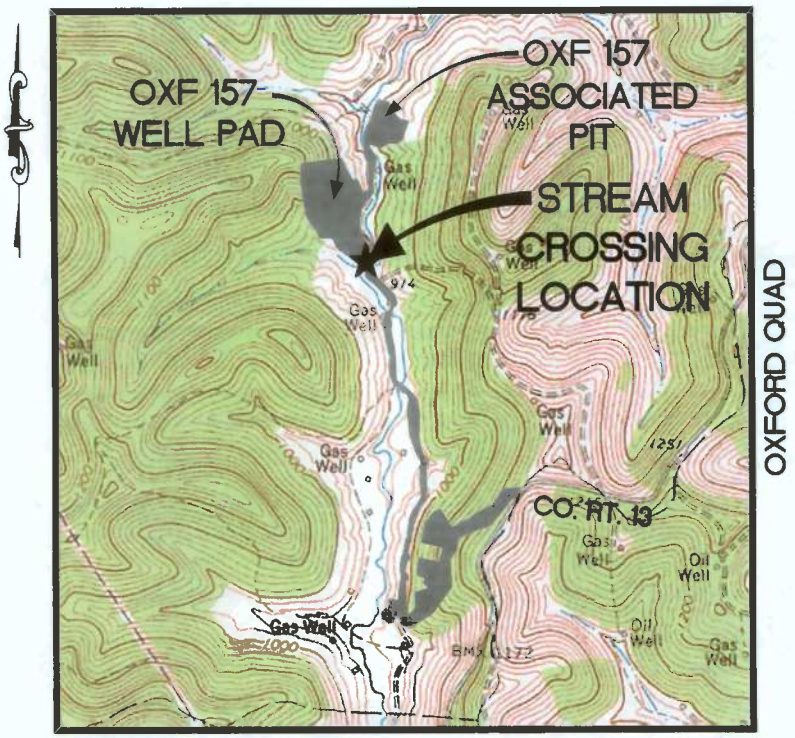
STREAM CROSSING "B"
STORMWATER COMPUTATIONS
OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Cyrus Kump, PE
ckump@navituseng.com

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: December 4, 2013

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "B"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. Bluestone Creek, which has been classified as a perennial stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 41+44.952 of the proposed access road.

Drainage Narrative

Using the SCS Method, with HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HEC-RAS to design the crossings and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "B" has a drainage area of 1,420.2 Acres. Design flows are shown as Junction-6 in the drainage calculations in Section 3.

Stream Crossing "B" is to be a "low water crossing" which is designed to handle the base flow. The stream crossing was designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The base flow was determined during a site visit during what was considered to be atypical normal flow using best engineering judgment. The stream will be crossed with 4-18" CMP culverts embedded 6" to allow for aquatic passage, and incased in concrete. Stream diversions, temporary cofferdams, and pump-arounds will be utilized during construction to shield the stream flow from concrete placement and sediment disturbance. The 1-yr, 10-yr and 100-yr flood elevations are passed over the road which acts as a weir without creating an adverse raise to the 100-yr base flood elevations.

Prior to the construction of the "low water crossing" a 40 ft long steel bridge with timber abutments will be used to cross the stream channel. Disturbance to the stream channel will be limited to minor excavation at or near the stream bank, there will be no disturbance to the stream bed or flow.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(Stream B)

Map Scale: 1:13,900 if printed on B portrait (11" x 17") sheet.

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	345.8	24.3%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	778.6	54.8%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	1.0	0.1%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	46.6	3.3%
Se	Sensabaugh silt loam	B	102.8	7.2%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	20.2	1.4%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	70.0	4.9%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	52.0	3.7%
W	Water		3.1	0.2%
Totals for Area of Interest			**1,420.2**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

HEC-HMS
Drainage Computations

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	443.8	04Sep2013, 12:55	95.5
Upper1 Bluestone	0.17	221.9	04Sep2013, 12:10	20.3
Junction-1	1.052	482.7	04Sep2013, 12:50	115.8
Reach-1	1.052	482.7	04Sep2013, 13:00	115.4
Middle1 Bluestone	0.252	189.6	04Sep2013, 12:30	28.7
Junction-2	1.304	601.9	04Sep2013, 12:50	144.1
Reach-2	1.304	601	04Sep2013, 13:10	143.1
Middle Bluestone	0.363	303	04Sep2013, 12:25	41.4
Junction-3	1.667	763.6	04Sep2013, 12:40	184.5
Reach-3	1.667	762	04Sep2013, 13:00	183.2
Lower Bluestone	0.286	238.7	04Sep2013, 12:20	31.4
Junction-4	1.953	855.6	04Sep2013, 13:00	214.6
Reach-4	1.953	853.6	04Sep2013, 13:05	214.2
Lower1 Bluestone	0.078	130	04Sep2013, 12:00	9
Junction-5	2.031	865	04Sep2013, 13:05	223.1
Reach-5	2.031	865	04Sep2013, 13:10	222.7
Lower2 Bluestone	0.188	175.7	04Sep2013, 12:20	22.3
Junction-6	2.219	914.4	04Sep2013, 13:10	245
Reach-6	2.219	910.4	04Sep2013, 13:25	243.8
Lower3 Bluestone	0.425	337.3	04Sep2013, 12:30	50.2
Downstream	2.644	1021.2	04Sep2013, 13:20	294

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	189.7	04Sep2013, 13:00	44.7
Upper1 Bluestone	0.17	101.9	04Sep2013, 12:10	9.8
Junction-1	1.052	208.9	04Sep2013, 12:55	54.5
Reach-1	1.052	208.9	04Sep2013, 13:05	54.3
Middle1 Bluestone	0.252	83.2	04Sep2013, 12:30	13.7
Junction-2	1.304	259.4	04Sep2013, 12:55	67.9
Reach-2	1.304	259.3	04Sep2013, 13:10	67.4
Middle Bluestone	0.363	133.4	04Sep2013, 12:25	19.7
Junction-3	1.667	326.8	04Sep2013, 12:40	87.1
Reach-3	1.667	326.6	04Sep2013, 13:00	86.4
Lower Bluestone	0.286	102.3	04Sep2013, 12:25	14.7
Junction-4	1.953	371.5	04Sep2013, 13:00	101.1
Reach-4	1.953	369.7	04Sep2013, 13:05	100.8
Lower1 Bluestone	0.078	57.7	04Sep2013, 12:00	4.3
Junction-5	2.031	375.8	04Sep2013, 13:05	105.1
Reach-5	2.031	375.8	04Sep2013, 13:10	104.9
Lower2 Bluestone	0.188	79	04Sep2013, 12:20	10.8
Junction-6	2.219	400.9	04Sep2013, 13:10	115.7
Reach-6	2.219	399.6	04Sep2013, 13:25	115
Lower3 Bluestone	0.425	152.3	04Sep2013, 12:30	24.3
Downstream	2.644	453	04Sep2013, 13:25	139.3

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	1 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	38.4	04Sep2013, 13:10	12.3
Upper1 Bluestone	0.17	22.4	04Sep2013, 12:10	2.9
Junction-1	1.052	43.9	04Sep2013, 13:05	15.3
Reach-1	1.052	43.9	04Sep2013, 13:15	15.2
Middle1 Bluestone	0.252	17.3	04Sep2013, 12:35	3.9
Junction-2	1.304	55	04Sep2013, 13:05	19.1
Reach-2	1.304	55	04Sep2013, 13:25	18.9
Middle Bluestone	0.363	27.6	04Sep2013, 12:30	5.7
Junction-3	1.667	68.2	04Sep2013, 13:05	24.6
Reach-3	1.667	68.2	04Sep2013, 13:25	24.3
Lower Bluestone	0.286	19.5	04Sep2013, 12:30	4.1
Junction-4	1.953	78.9	04Sep2013, 13:05	28.4
Reach-4	1.953	78.8	04Sep2013, 13:10	28.3
Lower1 Bluestone	0.078	12.9	04Sep2013, 12:05	1.2
Junction-5	2.031	80.8	04Sep2013, 13:10	29.5
Reach-5	2.031	80.8	04Sep2013, 13:15	29.4
Lower2 Bluestone	0.188	17.6	04Sep2013, 12:25	3.2
Junction-6	2.219	88	04Sep2013, 13:15	32.7
Reach-6	2.219	87.6	04Sep2013, 13:30	32.4
Lower3 Bluestone	0.425	34.2	04Sep2013, 12:35	7.3
Downstream	2.644	104.1	04Sep2013, 13:25	39.7

SECTION 4

HEC-RAS Culvert Analysis Report and Sections

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: OXF 157-159 Bridges
Project File : OXF157-159Bridges.prj
Run Date and Time: 11/6/2013 3:30:43 PM

Project in English units

INLINE STRUCTURE

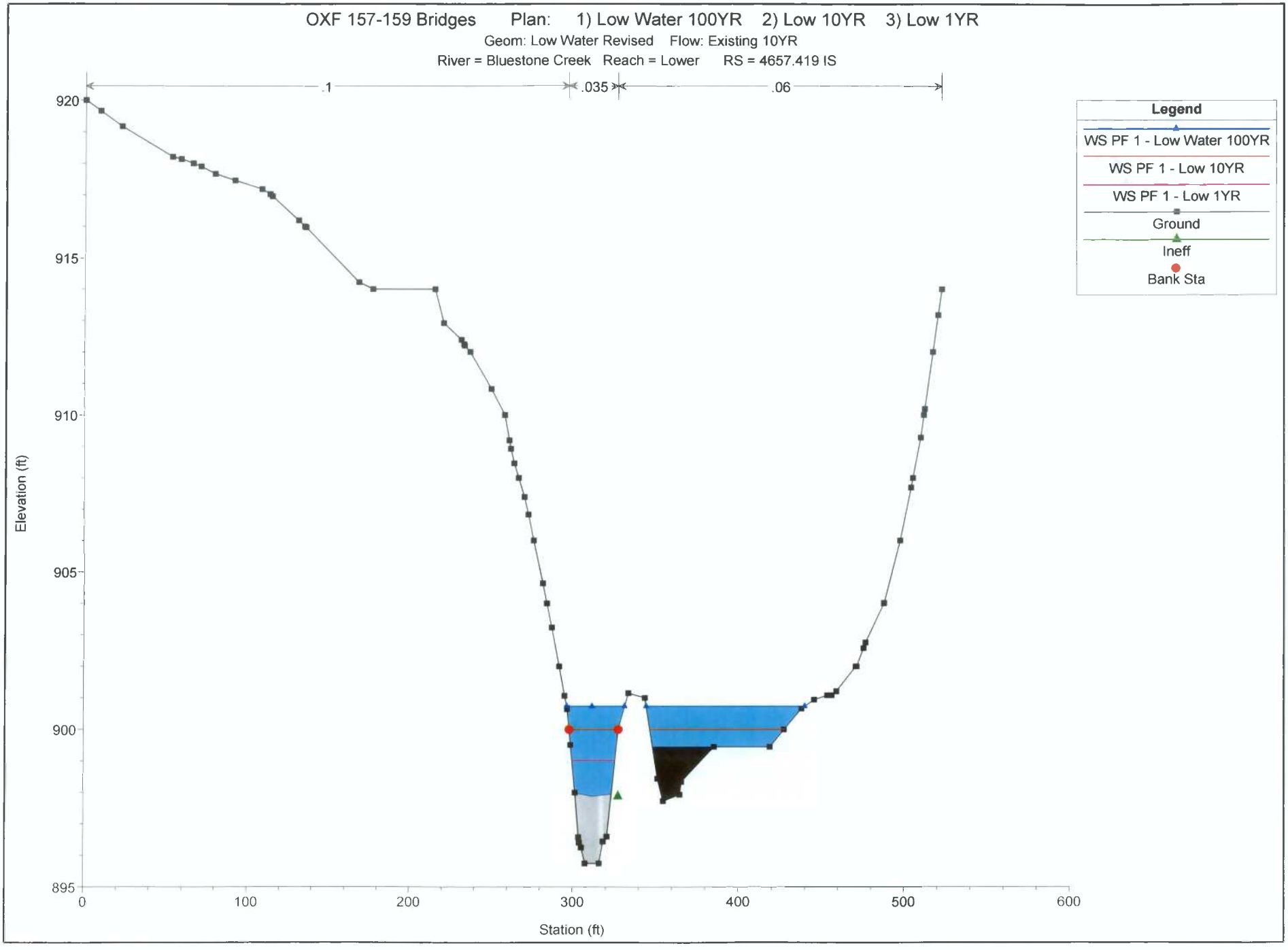
RIVER: Bluestone Creek
REACH: Lower RS: 4657.419

INLINE STRUCTURE OUTPUT Profile #PF 1 Inl Struct:

E.G. Elev (ft)	900.49	Q Gates (cfs)			
W.S. Elev (ft)	900.00	Q Gate Group (cfs)		0.00	
Q Total (cfs)	400.90	Gate Open Ht (ft)		899.24	
Q Weir (cfs)	400.90	Gate #Open			
Weir Flow Area (sq ft)	152.73	Gate Area (sq ft)		1.00	
Weir Sta Lft (ft)	296.93	Gate Submerg		0.00	
Weir Sta Rgt (ft)	435.16	Gate Invert (ft)		0.00	
Weir Max Depth (ft)	2.61	Gate Weir Coef		0.000	
Weir Avg Depth (ft)	1.24				
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)			
Weir Submerg	0.26	Breach Avg Velocity (ft/s)			
Min El Weir Flow (ft)	897.89	Breach Flow Area (sq ft)			
Wr Top Wdth (ft)	123.18				

Warning: Critical depth in the cross section upstream of the inline structure produced too much flow past the inline structure. This

means there is not a valid subcritical answer. The upstream cross section defaulted to critical depth.

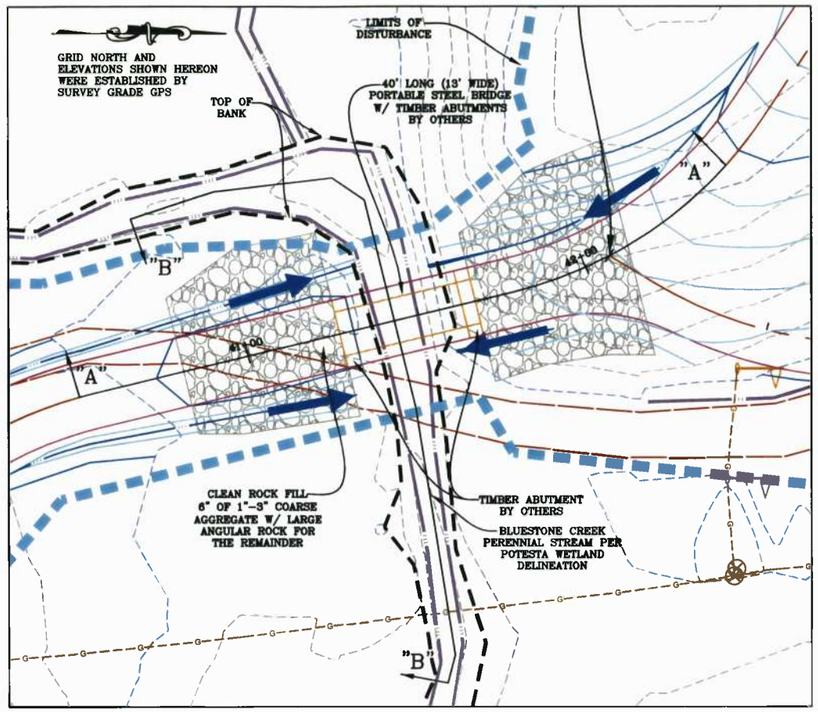

OXF 157-159 Bridges Plan: 1) Low Water 100YR 2) Low 10YR 3) Low 1YR
Geom: Low Water Revised Flow: Existing 10YR
River = Bluestone Creek Reach = Lower RS = 4657.419 IS
.1
.035
.06
Legend
WS PF 1 - Low Water 100YR
WS PF 1 - Low 10YR
WS PF 1 - Low 1YR
Ground
Ineff
Bank Sta
Elevation (ft)
920
915
910
905
900
895
0
100
200
300
400
500
600
Station (ft)

SECTION 5

Stream Crossing "B" Details

TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "B" DETAILS

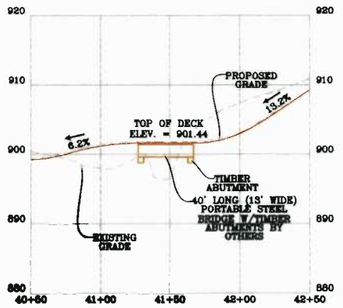


20 10 0 20 40

SCALE: 1" = 20'

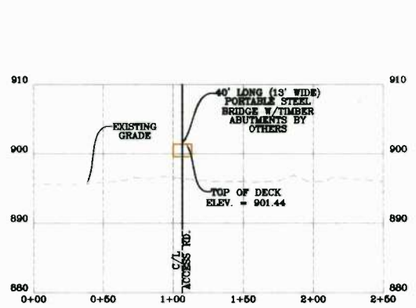
NOTE:
1) SEE SHEET 20 FOR PUMP AROUND NOTES AND DETAILS
2) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
3) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "B".

STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

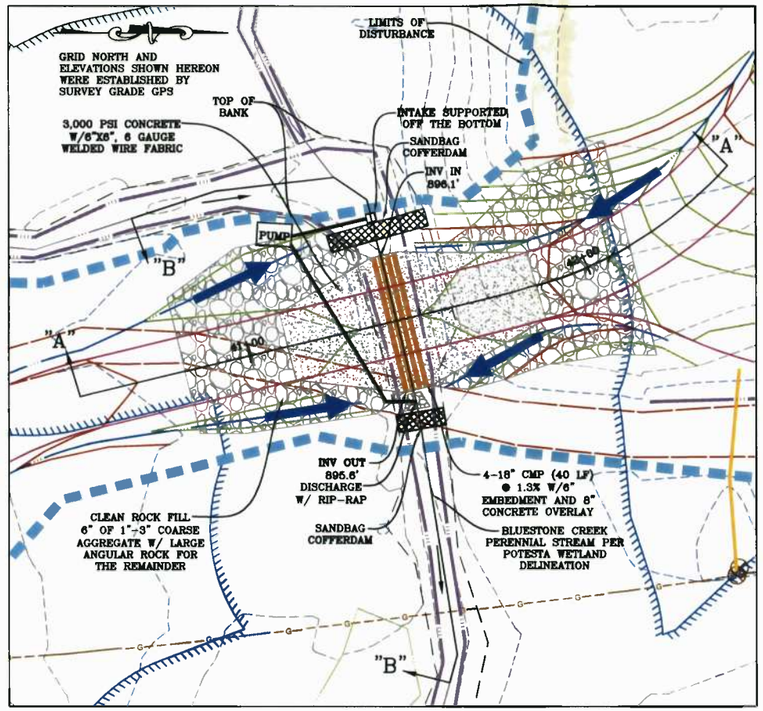
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

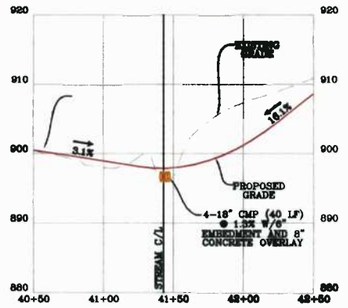
STREAM CROSSING "B" DETAILS



20 10 0 20 40

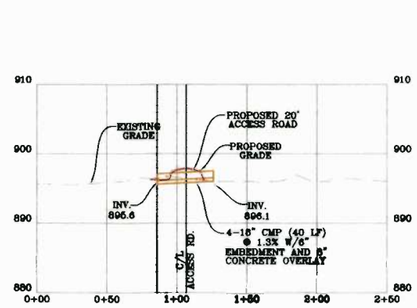
SCALE: 1" = 20'

STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
2) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
3) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
4) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
8) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 60 LBS PER ASTM D 4833.
9) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
10) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT MGMT. SLS ENGINEERS ENVIRONMENTAL
6055 Dixie Bottom Road Mayfield, OH 44067 (440) 571-3611
238 West Main St. P.O. Box 189 Salem, WV 26426 (304) 782-3924
HONESTY. INTEGRITY. QUALITY.

