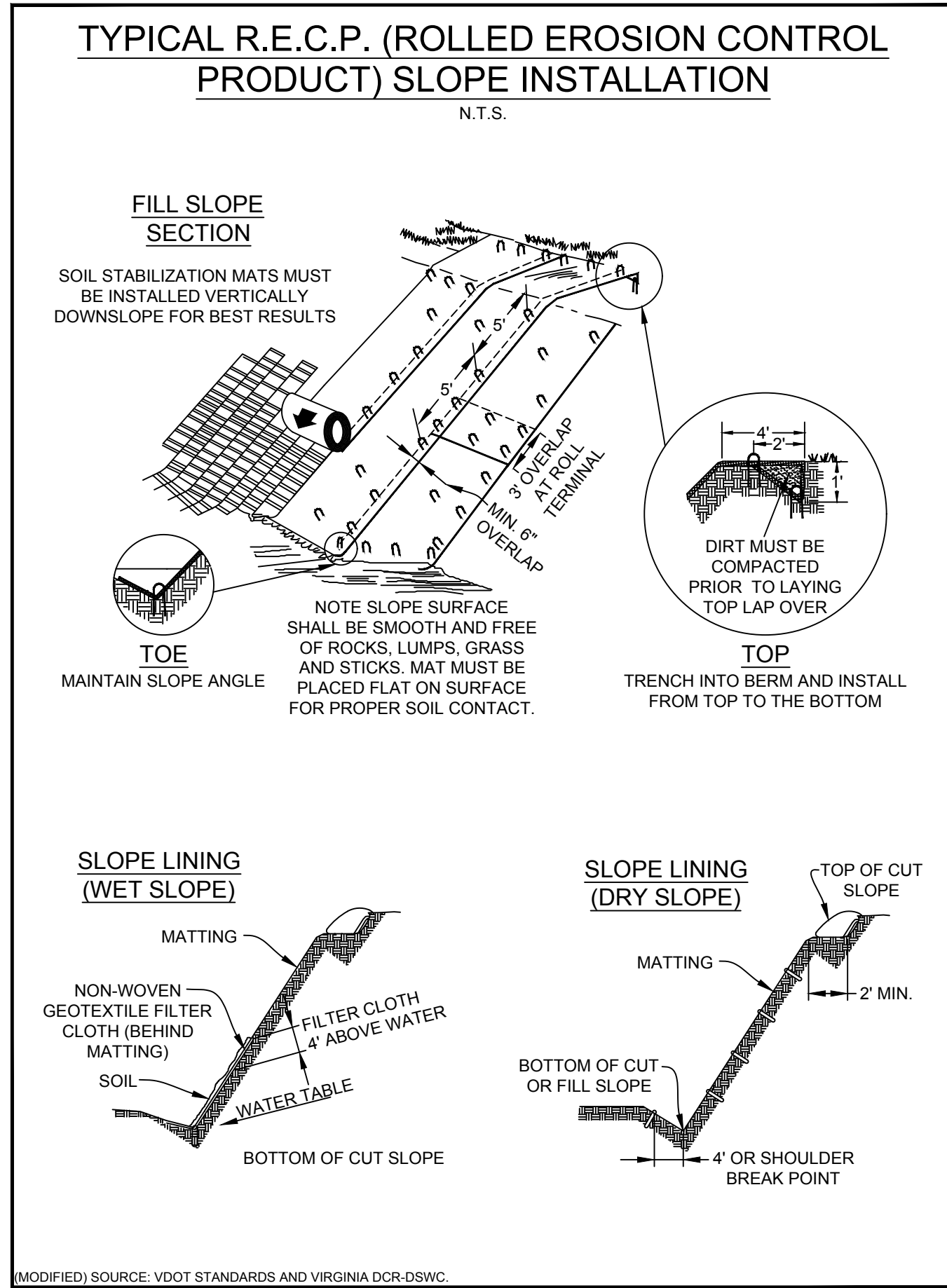
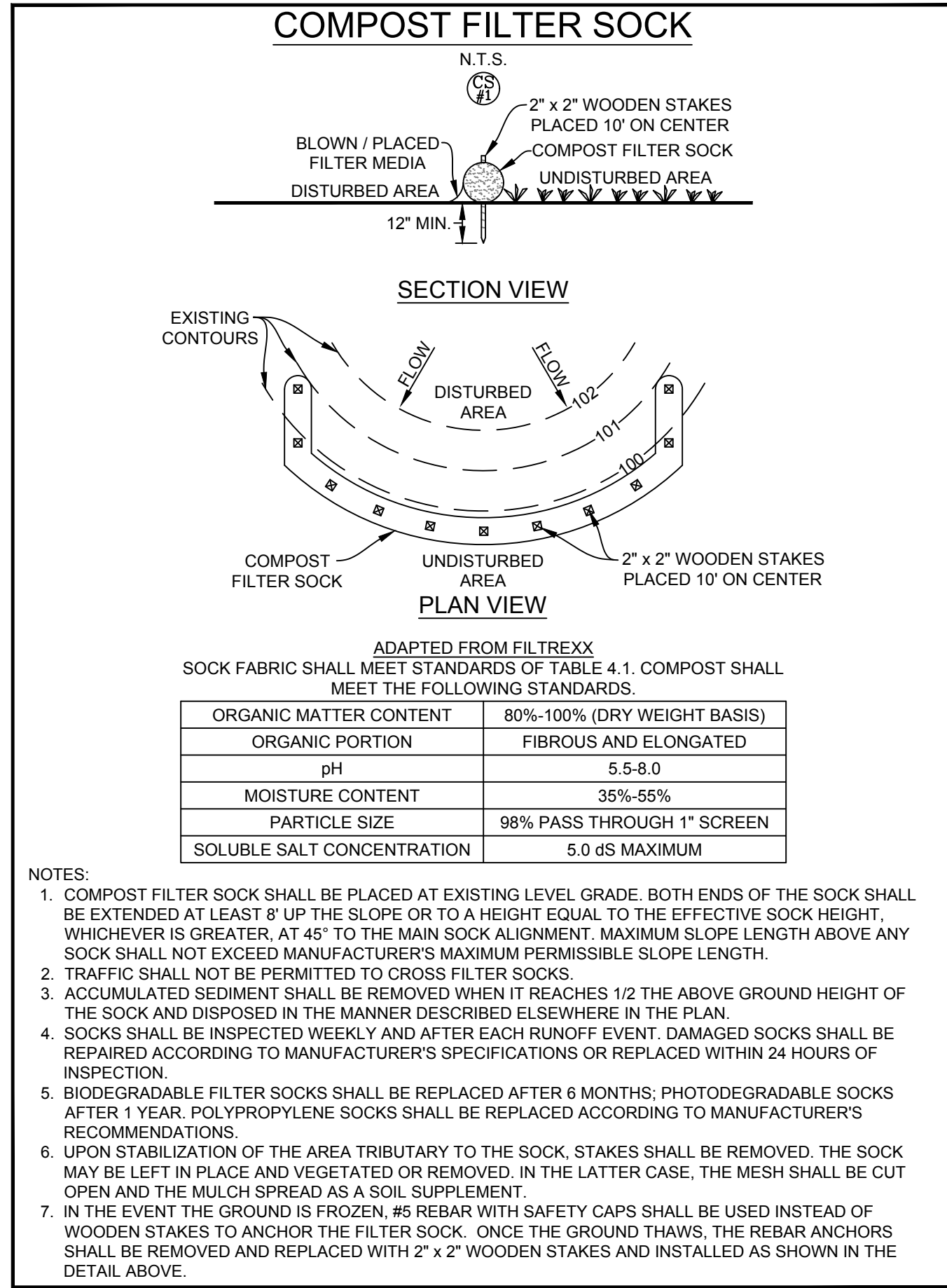
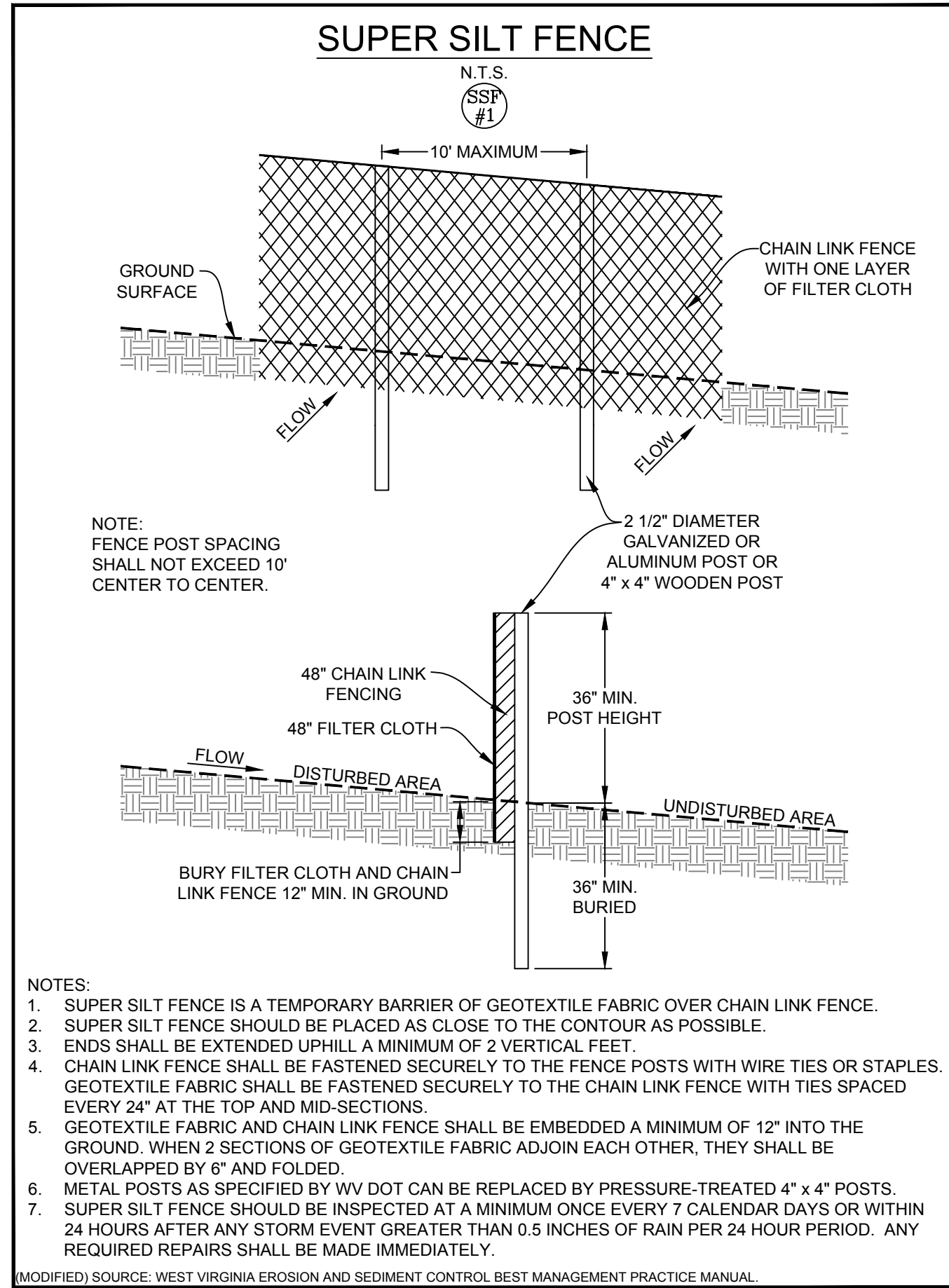
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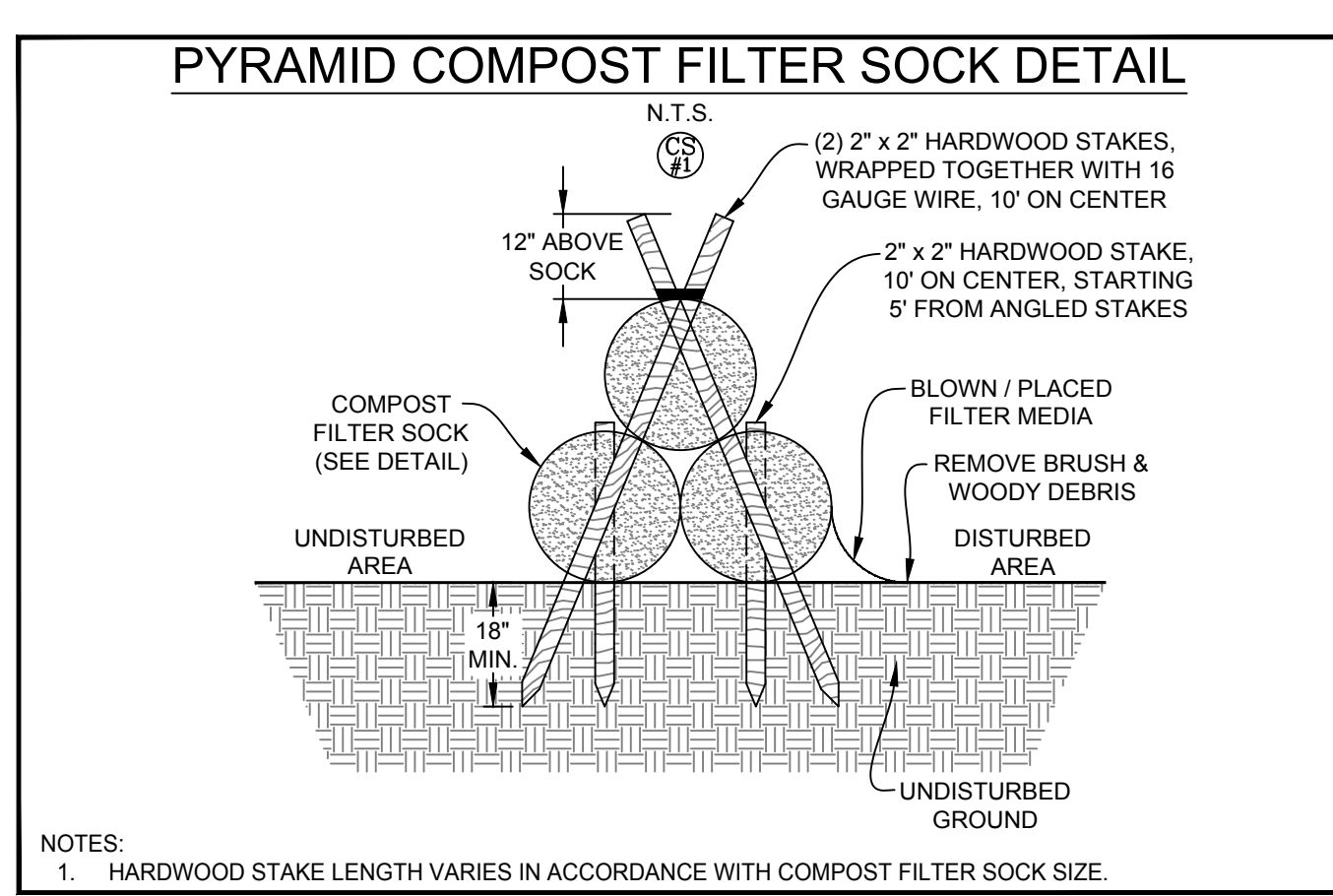
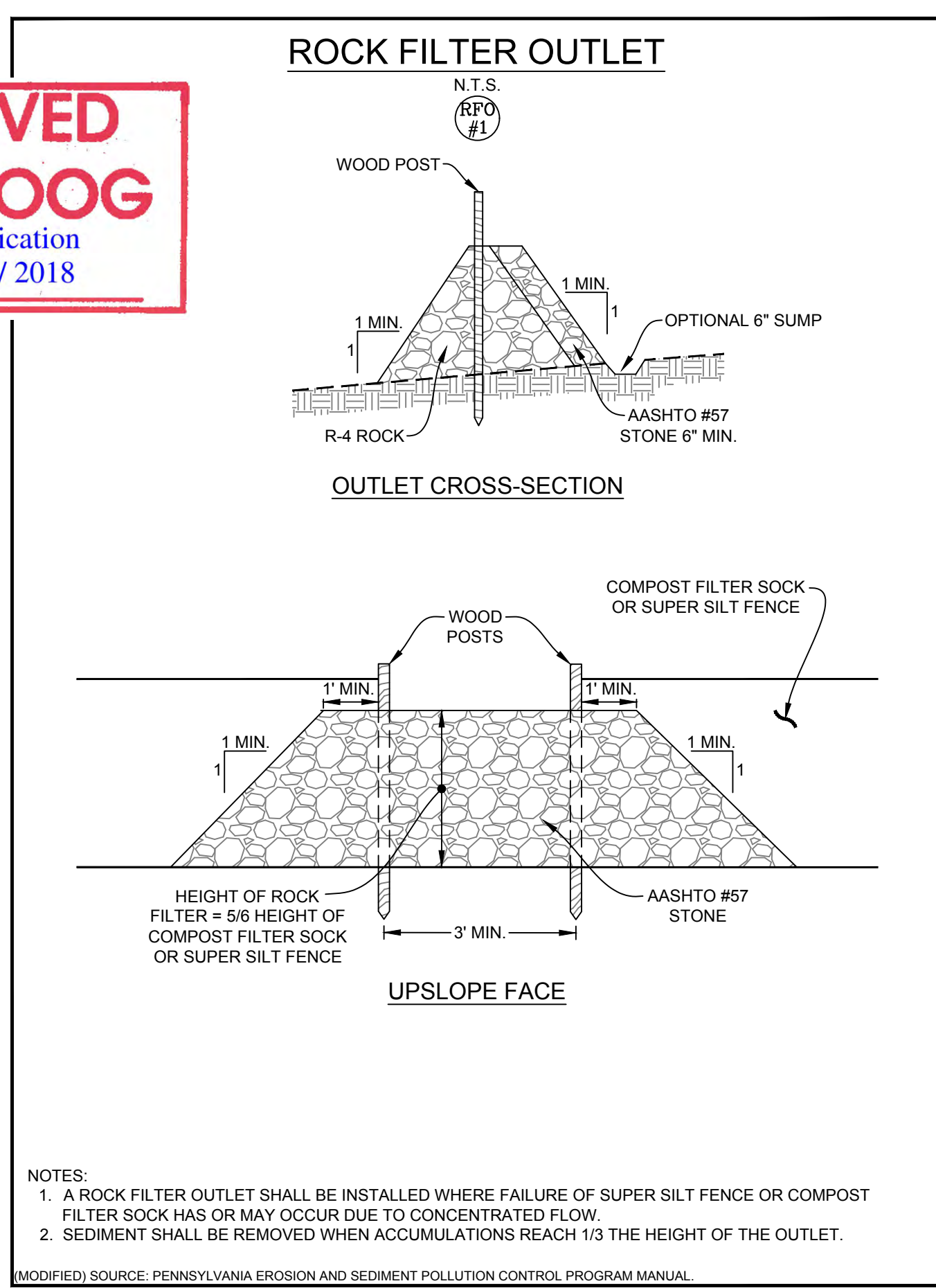
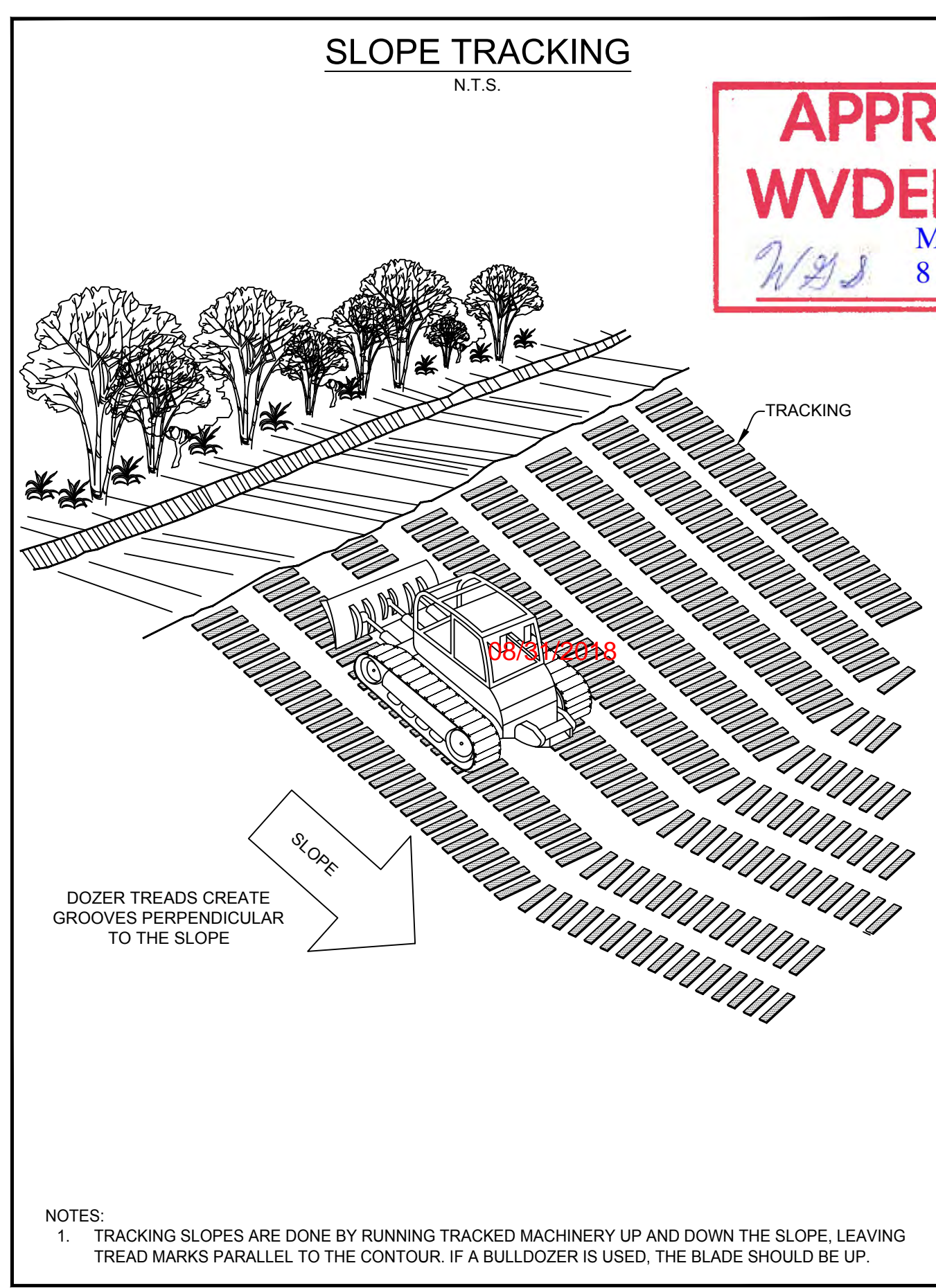
COMPOST SOCK FABRIC MINIMUM SPECIFICATIONS (TABLE 4.1)

MATERIAL TYPE	3 MIL. HDPE PHOTO-DEGRADABLE	5 MIL. HDPE PHOTO-DEGRADABLE	5 MIL. HDPE BIO-DEGRADABLE	MULTI-FILAMENT POLYPROPYLENE (MFPP) PHOTO-DEGRADABLE	HEAVY DUTY MULTI-FILAMENT POLYPROPYLENE (HDMFPP) PHOTO-DEGRADABLE
SOCK DIAMETERS	12" 18"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"
MESH OPENING	3/8"	3/8"	3/8"	3/8"	1/8"
TEXTILE 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	HOPE BIAXIAL NET CONTINUOUSLY WOUND FUSION-WELDED JUNCTURES 3/4" x 3/4" MAX. APERTURE SIZE
OUTER FILTRATION MESH	COMPOSITE POLYPROPYLENE FABRIC (WOVEN LAYER & 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.



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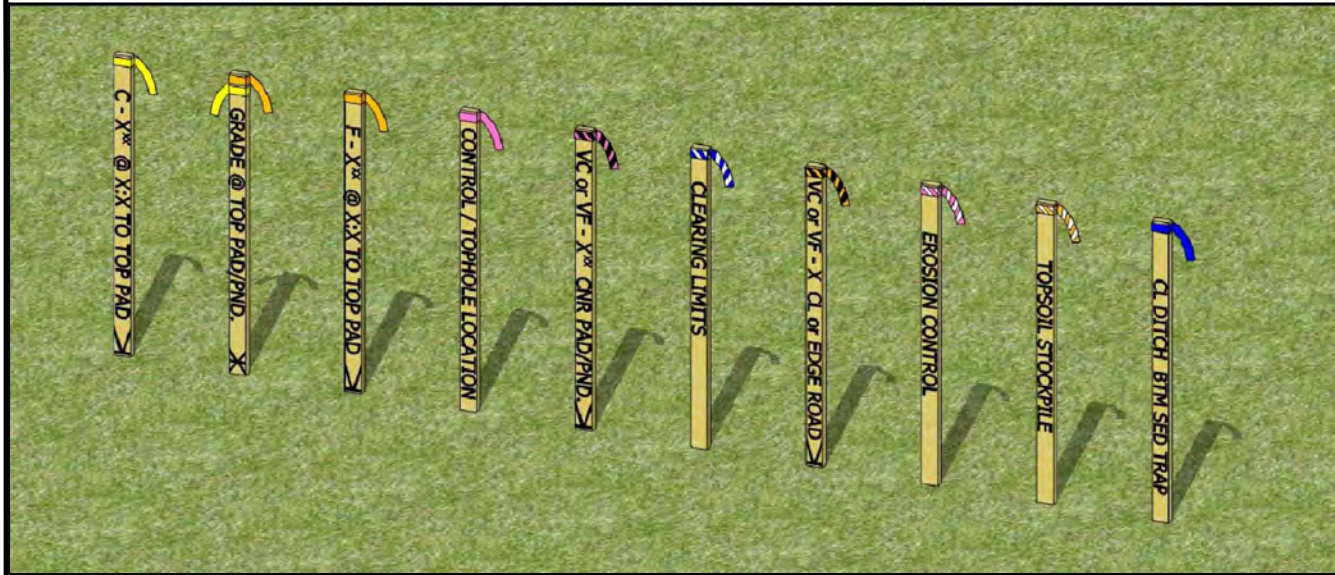
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STANDARD STAKEOUT RIBBON COLOR SCHEME

N.T.S.

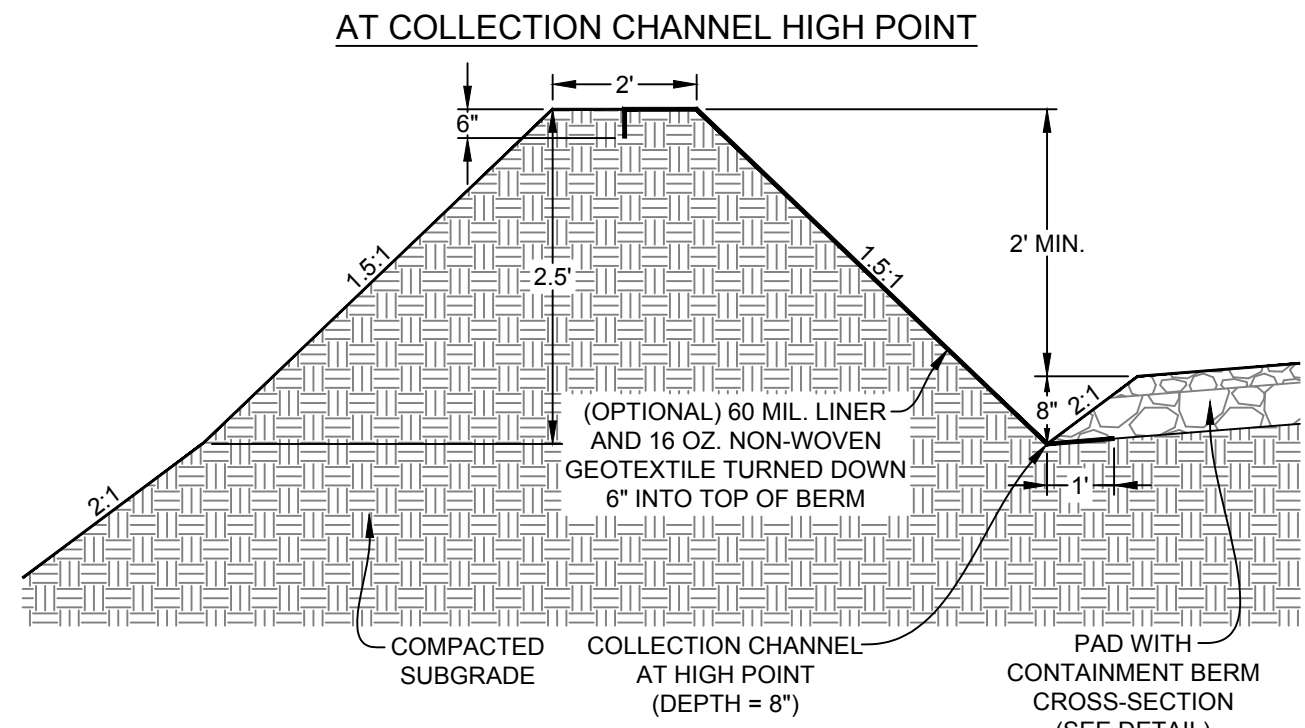


	YELLOW RIBBON: YELLOW RIBBON USED TO INDICATE TOP OF CUTS (C) CUT TO BE DETERMINED AT TIME OF STAKEOUT SLOPE DETERMINED BY SITE DESIGN
	YELLOW & ORANGE RIBBON: YELLOW AND ORANGE RIBBON USED TO INDICATE GRADE AT TOP OF PAD/POND/PIT
	ORANGE RIBBON: ORANGE RIBBON USED TO INDICATE TOES OF FILLS (F) FILL TO BE DETERMINED AT TIME OF STAKEOUT SLOPE DETERMINED BY SITE DESIGN
	PINK RIBBON: PINK RIBBON USED TO INDICATE TOP HOLE LOCATION PINK RIBBON USED TO INDICATE SURVEY CONTROL LOCATION
	PINK & BLACK STRIPE RIBBON: PINK & BLACK STRIPE RIBBON USED TO INDICATE VERTICAL CUT (VC) AT PAD/POND/PIT CORNER OR EDGE PINK & BLACK STRIPE RIBBON USED TO INDICATE VERTICAL FILL (VF) AT PAD/POND/PIT CORNER OR EDGE VERTICAL CUT/VERTICAL FILL TO BE DETERMINED AT TIME OF STAKEOUT
	BLUE & WHITE STRIPE RIBBON: BLUE & WHITE STRIPE RIBBON USED TO INDICATE CLEARING LIMITS/CONSTRUCTION LIMITS
	ORANGE & BLACK STRIPE RIBBON: ORANGE & BLACK STRIPE RIBBON USED TO INDICATE VERTICAL CUT (VC) AT CENTERLINE OR EDGE OF ACCESS ROAD ORANGE & BLACK STRIPE RIBBON USED TO INDICATE VERTICAL FILL (VF) AT CENTERLINE OR EDGE OF ACCESS ROAD
	PINK & WHITE STRIPE RIBBON: PINK & WHITE STRIPE RIBBON USED TO INDICATE EROSION AND SEDIMENT CONTROL STRUCTURES SILT FENCE (SF) REINFORCED FILTER FENCE (RF) SUPER SILT FENCE (SSF) FILTER SOCK (FS)
	ORANGE & WHITE STRIPE RIBBON: ORANGE & WHITE STRIPE RIBBON USED TO INDICATE TOPSOIL STOCKPILE LOCATIONS
	BLUE RIBBON: BLUE RIBBON USED TO INDICATE CENTERLINE (CL) DITCH BLUE RIBBON USED TO INDICATE BOTTOM (BTM) SEDIMENT TRAPS

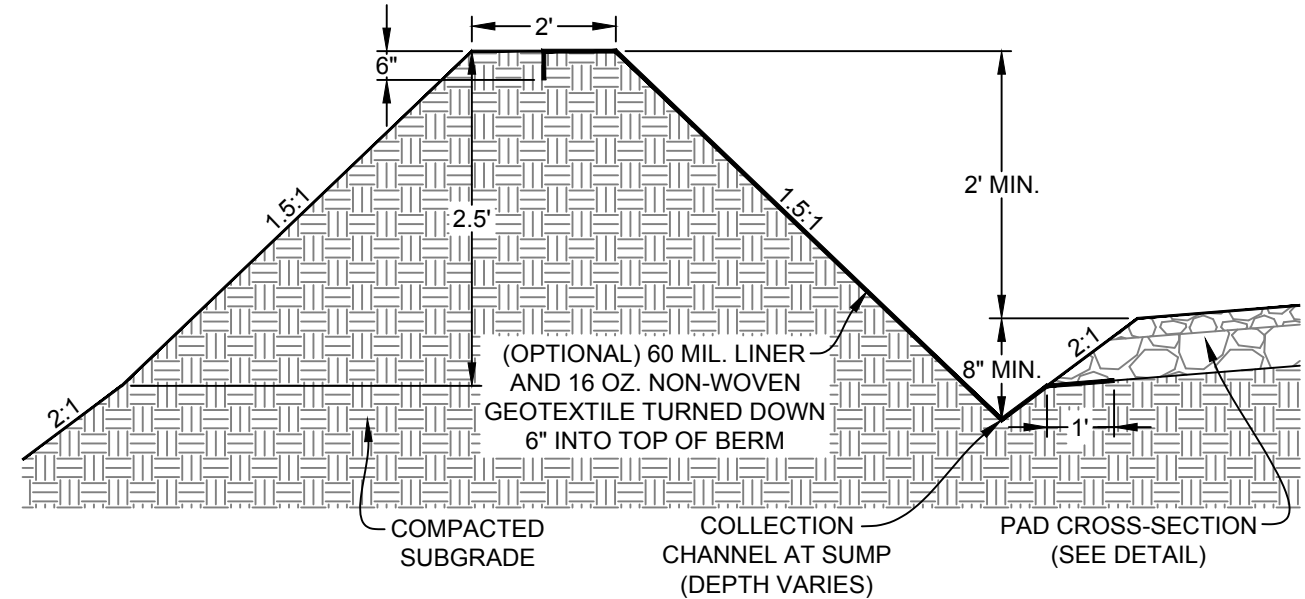
(MODIFIED) SOURCE: ANTERO RESOURCES CORPORATION

PAD CONTAINMENT BERM

N.T.S.