CHRIS S. KING REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

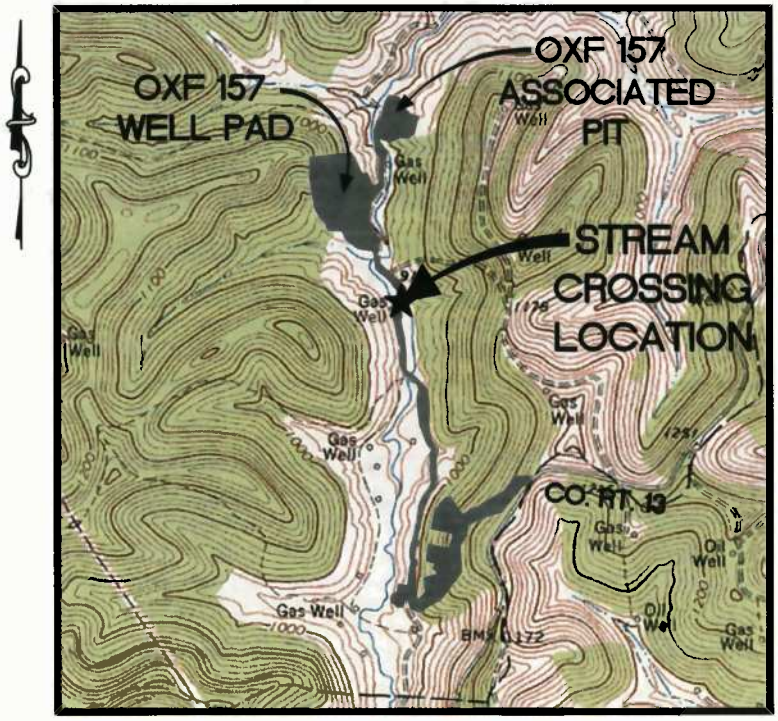
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 21 OF 26
REV: 12/04/2013

STREAM CROSSING "C"
STORMWATER COMPUTATIONS

OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

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Prepared For:
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115 Professional Place
P.O. Box 280
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Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Cyrus Kump, PE
ckump@navituseng.com

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: December 4, 2013

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "C"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. Bluestone Creek, which has been classified as a perennial stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 35+06.795 of the proposed access road.

Drainage Narrative

Using the SCS Method, with HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HEC-RAS to design the crossings and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "C" has a drainage area of 1,299.9 Acres. Design flows are shown as Junction-5 in the drainage calculations in Section 3.

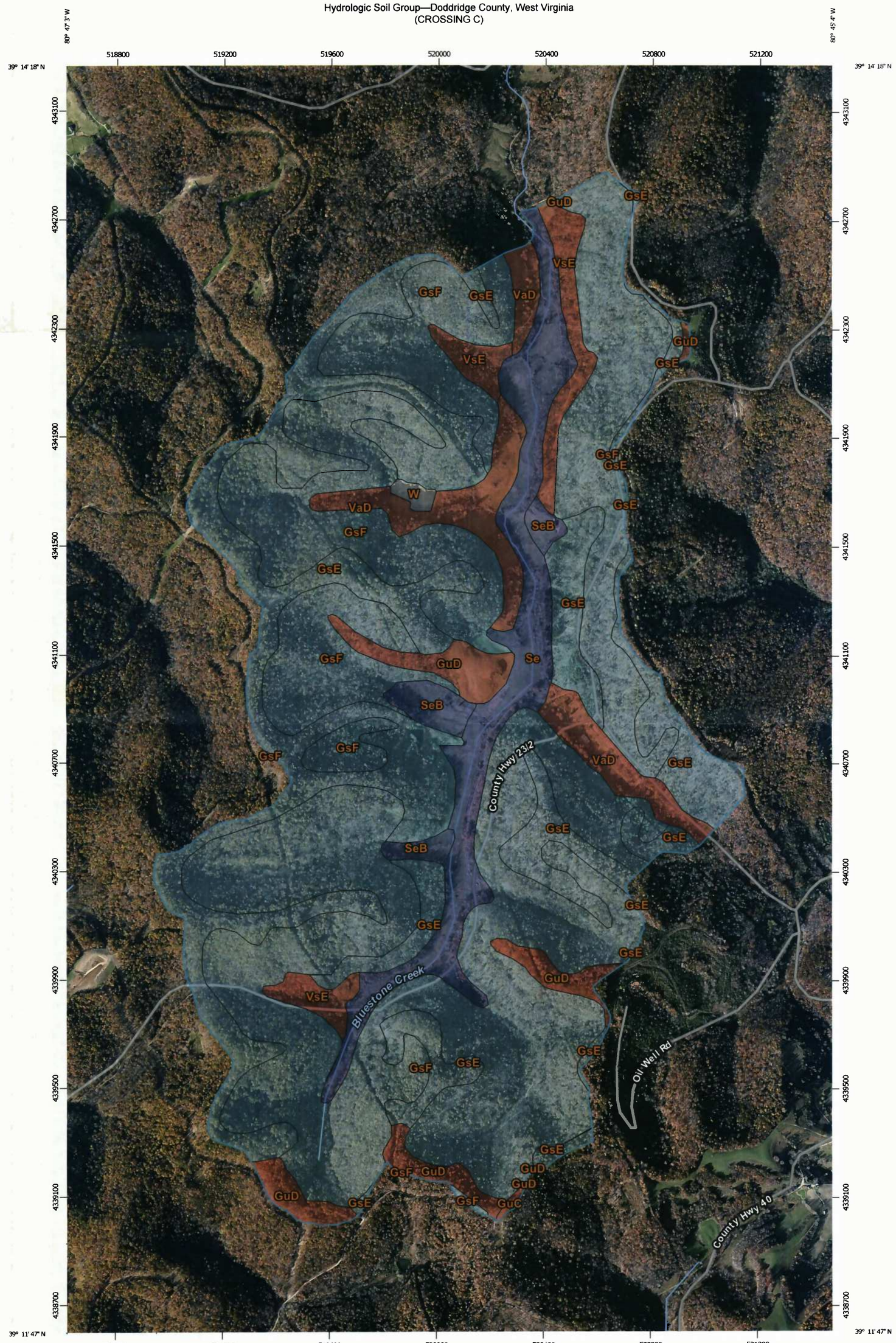
Stream Crossing "C" is to be a "low water crossing" which is designed to handle the base flow. The stream crossing was designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The base flow was determined during a site visit during what was considered to be atypical normal flow using best engineering judgment. The stream will be crossed with 3-18" CMP culverts embedded 6" to allow for aquatic passage, and incased in concrete. Stream diversions, temporary cofferdams, and pump-arounds will be utilized during construction to shield the stream flow from concrete placement and sediment disturbance. The 1-yr, 10-yr and 100-yr flood elevations are passed over the road which acts as a weir without creating an adverse raise to the 100-yr base flood elevations.

Prior to the construction of the "low water crossing" a 40 ft long steel bridge with timber abutments will be used to cross the stream channel. Disturbance to the stream channel will be limited to minor excavation at or near the stream bank, there will be no disturbance to the stream bed or flow.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(CROSSING C)



Map Scale: 1:13,100 if printed on B portrait (11" x 17") sheet.

N

0 150 300 600 900 Meters

0 500 1000 2000 3000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	316.0	24.3%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	710.4	54.6%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	1.0	0.1%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	46.6	3.6%
Se	Sensabaugh silt loam	B	101.2	7.8%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	20.2	1.6%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	62.9	4.8%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	38.4	3.0%
W	Water		3.1	0.2%
Totals for Area of Interest			**1,299.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

HEC-HMS
Drainage Computations

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	443.8	04Sep2013, 12:55	95.5
Upper1 Bluestone	0.17	221.9	04Sep2013, 12:10	20.3
Junction-1	1.052	482.7	04Sep2013, 12:50	115.8
Reach-1	1.052	482.7	04Sep2013, 13:00	115.4
Middle1 Bluestone	0.252	189.6	04Sep2013, 12:30	28.7
Junction-2	1.304	601.9	04Sep2013, 12:50	144.1
Reach-2	1.304	601	04Sep2013, 13:10	143.1
Middle Bluestone	0.363	303	04Sep2013, 12:25	41.4
Junction-3	1.667	763.6	04Sep2013, 12:40	184.5
Reach-3	1.667	762	04Sep2013, 13:00	183.2
Lower Bluestone	0.286	238.7	04Sep2013, 12:20	31.4
Junction-4	1.953	855.6	04Sep2013, 13:00	214.6
Reach-4	1.953	853.6	04Sep2013, 13:05	214.2
Lower1 Bluestone	0.078	130	04Sep2013, 12:00	9
Junction-5	2.031	865	04Sep2013, 13:05	223.1
Reach-5	2.031	865	04Sep2013, 13:10	222.7
Lower2 Bluestone	0.188	175.7	04Sep2013, 12:20	22.3
Junction-6	2.219	914.4	04Sep2013, 13:10	245
Reach-6	2.219	910.4	04Sep2013, 13:25	243.8
Lower3 Bluestone	0.425	337.3	04Sep2013, 12:30	50.2
Downstream	2.644	1021.2	04Sep2013, 13:20	294

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	189.7	04Sep2013, 13:00	44.7
Upper1 Bluestone	0.17	101.9	04Sep2013, 12:10	9.8
Junction-1	1.052	208.9	04Sep2013, 12:55	54.5
Reach-1	1.052	208.9	04Sep2013, 13:05	54.3
Middle1 Bluestone	0.252	83.2	04Sep2013, 12:30	13.7
Junction-2	1.304	259.4	04Sep2013, 12:55	67.9
Reach-2	1.304	259.3	04Sep2013, 13:10	67.4
Middle Bluestone	0.363	133.4	04Sep2013, 12:25	19.7
Junction-3	1.667	326.8	04Sep2013, 12:40	87.1
Reach-3	1.667	326.6	04Sep2013, 13:00	86.4
Lower Bluestone	0.286	102.3	04Sep2013, 12:25	14.7
Junction-4	1.953	371.5	04Sep2013, 13:00	101.1
Reach-4	1.953	369.7	04Sep2013, 13:05	100.8
Lower1 Bluestone	0.078	57.7	04Sep2013, 12:00	4.3
Junction-5	2.031	375.8	04Sep2013, 13:05	105.1
Reach-5	2.031	375.8	04Sep2013, 13:10	104.9
Lower2 Bluestone	0.188	79	04Sep2013, 12:20	10.8
Junction-6	2.219	400.9	04Sep2013, 13:10	115.7
Reach-6	2.219	399.6	04Sep2013, 13:25	115
Lower3 Bluestone	0.425	152.3	04Sep2013, 12:30	24.3
Downstream	2.644	453	04Sep2013, 13:25	139.3

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	1 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	38.4	04Sep2013, 13:10	12.3
Upper1 Bluestone	0.17	22.4	04Sep2013, 12:10	2.9
Junction-1	1.052	43.9	04Sep2013, 13:05	15.3
Reach-1	1.052	43.9	04Sep2013, 13:15	15.2
Middle1 Bluestone	0.252	17.3	04Sep2013, 12:35	3.9
Junction-2	1.304	55	04Sep2013, 13:05	19.1
Reach-2	1.304	55	04Sep2013, 13:25	18.9
Middle Bluestone	0.363	27.6	04Sep2013, 12:30	5.7
Junction-3	1.667	68.2	04Sep2013, 13:05	24.6
Reach-3	1.667	68.2	04Sep2013, 13:25	24.3
Lower Bluestone	0.286	19.5	04Sep2013, 12:30	4.1
Junction-4	1.953	78.9	04Sep2013, 13:05	28.4
Reach-4	1.953	78.8	04Sep2013, 13:10	28.3
Lower1 Bluestone	0.078	12.9	04Sep2013, 12:05	1.2
Junction-5	2.031	80.8	04Sep2013, 13:10	29.5
Reach-5	2.031	80.8	04Sep2013, 13:15	29.4
Lower2 Bluestone	0.188	17.6	04Sep2013, 12:25	3.2
Junction-6	2.219	88	04Sep2013, 13:15	32.7
Reach-6	2.219	87.6	04Sep2013, 13:30	32.4
Lower3 Bluestone	0.425	34.2	04Sep2013, 12:35	7.3
Downstream	2.644	104.1	04Sep2013, 13:25	39.7

SECTION 4

HEC-RAS In-Line Structure Analysis Report and Sections

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: OXF 157-159 Bridges
Project File : OXF157-159Bridges.prj
Run Date and Time: 11/6/2013 3:30:43 PM

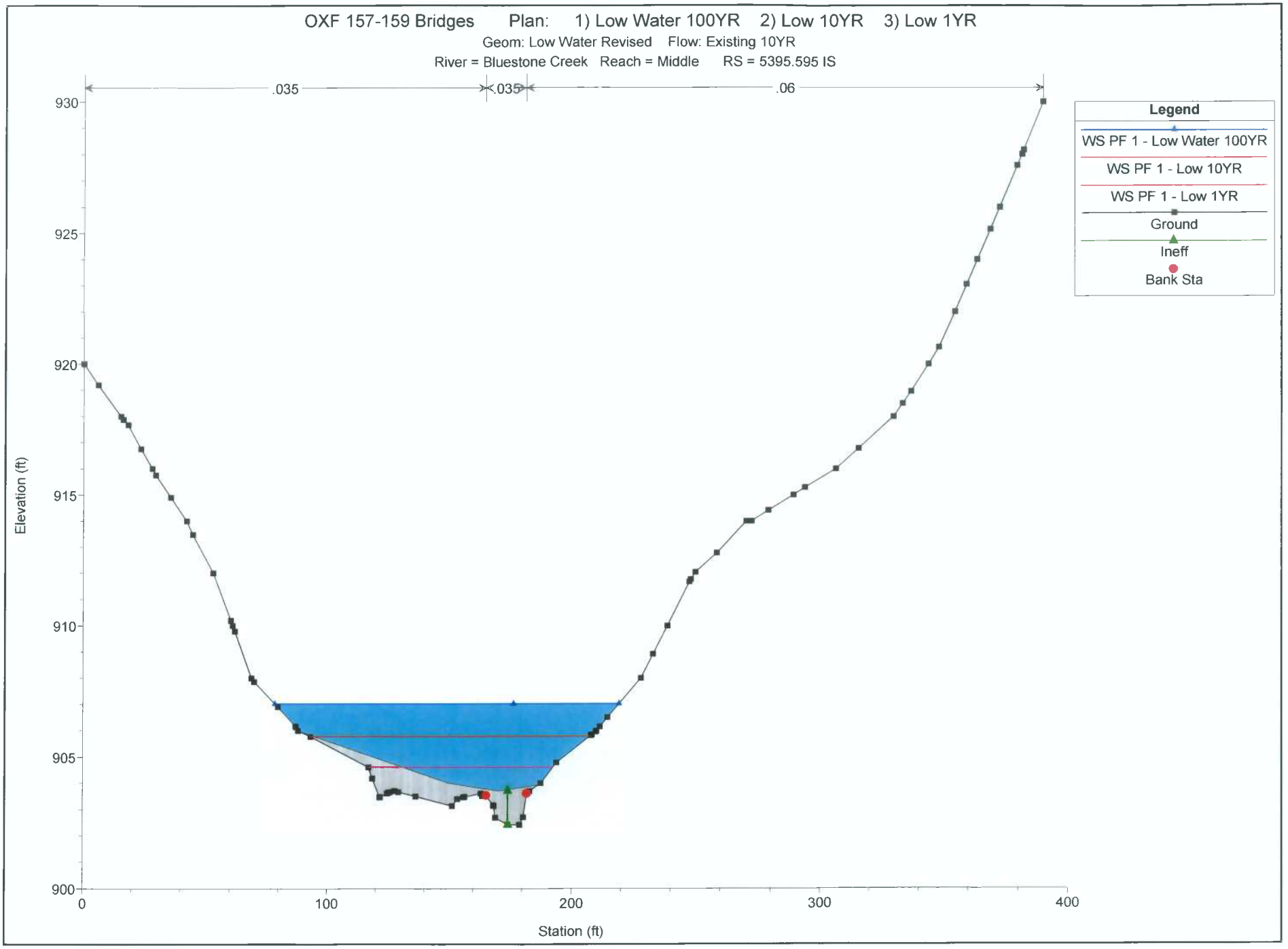
Project in English units

INLINE STRUCTURE

RIVER: Bluestone Creek
REACH: Middle RS: 5395.595

INLINE STRUCTURE OUTPUT Profile #PF 1 Inl Struct:

E.G. Elev (ft)	905.87	Q Gates (cfs)			
W.S. Elev (ft)	905.79	Q Gate Group (cfs)		0.00	
Q Total (cfs)	375.80	Gate Open Ht (ft)		905.74	
Q Weir (cfs)	375.80	Gate #Open			
Weir Flow Area (sq ft)	147.37	Gate Area (sq ft)		1.00	
Weir Sta Lft (ft)	92.21	Gate Submerg		0.00	
Weir Sta Rgt (ft)	208.56	Gate Invert (ft)		0.00	
Weir Max Depth (ft)	2.16	Gate Weir Coef		0.000	
Weir Avg Depth (ft)	1.27				
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)			
Weir Submerg	0.91	Breach Avg Velocity (ft/s)			
Min El Weir Flow (ft)	903.72	Breach Flow Area (sq ft)			
Wr Top Wdth (ft)	116.36				

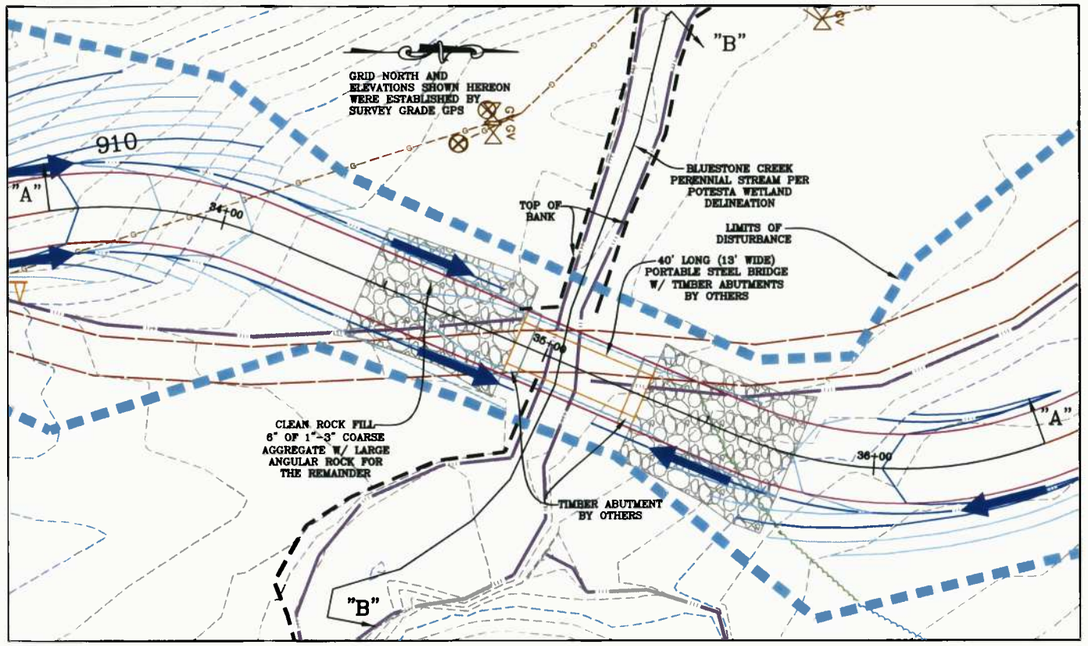

OXF 157-159 Bridges Plan: 1) Low Water 100YR 2) Low 10YR 3) Low 1YR
Geom: Low Water Revised Flow: Existing 10YR
River = Bluestone Creek Reach = Middle RS = 5395.595 IS
.035
.035
.06
Legend
WS PF 1 - Low Water 100YR
WS PF 1 - Low 10YR
WS PF 1 - Low 1YR
Ground
Ineff
Bank Sta
Elevation (ft)
930
925
920
915
910
905
900
0
100
200
300
400
Station (ft)