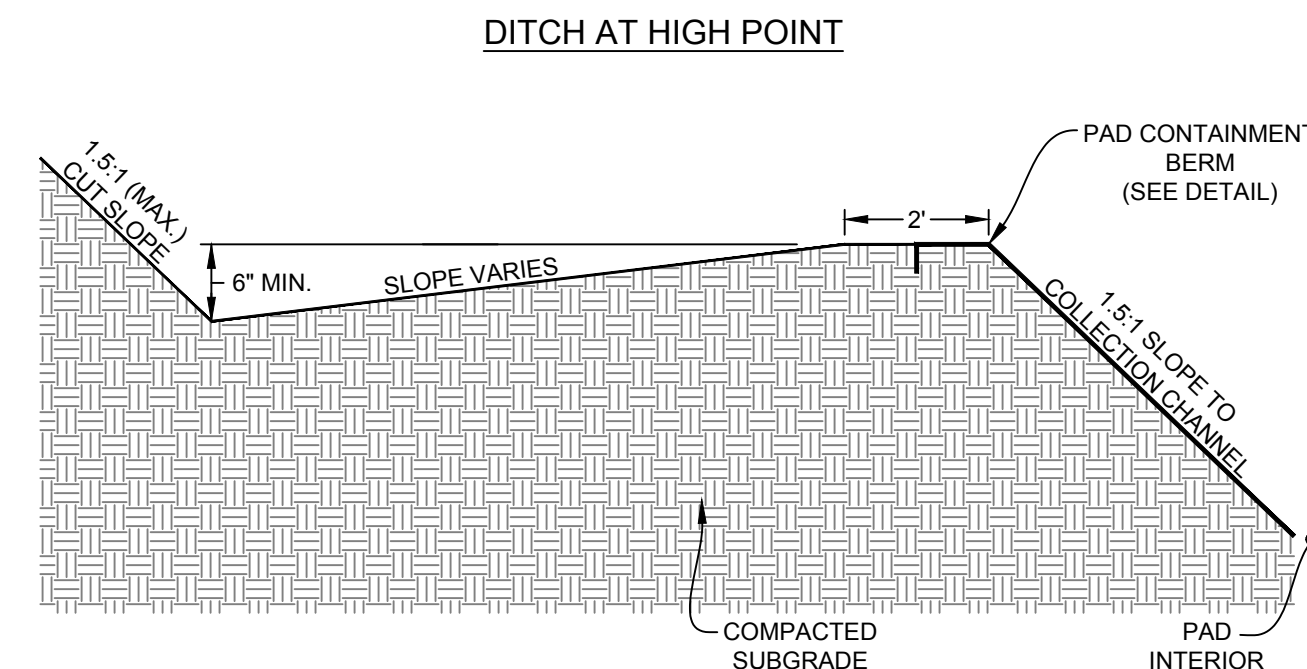
AT COLLECTION CHANNEL SUMP END



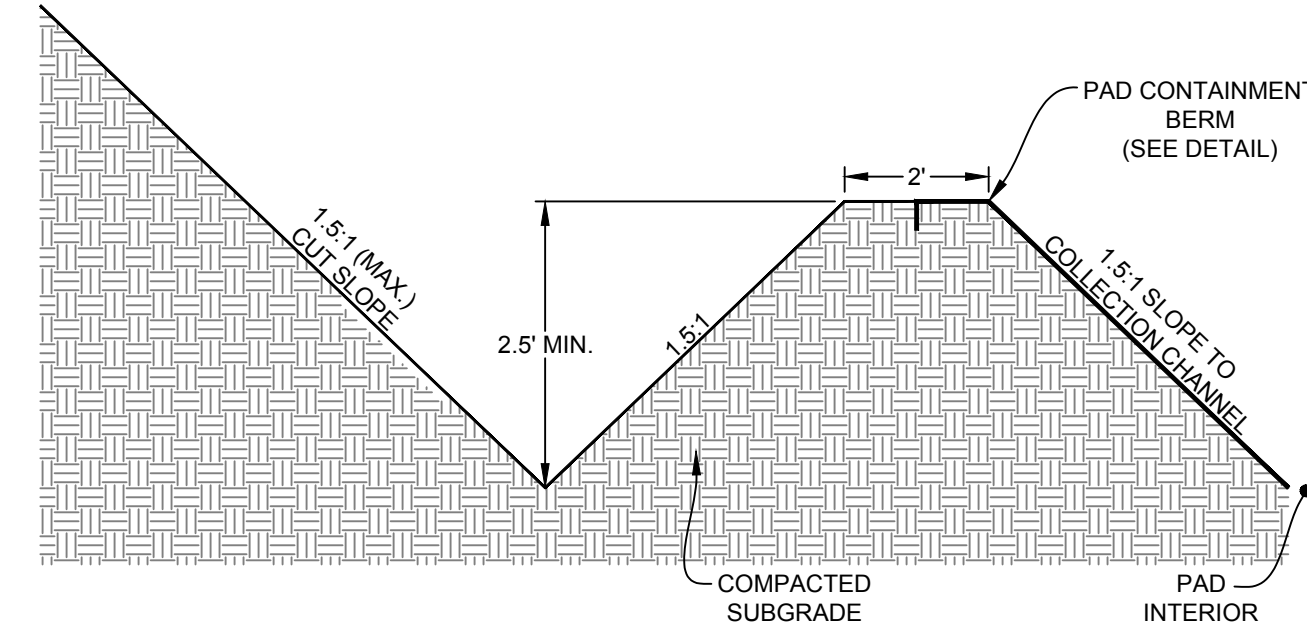
NOTES:
1. THE CONTAINMENT BERM SHALL BE CONSTRUCTED TO FULL BASE WIDTH AND COMPACTED TO 95% DENSITY. FOLLOWING COMPACTION THE SIDE SLOPES SHALL BE RE-SHAPED AT 1.5:1 SLOPE.
2. IT IS RECOMMENDED THAT THE CONTAINMENT BERM LINER BE INSTALLED TO PREVENT INFILTRATION. IF INFILTRATION CAN BE ADEQUATELY PREVENTED WITHOUT THE USE OF THE LINER, INSTALLATION IS AT THE OPERATOR'S DISCRETION.

PAD WITH CONTAINMENT BERM DITCH ON CUT SLOPE SIDE

N.T.S.



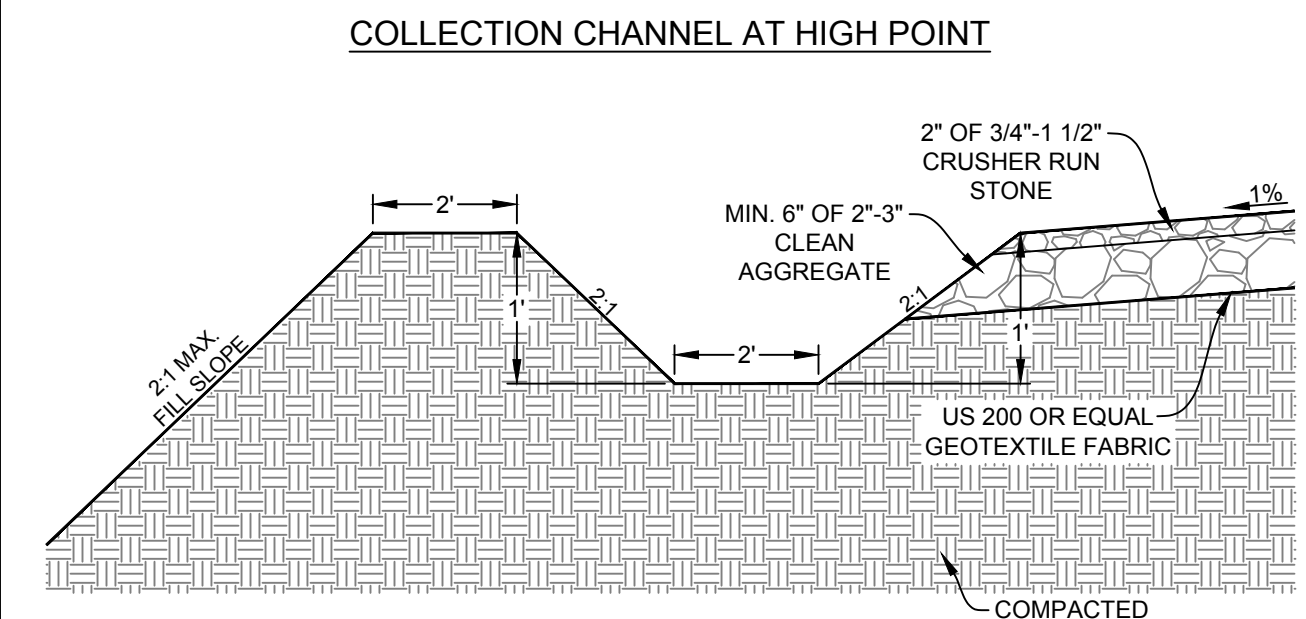
DITCH AT LOW POINT



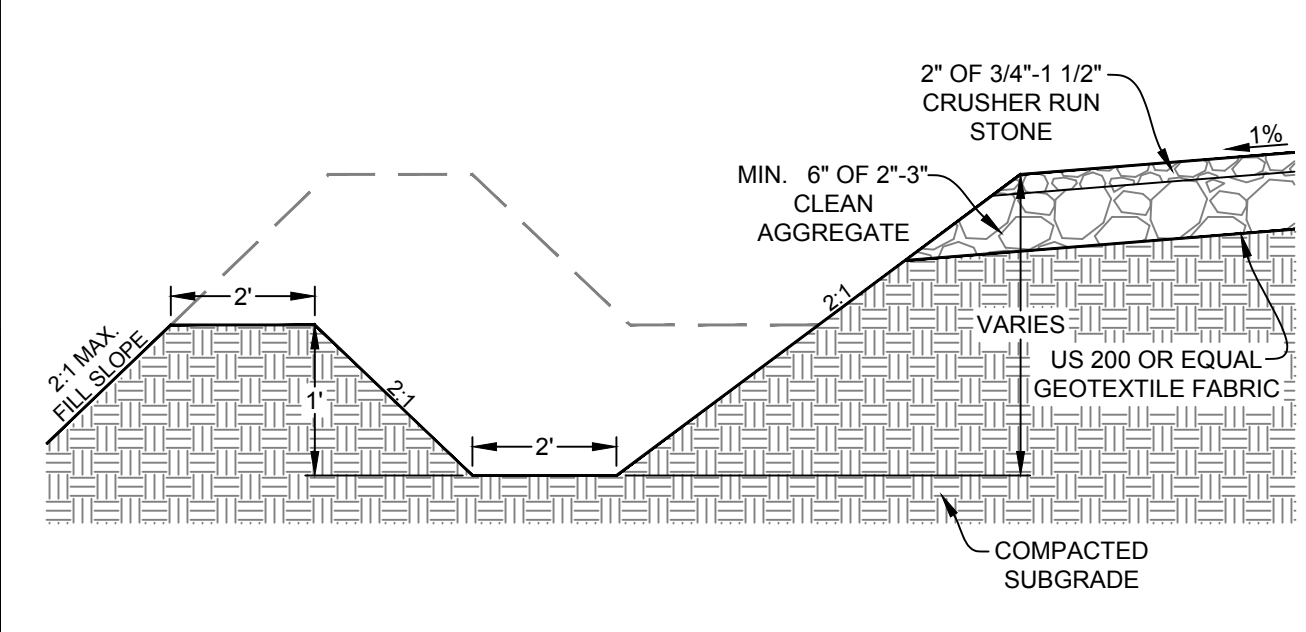
NOTES:
1. DITCH SHALL MAINTAIN A 1% MIN. GRADE TO THE OUTLET.
2. NO RUNOFF FROM THE CUT SLOPE SHALL ENTER THE INTERIOR OF THE PAD CONTAINMENT BERM.

COLLECTION CHANNEL ON PAD WITHOUT CONTAINMENT BERM

N.T.S.



COLLECTION CHANNEL AT LOW POINT

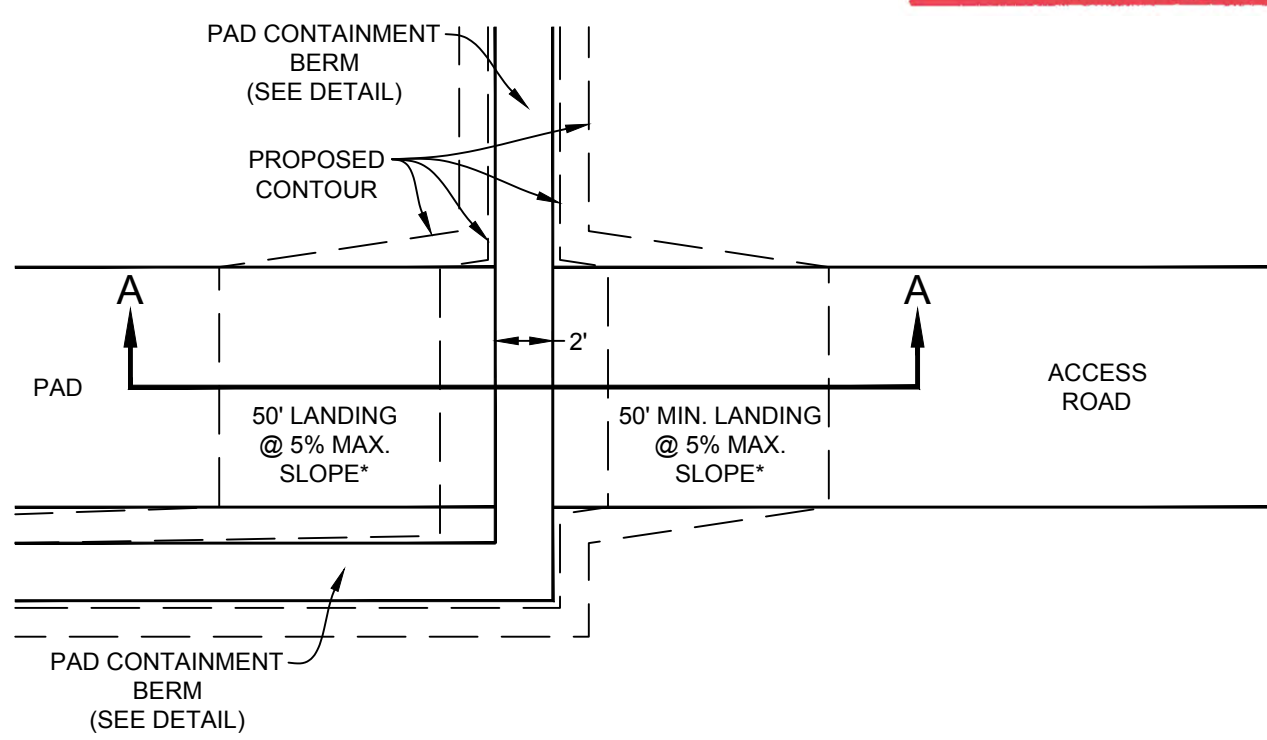


NOTES:
1. COLLECTION CHANNEL SHALL MAINTAIN A 1% MIN. GRADE TO THE OUTLET.

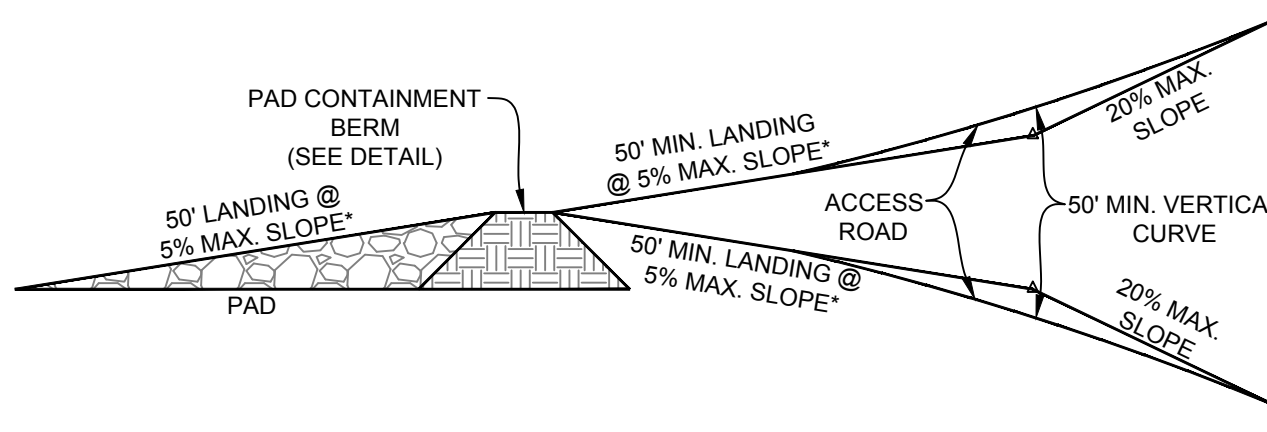
MOUNTABLE BERM

N.T.S.

PLAN VIEW



CROSS-SECTION A-A

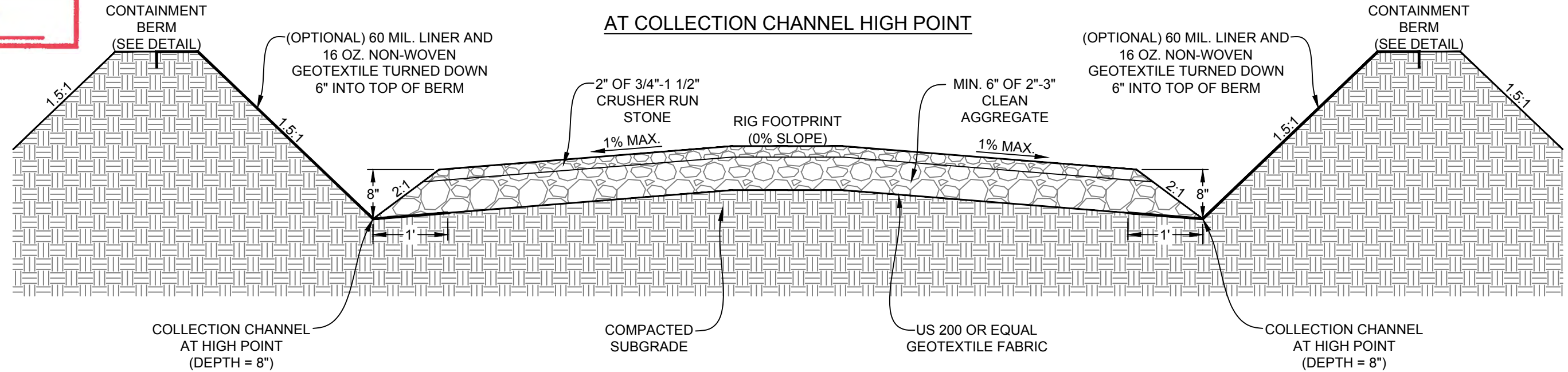


NOTES:
1. MOUNTABLE BERMS THAT DO NOT SERVE AS THE MAIN PAD ACCESS MAY BE STEEPER THAN 5% IF NOTED IN THE PLANS.

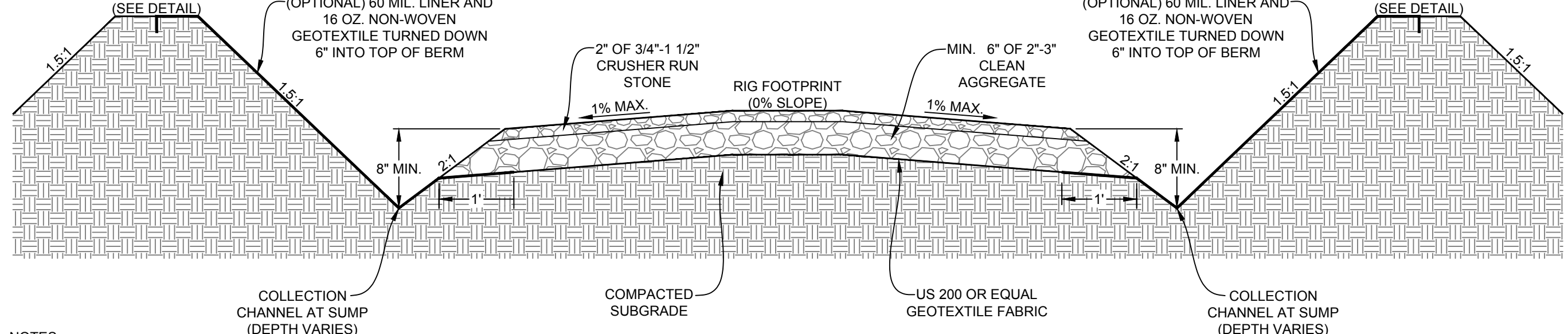
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PAD WITH CONTAINMENT BERM CROSS-SECTION

N.T.S.



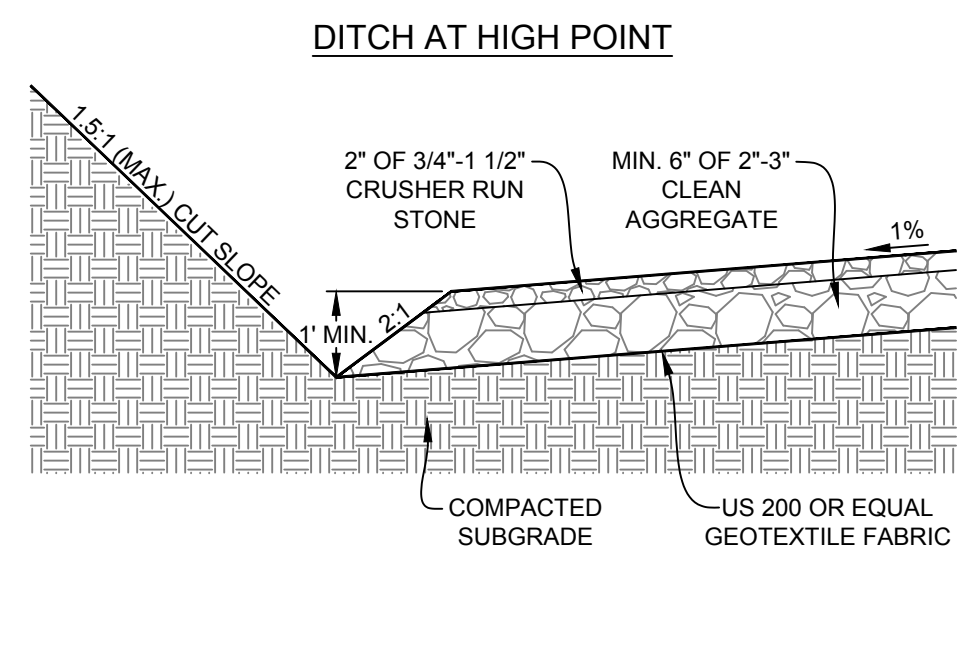
AT COLLECTION CHANNEL SUMP END



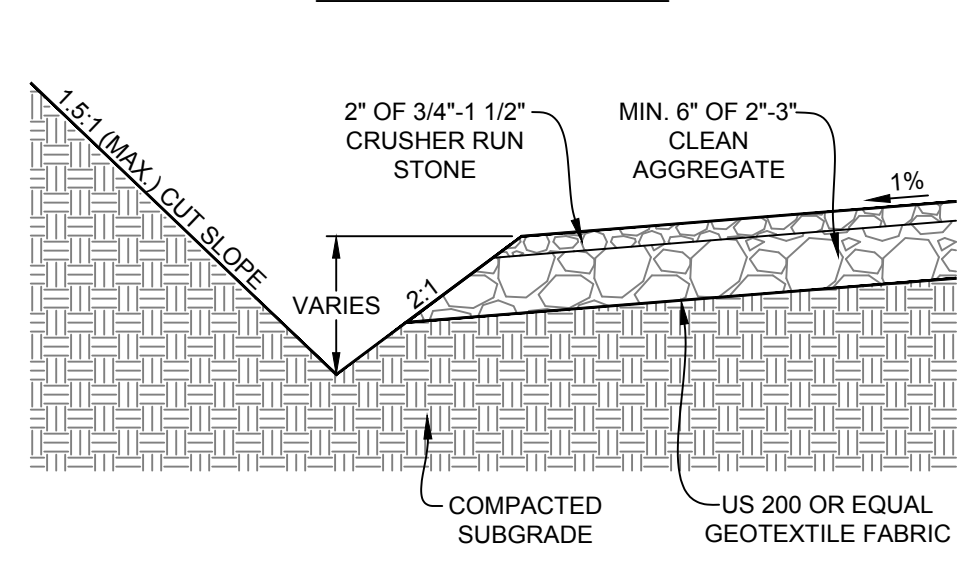
NOTES:
1. CRUSHER RUN STONE SHALL SLOPE TO COLLECTION CHANNEL AT 1% MAX. GRADE FROM RIG FOOTPRINT, SEE PLAN FOR PAD SLOPE.
2. COMPACTED SUBGRADE SHALL HAVE POSITIVE SLOPE TO THE COLLECTION CHANNELS OR SUMPS.
3. IT IS RECOMMENDED THAT THE CONTAINMENT BERM LINER BE INSTALLED TO PREVENT INFILTRATION. IF INFILTRATION CAN BE ADEQUATELY PREVENTED WITHOUT THE USE OF THE LINER, INSTALLATION IS AT THE OPERATOR'S DISCRETION.
4. THE 3/4"-1 1/2" CRUSHER RUN STONE CAP SHALL COMPLETELY COVER THE 2"-3" CLEAN AGGREGATE BELOW. ANY PROJECTING LARGER STONE SHALL BE REMOVED.

PAD WITHOUT CONTAINMENT BERM DITCH ON CUT SLOPE SIDE

N.T.S.

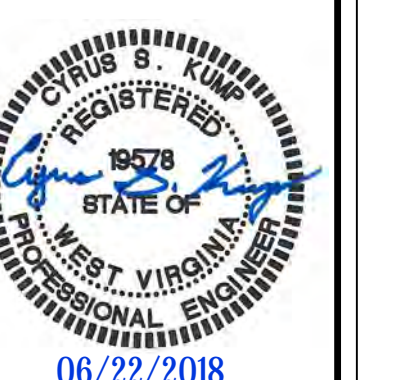


DITCH AT LOW POINT

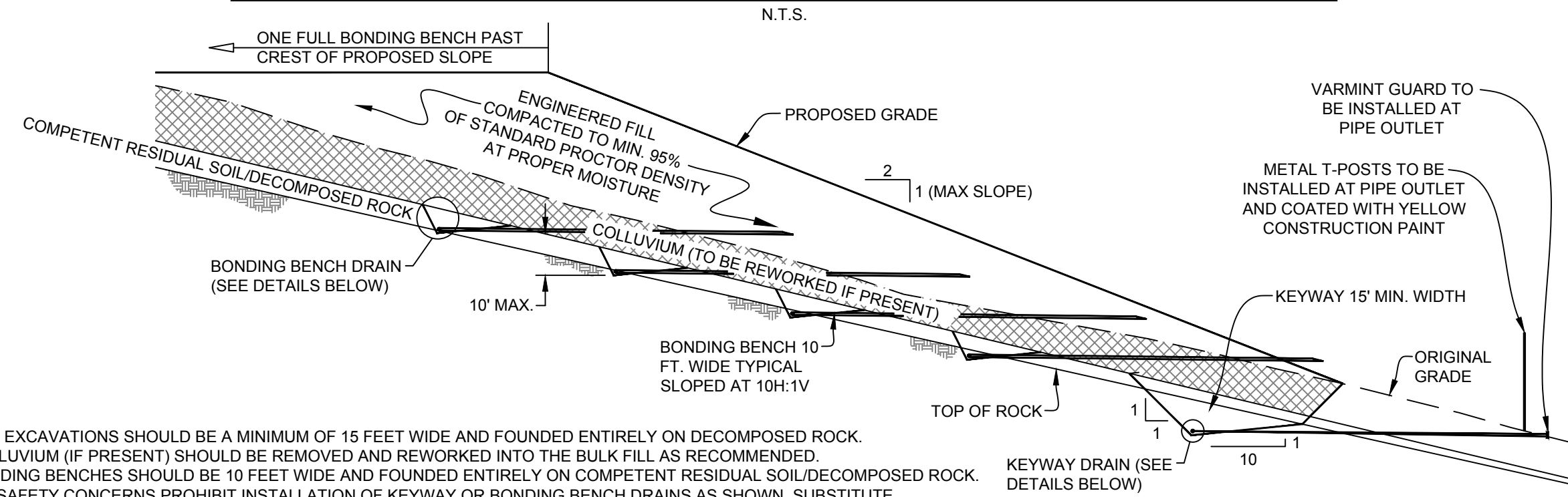


NOTES:
1. DITCH SHALL MAINTAIN A 1% MIN. GRADE TO THE OUTLET.
2. NO RUNOFF FROM THE CUT SLOPE SHALL ENTER THE INTERIOR OF THE PAD.

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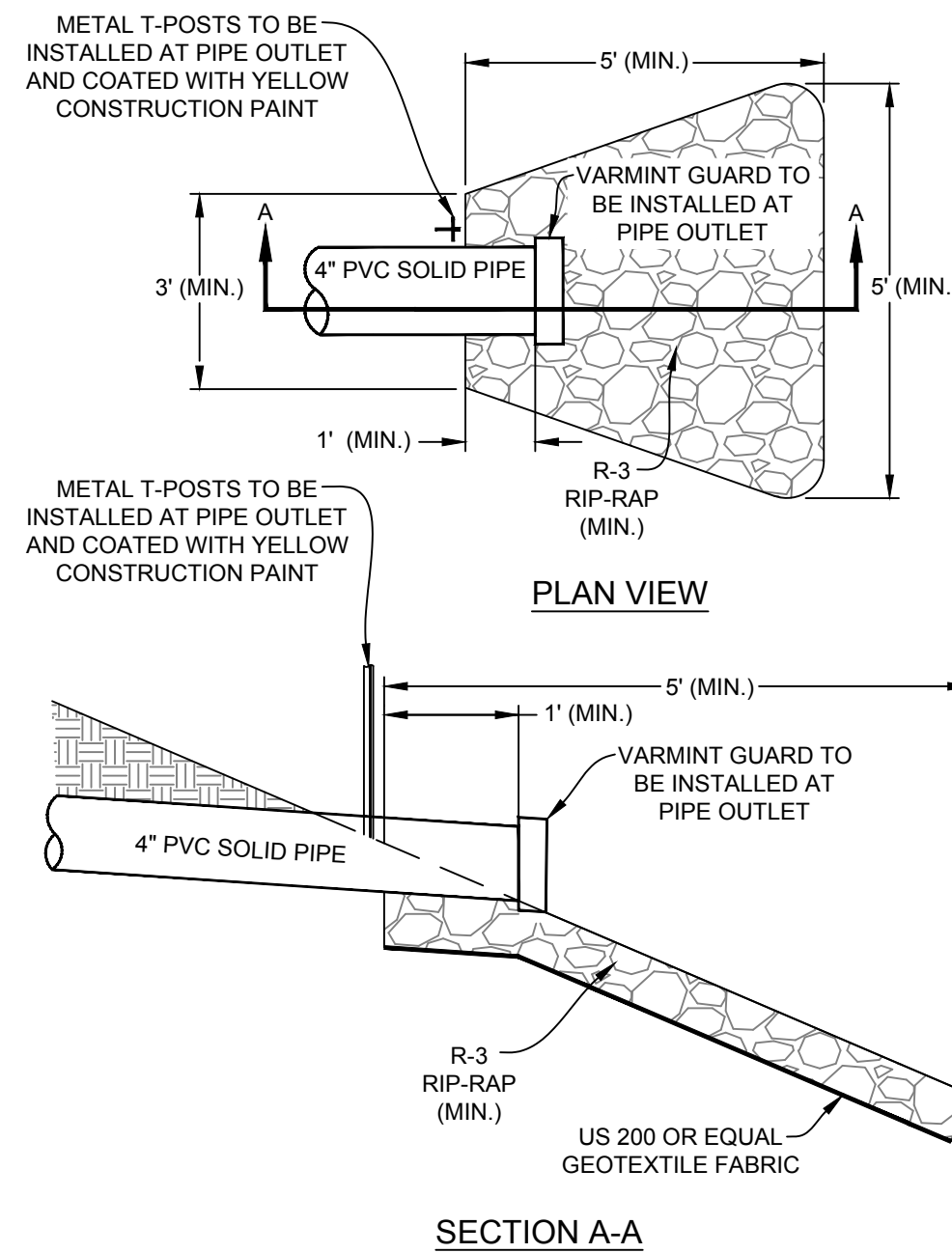


D1 TYPICAL WELL AND TANK PAD KEYWAY, BENCH, AND DRAINAGE



- NOTES:
1. KEYWAY EXCAVATIONS SHOULD BE A MINIMUM OF 15 FEET WIDE AND FOUNDED ENTIRELY ON DECOMPOSED ROCK.
 2. ALL COLLUVIUM (IF PRESENT) SHOULD BE REMOVED AND REWORKED INTO THE BULK FILL AS RECOMMENDED.
 3. ALL BONDING BENCHES SHOULD BE 10 FEET WIDE AND FOUNDED ENTIRELY ON COMPETENT RESIDUAL SOIL/DECOMPOSED ROCK.
 4. WHERE SAFETY CONCERNS PROHIBIT INSTALLATION OF KEYWAY OR BONDING BENCH DRAINS AS SHOWN, SUBSTITUTE ALTERNATE DRAIN DETAIL.

TYPICAL KEYWAY / BONDING BENCH DRAIN OUTLET PROTECTION



- NOTES:
1. ALL APRONS SHALL BE INSPECTED AT LEAST WEEKLY AND AFTER EACH RUNOFF EVENT. DISPLACED RIP-RAP WITHIN THE APRON SHALL BE RESTORED IMMEDIATELY.
 2. IF EROSION IS OCCURRING DOWNSTREAM OF OUTLET PROTECTION, CONTRACTOR TO EXTEND OUTLET PROTECTION TO DOWNSTREAM EROSION CONTROL DEVICES.
 3. CONTRACTOR IS TO EXTEND ALL KEYWAY AND BONDING BENCH OUTLET DRAINS A MINIMUM OF ONE FOOT PAST THE FINISHED GRADE OF THE SLOPE.