SECTION 5

Stream Crossing "C" Details

TEMPORARY STREAM CROSSING DETAILS

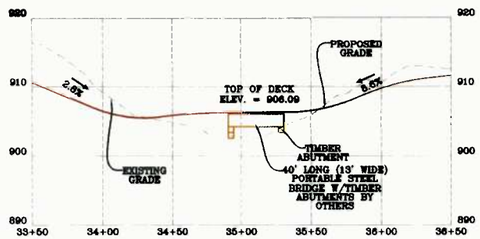
STREAM CROSSING "C" DETAILS



20 10 0 20 40

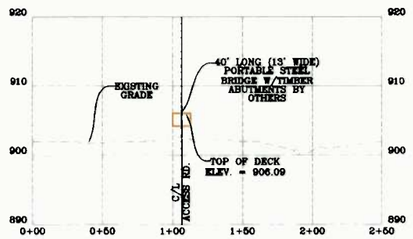
SCALE: 1" = 20'

STREAM CROSSING "C" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

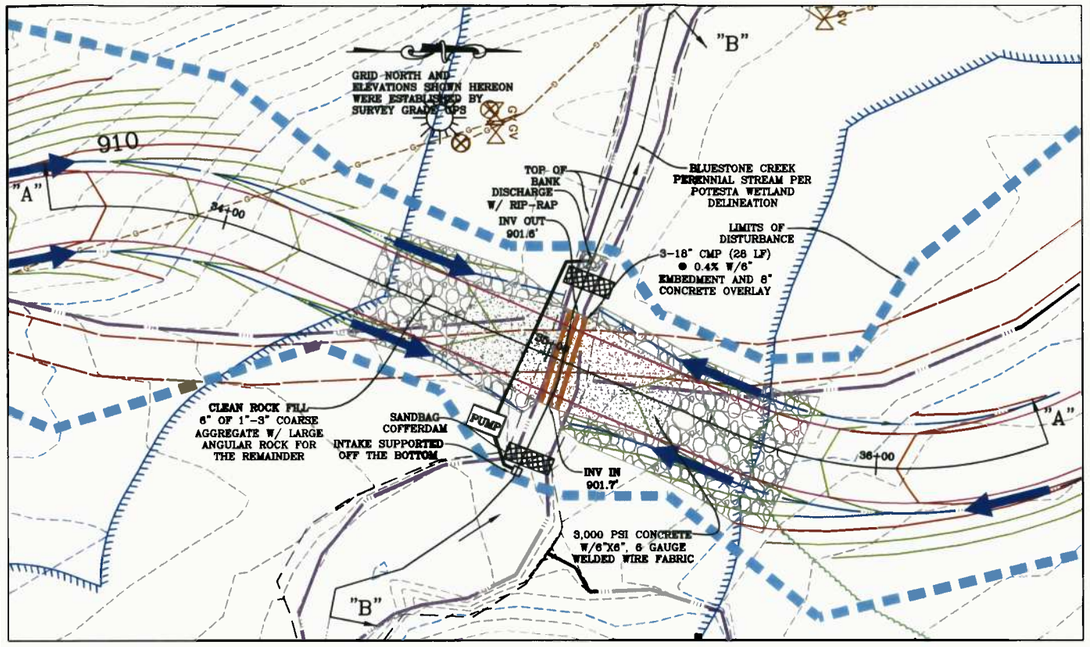
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

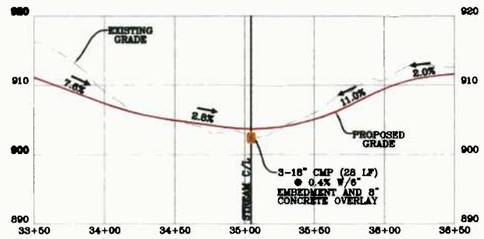
STREAM CROSSING "C" DETAILS



20 10 0 20 40

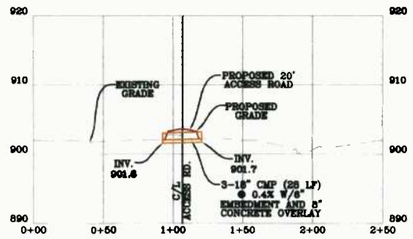
SCALE: 1" = 20'

STREAM CROSSING "C" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
2) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
3) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
4) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
8) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
9) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
10) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

NOTE:

1) SEE SHEET 20 FOR PUMP AROUND NOTES AND DETAILS
2) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
3) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "B".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT MGMT. SLS ENGINEERS ENVIRONMENTAL
223 West Main St. P.O. Box 187 Salem, WV 26426 (304) 782-1866
9065 Ohio Station Road Pinedale, OH 43567 (740) 971-9911
HONESTY. INTEGRITY. QUALITY.

CYRUS S. KING REGISTERED 15578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013

SCALE: N/A

DESIGNED BY: CSK

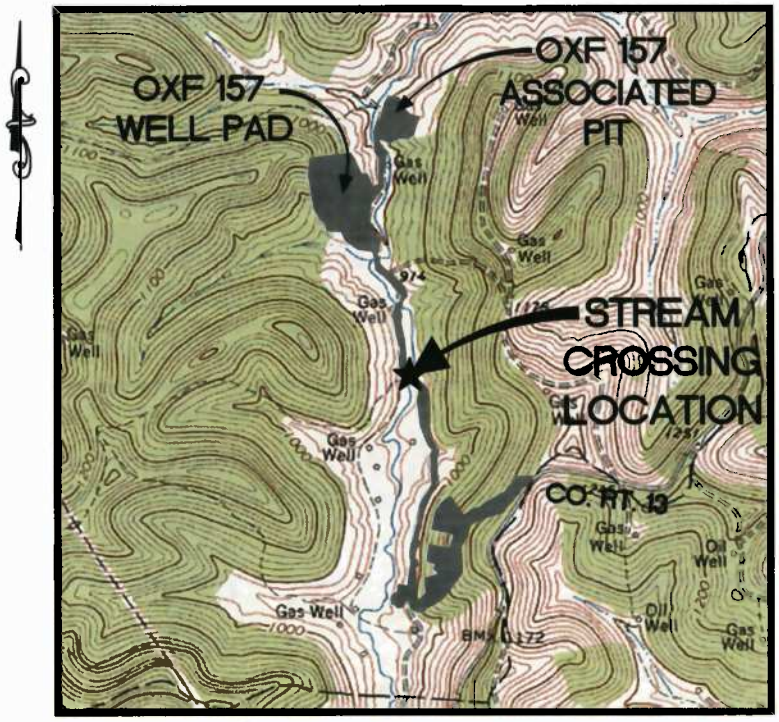
FILE NO. 7889

SHEET 22 OF 26

REV: 12/04/2013

STREAM CROSSING "D"
STORMWATER COMPUTATIONS

OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Cyrus Kump, PE
ckump@navituseng.com

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: December 4, 2013

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "D"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. Bluestone Creek, which has been classified as a perennial stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 26+81.854 of the proposed access road.

Drainage Narrative

Using the SCS Method, with HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HEC-RAS to design the crossings and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "D" has a drainage area of 1,249.9 Acres. Design flows are shown as Junction-4 in the drainage calculations in Section 3.

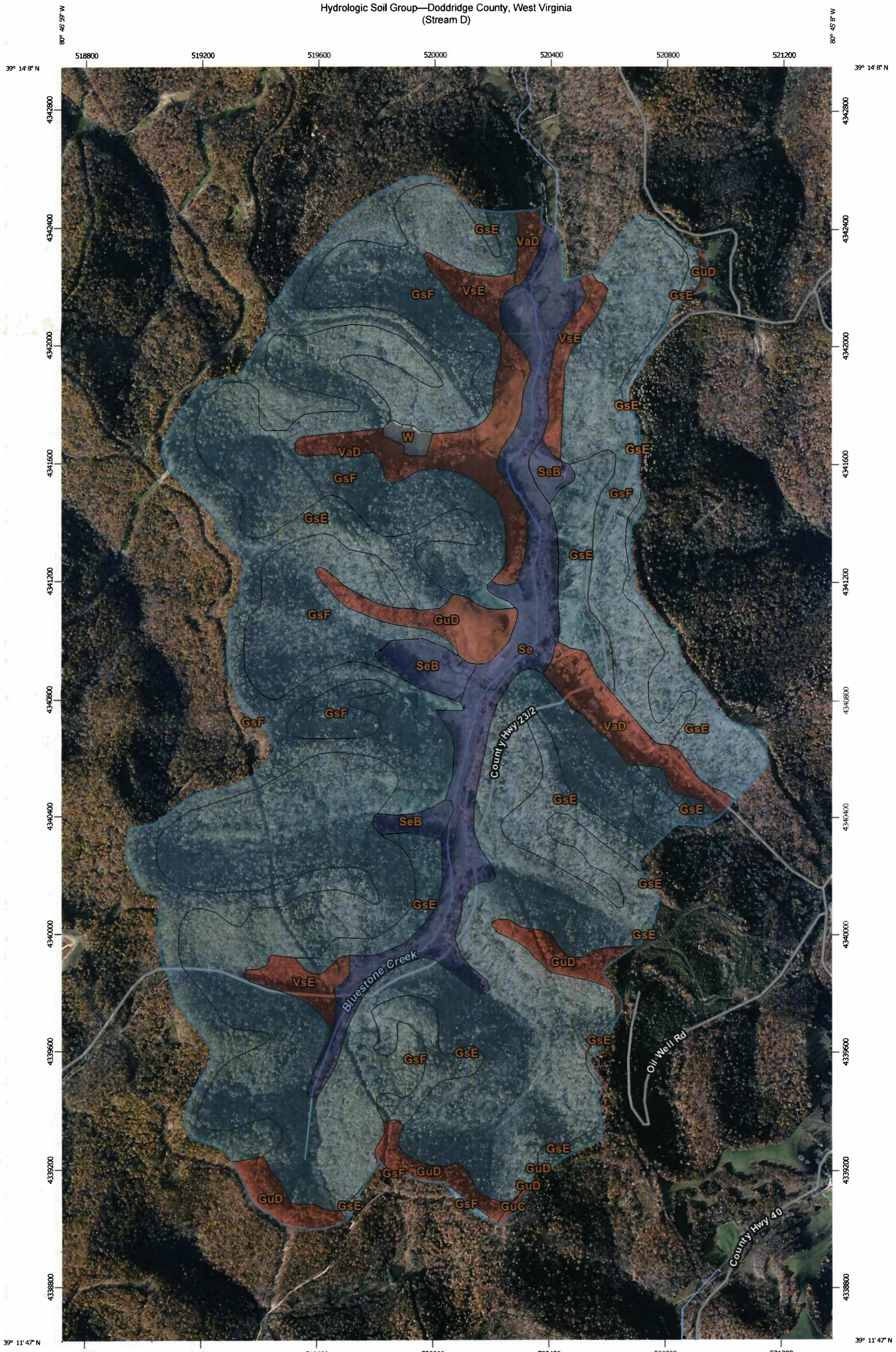
Stream Crossing "D" is to be a "low water crossing" which is designed to handle the base flow. The base flow was determined during a site visit during what was considered to be atypical normal flow using best engineering judgment. The stream will be crossed with 3-18" CMP culverts embedded 6" to allow for aquatic passage, and incased in concrete. Stream diversions, temporary cofferdams, and pump-arounds will be utilized during construction to shield the stream flow from concrete placement and sediment disturbance. The 1-yr, 10-yr and 100-yr flood elevations are passed over the road which acts as a weir without creating an adverse raise to the 100-yr base flood elevations.

Prior to the construction of the "low water crossing" a 40 ft long steel bridge with timber abutments will be used to cross the stream channel. Disturbance to the stream channel will be limited to minor excavation at or near the stream bank, there will be no disturbance to the stream bed or flow.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(Stream D)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	314.8	25.2%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	684.0	54.7%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	1.0	0.1%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	46.4	3.7%
Se	Sensabaugh silt loam	B	93.6	7.5%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	20.2	1.6%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	58.9	4.7%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	27.9	2.2%
W	Water		3.1	0.2%
Totals for Area of Interest			**1,249.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

SECTION 3

HEC-HMS
Drainage Computations

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	443.8	04Sep2013, 12:55	95.5
Upper1 Bluestone	0.17	221.9	04Sep2013, 12:10	20.3
Junction-1	1.052	482.7	04Sep2013, 12:50	115.8
Reach-1	1.052	482.7	04Sep2013, 13:00	115.4
Middle1 Bluestone	0.252	189.6	04Sep2013, 12:30	28.7
Junction-2	1.304	601.9	04Sep2013, 12:50	144.1
Reach-2	1.304	601	04Sep2013, 13:10	143.1
Middle Bluestone	0.363	303	04Sep2013, 12:25	41.4
Junction-3	1.667	763.6	04Sep2013, 12:40	184.5
Reach-3	1.667	762	04Sep2013, 13:00	183.2
Lower Bluestone	0.286	238.7	04Sep2013, 12:20	31.4
Junction-4	1.953	855.6	04Sep2013, 13:00	214.6
Reach-4	1.953	853.6	04Sep2013, 13:05	214.2
Lower1 Bluestone	0.078	130	04Sep2013, 12:00	9
Junction-5	2.031	865	04Sep2013, 13:05	223.1
Reach-5	2.031	865	04Sep2013, 13:10	222.7
Lower2 Bluestone	0.188	175.7	04Sep2013, 12:20	22.3
Junction-6	2.219	914.4	04Sep2013, 13:10	245
Reach-6	2.219	910.4	04Sep2013, 13:25	243.8
Lower3 Bluestone	0.425	337.3	04Sep2013, 12:30	50.2
Downstream	2.644	1021.2	04Sep2013, 13:20	294

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	189.7	04Sep2013, 13:00	44.7
Upper1 Bluestone	0.17	101.9	04Sep2013, 12:10	9.8
Junction-1	1.052	208.9	04Sep2013, 12:55	54.5
Reach-1	1.052	208.9	04Sep2013, 13:05	54.3
Middle1 Bluestone	0.252	83.2	04Sep2013, 12:30	13.7
Junction-2	1.304	259.4	04Sep2013, 12:55	67.9
Reach-2	1.304	259.3	04Sep2013, 13:10	67.4
Middle Bluestone	0.363	133.4	04Sep2013, 12:25	19.7
Junction-3	1.667	326.8	04Sep2013, 12:40	87.1
Reach-3	1.667	326.6	04Sep2013, 13:00	86.4
Lower Bluestone	0.286	102.3	04Sep2013, 12:25	14.7
Junction-4	1.953	371.5	04Sep2013, 13:00	101.1
Reach-4	1.953	369.7	04Sep2013, 13:05	100.8
Lower1 Bluestone	0.078	57.7	04Sep2013, 12:00	4.3
Junction-5	2.031	375.8	04Sep2013, 13:05	105.1
Reach-5	2.031	375.8	04Sep2013, 13:10	104.9
Lower2 Bluestone	0.188	79	04Sep2013, 12:20	10.8
Junction-6	2.219	400.9	04Sep2013, 13:10	115.7
Reach-6	2.219	399.6	04Sep2013, 13:25	115
Lower3 Bluestone	0.425	152.3	04Sep2013, 12:30	24.3
Downstream	2.644	453	04Sep2013, 13:25	139.3

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	1 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	38.4	04Sep2013, 13:10	12.3
Upper1 Bluestone	0.17	22.4	04Sep2013, 12:10	2.9
Junction-1	1.052	43.9	04Sep2013, 13:05	15.3
Reach-1	1.052	43.9	04Sep2013, 13:15	15.2
Middle1 Bluestone	0.252	17.3	04Sep2013, 12:35	3.9
Junction-2	1.304	55	04Sep2013, 13:05	19.1
Reach-2	1.304	55	04Sep2013, 13:25	18.9
Middle Bluestone	0.363	27.6	04Sep2013, 12:30	5.7
Junction-3	1.667	68.2	04Sep2013, 13:05	24.6
Reach-3	1.667	68.2	04Sep2013, 13:25	24.3
Lower Bluestone	0.286	19.5	04Sep2013, 12:30	4.1
Junction-4	1.953	78.9	04Sep2013, 13:05	28.4
Reach-4	1.953	78.8	04Sep2013, 13:10	28.3
Lower1 Bluestone	0.078	12.9	04Sep2013, 12:05	1.2
Junction-5	2.031	80.8	04Sep2013, 13:10	29.5
Reach-5	2.031	80.8	04Sep2013, 13:15	29.4
Lower2 Bluestone	0.188	17.6	04Sep2013, 12:25	3.2
Junction-6	2.219	88	04Sep2013, 13:15	32.7
Reach-6	2.219	87.6	04Sep2013, 13:30	32.4
Lower3 Bluestone	0.425	34.2	04Sep2013, 12:35	7.3
Downstream	2.644	104.1	04Sep2013, 13:25	39.7

SECTION 4

HEC-RAS In-Line Structure Analysis Report and Sections

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: OXF 157-159 Bridges
Project File : OXF157-159Bridges.prj
Run Date and Time: 11/6/2013 3:30:43 PM

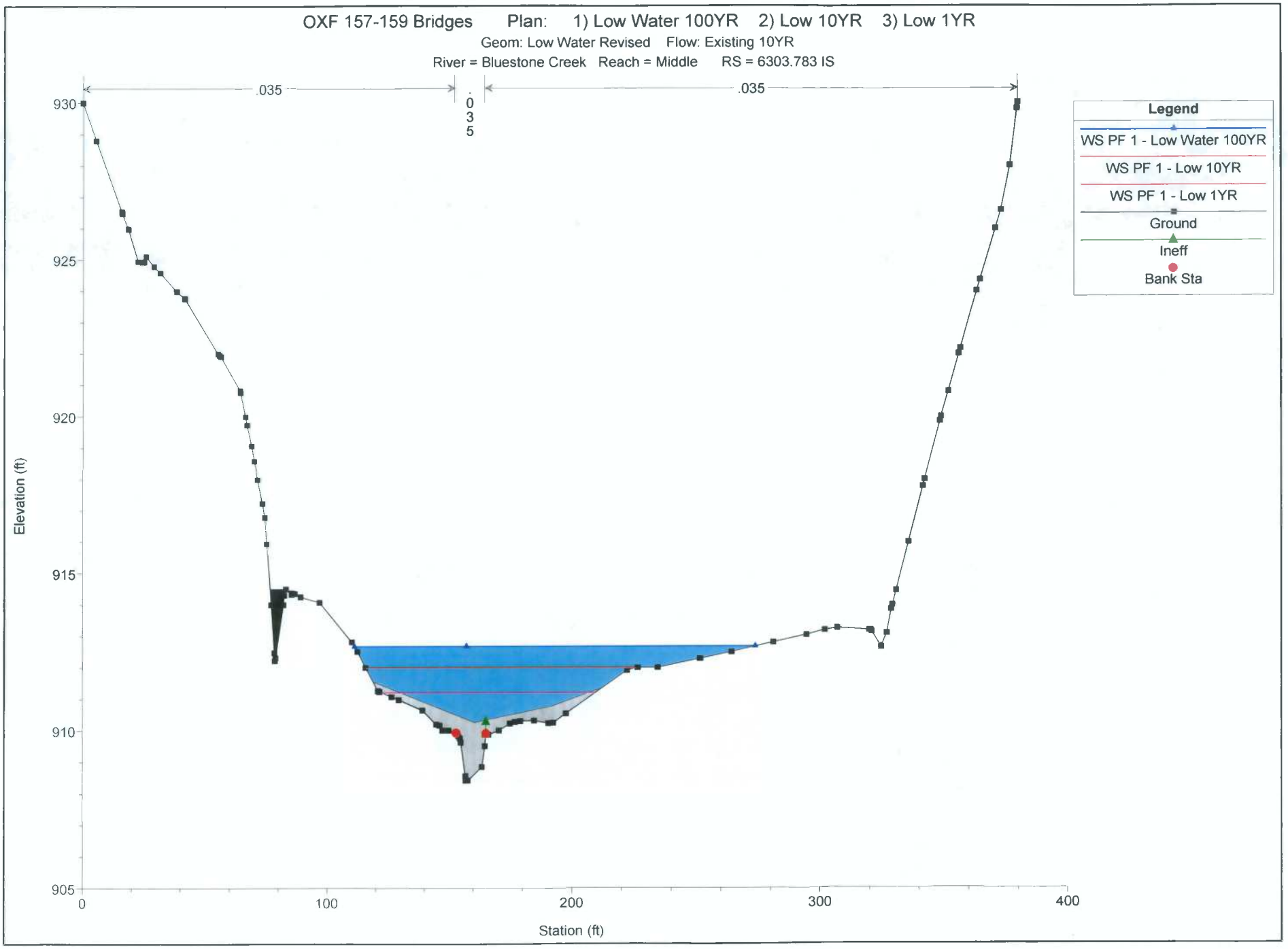
Project in English units

INLINE STRUCTURE

RIVER: Bluestone Creek
REACH: Middle RS: 6303.783

INLINE STRUCTURE OUTPUT Profile #PF 1 Inl Struct:

E.G. Elev (ft)	912.10	Q Gates (cfs)			
W.S. Elev (ft)	911.99	Q Gate Group (cfs)		0.00	
Q Total (cfs)	371.50	Gate Open Ht (ft)		911.32	
Q Weir (cfs)	371.50	Gate #Open			
Weir Flow Area (sq ft)	127.61	Gate Area (sq ft)		1.00	
Weir Sta Lft (ft)	115.35	Gate Submerg		0.00	
Weir Sta Rgt (ft)	240.80	Gate Invert (ft)		0.00	
Weir Max Depth (ft)	1.84	Gate Weir Coef		0.000	
Weir Avg Depth (ft)	1.02				
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)			
Weir Submerg	0.39	Breach Avg Velocity (ft/s)			
Min El Weir Flow (ft)	910.27	Breach Flow Area (sq ft)			
Wr Top Wdth (ft)	125.44				

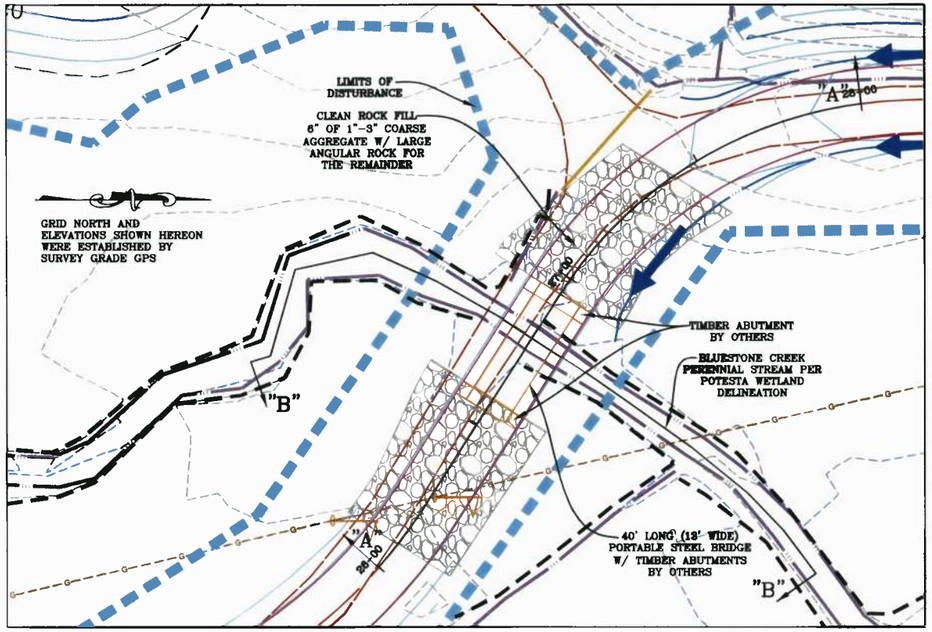

OXF 157-159 Bridges Plan: 1) Low Water 100YR 2) Low 10YR 3) Low 1YR
Geom: Low Water Revised Flow: Existing 10YR
River = Bluestone Creek Reach = Middle RS = 6303.783 IS
.035
.035
.035
Legend
WS PF 1 - Low Water 100YR
WS PF 1 - Low 10YR
WS PF 1 - Low 1YR
Ground
Ineff
Bank Sta
930
925
920
915
910
905
Elevation (ft)
0
100
200
300
400
Station (ft)

SECTION 5

Stream Crossing "D" Details

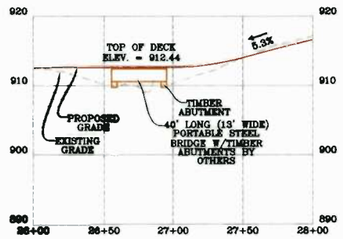
TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "D" DETAILS



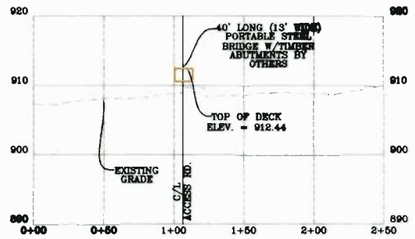
SCALE: 1" = 20'

STREAM CROSSING "D" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

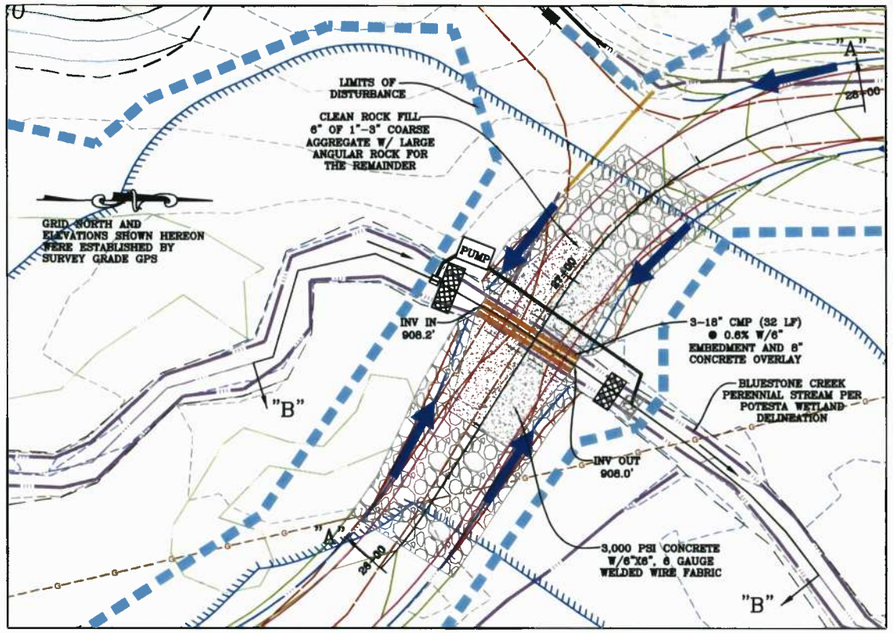
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

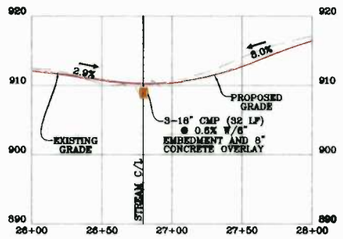
PERMANENT STREAM CROSSING DETAILS

STREAM CROSSING "D" DETAILS



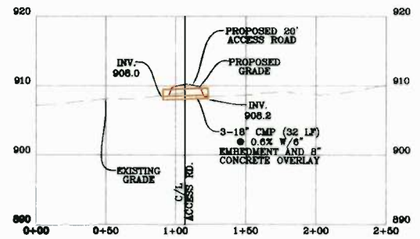
SCALE: 1" = 20'

STREAM CROSSING "D" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
2) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
3) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
4) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
8) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
9) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
10) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

NOTE:

1) SEE SHEET 20 FOR PUMP AROUND NOTES AND DETAILS
2) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
3) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "B".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT MGMT. ENGINEERS ENVIRONMENTAL
SLS
228 West Main St. P.O. Box 189 Salem, WV 26426 (304) 782-1866
6055 Dille Bottom Road Sherrodsville, OH 44675 (740) 871-2811

CYRUS B. KIMP REGISTERED 15578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013

SCALE: N/A

DESIGNED BY: CSK

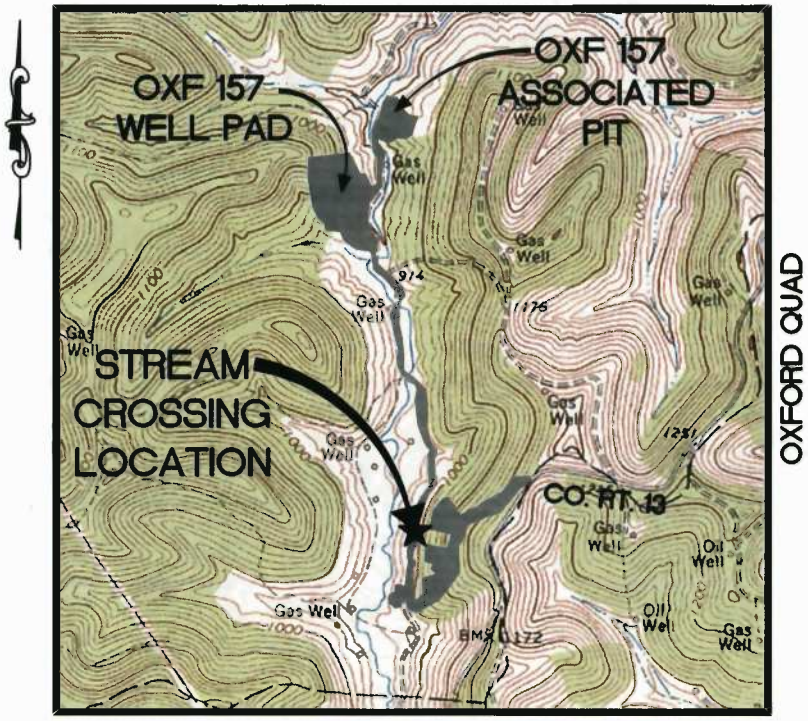
FILE NO. 7889

SHEET 23 OF 26

REV: 12/04/2013

STREAM CROSSING "H"
STORMWATER COMPUTATIONS

OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Cyrus Kump, PE
ckump@navituseng.com

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: December 4, 2013

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "H"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 15, which has been classified as a ephemeral stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 08+03.679 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "H" has a drainage area of 1.40 Acres. Design flows are provided in the drainage calculations in Section 3.

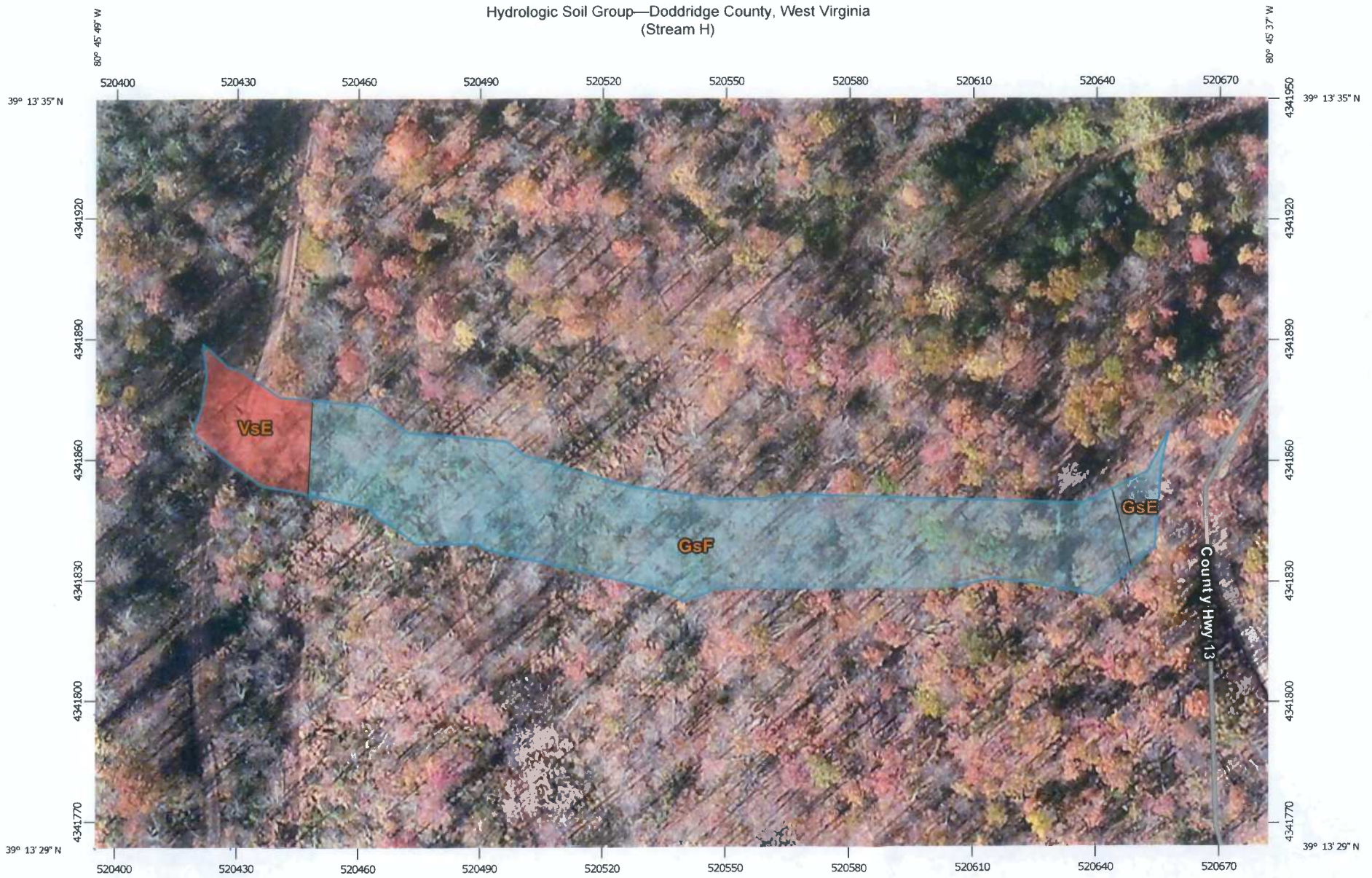
The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 2.14 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 15 inch high-density polyethylene pipe culvert. The culvert is 52.00 LF with a slope of 10.90%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 39.5' of the ephemeral stream, UNT 15.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(Stream H)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	0.0	3.5%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	1.2	84.8%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	0.2	11.7%
Totals for Area of Interest			**1.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.00
Woods (Good)	70	C	1.20
Woods (Good)	77	D	0.20
CN (weighted):	71		
Total Area:	1.40	Acre(s)	

Time of Concentration (SCS)

Curve Number:	71	
Length of Flow:	900.45	ft
Average Land Slope:	32.89	%
Time of Concentration:	0.110	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	1.40	Acre(s)
Runoff Curve Number, CN	71	
Time of Concentration	0.110	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	
Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	0.59	cfs
Runoff Volume, 1-year	0.04	acre-ft
Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	2.14	cfs
Runoff Volume	0.12	acre-ft
Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	4.34	cfs
Runoff Volume	0.24	acre-ft

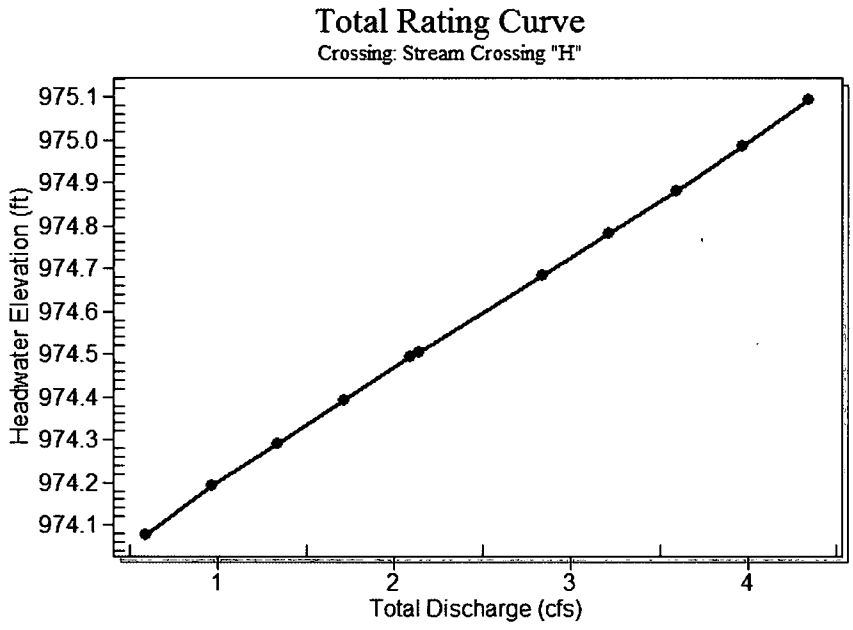
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing H Discharge (cfs)	Roadway Discharge (cfs)	Iterations
974.08	0.59	0.59	0.00	1
974.19	0.96	0.96	0.00	1
974.29	1.34	1.34	0.00	1
974.39	1.71	1.71	0.00	1
974.49	2.09	2.09	0.00	1
974.51	2.14	2.14	0.00	1
974.68	2.84	2.84	0.00	1
974.78	3.21	3.21	0.00	1
974.88	3.59	3.59	0.00	1
974.98	3.96	3.96	0.00	1
975.10	4.34	4.34	0.00	1
976.30	7.31	7.31	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "H"



Rating Curve Plot for Crossing: Stream Crossing "H"

Table 2 - Culvert Summary Table: Stream Crossing "H"

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.59	0.59	974.08	0.409	0.0*	1-S2n	0.181	0.294	0.184	0.211	5.079	5.160
0.96	0.96	974.19	0.521	0.0*	1-S2n	0.242	0.385	0.244	0.253	5.711	5.835
1.34	1.34	974.29	0.620	0.0*	1-S2n	0.283	0.454	0.284	0.287	6.550	6.334
1.71	1.71	974.39	0.723	0.0*	1-S2n	0.320	0.518	0.327	0.314	6.645	6.737
2.09	2.09	974.49	0.822	0.0*	1-S2n	0.357	0.573	0.358	0.339	7.162	7.078
2.14	2.14	974.51	0.835	0.0*	1-S2n	0.362	0.581	0.363	0.342	7.217	7.120
2.84	2.84	974.68	1.014	0.0*	1-S2n	0.419	0.674	0.423	0.380	7.852	7.642
3.21	3.21	974.78	1.111	0.0*	1-S2n	0.447	0.720	0.449	0.398	8.076	7.883
3.59	3.59	974.88	1.210	0.0*	1-S2n	0.476	0.764	0.478	0.415	8.300	8.104
3.96	3.96	974.98	1.315	0.0*	5-S2n	0.504	0.803	0.505	0.431	8.545	8.307
4.34	4.34	975.10	1.425	0.0*	5-S2n	0.529	0.842	0.532	0.445	8.746	8.497