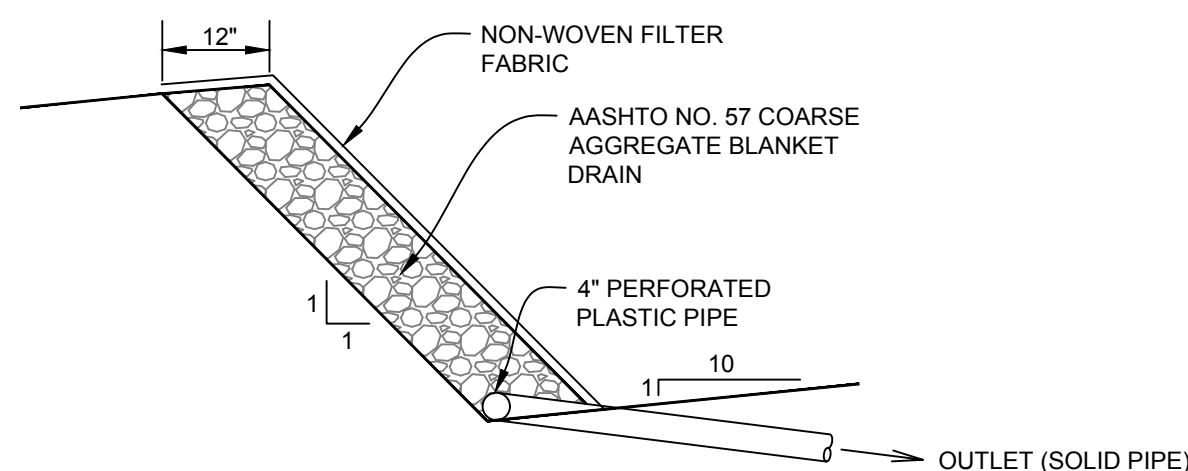
GENERAL SITE EARTHWORK RECOMMENDATIONS

1. ALL FILL AREAS SHOULD BE CLEARED OF TREES, STUMPS, AND VEGETATION AND STRIPPED OF TOPSOIL/ORGANIC SOILS PRIOR TO THE START OF FILL PLACEMENT.
2. THE DISTRIBUTION AND GRADATION OF FILL MATERIALS SHALL BE SUCH THAT THE FILL WILL BE FREE OF LENSES, POCKETS, OR LAYERS OF MATERIALS DIFFERING SUBSTANTIALLY IN GRADATION FROM THE SURROUNDING MATERIALS WITHIN THE DESIGNATED FILL AREAS.
3. FILL SHALL BE PLACED AND SPREAD IN SUCCESSIVE AND APPROXIMATE HORIZONTAL LAYERS OF UNIFORM THICKNESS BASED ON THE NOMINAL PARTICLE SIZE OF MATERIAL AND THE SIZE AND TYPE OF THE AVAILABLE COMPACTION EQUIPMENT. IN GENERAL, SOIL SHOULD BE PLACED IN NOMINAL 12 INCH MAXIMUM LOOSE LIFTS. LARGER ROCK INCORPORATED INTO THE FILL SHOULD TYPICALLY BE LIMITED TO 12 INCHES THICK X 3 FEET X 3 FEET, WITH ALL VOID SPACE CHOKED WITH SMALLER PARTICLE SIZE MATERIAL.
4. ADEQUATE COMPACTIVE EFFORT IS APPLIED BY UTILIZING THE PROPER COMPACTION EQUIPMENT FOR THE COMPOSITION OF THE FILL MATERIALS BEING PLACED. SEGMENTED, SHEEPSFOOT, AND/OR PADFOOT ROLLERS SHOULD BE USED WHEN PLACING PREDOMINATELY CLAYEY (COHESIVE) FILL MATERIALS. THESE TYPES OF ROLLERS ARE ALSO EFFECTIVE ON CLAYEY SHALES, CLAYSTONE, AND SOFTER SANDSTONE TO BREAK DOWN THE ROCK PARTICLES. SMOOTH DRUM VIBRATORY ROLLERS SHOULD BE UTILIZED ON PREDOMINATELY GRANULAR FILL MATERIALS AND TO SEAL CLAYEY SOILS TO HELP PREVENT SURFACE WATER INFILTRATION AND/OR TO PROMOTE DRAINAGE.
5. ALL FILL MATERIALS SHALL BE COMPACTED BY A SUFFICIENT NUMBER OF COMPLETE TRIPS (I.E. PASSES) OF THE APPROPRIATE COMPACTION EQUIPMENT TO ATTAIN A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED IN ACCORDANCE WITH ASTM TEST DESIGNATION D698 (STANDARD PROCTOR). MAINTAIN THE MOISTURE CONTENT OF THE FILL MATERIALS AS NECESSARY TO ATTAIN THE DESIRED COMPACTION DENSITY.
6. UNDISTURBED AND/OR FILL MATERIALS PLACED WITHIN THE UPPER 12 INCHES OF FINAL GRADE SHOULD BE COMPACTED TO ATTAIN A MINIMUM OF 100% OF THE MAXIMUM DRY DENSITY AS DETERMINED IN ACCORDANCE WITH ASTM TEST DESIGNATION D698 (STANDARD PROCTOR) AT AN IN-PLACE MOISTURE WITHIN 3% OF THE MATERIAL'S OPTIMUM MOISTURE CONTENT. THE ENTIRE SUBGRADE SURFACE SHOULD BE THOROUGHLY SEALED USING A VIBRATORY SMOOTH DRUM ROLLER.
7. TO VERIFY THE SPECIFIED DEGREE OF COMPACTION AND TO DETERMINE THE IN-PLACE MOISTURE CONTENT AS STATED ABOVE, IN-PLACE FIELD DENSITY TESTS SHOULD BE PERFORMED IN ACCORDANCE TO THE PROCEDURES OF ASTM D2922 (NUCLEAR DENSOMETER).
8. IN ADDITION TO IN-PLACE FIELD DENSITY TESTING, ACCEPTANCE SHOULD ALSO BE PREDICATED ON A VISUAL PERFORMANCE CRITERIA. OBVIOUS SURFACE RUTTING AND/OR DEFLECTION THAT ARE JUDGED TO BE DETRIMENTAL TO THE OVERALL STABILITY OF THE FILL AREA SHOULD BE REMOVED, MOISTURE CONDITIONED AND RECOMPACTED, OR OTHERWISE ADDRESSED PRIOR TO ACCEPTING THE LIFT.
9. WHERE PREDOMINATELY "ROCKY" FILL MATERIALS ARE PLACED OR WHERE REPRESENTATIVE NUCLEAR DENSOMETER TESTS CANNOT BE OBTAINED, A VISUAL NON-DEFLECTION CRITERIA SHOULD BE DEVELOPED IN CONJUNCTION WITH AN ADEQUATE NUMBER OF ROLLER PASSES FOR ACCEPTANCE.

NOTE:

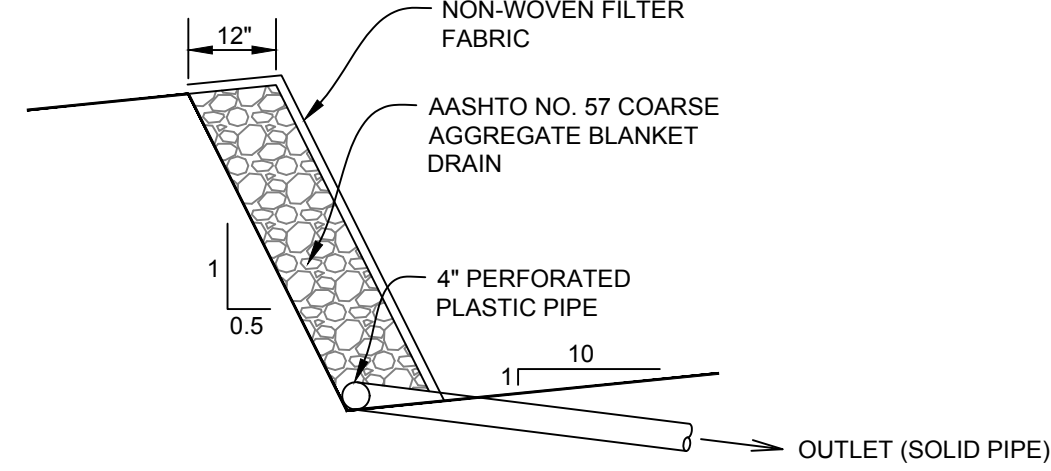
1. THE GEOTECHNICAL NOTES AND DETAILS SHOWN ON THIS SHEET ARE FOR THE GENERAL EARTHWORK AND SUBSURFACE DRAINAGE ASSOCIATED WITH THE CONSTRUCTION OF THIS SITE. THE CONTRACTOR SHALL REFER TO THE GEOTECHNICAL INVESTIGATION REPORT FOR ADDITIONAL GUIDANCE AND RECOMMENDATIONS.

D1 KEYWAY DRAIN - AGGREGATE



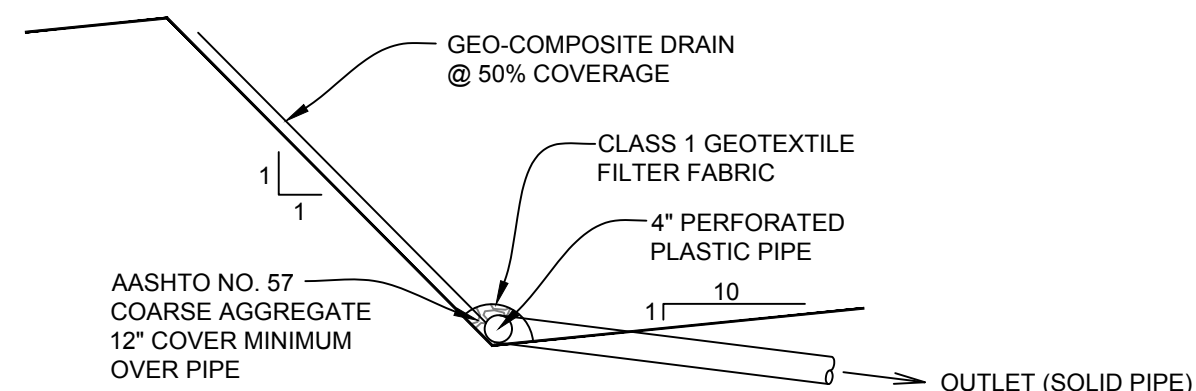
- *OUTLETS AT 100 FT. CENTERS MAX. OR AS DEEMED NECESSARY
*ALL OUTLET DRAINS TO BE COVERED WITH 12" OF NO. 57 AGGREGATE AND WRAPPED IN NON-WOVEN FILTER FABRIC

D1 BONDING BENCH DRAIN - AGGREGATE



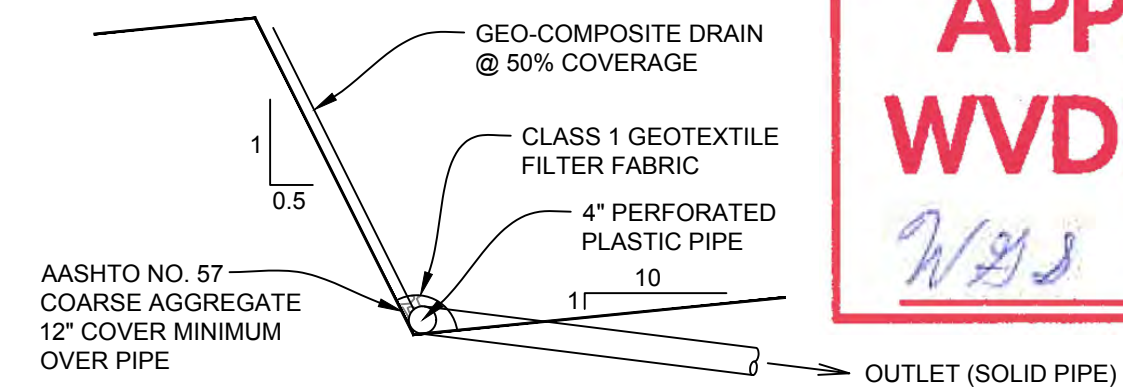
- *SLOPE OUTLET TO PROVIDE POSITIVE DRAINAGE TO SLOPE FACE
*OUTLETS AT 250 FT. CENTERS MAX. OR AS DEEMED NECESSARY
*ALL OUTLET DRAINS TO BE COVERED WITH 12" OF NO. 57 AGGREGATE AND WRAPPED IN NON-WOVEN FILTER FABRIC

D1 KEYWAY DRAIN - GEO-COMPOSITE



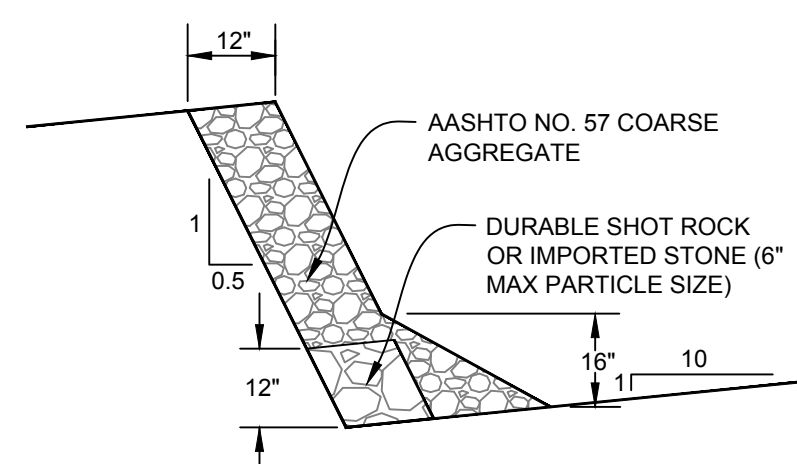
- *OUTLETS AT 100 FT. CENTERS MAX. OR AS DEEMED NECESSARY
*ALL OUTLET DRAINS TO BE COVERED WITH 12" OF NO. 57 AGGREGATE AND WRAPPED IN NON-WOVEN FILTER FABRIC
*GEO-COMPOSITE DRAIN TO CONSIST OF HANES GEO COMPONENTS TERRADRAIN 104/2, MIRAFI G200N, OR EQUIVALENT.

D1 BONDING BENCH DRAIN - GEO-COMPOSITE



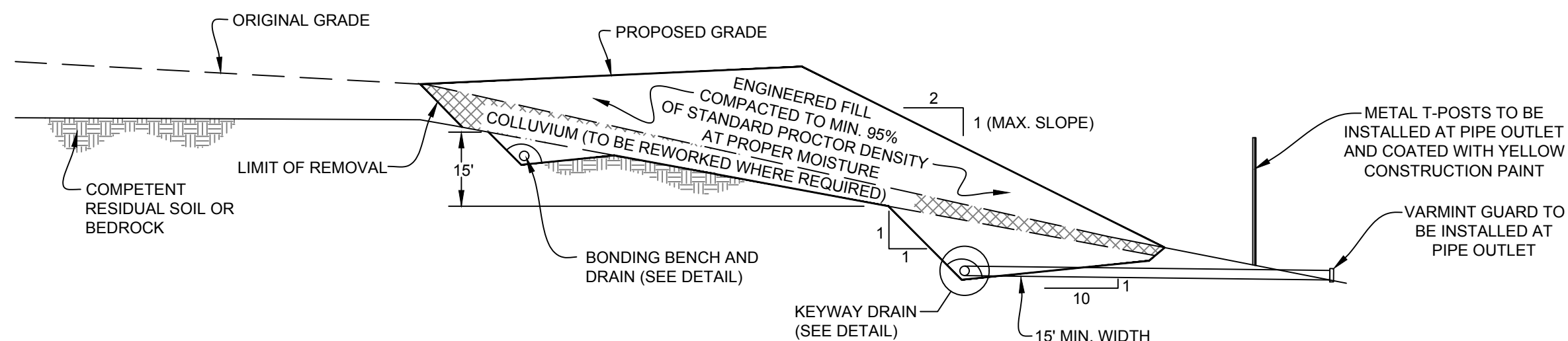
- *SLOPE OUTLET TO PROVIDE POSITIVE DRAINAGE TO SLOPE FACE
*OUTLETS AT 250 FT. CENTERS MAX. OR AS DEEMED NECESSARY
*ALL OUTLET DRAINS TO BE COVERED WITH 12" OF NO. 57 AGGREGATE AND WRAPPED IN NON-WOVEN FILTER FABRIC
*GEO-COMPOSITE DRAIN TO CONSIST OF HANES GEO COMPONENTS TERRADRAIN 104/2, MIRAFI G200N, OR EQUIVALENT.

D1 ALTERNATE KEYWAY/BONDING BENCH DRAIN



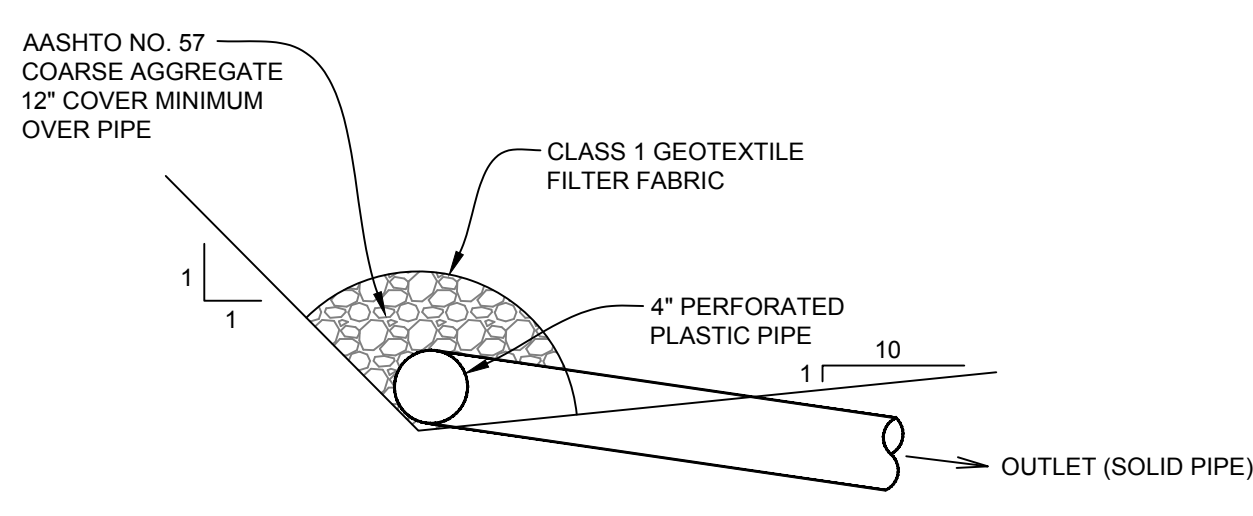
08/31/2018

D2 TYPICAL ACCESS DRIVE KEYWAY, BENCH, AND DRAINAGE



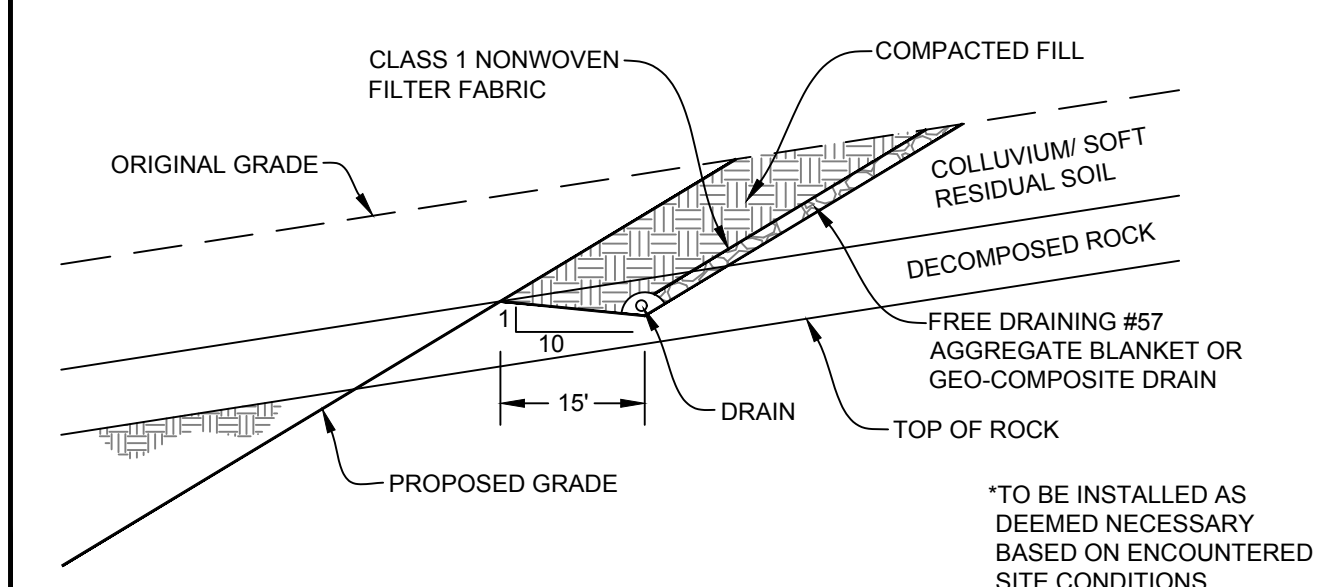
- NOTES:
1. KEYWAY EXCAVATIONS SHOULD BE A MINIMUM OF 15 FEET WIDE AND EXTEND THROUGH ALL COLLUVIUM AND/OR RESIDUAL SOIL TO BE FOUNDED ENTIRELY ON DECOMPOSED ROCK.
 2. 4" PERFORATED KEYWAY DRAIN SHOULD BE INSTALLED ALONG THE ENTIRE LENGTH OF THE KEYWAY WITH OUTLETS AT 100 FT. CENTERS.
 3. A 10" BONDING BENCH AND DRAIN SHOULD BE INSTALLED 15 FEET HIGHER IN ELEVATION ABOVE THE TOP OF THE REAR WALL OF THE KEYWAY EXCAVATION.