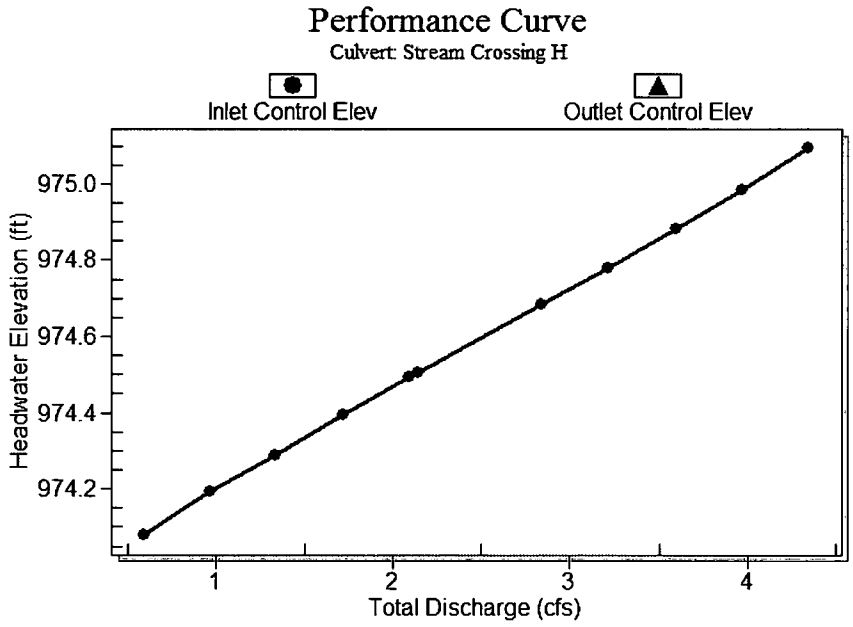
* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 973.67 ft, Outlet Elevation (invert): 968.00 ft

Culvert Length: 52.31 ft, Culvert Slope: 0.1090

****

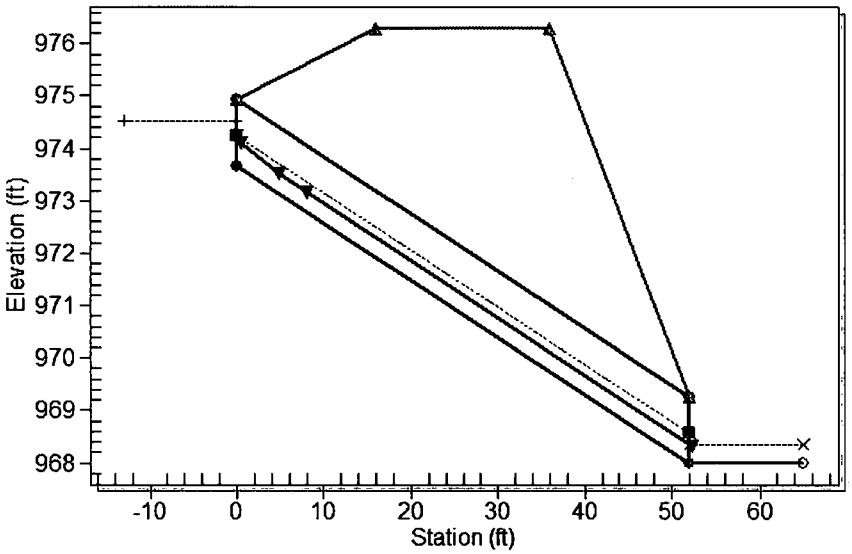


Culvert Performance Curve Plot: Stream Crossing "H"

Water Surface Profile Plot for Culvert: Stream Crossing "H"

Crossing - Stream Crossing "H", Design Discharge - 2.1 cfs

Culvert - Stream Crossing H, Culvert Discharge - 2.1 cfs



Site Data - Stream Crossing "H"

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 973.67 ft

Outlet Station: 52.00 ft

Outlet Elevation: 968.00 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing "H"

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "H")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.59	968.21	0.21	5.16	4.29	2.80
0.96	968.25	0.25	5.83	5.16	2.89
1.34	968.29	0.29	6.33	5.83	2.95
1.71	968.31	0.31	6.74	6.40	2.99
2.09	968.34	0.34	7.08	6.89	3.03
2.14	968.34	0.34	7.12	6.95	3.04
2.84	968.38	0.38	7.64	7.73	3.09
3.21	968.40	0.40	7.88	8.10	3.11
3.59	968.41	0.41	8.10	8.44	3.14
3.96	968.43	0.43	8.31	8.76	3.16
4.34	968.45	0.45	8.50	9.06	3.17

Tailwater Channel Data - Stream Crossing "H"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.3260

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	972.00	0.0350
2	14.70	970.00	0.0350
3	20.20	968.00	0.0350
4	25.00	970.00	0.0350
5	43.20	972.00	0.0350

Roadway Data for Crossing: Stream Crossing "H"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

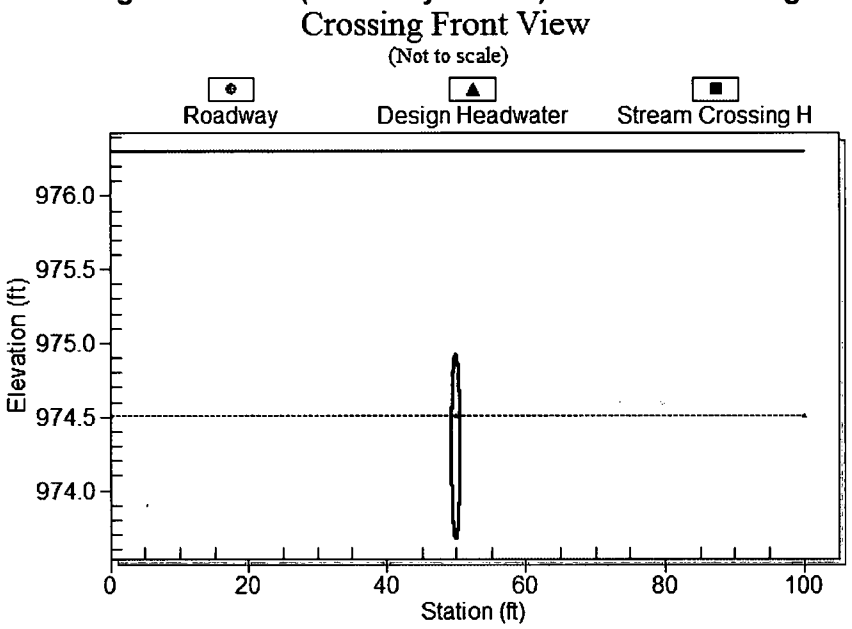
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	976.30
1	50.00	976.30
2	100.00	976.30

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "H"

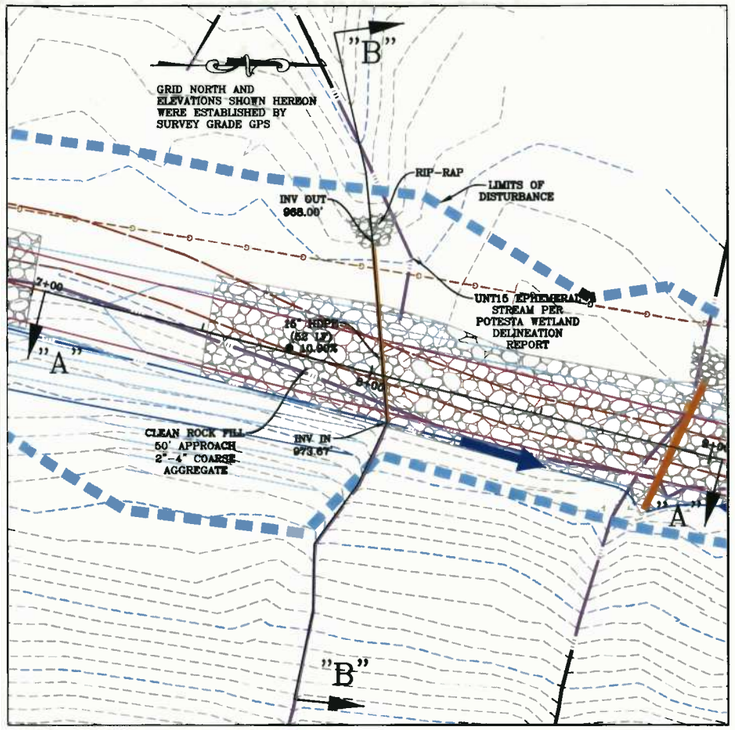


SECTION 5

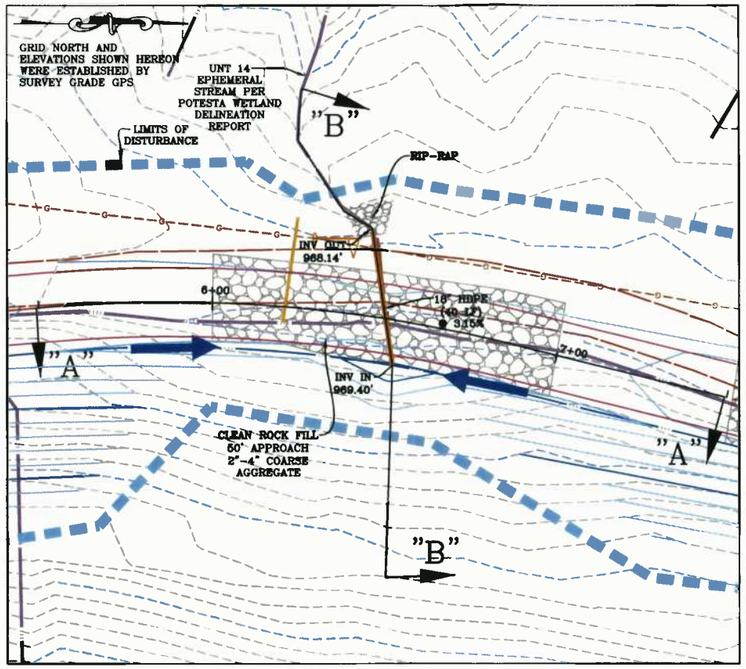
Stream Crossing "H" Details

STREAM CROSSING DETAILS

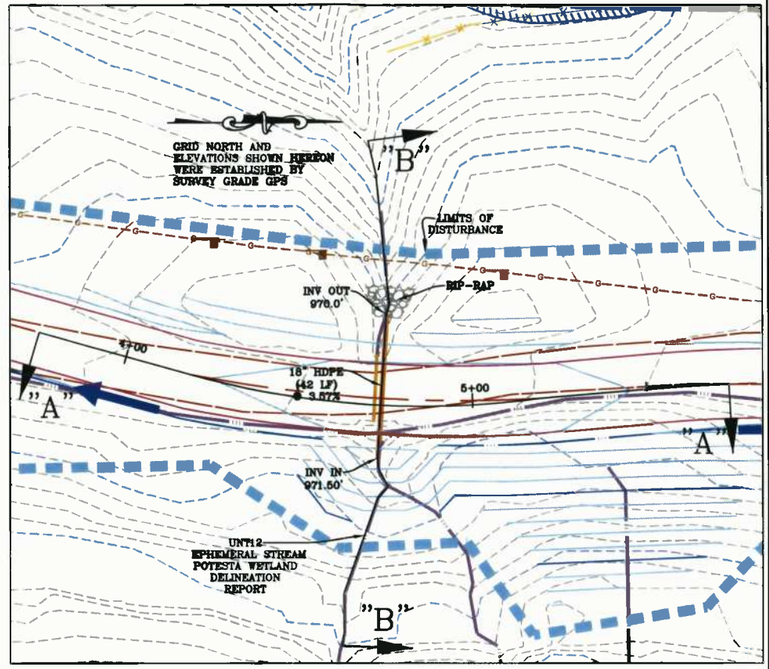
STREAM CROSSING "H" DETAILS



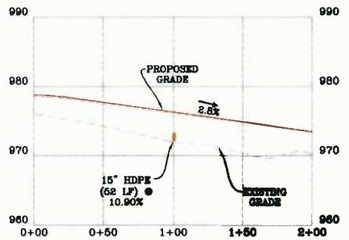
STREAM CROSSING "I" DETAILS



STREAM CROSSING "J" DETAILS

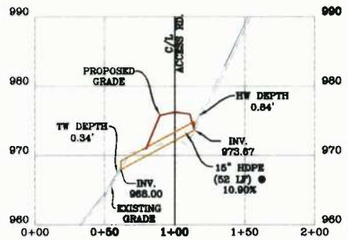


STREAM CROSSING "H" SECTIONS



CROSS SECTION "A-A"

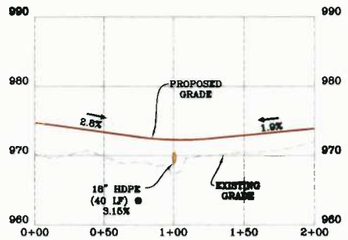
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

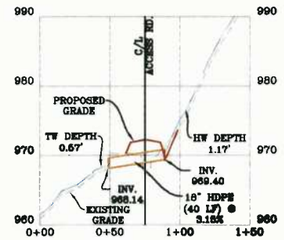
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "I" SECTIONS



CROSS SECTION "A-A"

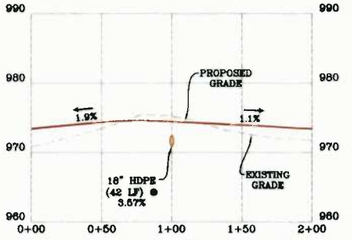
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

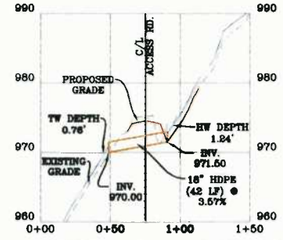
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "J" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "H", "I" & "J".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
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KENTUCKY · INTEGRITY · QUALITY

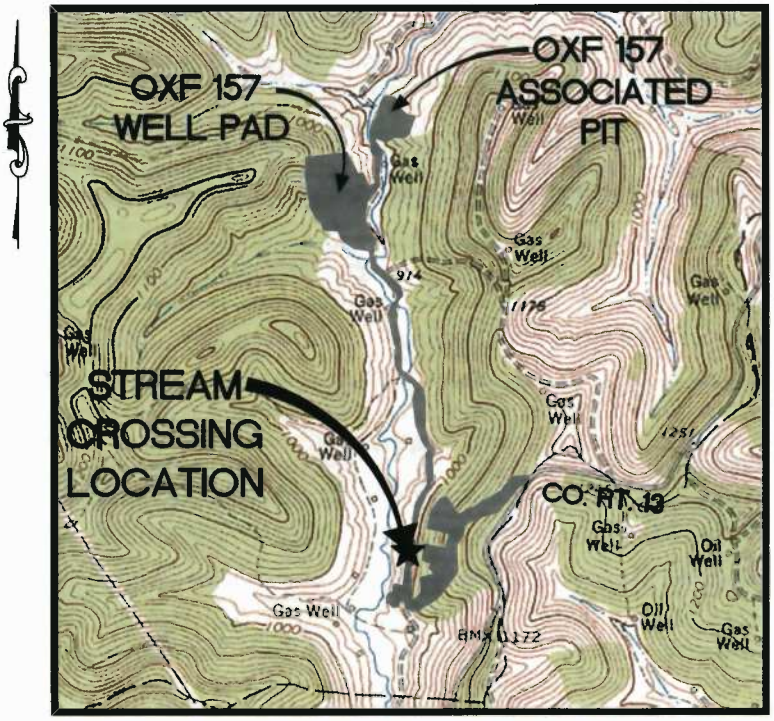
CRAIG S. KING REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 25 OF 31
REV: 12/04/2013

STREAM CROSSING "I"
STORMWATER COMPUTATIONS
OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Cyrus Kump, PE
ckump@navituseng.com

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

Date: December 4, 2013

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "I"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 14, which has been classified as a ephemeral stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 06+49.563 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "I" has a drainage area of 2.40 Acres. Design flows are provided in the drainage calculations in Section 3.

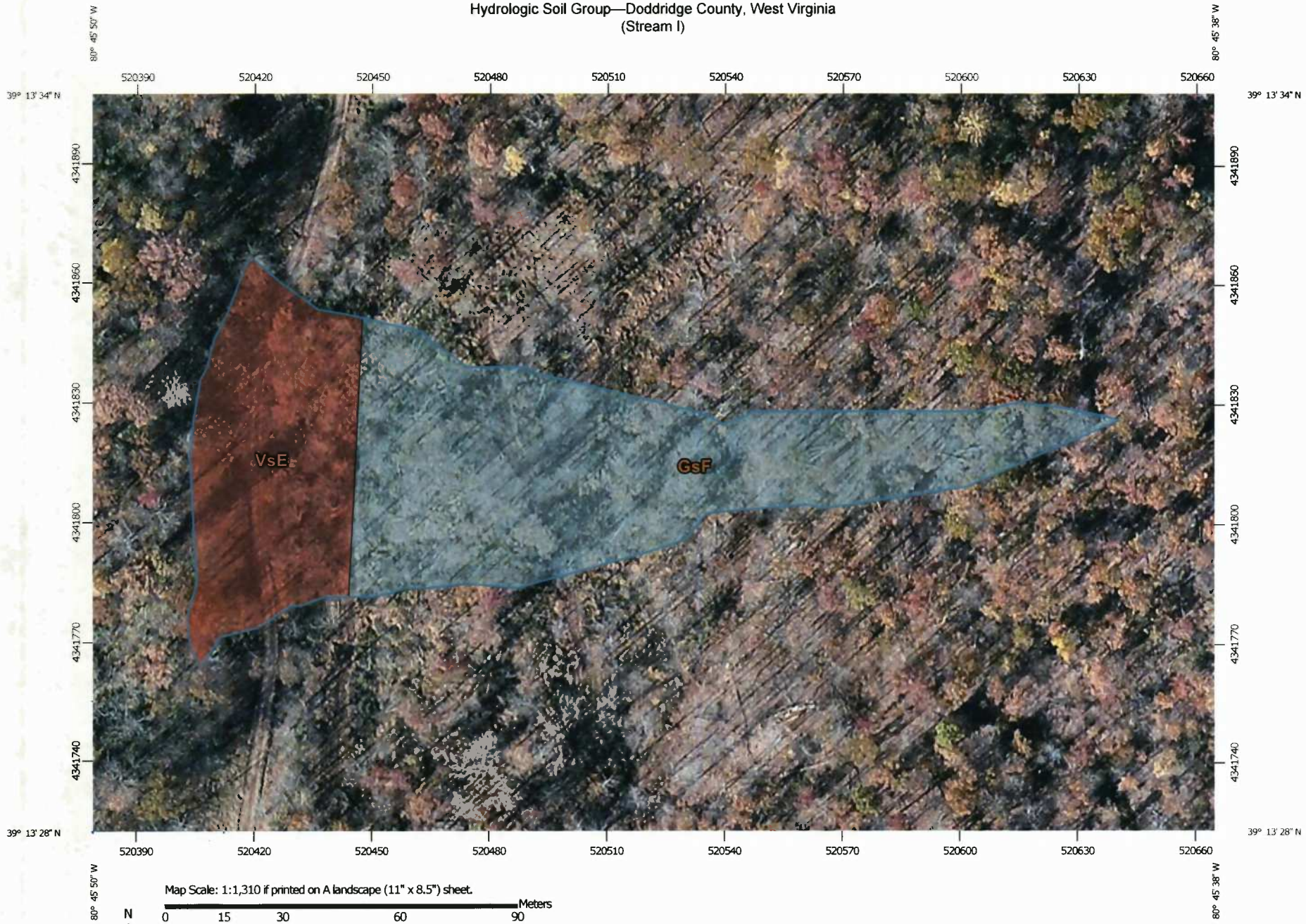
The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 3.94 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 18 inch high-density polyethylene pipe culvert. The culvert is 40.00 LF with a slope of 3.15%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 222.13' of the ephemeral stream, UNT 14.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(Stream I)



Map Scale: 1:1,310 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	1.6	66.4%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	0.8	33.6%
Totals for Area of Interest			**2.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.00
Woods (Good)	70	C	1.60
Woods (Good)	77	D	0.80
CN (weighted):	72		
Total Area:	2.40	Acre(s)	

Time of Concentration (SCS)

Curve Number:	72	
Length of Flow:	929.95	ft
Average Land Slope:	30.85	%
Time of Concentration:	0.114	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	2.40	Acre(s)
Runoff Curve Number, CN	72	
Time of Concentration	0.114	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	
Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	1.16	cfs
Runoff Volume, 1-year	0.07	acre-ft
Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	3.94	cfs
Runoff Volume	0.22	acre-ft
Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	7.85	cfs
Runoff Volume	0.44	acre-ft