D2 KEYWAY DRAIN



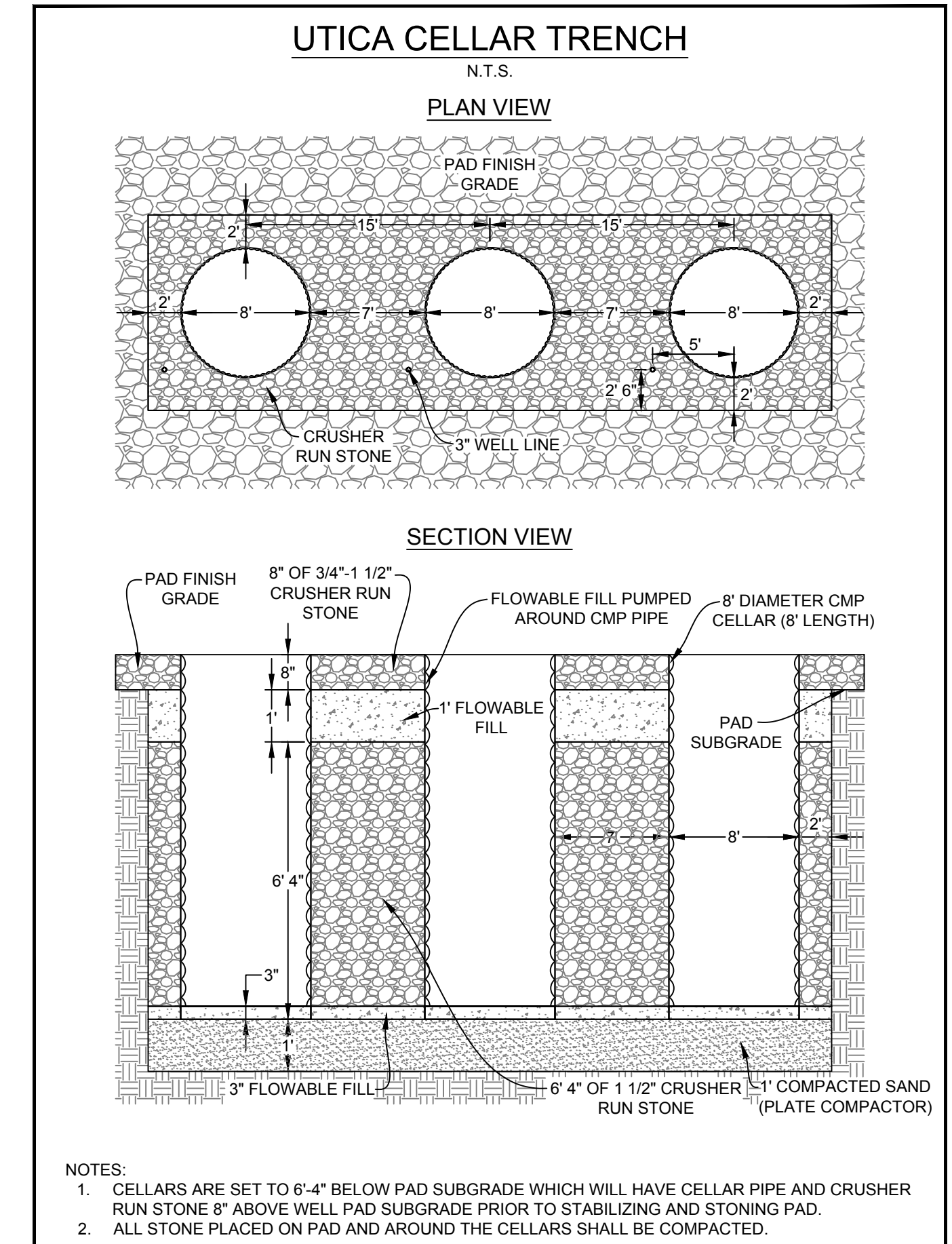
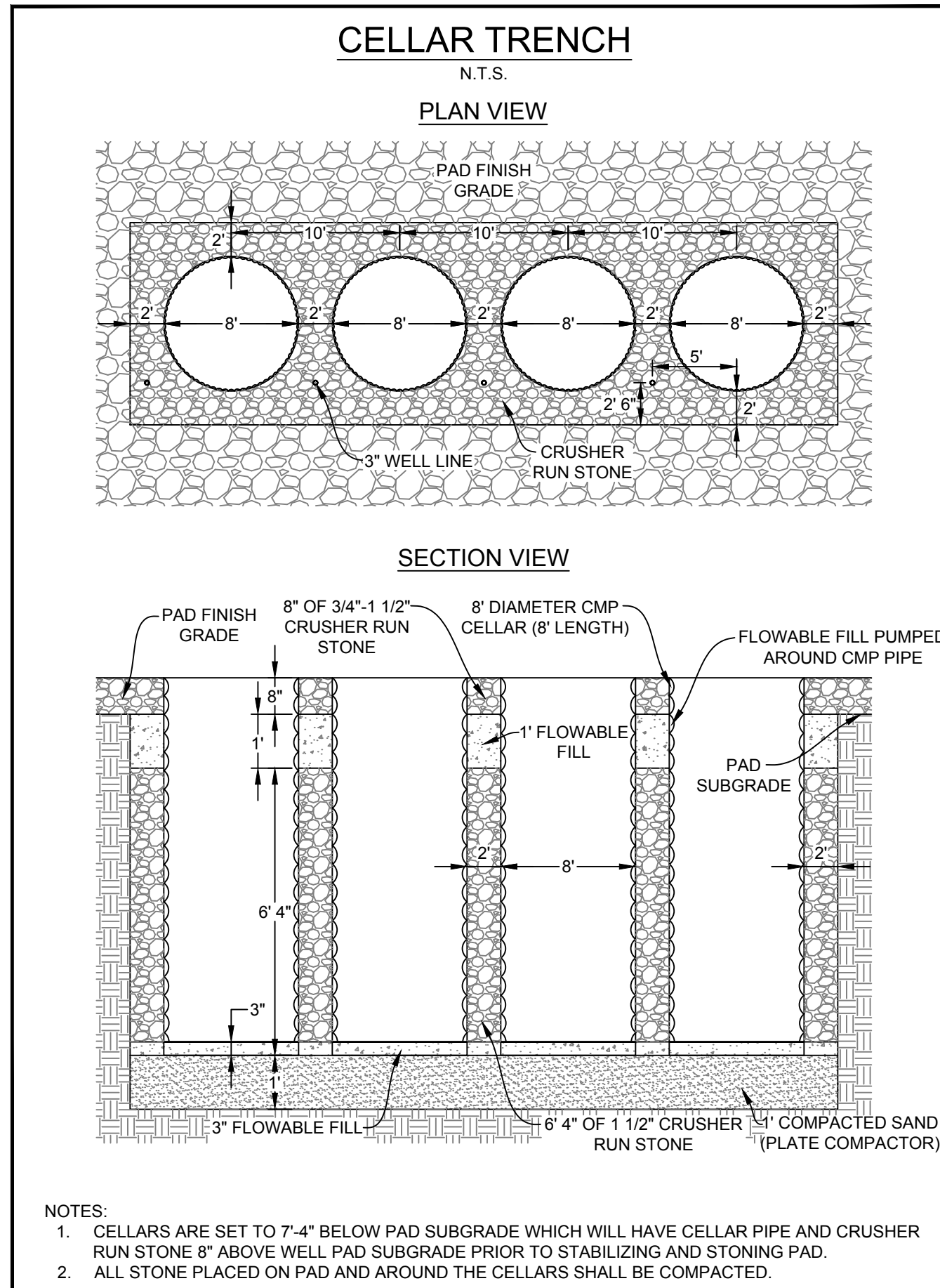
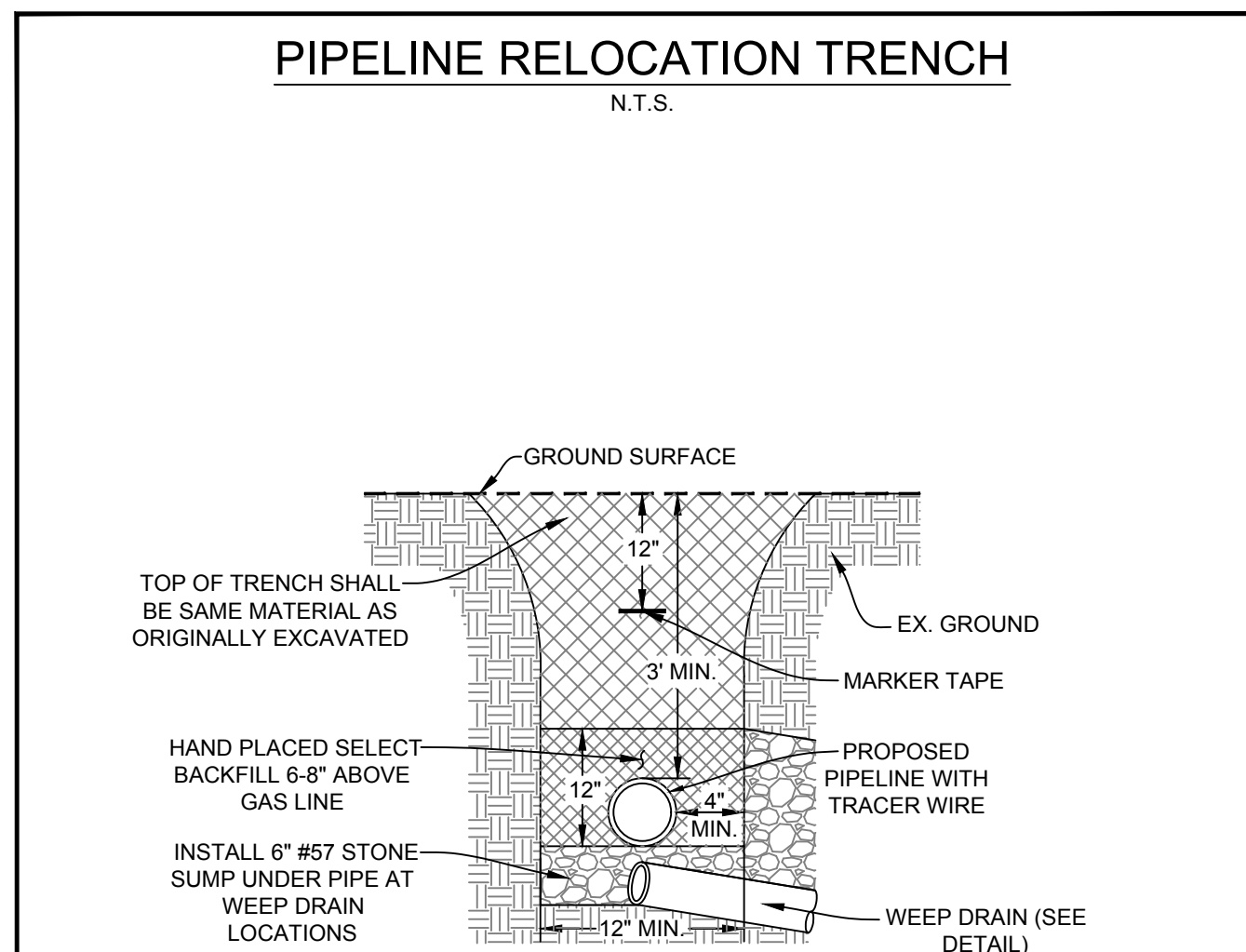
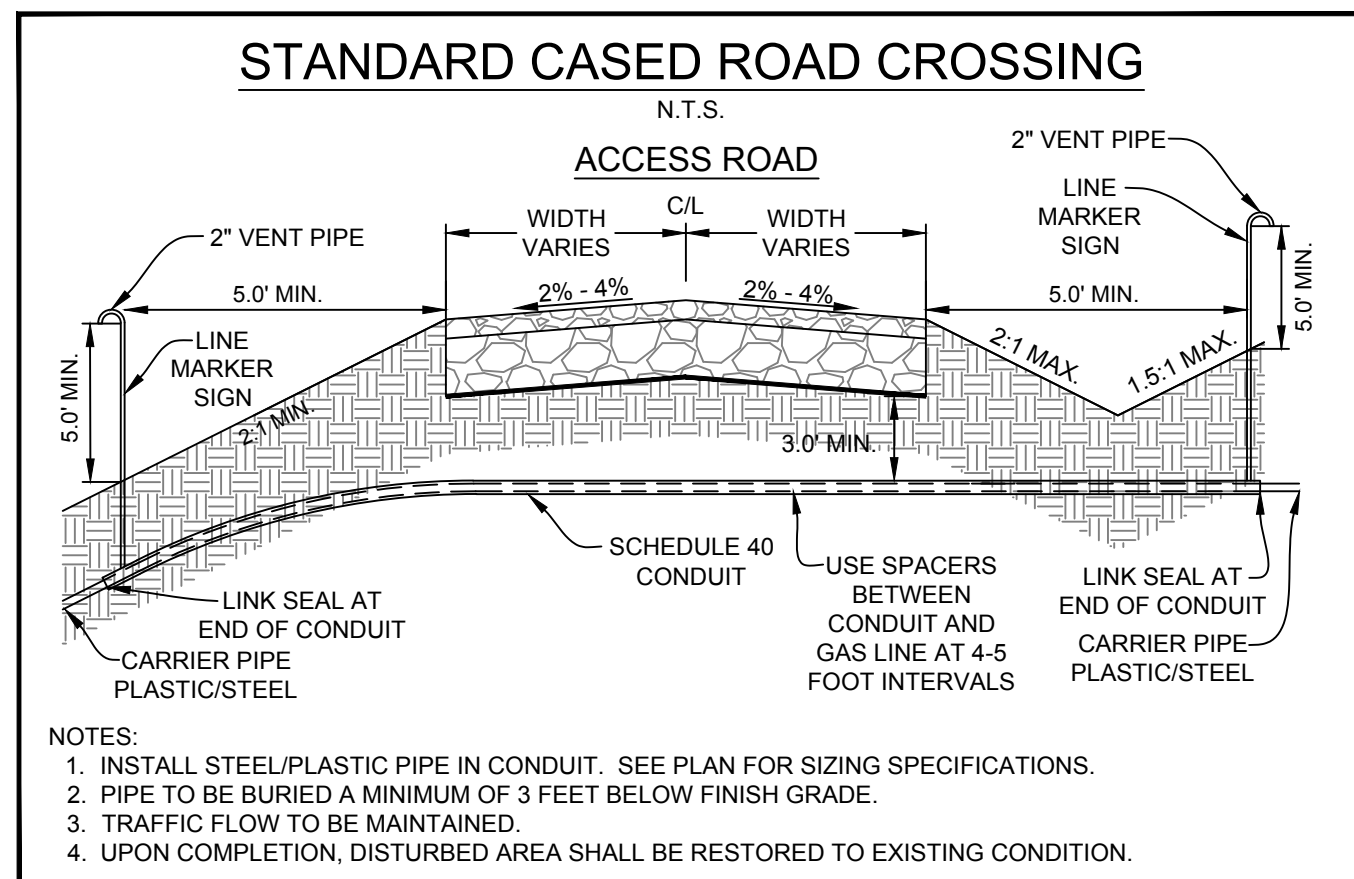
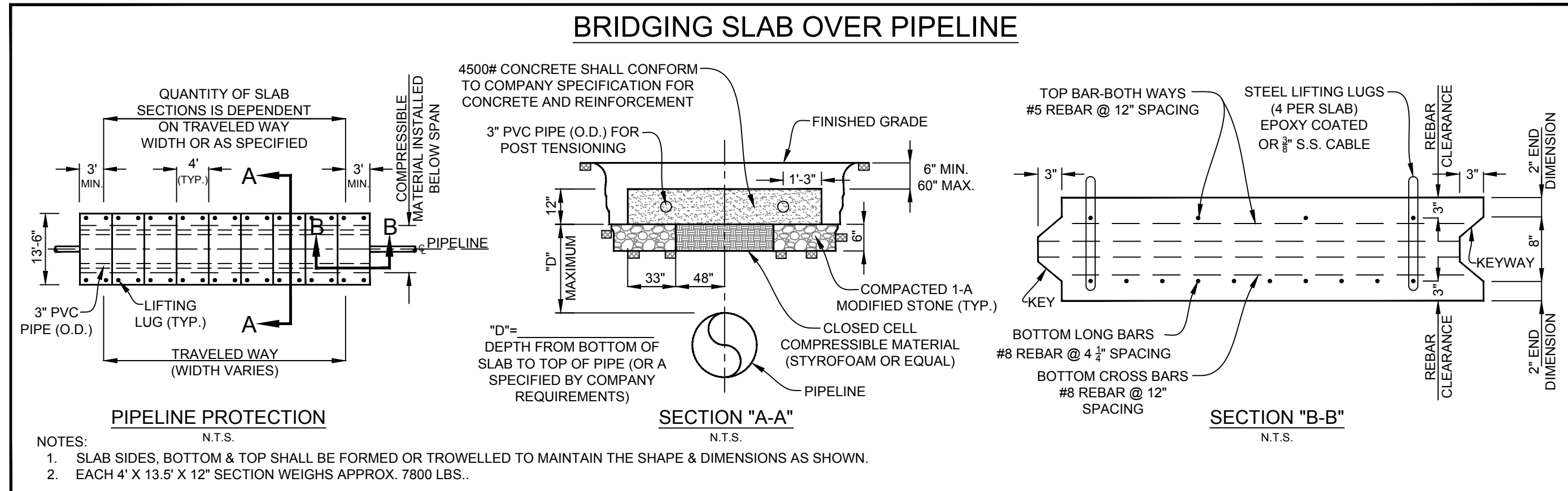
- *OUTLETS AT 100 FT. CENTERS MAX FOR KEYWAY
*OUTLETS AT 250 FT. CENTERS MAX. FOR BONDING BENCH
*ALL OUTLET DRAINS TO BE COVERED WITH 12" OF NO. 57 AGGREGATE AND WRAPPED IN NON-WOVEN FILTER FABRIC