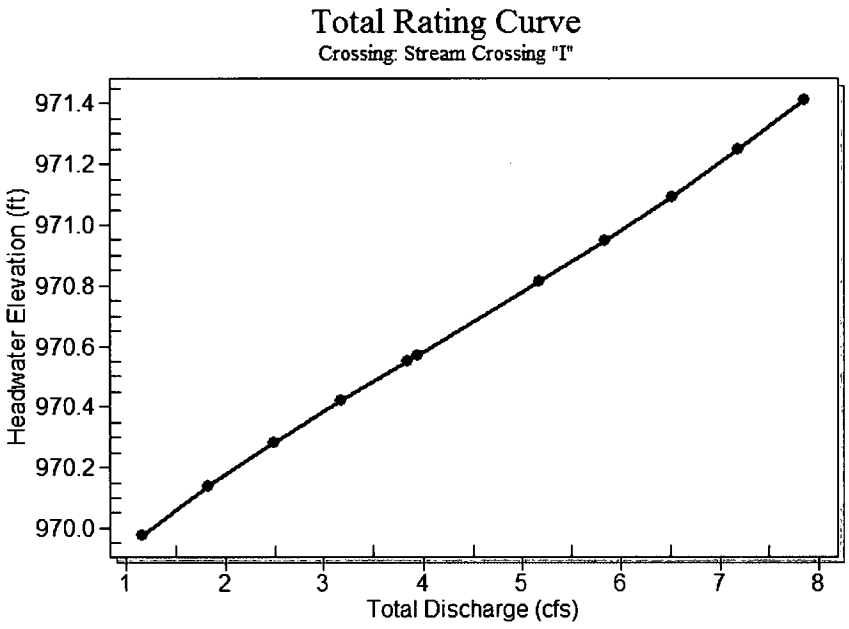
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing I Discharge (cfs)	Roadway Discharge (cfs)	Iterations
969.98	1.16	1.16	0.00	1
970.14	1.83	1.83	0.00	1
970.28	2.50	2.50	0.00	1
970.42	3.17	3.17	0.00	1
970.55	3.84	3.84	0.00	1
970.57	3.94	3.94	0.00	1
970.81	5.17	5.17	0.00	1
970.95	5.84	5.84	0.00	1
971.09	6.51	6.51	0.00	1
971.25	7.18	7.18	0.00	1
971.41	7.85	7.85	0.00	1
972.29	10.68	10.68	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "I"



Rating Curve Plot for Crossing: Stream Crossing "I"

Table 2 - Culvert Summary Table: Stream Crossing "I"

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.16	1.16	969.98	0.578	0.0*	1-S2n	0.338	0.396	0.345	0.358	3.867	4.426
1.83	1.83	970.14	0.738	0.0*	1-S2n	0.429	0.504	0.433	0.425	4.309	4.960
2.50	2.50	970.28	0.883	0.0*	1-S2n	0.504	0.598	0.507	0.478	4.734	5.362
3.17	3.17	970.42	1.019	0.0*	1-S2n	0.574	0.674	0.576	0.522	5.065	5.690
3.84	3.84	970.55	1.150	0.0*	1-S2n	0.639	0.749	0.640	0.561	5.352	5.969
3.94	3.94	970.57	1.170	0.0*	1-S2n	0.648	0.759	0.649	0.567	5.401	6.009
5.17	5.17	970.81	1.411	0.0*	1-S2n	0.760	0.874	0.760	0.627	5.756	6.432
5.84	5.84	970.95	1.548	0.0*	5-S2n	0.818	0.931	0.821	0.657	5.907	6.631
6.51	6.51	971.09	1.693	0.0*	5-S2n	0.875	0.984	0.876	0.684	6.081	6.813
7.18	7.18	971.25	1.847	0.0*	5-S2n	0.934	1.037	0.934	0.710	6.200	6.982
7.85	7.85	971.41	2.014	0.0*	5-S2n	0.994	1.082	0.995	0.734	6.314	7.139

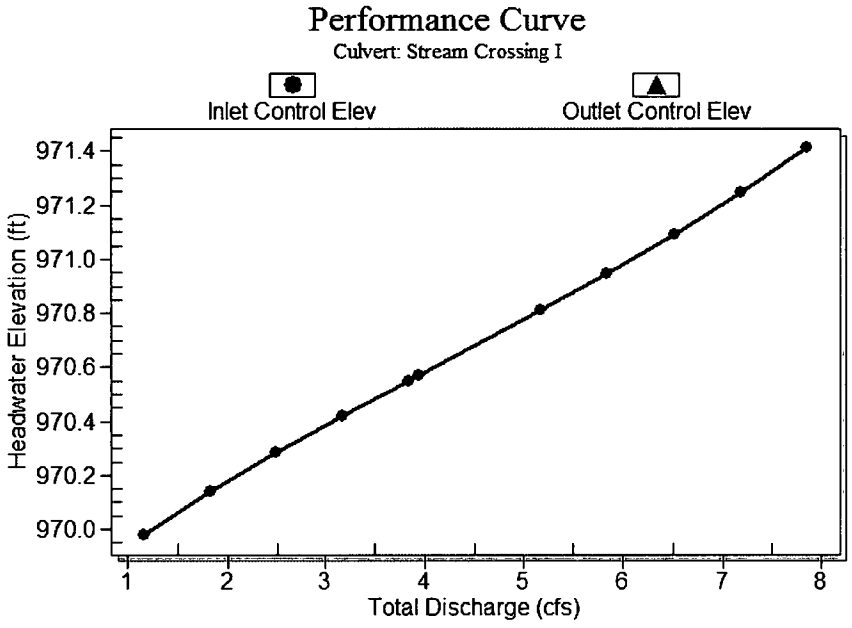
* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 969.40 ft, Outlet Elevation (invert): 968.14 ft

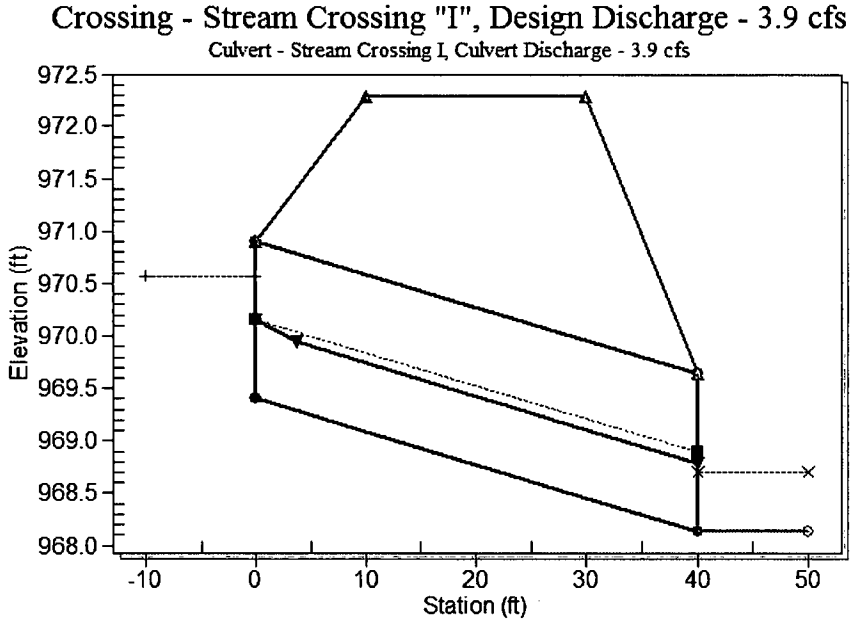
Culvert Length: 40.02 ft, Culvert Slope: 0.0315

****



Culvert Performance Curve Plot: Stream Crossing "I"

Water Surface Profile Plot for Culvert: Stream Crossing "I"



Site Data - Stream Crossing "I"

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 969.40 ft

Outlet Station: 40.00 ft

Outlet Elevation: 968.14 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing "I"

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "I")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.16	968.50	0.36	4.43	2.79	1.84
1.83	968.56	0.42	4.96	3.31	1.90
2.50	968.62	0.48	5.36	3.72	1.93
3.17	968.66	0.52	5.69	4.07	1.96
3.84	968.70	0.56	5.97	4.37	1.99
3.94	968.71	0.57	6.01	4.42	1.99
5.17	968.77	0.63	6.43	4.89	2.02
5.84	968.80	0.66	6.63	5.12	2.04
6.51	968.82	0.68	6.81	5.34	2.05
7.18	968.85	0.71	6.98	5.53	2.07
7.85	968.87	0.73	7.14	5.72	2.08

Tailwater Channel Data - Stream Crossing "I"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.1250

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	972.00	0.0350
2	15.80	970.00	0.0350
3	18.70	968.14	0.0350
4	23.40	970.00	0.0350
5	40.20	972.00	0.0350

Roadway Data for Crossing: Stream Crossing "I"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

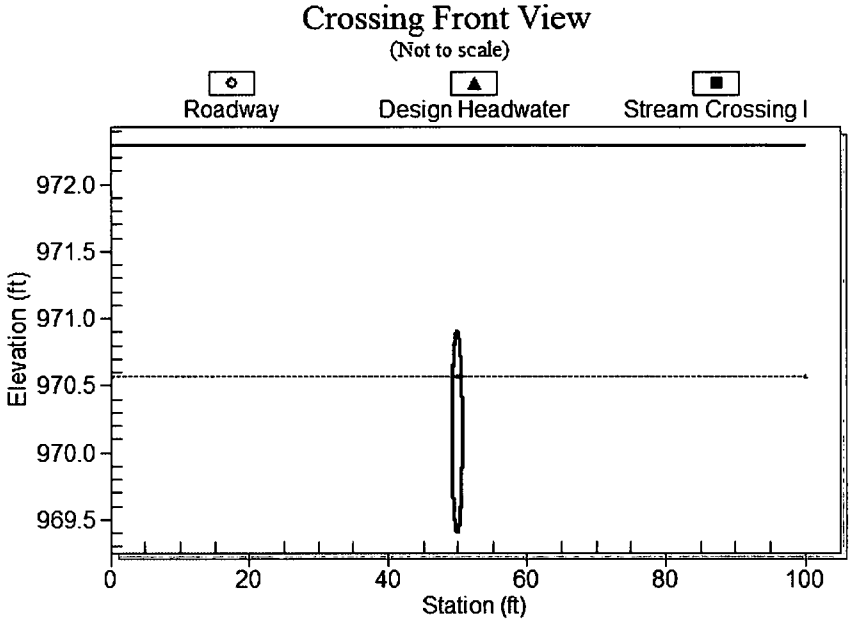
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	972.29
1	50.00	972.29
2	100.00	972.29

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "I"

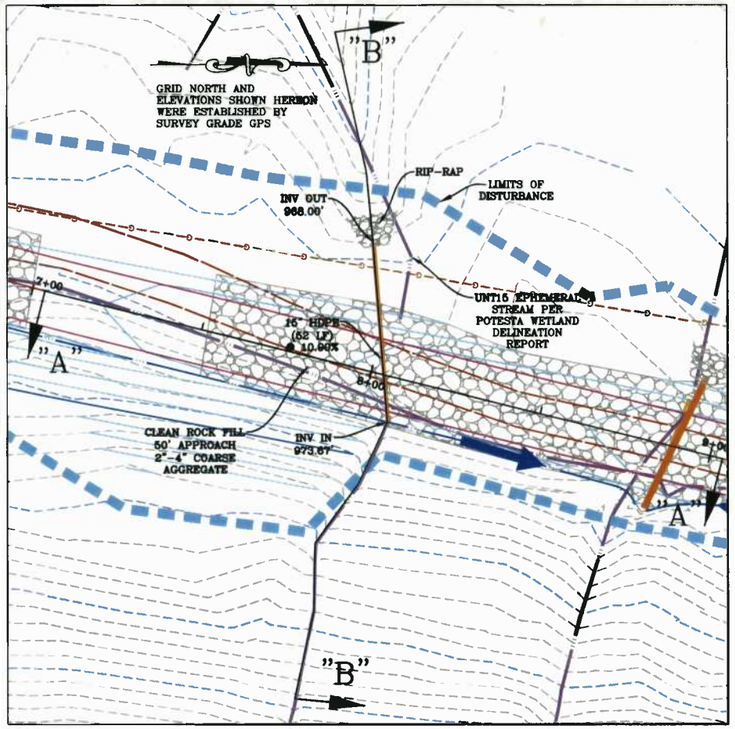


SECTION 5

Stream Crossing "I" Details

STREAM CROSSING DETAILS

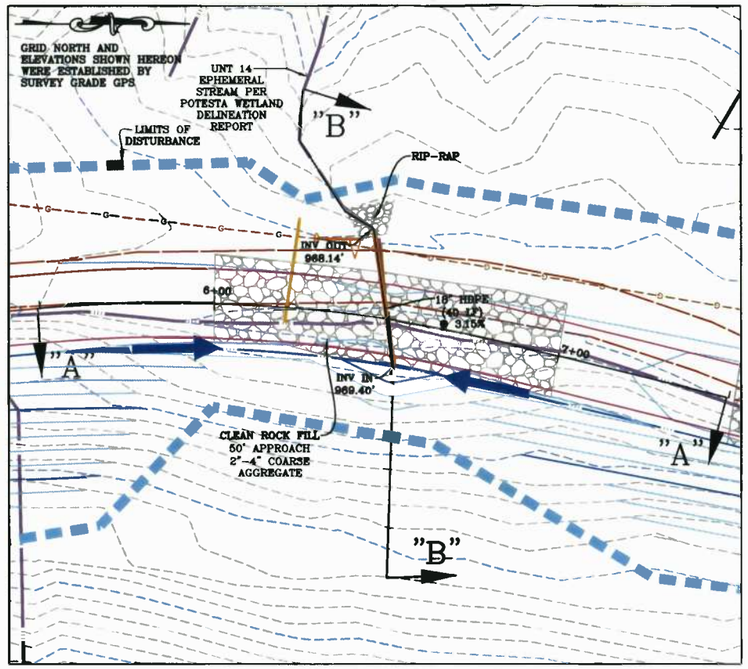
STREAM CROSSING "H" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

STREAM CROSSING "I" DETAILS



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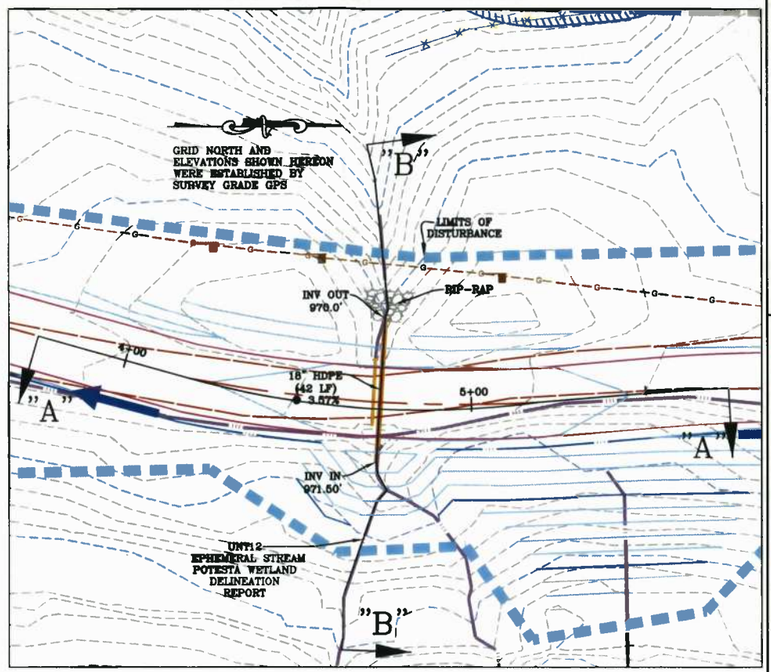
SCALE: 1" = 20'

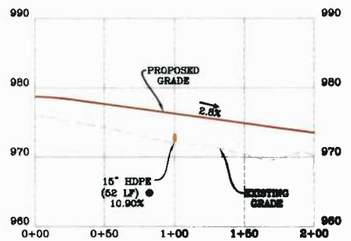
STREAM CROSSING "J" DETAILS



20 10 0 20 40

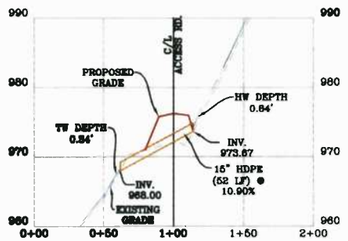
SCALE: 1" = 20'

STREAM CROSSING "H" SECTIONS



CROSS SECTION "A-A"

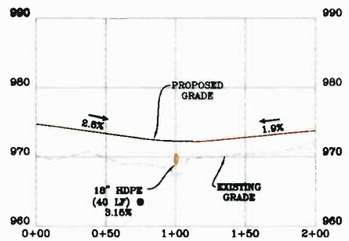
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

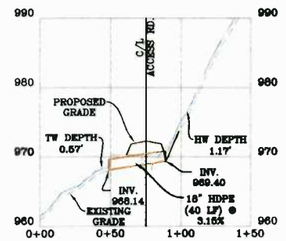
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "I" SECTIONS



CROSS SECTION "A-A"

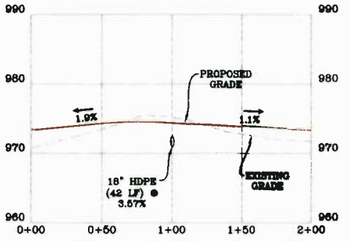
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

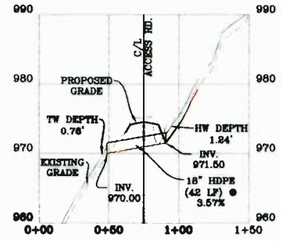
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "J" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "H", "I" & "J".

NAVITUS ENERGY ENGINEERING
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WEST VIRGINIA
PROFESSIONAL ENGINEER

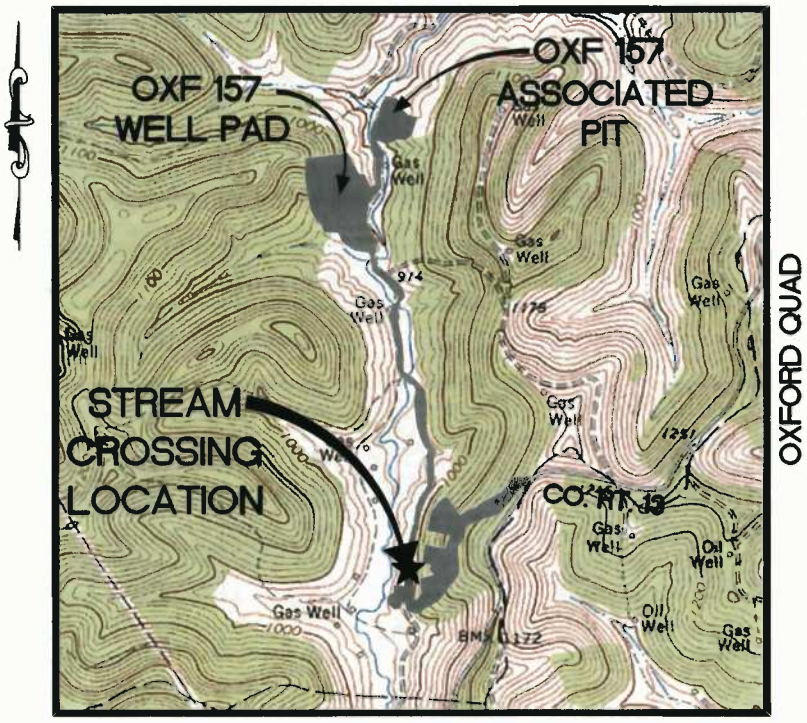
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	25 OF 31
REV:	12/04/2013

STREAM CROSSING "J"
STORMWATER COMPUTATIONS

OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

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Bridgeport, WV 26330

Contact:
Victoria J. Roark
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(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Cyrus Kump, PE
ckump@navituseng.com

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: December 4, 2013

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "J"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 12, which has been classified as a ephemeral stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 04+73.962 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "J" has a drainage area of 2.70 Acres. Design flows are provided in the drainage calculations in Section 3.