D4 TYPICAL SLOPE PROTECTION



- *OUTLET AT ENDS AND AT 250' CENTERS MAX SIMILAR TO KEYWAY DRAIN DETAIL
*ALL OUTLET DRAINS TO BE COVERED WITH 12" MINIMUM NO. 57 AGGREGATE AND WRAPPED IN NON-WOVEN FILTER FABRIC

DATE	REVISION
05/26/2016	REVISED PER IOD COMMENTS
12/21/2016	REVISED PER SLIDE REPAIR
03/16/2017	REVISED PER SLIDE AREAS #1, #2, & #3
05/03/2017	REVISED IOD MODIFICATION
06/14/2017	REVISED PER LANDOWNER CHANGE
07/27/2017	REVISED PER SITE VISIT
06/22/2018	REVISED PER SLIDE AREAS #9, #11, & #12

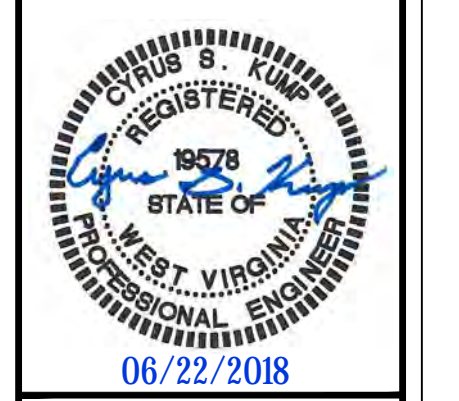


APPROVED
WVDEP OOG
Modification
8/30/2018

DATE	REVISION
05/26/2016	REVISED PER LOD COMMENTS
12/21/2016	REVISED PER SLIDE REPAIR
03/16/2017	REVISED PER SLIDE AREAS #1, #2, & #3
05/03/2017	REVISED LOD MODIFICATION
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Antero Resources
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

CONSTRUCTION DETAILS
NASH
WELL PAD
WEST UNION & GRANT DISTRICTS
DODDRIDGE COUNTY, WEST VIRGINIA





TEMPORARY SEEDING:

- GENERAL CONDITIONS WHERE PRACTICE APPLIES
WHERE EXPOSED SOIL SURFACES ARE NOT TO BE FINE-GRADED OR WORKED FOR PERIODS LONGER THAN 21 DAYS. TEMPORARY VEGETATIVE COVER WITH SEDIMENT CONTROLS MUST BE ESTABLISHED WHERE RUNOFF WILL GO DIRECTLY INTO A STREAM. IMMEDIATELY UPON CONSTRUCTION OF THE SITE (SITE INCLUDES ROAD AND LOCATION), VEGETATION MUST BE ESTABLISHED ON ROAD BANK AND LOCATION SLOPES. A PERMANENT VEGETATIVE COVER SHALL BE APPLIED TO AREAS THAT WILL BE LEFT UN-WORKED FOR A PERIOD OF MORE THAN SIX MONTHS.
- SEED MIXTURES AND PLANTING DATES
REFER TO TABLES IV-2 THROUGH IV-4 FOR RECOMMENDED DATES TO ESTABLISH VEGETATIVE COVER AND THE APPROVED LISTS OF TEMPORARY AND PERMANENT PLANT SPECIES AND PLANTING RATES. TABLE IV-3 GIVES RECOMMENDED TYPES OF TEMPORARY VEGETATION, RATES OF APPLICATION, AND OPTIMUM SEEDING DATES. IN SITUATIONS WHERE ANOTHER COVER IS DESIRED, CONTACT THE LOCAL SOIL CONSERVATION DISTRICT FOR SEEDING RECOMMENDATIONS.
- SEED APPLICATION
APPLY SEED BY BROADCASTING, DRILLING, OR BY HYDROSEED ACCORDING TO THE RATES INDICATED IN TABLE IV-3. PERFORM ALL PLANTING OPERATIONS AT RIGHT ANGLES TO THE SLOPE. NECESSARY SITE PREPARATION AND ROUGHENING OF THE SOIL SURFACE SHOULD BE DONE JUST PRIOR TO SEEDING. SEEDBED PREPARATION MAY NOT BE REQUIRED ON NEWLY DISTURBED AREAS.

PERMANENT SEEDING:

- GENERAL
PERMANENT VEGETATIVE COVER WILL BE ESTABLISHED WHERE NO FURTHER SOIL DISTURBANCE IS ANTICIPATED OR NEEDED. SOIL FERTILITY AND PH LEVEL SHOULD BE TESTED AND ADJUSTED ACCORDING TO SEED SPECIES PLANTED. PLANTING OF PERMANENT VEGETATIVE COVERS MUST BE PERFORMED ON ALL DISTURBED AREAS AFTER COMPLETION OF THE DRILLING PROCESS. ANY SITE THAT CONTAINS SIGNIFICANT AMOUNTS OF TOPSOIL SHALL HAVE THE TOPSOIL REMOVED AND STOCKPILED WHEN FEASIBLE. TOPSOIL SHOULD NOT BE ADDED TO SLOPES STEEPER THAN 2:1 UNLESS A GOOD BONDING TO THE SUB-LAYER CAN BE ACHIEVED. AFTER PROPER GRADING AND SEEDBED PREPARATION, THE VEGETATION WILL REESTABLISH GROUND COVER FOR THE CONTROL OF SURFACE WATER RUNOFF EROSION. ALL REQUIRED SEEDBED PREPARATION AND LOOSENING OF SOIL BY DISKING OR DOZER TRACKING SHOULD BE PERFORMED JUST PRIOR TO SEEDING. IF SEEDBED PREPARATION IS NOT FEASIBLE, 50% MORE SEED SHALL BE ADDED TO THE RECOMMENDED RATES SHOWN IN TABLES IV-3 AND IV-4. WHEN HYDROSEEDING, SEEDBED PREPARATION MAY NOT BE NECESSARY IF ADEQUATE SITE PREPARATION WAS PERFORMED. INCORPORATE THE APPROPRIATE AMOUNT OF LIME AND/OR FERTILIZER IN THE SLURRY MIX WHEN HYDROSEEDING. WHEN HYDROSEEDING, FIRST MIX THE LIME, FERTILIZER, AND HYDRO-MULCH IN THE RECOMMENDED AMOUNT OF WATER. MIX THE SEED AND INOCULANTS TOGETHER WITHIN ONE HOUR PRIOR TO PLANTING, AND ADD TO THE SLURRY JUST BEFORE SEEDING. APPLY THE SLURRY UNIFORMLY OVER THE PREPARED SITE. ASSURE THAT AGITATION IS CONTINUOUS THROUGHOUT THE SEEDING OPERATION AND THE MIX IS APPLIED WITHIN ONE HOUR OF INITIAL MIXING.
- LIME AND FERTILIZER
1. LIME SHALL BE APPLIED TO ALL PERMANENT SEEDINGS. THE PH OF THE SOIL IS TO BE DETERMINED AND LIME APPLIED ACCORDINGLY. ONCE THE PH IS KNOWN, SELECT THE AMOUNT OF LIME TO BE APPLIED FROM TABLE IV-5.
2. FERTILIZER SHALL BE APPLIED IN ALL PERMANENT SEEDINGS. APPLY THE EQUIVALENT FOR 500 LBS. MINIMUM 10-20-20 FERTILIZER PER ACRE OR USE THE AMOUNT OF FERTILIZER AND LIME RECOMMENDED BY A CERTIFIED SOIL TEST.
3. APPLICATION: FOR BEST RESULTS AND MAXIMUM BENEFITS, THE LIME AND FERTILIZER ARE TO BE APPLIED AT THE TIME OF SEEDBED PREPARATION.
- PERMANENT SEED MIXTURES
PLANNERS SHOULD TAKE INTO CONSIDERATION THE SPECIES MAKEUP OF THE EXISTING PASTURE AND THE LANDOWNER'S FUTURE PASTURE MANAGEMENT PLANS WHEN RECOMMENDING SEED MIXTURES. SELECTION: FROM TABLES IV-4A AND IV-4B, PERMANENT SEEDING MIXTURES SUITABLE FOR ESTABLISHMENT IN WEST VIRGINIA.
NOTES:
1. ALL LEGUMES MUST BE PLANTED WITH THE PROPER INOCULANTS PRIOR TO SEEDING.
2. LATHCO FLATPEA IS POTENTIALLY POISONOUS TO SOME LIVESTOCK.
3. ONLY ENDOPHYTE FREE VARIETIES OF TALL FESCUE SHOULD BE USED. TALL FESCUE AND CROWNVELTCH ARE ALSO VERY INVASIVE SPECIES, NON-NATIVE TO WV.
4. FOR UNPREPARED SEEDBEDS OR SEEDING OUTSIDE THE OPTIMUM TIMEFRAMES, ADD 50% MORE SEED TO THE SPECIFIED RATE. MIXTURES IN TABLE IV-4B ARE MORE WILDLIFE AND FARM FRIENDLY; THOSE LISTED IN BOLD ARE SUITABLE FOR USE IN SHADED WOODLAND SETTINGS. MIXTURES IN ITALIC ARE SUITABLE FOR USE IN FILTER STRIPS.

SEEDING FOR WILDLIFE HABITAT

CONSIDER THE USE OF THE NATIVE PLANTS OR LOCALLY ADAPTED PLANTS WHEN SELECTING COVER TYPES AND SPECIES FOR WILDLIFE HABITAT. WILDLIFE FRIENDLY SPECIES OR MIXES THAT HAVE MULTIPLE VALUES SHOULD BE CONSIDERED. SEE WILDLIFE FRIENDLY SPECIES/MIXTURES IN TABLE IV-4B. CONSIDER SELECTING NO OR LOW MAINTENANCE LONG-LIVED PLANTS ADAPTABLE TO SITES WHICH MAY BE DIFFICULT TO MAINTAIN WITH EQUIPMENT.

MULCHING

- GENERAL ORGANIC MULCHES
THE APPLICATION OF STRAW, HAY, OR OTHER SUITABLE MATERIALS TO THE SOIL SURFACE TO PREVENT EROSION. STRAW MADE FROM WHEAT OR OATS IS THE PREFERRED MULCH. THE USE OF HAY IS PERMISSIBLE, BUT NOT ENCOURAGED DUE TO THE RISK OF SPREADING INVASIVE SPECIES. MULCH MUST BE APPLIED TO ALL TEMPORARY AND PERMANENT SEEDING ON ALL DISTURBED AREAS. DEPENDING ON SITE CONDITIONS, IN CRITICAL AREAS SUCH AS WATERWAYS OR STEEP SLOPES, ADDITIONAL OR SUBSTITUTE SOIL PROTECTIVE MEASURES MAY BE USED IF DEEMED NECESSARY. EXAMPLES INCLUDE JUTE MESH AND SOIL STABILIZATION BLANKETS OR EROSION CONTROL MATTING.
AREAS THAT HAVE BEEN TEMPORARILY OR PERMANENTLY SEEDING SHOULD BE MULCHED IMMEDIATELY FOLLOWING SEEDING. MULCHES CONSERVE DESIRABLE SOIL PROPERTIES, REDUCE SOIL MOISTURE LOSS, PREVENT CRUSTING AND SEALING OF THE SOIL SURFACE, AND PROVIDE A SUITABLE MICROCLIMATE FOR SEED GERMINATION.
AREAS THAT CANNOT BE SEEDING BECAUSE OF THE SEASON SHOULD BE MULCHED TO PROVIDE SOME PROTECTION TO THE SOIL SURFACE. AN ORGANIC MULCH, STRAW, OR HAY SHOULD BE USED AND THE AREA THEN SEEDING AS SOON AS WEATHER OR SEASONAL CONDITIONS PERMIT. DO NOT USE FIBER MULCH (CELLULOSE-HYDROSEED) ALONE FOR THIS PRACTICE; AT NORMAL APPLICATION RATES IT WILL NOT GIVE THE SOIL PROTECTION OF OTHER TYPES OF MULCH.
WOOD CELLULOSE FIBER MULCH IS USED IN HYDROSEEDING OPERATIONS AND APPLIED AS PART OF THE SLURRY. IT CREATES THE BEST SEED-SOIL CONTACT WHEN APPLIED OVER THE TOP OF (AS A SEPARATE OPERATION) NEWLY SEEDING AREAS. FIBER MULCH DOES NOT ALONE PROVIDE SUFFICIENT PROTECTION ON HIGHLY ERODIBLE SOILS, OR DURING LESS THAN FAVORABLE GROWING CONDITIONS. FIBER MULCH SHOULD NOT BE USED ALONE DURING THE DRY SUMMER MONTHS OR WHEN USED FOR LATE FALL MULCH COVER. USE STRAW MULCH DURING THESE PERIODS AND FIBER MULCH MAY BE USED TO TACK (ANCHOR) THE STRAW MULCH. FIBER MULCH IS WELL SUITED FOR STEEP SLOPES, CRITICAL AREAS, AND AREAS SUSCEPTIBLE TO WIND.
- CHEMICAL MULCHES, SOIL BINDERS, AND TACKIFIERS
A WIDE RANGE OF SYNTHETIC SPRAY ON MATERIALS ARE MARKETED TO STABILIZE AND PROTECT THE SOIL SURFACE. THESE ARE MIXED WITH WATER AND SPRAYED OVER THE MULCH AND TO THE SOIL. THEY MAY BE USED ALONE IN SOME CASES AS TEMPORARY STABILIZERS, OR IN CONJUNCTION WITH FIBER MULCH, STRAW, OR HAY.
WHEN USED ALONE, MOST CHEMICAL MULCHES DO NOT HAVE THE CAPABILITY TO INSULATE THE SOIL OR RETAIN SOIL MOISTURE THAT ORGANIC MULCHES HAVE.
- SPECIFICATIONS
FROM TABLE IV-6 SELECT THE TYPE OF MULCH AND RATE OF APPLICATION THAT WILL BEST SUIT THE CONDITIONS AT THE SITE.
- ANCHORING
DEPENDING ON THE FIELD SITUATION, MULCH MAY NOT STAY IN PLACE BECAUSE OF WIND ACTION OR RAPID WATER RUNOFF. IN SUCH CASES, MULCH IS TO BE ANCHORED MECHANICALLY OR WITH MULCH NETTING.
1. MECHANICAL ANCHORING
APPLY MULCH AND PULL MULCH ANCHORING TOOL OVER THE MULCH. WHEN A DISK IS USED, SET THE DISK STRAIGHT AND PULL ACROSS SLOPE. MULCH MATERIAL SHOULD BE TUCKED INTO THE SOIL ABOUT 3".
2. MULCH NETTING
FOLLOW MANUFACTURER'S RECOMMENDATION WHEN POSITIONING AND STAPLING THE MULCH NETTING IN THE SOIL.

ANTERO'S PREFERRED SEED MIXTURE

HALL'S #1 PASTURE MIXTURE			
Species/Contains	Pure Seed	Germ	Origin
Bestfor Intermediate Ryegrass	29.95%	90%	OR
Climax Timothy	24.96%	90%	CAN
Annual Ryegrass *	24.92%	90%	OR
Medium Red Clover *	9.99%	90%	OR
Potomac Orchardgrass	9.46%	90%	OR
Other Crop Seeds:	0.01%	* Variety Not Stated	
Inert Matter:	0.69%		
Weed Seeds:	0.02%	AMS: 5143	

Table IV-1 Recommended Seeding Dates		
Planting Dates	Recommended Seeding Dates	Suitability
March 1 - April 15 and August 1 - October 1	Best Seeding Periods	
April 15 - August 1	HIGH RISK - moisture stress likely	
October 1 - December 1	HIGH RISK - freeze damage to young seedlings	
December 1 - March 1	Good seeding period. Dormant seeding	

Table IV-2 Acceptable Fertilization Recommendation			
Species	N (lbs/ac)	P2O5 (lbs/ac)	Example Rec. (per acre)
Cool Season Grass	40	80	400 lbs. 10-20-20
CS Grass & Legume	30	60	300 lbs. 10-20-20
Temporary Cover	40	40	200 lbs. 19-19-19

Table IV-3 Temporary Cover				
Species	Seeding Rate (lbs/acre)	Optimum Seeding Dates	Drainage	pH Range
Annual Ryegrass	40	3/1 - 6/15 or 8/15 - 9/15	Well - Poorly	5.5 - 7.5
Field Bromegrass	40	3/1 - 6/15 or 8/15 - 9/15	Well - Mod. Well	6.0 - 7.0
Spring Oats	96	3/1 - 6/15	Well - Poorly	5.5 - 7.0
Sundagrass	40	5/15 - 8/15	Well - Poorly	5.5 - 7.5
Winter Rye	168	8/15 - 10/15	Well - Poorly	5.5 - 7.5
Winter Wheat	180	8/15 - 11/15	Well - Mod. Well	5.5 - 7.0
Japanese Millet	30	6/15 - 8/15	Well	4.5 - 7.0
Redtop	5	3/1 - 6/15	Well	4.0 - 7.5
Annual Ryegrass	26	3/1 - 6/15	Well - Poorly	5.5 - 7.5
Spring Oats	64	3/1 - 6/15	Well - Poorly	5.5 - 7.5

NOTE: These rates should be increased by 50% if planted April 15 - August 1 and October 1 - March 1.