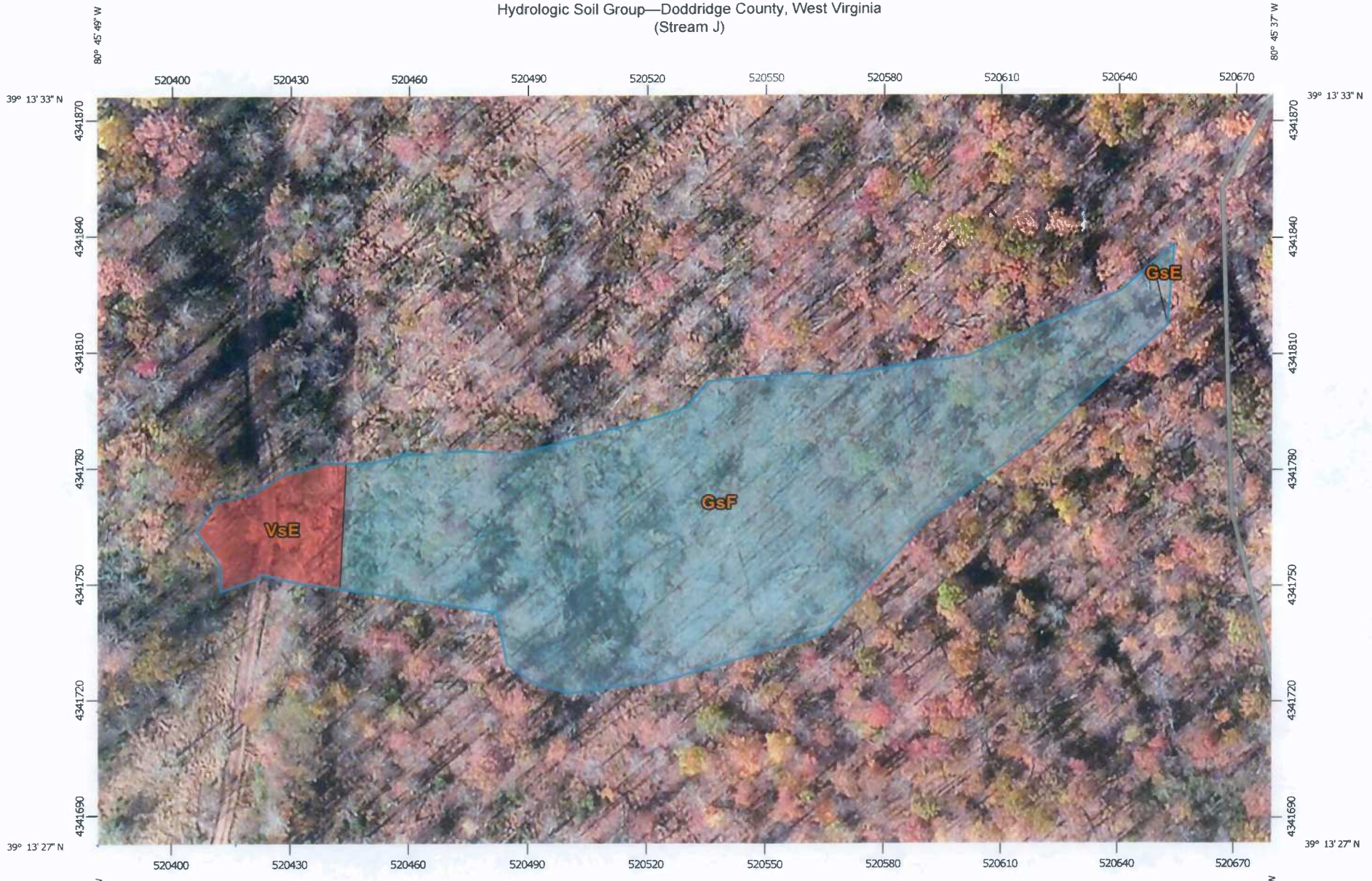
The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 4.34 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 18 inch high-density polyethylene pipe culvert. The culvert is 42.00 LF with a slope of 3.57%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 90.3' of the ephemeral stream, UNT 12.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(Stream J)



Map Scale: 1:1,360 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	0.0	0.5%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	2.5	91.5%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	0.2	8.0%
Totals for Area of Interest			**2.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55

Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.00
Woods (Good)	70	C	2.50
Woods (Good)	77	D	0.20
CN (weighted):	71		
Total Area:	2.70	Acre(s)	

Time of Concentration (SCS)

Curve Number:	71	
Length of Flow:	973.07	ft
Average Land Slope:	29.93	%
Time of Concentration:	0.123	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	2.70	Acre(s)
Runoff Curve Number, CN	71	
Time of Concentration	0.123	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	

Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	1.19	cfs
Runoff Volume, 1-year	0.07	acre-ft

Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	4.34	cfs
Runoff Volume	0.24	acre-ft

Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	8.81	cfs
Runoff Volume	0.50	acre-ft

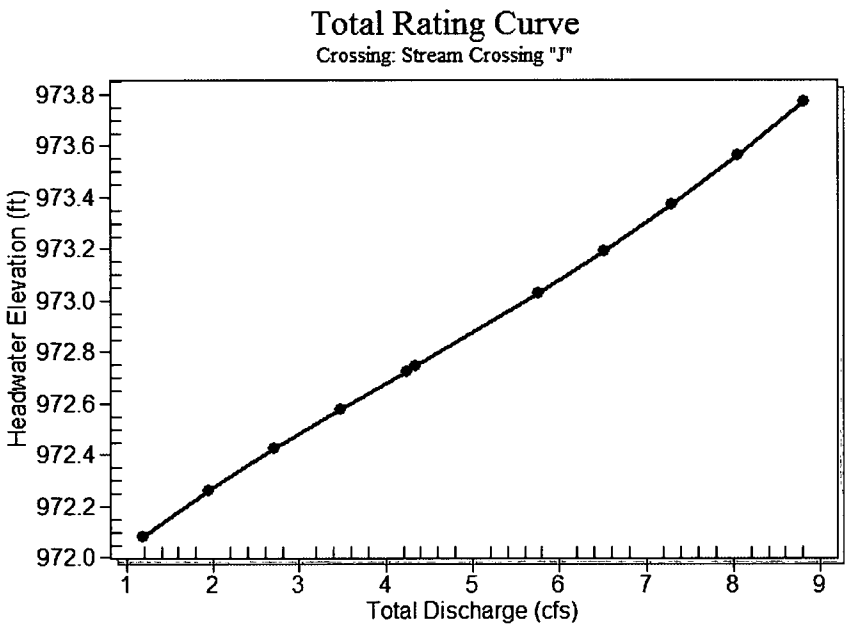
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing J Discharge (cfs)	Roadway Discharge (cfs)	Iterations
972.08	1.19	1.19	0.00	1
972.26	1.95	1.95	0.00	1
972.42	2.71	2.71	0.00	1
972.58	3.48	3.48	0.00	1
972.72	4.24	4.24	0.00	1
972.74	4.34	4.34	0.00	1
973.03	5.76	5.76	0.00	1
973.19	6.52	6.52	0.00	1
973.37	7.29	7.29	0.00	1
973.56	8.05	8.05	0.00	1
973.77	8.81	8.81	0.00	1
976.00	14.23	14.23	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "J"



Rating Curve Plot for Crossing: Stream Crossing "J"

Table 2 - Culvert Summary Table: Stream Crossing J

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.19	1.19	972.08	0.584	0.0*	1-S2n	0.332	0.402	0.332	0.467	4.163	5.169
1.95	1.95	972.26	0.762	0.0*	1-S2n	0.430	0.522	0.431	0.562	4.638	5.850
2.71	2.71	972.42	0.924	0.0*	1-S2n	0.510	0.623	0.513	0.636	5.067	6.352
3.48	3.48	972.58	1.077	0.0*	1-S2n	0.585	0.708	0.587	0.698	5.415	6.757
4.24	4.24	972.72	1.225	0.0*	1-S2n	0.652	0.786	0.655	0.752	5.706	7.101
4.34	4.34	972.74	1.244	0.0*	1-S2n	0.661	0.796	0.665	0.758	5.734	7.143
5.76	5.76	973.03	1.528	0.0*	5-S2n	0.780	0.924	0.780	0.843	6.204	7.668
6.52	6.52	973.19	1.692	0.0*	5-S2n	0.842	0.985	0.844	0.884	6.376	7.909
7.29	7.29	973.37	1.869	0.0*	5-S2n	0.904	1.045	0.905	0.921	6.539	8.131
8.05	8.05	973.56	2.062	0.0*	5-S2n	0.968	1.095	0.969	0.956	6.674	8.336
8.81	8.81	973.77	2.274	0.0*	5-S2n	1.032	1.145	1.035	0.989	6.781	8.526

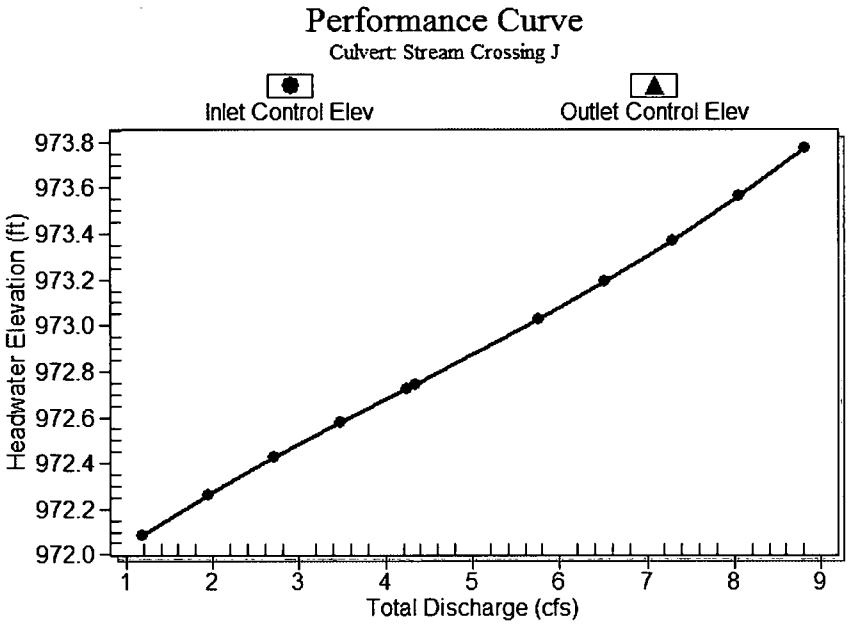
* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 971.50 ft, Outlet Elevation (invert): 970.00 ft

Culvert Length: 42.03 ft, Culvert Slope: 0.0357

****

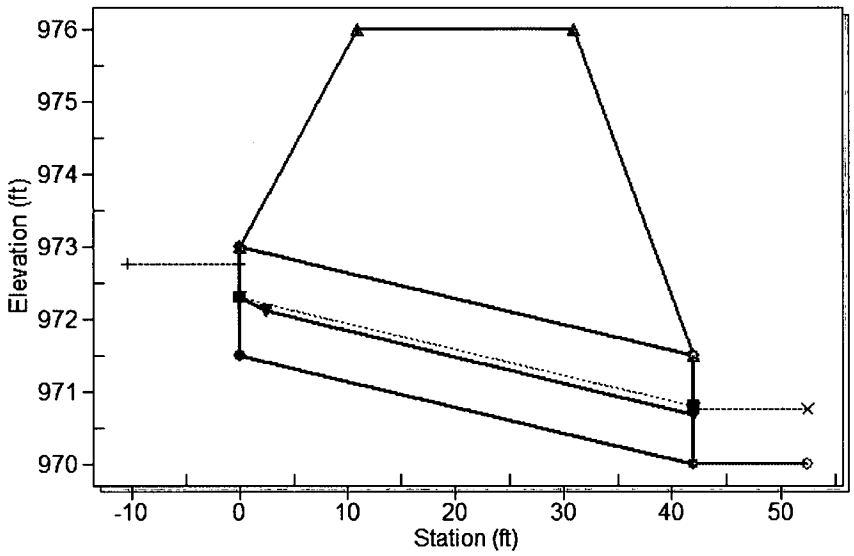


Culvert Performance Curve Plot: Stream Crossing J

Water Surface Profile Plot for Culvert: Stream Crossing J

Crossing - Stream Crossing "J", Design Discharge - 4.3 cfs

Culvert - Stream Crossing J, Culvert Discharge - 4.3 cfs



Site Data - Stream Crossing J

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 971.50 ft

Outlet Station: 42.00 ft

Outlet Elevation: 970.00 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing J

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "J")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.19	970.47	0.47	5.17	4.60	1.89
1.95	970.56	0.56	5.85	5.54	1.94
2.71	970.64	0.64	6.35	6.27	1.99
3.48	970.70	0.70	6.76	6.88	2.02
4.24	970.75	0.75	7.10	7.41	2.04
4.34	970.76	0.76	7.14	7.48	2.04
5.76	970.84	0.84	7.67	8.32	2.08
6.52	970.88	0.88	7.91	8.71	2.10
7.29	970.92	0.92	8.13	9.08	2.11
8.05	970.96	0.96	8.34	9.43	2.12
8.81	970.99	0.99	8.53	9.75	2.14

Tailwater Channel Data - Stream Crossing "J"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.1580

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	974.00	0.0350
2	4.15	970.00	0.0350
3	8.45	974.00	0.0350

Roadway Data for Crossing: Stream Crossing "J"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

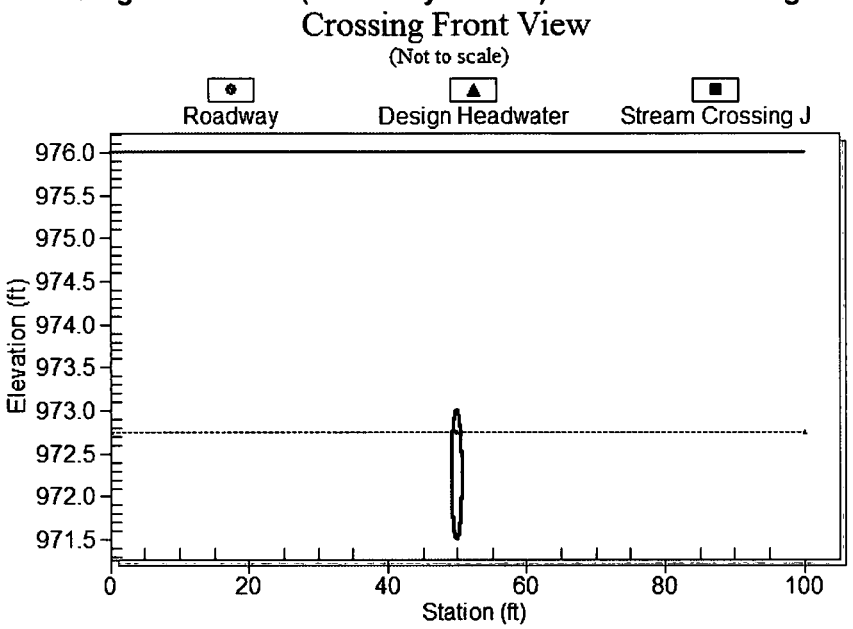
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	976.00
1	50.00	976.00
2	100.00	976.00

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "J"

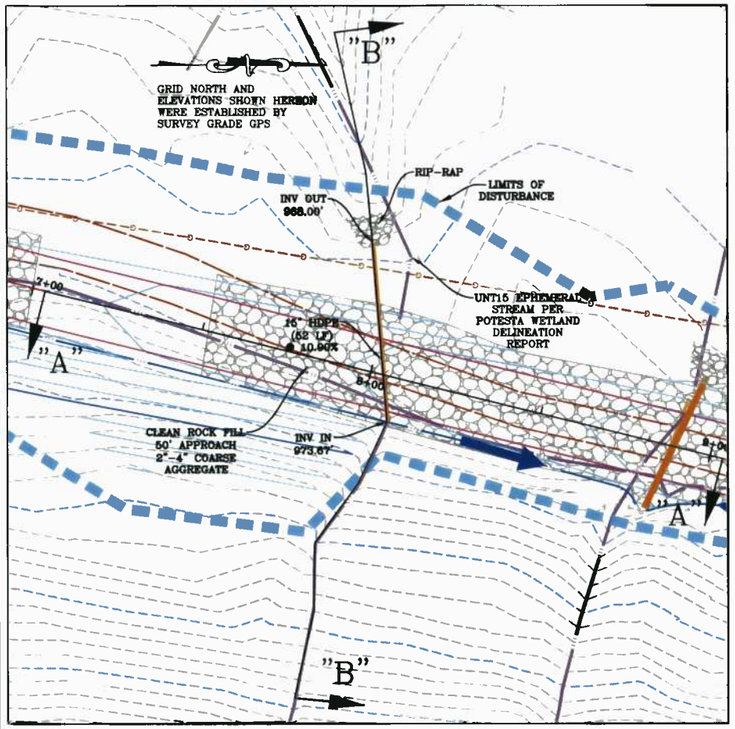


SECTION 5

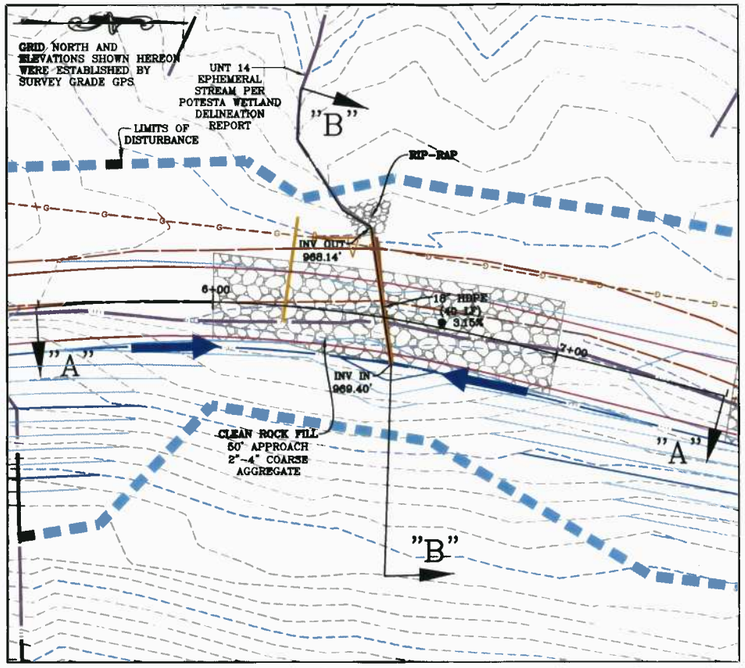
Stream Crossing "J" Details

STREAM CROSSING DETAILS

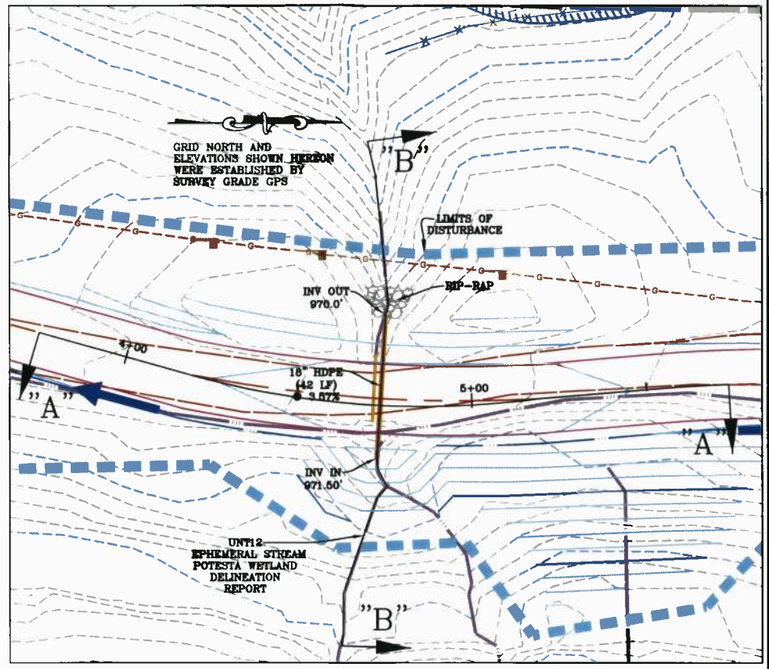
STREAM CROSSING "H" DETAILS



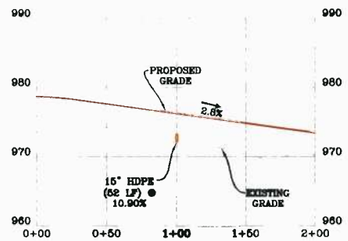
STREAM CROSSING "I" DETAILS



STREAM CROSSING "J" DETAILS

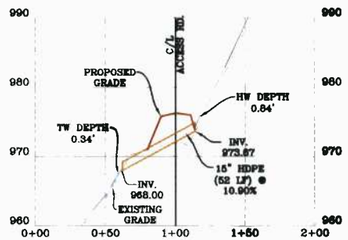


STREAM CROSSING "H" SECTIONS



CROSS SECTION "A-A"

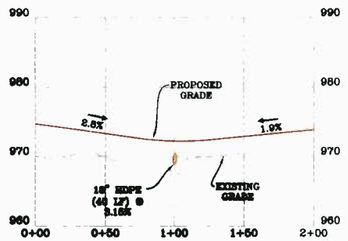
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

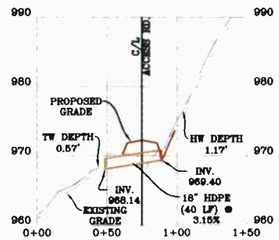
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "I" SECTIONS



CROSS SECTION "A-A"

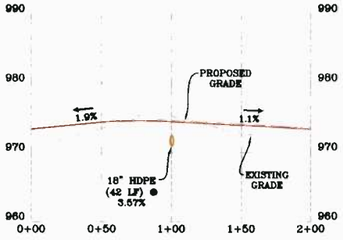
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

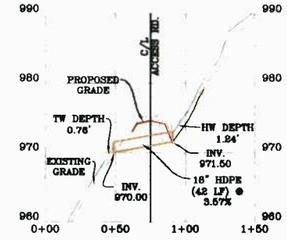
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "J" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "H", "I" & "J".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT MGMT. ENGINEERS ENVIRONMENTAL
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5053 Dike Bonton Road
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New Lexington, OH 43764
(740) 342-5534
HONESTY. INTEGRITY. QUALITY.