Table IV-4A Permanent Seeding Mixture				
Species/Mixture	Seeding Rate (lbs/acre)	Soil Drainage preference	pH Range	
Crownvetch / Tall Fescue	10 - 15	Well - Mod. Well	5.0 - 7.5	
Crownvetch / Perennial Ryegrass	10 - 15	Well - Mod. Well	5.0 - 7.5	
Flatpea or Perennial Pea / Tall Fescue	20 / 15	Well - Mod. Well	4.0 - 8.0	
Ladino Clover / Serecia Lespedeza / Tall Fescue	30 / 25 / 2	Well - Mod. Well	4.5 - 7.5	
Tall Fescue / Ladino Clover / Redtop	40 / 3 / 3	Well - Mod. Well	5.0 - 7.5	
Crownvetch / Tall Fescue / Redtop	10 / 20 / 3	Well - Mod. Well	5.0 - 7.5	
Tall Fescue / Birdsfoot Trefoil / Redtop	40 / 3	Well - Mod. Well	5.0 - 7.5	
Serecia Lespedeza / Tall Fescue / Redtop	25 / 30 / 3	Well - Mod. Well	4.5 - 7.5	
Redtop / Tall Fescue / Creeping Red	30 / 3 / 50	Well - Mod. Well	5.0 - 7.5	
Tall Fescue	50	Well - Poorly	4.5 - 7.5	
Perennial Ryegrass / Tall Fescue / Lathco Flatpea *	10 / 15 / 20	Well - Poorly	5.8 - 8.0	

* Lathco Flatpea is potentially poisonous to some livestock. All legumes should be planted with proper inoculants prior to seeding. For unprepared seedbeds or seeding outside the optimum timeframe, add 50% more seed to the specified rate.
Mixtures listed in bold are suitable for use in shaded woodland settings; those in italics are suitable for use in filter strips.

Table IV-4B Wildlife and Farm Friendly Seed Mixtures				
Species/Mixture	Seeding Rate (lbs/acre)	Soil Drainage preference	pH Range	
KY Bluegrass / Redtop / Ladino Clover or Birdsfoot Trefoil	20 / 3 / 2 / 10	Well - Mod. Well	5.5 - 7.5	
Timothy / Alfalfa / Timothy / Birdsfoot Trefoil	5 / 12 / 5 / 8	Well - Mod. Well	6.5 - 8.0	
Orchardgrass / Ladino Clover / Redtop	10 / 2 / 3	Well - Mod. Well	5.5 - 7.5	
Orchardgrass / Ladino Clover	10 / 2	Well - Mod. Well	5.5 - 7.5	
Orchardgrass / Perennial Ryegrass	20 / 10	Well - Mod. Well	5.5 - 7.5	
Creeping Red Fescue / Perennial Ryegrass	30 / 10	Well - Mod. Well	5.5 - 7.5	
Orchardgrass or KY Bluegrass	20	Well - Mod. Well	6.0 - 7.5	
Birdsfoot Trefoil / Redtop / Orchardgrass	10 / 5 / 20	Well - Mod. Well	5.5 - 7.5	
Lathco Flatpea * / Perennial Ryegrass	30 / 20	Well - Mod. Well	5.5 - 7.5	
Lathco Flatpea * / Orchardgrass	30 / 20	Well - Mod. Well	5.5 - 7.5	

* Lathco Flatpea is potentially poisonous to some livestock. All legumes should be planted with proper inoculants prior to seeding. For unprepared seedbeds or seeding outside the optimum timeframe, add 50% more seed to the specified rate.
Mixtures listed in bold are suitable for use in shaded woodland settings; those in italics are suitable for use in filter strips.

08/31/2018

Table IV-5 Lime and Fertilizer Application Table			
pH of Soil	Lime in Tons per Acre	Fertilizer, Lbs. per Acre (10-20-20 or Equivalent)	
Above 6.0	2	500	
5.0 to 6.0	3	500	
Below 5.0	4	500	

The pH can be determined with a portable pH testing kit or by sending the soil samples to a soil testing laboratory. When 4 tons of lime per acre are applied it must be incorporated into the soil by disking, backblading or tracking up and down the slope.

Table IV-6 Mulch Materials Rates and Uses			
Material	Minimum Rates per acre	Coverage	Remarks
Hay or Straw	2 to 3 Tons	Cover 75% to 90% of Surface	Subject to wind blowing or washing unless tied down
Wood Fiber Pulp Fiber	1000 to 1500 lbs	Cover all Disturbed Areas	For hydroseeding
Wood - Cellulose Recirculated Paper			US 200 OR EQUAL GEOTEXTILE FABRIC

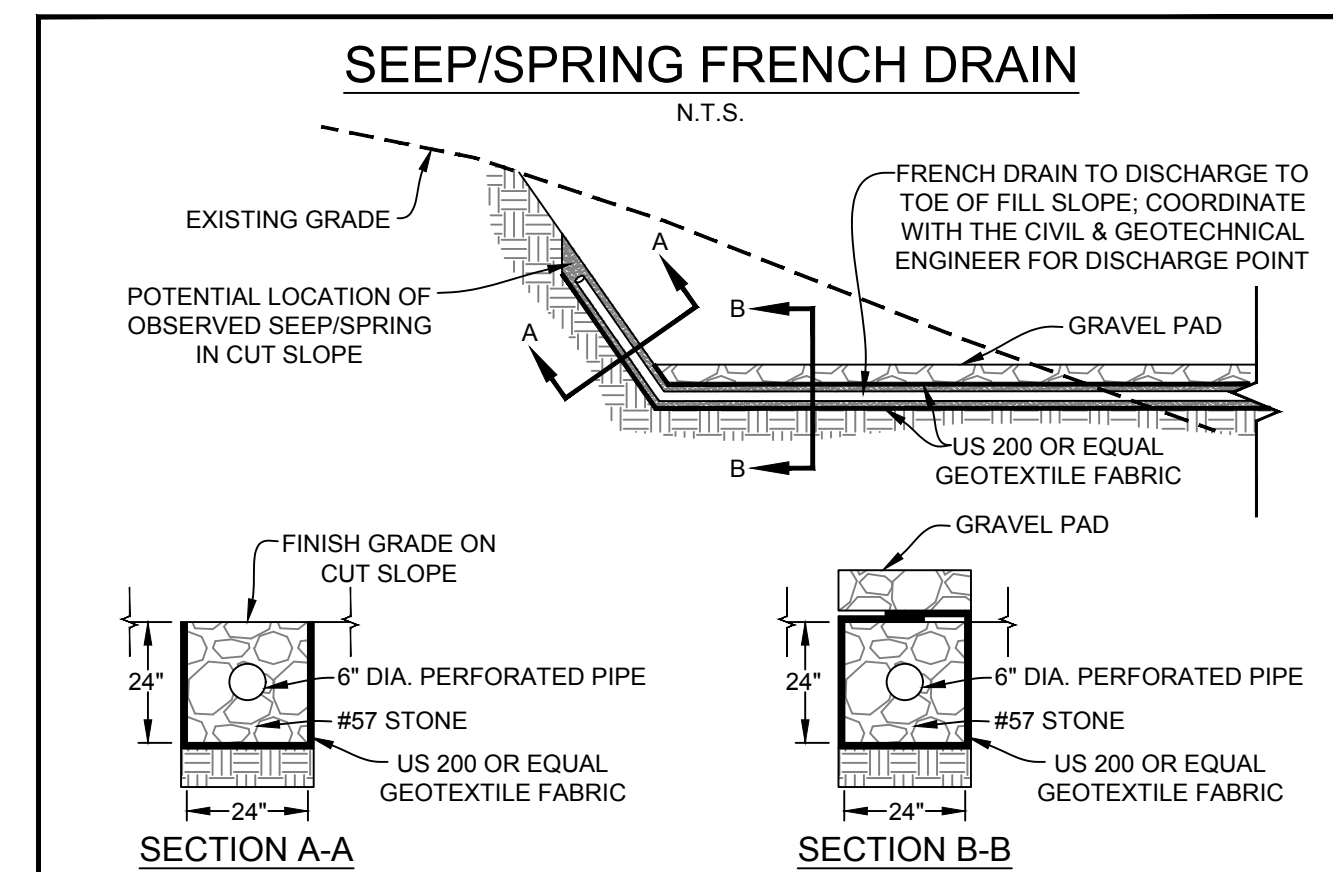
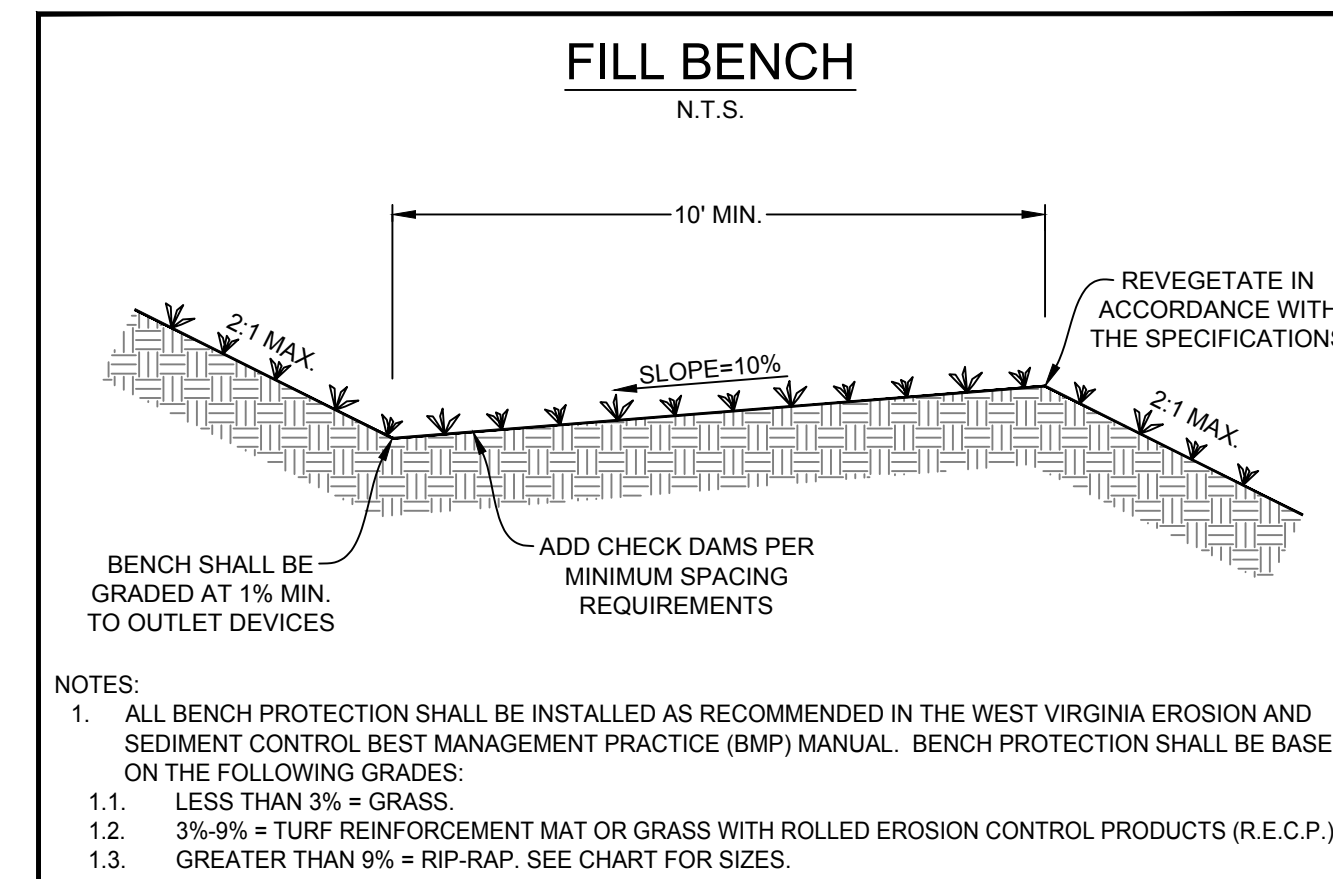
SITE RECLAMATION NARRATIVE:

POST CONSTRUCTION - THE CONSTRUCTION SITE SHALL BE STABILIZED AS SOON AS POSSIBLE AFTER COMPLETION. THE ESTABLISHMENT OF FINAL COVER MUST BE INITIATED NO LATER THAN 7 DAYS AFTER REACHING FINAL GRADE. THE ACCESS ROADS, WATER CONTAINMENT PAD, AND WELL PAD ARE TO BE MAINTAINED THROUGHOUT THE LIFE OF THE FACILITY. ALL CULVERTS, ROADSIDE DITCHES, BROAD-BASED DIPS, DIVERSION DITCHES, ETC. MUST BE MAINTAINED IN PROPER WORKING ORDER. ANY SOIL THAT IS DISTURBED ALONG THE ACCESS ROAD, WATER CONTAINMENT PAD, OR WELL PAD MUST BE REVEGETATED ACCORDING TO THESE PLANS AND THE WVDEP OFFICE OF OIL AND GAS FIELD MANUAL. IF NECESSARY, ALL TEMPORARY BMP MEASURES CAN BE REMOVED AFTER THE SITE IS PERMANENTLY STABILIZED AND APPROVAL IS RECEIVED FROM THE WVDEP. ANY AREAS DISTURBED BY REMOVAL OF THE BMP'S SHALL BE REPAIRED, STABILIZED, AND PERMANENTLY SEEDING.

POST USE - WITHIN 6 MONTHS OF THE COMPLETION OF THE FINAL HORIZONTAL WELL ON THE PAD OR THE EXPIRATION OF THE FIVE-YEAR MAXIMUM AGGREGATE PARTIAL RECLAMATION PERIOD, WHICHEVER OCCURS FIRST, THE OPERATOR SHALL COMPLETE FINAL RECLAMATION OF THE WELL PAD & WATER CONTAINMENT PAD AS SET FORTH IN THESE PLANS. ALL EXISTING BMP'S SHOWN SHALL BE INSPECTED FOR DAMAGE AND REPLACED AS NECESSARY BEFORE RECLAMATION CAN BEGIN. DRILL CUTTINGS, DRILLING MUD, AND LINERS FOR WELLS PERMITTED UNDER WV CODE §35-4-21, §22-6A, AND CRS 35-8, MUST BE REMOVED FROM SITE AND DISPOSED OF AT AN APPROVED SOLID WASTE FACILITY OR, IF THE SURFACE OWNER CONSENTS, THE DRILL CUTTINGS AND ASSOCIATED DRILLING MUD MAY BE MANAGED ON SITE IN A MANNER APPROVED BY THE SECRETARY. THE WATER CONTAINMENT SYSTEM AND ALL PIPING, WATER LINES, AND ASSOCIATED STRUCTURES SHALL BE REMOVED. THE SITE SHALL BE REGRADED AS INDICATED ON THE PLANS. STOCKPILED TOPSOIL SHOULD BE RE-SPREAD OVER DISTURBED AREA. TOPSOIL SHOULD NOT BE ADDED TO SLOPES STEEPER THAN 2:1 UNLESS GOOD BONDING TO THE SUB-SOIL CAN BE ACHIEVED. UPON COMPLETION OF THE GRADING, THE SITE SHALL BE SEEDING AND MULCHED PER THE REVEGETATION DETAILS. ESTABLISHMENT OF FINAL STABILIZATION MUST BE INITIATED NO LATER THAN 7 DAYS AFTER REACHING FINAL GRADE. FINAL STABILIZATION MEANS THAT ALL SOIL-DISTURBING ACTIVITIES ARE COMPLETED, AND THAT EITHER A PERMANENT VEGETATIVE COVER WITH A DENSITY OF 70% OR GREATER HAS BEEN ESTABLISHED OR THAT THE SURFACE HAS BEEN STABILIZED BY HARD COVER SUCH AS GRAVEL AND PAVEMENT ACCESS ROADS OR BUILDINGS. IT SHOULD BE NOTED THAT THE 70% REQUIREMENT REFERS TO THE TOTAL AREA VEGETATED AND NOT JUST A PERCENT OF THE SITE.

NOTES:

- DURING SITE RECLAMATION ALL FILL AREAS SHALL BE COMPACTED IN 12" MAXIMUM LIFT THICKNESS WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR DENSITY, ASTM D-698. MOISTURE CONTENT WILL BE CONTROLLED IN ACCORDANCE WITH THE STANDARD PROCTOR TEST (ASTM-D698) RESULTS. DEWATERING SYSTEMS SHALL REMAIN IN PLACE WITH VALVES REMAINING OPEN. ALL DEWATERING SYSTEMS SHALL BE INSPECTED REGULARLY PER STANDARD OPERATING PROCEDURE.



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DATE	REVISION
05/26/2016	REVISED PER LOD COMMENTS
12/21/2016	REVISED PER SLIDE REPAIR
03/16/2017	REVISED PER SLIDE AREAS #1, #2, & #3
05/03/2017	REVISED LOD MODIFICATION
06/14/2017	REVISED PER LANDOWNER CHANGE
07/27/2017	REVISED PER SITE VISIT
06/22/2018	REVISED PER SLIDE AREAS #9, #11, & #12

Antero Resources
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

NASH WELL PAD
WEST UNION & GRANT DISTRICTS
DODDRIDGE COUNTY, WEST VIRGINIA

PROFESSIONAL ENGINEER
REGISTERED
1958
STATE OF WEST VIRGINIA
06/22/2018

DATE: 02/22/2016
SCALE: AS SHOWN
SHEET 16 OF 16