CHRIS S. KAMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	25 OF 31
REV:	12/04/2013

#13-113

HENDERSON CENTRALIZED IMPOUNDMENT
SITE PLAN
EQT PRODUCTION COMPANY

SITUATE ON THE WATERS OF BLUESTONE CREEK IN
WEST UNION DISTRICT, DODDRIDGE COUNTY, WEST VIRGINIA.

PROJECT INFORMATION

PROJECT NAME: HENDERSON CENTRALIZED IMPOUNDMENT

TAX PARCEL:
WEST UNION DISTRICT
MAP 6-1

SURFACE OWNER:
JUSTIN L. HENDERSON
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV
TOTAL PROPERTY AREA: 1,602.9 ± ACRES

OIL AND GAS ROYALTY OWNER:
LEEMAN MAXWELL HRS
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV
TOTAL PROPERTY AREA: 2,164 ± ACRES

SITE LOCATION:
THE HENDERSON CENTRALIZED IMPOUNDMENT SITE IS WEST OF MAXWELL RIDGE ALONG BLUESTONE CREEK OFF COUNTY ROUTE 13. THE ENTRANCE TO THE SITE IS APPROXIMATELY 1 MILE SOUTHWEST OF THE CO. RT. 13 AND CO. RT. 13/3 INTERSECTION.

LOCATION COORDINATES

HENDERSON CENTRALIZED IMPOUNDMENT ENTRANCE
LATITUDE: 39.227701 LONGITUDE: -80.758964 (NAD 83)

HENDERSON CENTRALIZED IMPOUNDMENT
LATITUDE: 39.224948 LONGITUDE: -80.765453 (NAD 83)

SITE DISTURBANCE COMPUTATIONS

ROAD A PHASE 1 & 2= 13.80 ± ACRES (ROAD A PHASE I, II & STOCKPILES A-D)
HENDERSON CENTRALIZED IMPOUNDMENT AREA = 7.82 ± ACRES*
ACCESS ROAD "B"= 1.44 ± ACRES
TOTAL SITE DISTURBANCE = 23.06 ± ACRES
*INCLUDES AREA OF THE HENDERSON CENTRALIZED IMPOUNDMENT & STOCKPILES

ENTRANCE PERMIT

EQT PRODUCTION COMPANY WILL OBTAIN AN ENCROACHMENT PERMIT (FORM MM-109) FROM THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS, PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

MISS UTILITY STATEMENT

MISS UTILITY OF WEST VIRGINIA WAS NOTIFIED FOR THE LOCATING OF UTILITIES PRIOR TO THIS PROJECT DESIGN; TICKET #1328176253.
IN ADDITION, MISS UTILITY WILL BE CONTACTED PRIOR TO START OF THE PROJECT.

FLOODPLAIN NOTE

THE PROPOSED LIMITS OF DISTURBANCE FOR THIS PROJECT IS LOCATED IN FEMA FLOOD ZONE X AND A, PER THE FLOOD INSURANCE RATE MAP (FIRM) NUMBER 54017C0225C, DATED OCTOBER 4, 2011.

FOR A DETAILED ANALYSIS OF THE DEVELOPMENT WITHIN THE FEMA FLOOD ZONE "A", SEE THE REPORT BY NAVITUS ENGINEERING ENTITLED "FLOODPLAIN ANALYSIS OF BLUESTONE CREEK" DATED DECEMBER 4, 2013.

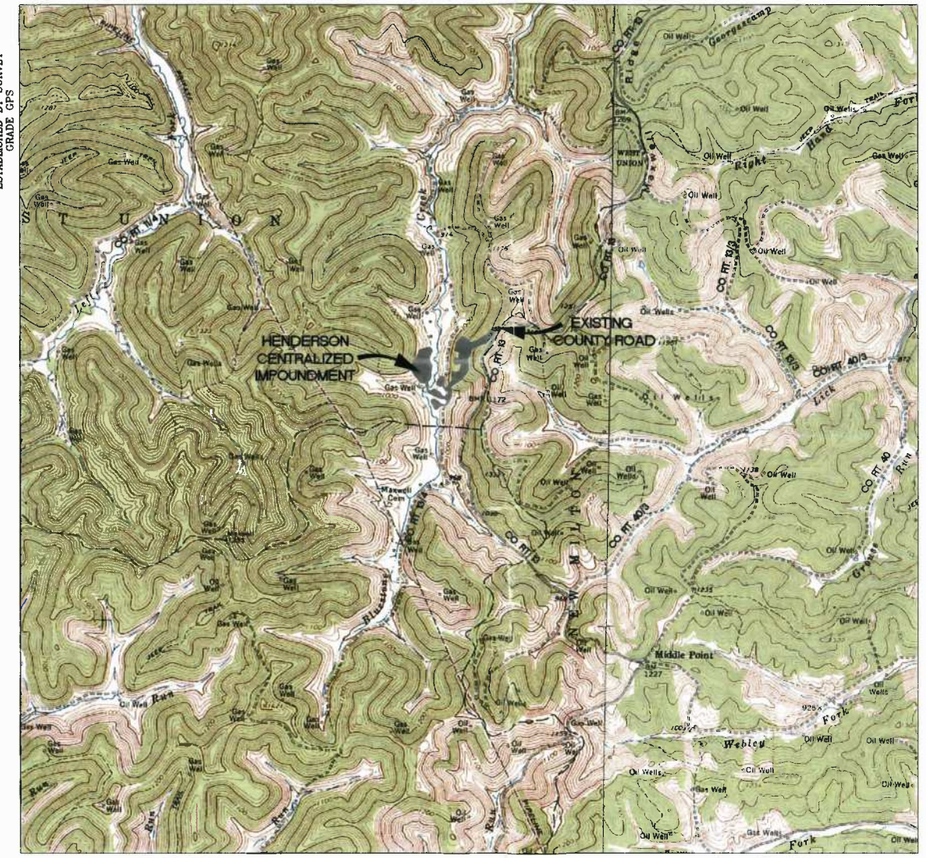
ENVIRONMENTAL NOTES

A WETLAND DELINEATION WAS PERFORMED ON APRIL 25-26, 2013 BY POTESTA AND ASSOCIATES, INC. 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). THE MAY 29, 2013 REPORT PROJECT # 0101-11-147-15701 WAS PREPARED BY POTESTA AND ASSOCIATES, INC. SUMMARIZES THE RESULTS OF THE FIELD DELINEATION. THE REPORT DOES NOT, IN ANY WAY, REPRESENT A JURISDICTIONAL DETERMINATION OF THE LANDWARD LIMITS OF WATERS AND WETLANDS WHICH MAY BE REGULATED BY THE USACE OR THE WVDEP. IT IS STRONGLY RECOMMENDED THAT THE AFOREMENTIONED AGENCIES BE CONSULTED IN AN EFFORT TO GAIN WRITTEN CONFIRMATION OF THE DELINEATION DESCRIBED BY THIS REPORT PRIOR TO ENGAGING CONSTRUCTION ON THE PROPERTY DESCRIBED HEREIN. THE DEVELOPER SHALL OBTAIN THE APPROPRIATE PERMITS FROM THE FEDERAL AND/OR STATE REGULATORY AGENCIES PRIOR TO ANY PROPOSED IMPACTS TO WATERS OF THE U.S., INCLUDING WETLAND FILLS AND STREAM CROSSINGS.

GENERAL DESCRIPTION

THE HENDERSON CENTRALIZED IMPOUNDMENT IS BEING CONSTRUCTED TO AID IN THE DEVELOPMENT OF INDIVIDUAL MARCELLUS SHALE GAS WELLS.

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



2000 0 2000
SCALE: 1" = 2000'

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!!

LIST OF DRAWINGS

LEGEND

EX. INDEX CONTOUR	700	PROP. INDEX CONTOUR	700
EX. INTERMEDIATE CONTOUR		PROP. INTERMEDIATE CONTOUR	
EX. BOUNDARY LINE		PROP. GRADING LIMITS	
EX. ROAD EDGE OF GRAVEL/DIRT		PROP. LIMITS OF DISTURBANCE	
EX. ROAD EDGE OF PAVEMENT		PROP. WELL PAD	
EX. ROAD CENTERLINE		PROP. WELL HEAD	
EX. DITCHLINE		PROP. 4" PVC DRAIN PIPE	
EX. CULVERT		PROP. SUMP DRAIN	
EX. GUARDRAIL		PROP. CONTAINMENT BERM	
EX. FENCELINE		PROP. PIT/IMPOUNDMENT CL	
EX. GATE		PROP. PERIMETER SAFETY FENCE	
EX. OVERHEAD UTILITY		PROP. ACCESS GATE WITH EMERGENCY LIFELINE	
EX. OVERHEAD UTILITY R/W			
EX. POWER POLE			
EX. GUY WIRE			
EX. TELEPHONE LINE			
EX. GASLINE		PROP. ROCK CONSTRUCTION ENTRANCE	
EX. GASLINE R/W			
EX. WATERLINE			
EX. WATER WELL		PROP. ROAD EDGE OF GRAVEL	
EX. GAS WELL		PROP. ROAD CENTERLINE	
EX. TREELINE		PROP. V-DITCH W/ CHECK DAMS	
EX. REFERENCE TREE		PROP. DITCH RELIEF CULVERT (DRC)	
EX. DELINEATED STREAM		PROP. RIP-RAP OUTLET PROTECTION	
EX. DELINEATED WETLAND		PROP. GUARDRAIL	
EX. BUILDING		PROP. ROCK LEVEL SPREADER	
EX. BRIDGE		PROP. EARTHEN DIVERSION BERM	
100' WETLAND/STREAM BUFFER		PROP. ORANGE SAFETY FENCE	
		PROP. SUPER SILT FENCE	SSF SSF
		PROP. COMPOST FILTER SOCK	
		PROP. COMPOST SOCK DIVERSION	
		PROP. GROUNDWATER DEWATERING TRENCH	
		PROP. GROUNDWATER DEWATERING PIPE	
		SECTION LINE	"A" 0+00 "A" 0+50
		MATCHLINE	
		X-SECTION GRID INDEX	
		X-SECTION GRID INTERMEDIATE	
		X-SECTION PROPOSED GRADE	
		X-SECTION EXISTING GRADE	
		X-SECTION WATER SURFACE	
		SPOT ELEVATION CENTER OF PAD	1000

OPERATOR

EQT PRODUCTION COMPANY
OPERATOR ID: 306686
115 PROFESSIONAL PLACE
P.O. BOX 280
BRIDGEPORT, WV 26330
PHONE: (304) 348-3870

ENGINEER

NAVITUS ENGINEERING, INC.
151 WINDY HILL LANE
WINCHESTER, VA 22602
PHONE: (888) 662-4185

SURVEYOR

SMITH LAND SURVEYING, INC.
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STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

COVER SHEET
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: 1" = 2000'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 1 OF 21

CONSTRUCTION NOTES:

1. METHODS AND MATERIALS USED IN THE CONSTRUCTION OF THE IMPROVEMENTS HEREIN SHALL CONFORM TO THE CURRENT COUNTY CONSTRUCTION STANDARDS AND SPECIFICATIONS AND/OR CURRENT WVDEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL STANDARDS AND SPECIFICATIONS.

2. MEASURES TO CONTROL EROSION AND SILTATION, INCLUDING DETENTION PONDS SERVING AS SILT BASINS DURING CONSTRUCTION, MUST BE PROVIDED PRIOR TO ISSUANCE OF THE SITE DEVELOPMENT PERMIT. THE APPROVAL OF THESE PLANS IN NO WAY RELIEVES THE DEVELOPER OR HIS AGENT OF THE RESPONSIBILITIES CONTAINED IN THE WVDEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL.

3. AN APPROVED SET OF PLANS AND ALL APPLICABLE PERMITS MUST BE AVAILABLE AT THE CONSTRUCTION SITE. ALSO, A REPRESENTATIVE OF THE DEVELOPER MUST BE AVAILABLE AT ALL TIMES.

4. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING MUD FROM TRUCKS AND/OR OTHER EQUIPMENT PRIOR TO ENTERING PUBLIC STREETS, AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN STREETS, ALLAY DUST, AND TO TAKE WHATEVER MEASURES ARE NECESSARY TO INSURE THAT THE STREETS ARE MAINTAINED IN A CLEAN, MUD AND DUST FREE CONDITION AT ALL TIMES.

5. NOTIFICATION SHALL BE GIVEN TO THE APPROPRIATE UTILITY COMPANY PRIOR TO CONSTRUCTION OF WATER AND/OR GAS PIPE LINES. INFORMATION SHOULD ALSO BE OBTAINED FROM THE APPROPRIATE AUTHORITY CONCERNING PERMITS, CUT SHEETS, AND CONNECTIONS TO EXISTING LINES.

6. THE LOCATION OF EXISTING UTILITIES SHOWN IN THESE PLANS ARE FROM FIELD LOCATIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES AS NEEDED PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL INFORM THE ENGINEER OF ANY CONFLICTS ARISING FROM HIS EXISTING UTILITY VERIFICATION AND THE PROPOSED CONSTRUCTION.

7. THE DEVELOPER WILL BE RESPONSIBLE FOR ANY DAMAGE TO THE EXISTING STREETS AND UTILITIES WHICH OCCURS AS A RESULT OF HIS CONSTRUCTION PROJECT WITHIN OR CONTIGUOUS TO THE EXISTING RIGHT-OF-WAY.

8. WHEN GRADING IS PROPOSED WITHIN EASEMENTS OF UTILITIES, LETTERS OF PERMISSION FROM ALL INVOLVED COMPANIES MUST BE OBTAINED PRIOR TO GRADING AND/OR SITE DEVELOPMENT.

9. THE DEVELOPER WILL BE RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES WHICH IS REQUIRED AS A RESULT OF HIS PROJECT. THE RELOCATION SHOULD BE DONE PRIOR TO CONSTRUCTION.

10. THESE PLANS IDENTIFY THE LOCATION OF ALL KNOWN GRAVESITES. GRAVESITES SHOWN ON THIS PLAN WILL BE PROTECTED IN ACCORDANCE WITH STATE LAW. IN THE EVENT GRAVESITES ARE DISCOVERED DURING CONSTRUCTION, THE OWNER AND ENGINEER MUST BE NOTIFIED IMMEDIATELY.

11. THE CONTRACTOR IS TO VERIFY FIELD CONDITIONS PRIOR TO AND DURING CONSTRUCTION AND NOTIFY NAVITUS ENGINEERING AT (888) 662-4185 OR SMITH LAND SURVEYING AT (304) 462-5634 IMMEDIATELY OF ANY DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THE APPROVED PLAN.

12. CONTRACTORS SHALL NOTIFY OPERATORS WHO MAINTAIN UNDERGROUND UTILITY LINES IN THE AREA OF PROPOSED EXCAVATING OR BLASTING AT LEAST TWO (2) WORKING DAYS, BUT NOT MORE THAN TEN (10) WORKING DAYS, PRIOR TO COMMENCEMENT OF EXCAVATION OR DEMOLITION.

13. CONTRACTOR TO CONTACT OPERATOR AND ENGINEER IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION.

14. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED BY THE CONTRACTOR DAILY AND CHECKED AFTER EVERY RAINFALL. ALL DRAIN INLETS SHALL BE FREE OF SILTATION AND DEBRIS. INEFFECTIVE MEASURES SHALL BE REPLACED, AS NECESSARY.

15. THE CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR, 2 DAYS PRIOR TO THE START OF CONSTRUCTION.

CONSTRUCTION SEQUENCE

THE BMP'S SHALL BE IMPLEMENTED, MAINTAINED, AND OPERATED IN THE FOLLOWING GENERAL SEQUENCE OF CONSTRUCTION TO MITIGATE THE HAZARD OF ACCELERATED EROSION AND SEDIMENTATION TO ACCEPTABLE LEVELS. MINOR DEVIATIONS FROM THIS SEQUENCE SHALL BE EXECUTED BY THE PROJECT'S FOREMAN AS NEEDED TO ELIMINATE ANY POTENTIAL EROSIVE CONDITION THAT MAY ARISE FOR THE DURATION OF THE PROJECT. THE WVDEP OFFICE OF OIL AND GAS SHALL BE NOTIFIED OF ANY AND ALL SUCH DEVIATIONS FROM THE APPROVED PLANS.

1) STAKE THE LIMITS OF CONSTRUCTION.

2) INSTALL THE ROCK CONSTRUCTION ENTRANCE AS SHOWN ON THE PLANS.

3) INSTALL ALL ORANGE SAFETY FENCE AS SHOWN AROUND ANY DELINEATED STREAMS AND WETLANDS TO CLEARLY IDENTIFY THOSE AREAS THAT ARE NOT TO BE DISTURBED.

4) INSTALL ALL BMP'S (SUPER SILT FENCE, REINFORCED SILT FENCE, SEDIMENT TRAPS, ETC) AS SHOWN ON THE PLANS AND DETAILS.

5) CLEAR AND GRUB THE ACCESS ROAD AND IMPOUNDMENT AREA. ALL WOODY MATERIAL, BRUSH, TREES, STUMPS, LARGE ROOTS, BOULDERS, AND DEBRIS SHALL BE CLEARED FROM THE SITE AREA AND KEPT TO THE MINIMUM NECESSARY FOR PROPER CONSTRUCTION, INCLUDING THE INSTALLATION OF NECESSARY SEDIMENT CONTROLS. TREES SIX INCHES IN DIAMETER AND LARGER SHALL BE CUT AND LOGS STACKED. SMALLER TREES, BRUSH, & STUMPS SHALL BE CUT AND OR GRUBBED AND WINDROWED IN APPROPRIATE AREAS FOR USE AS SEDIMENT BARRIERS AT WATER DRAINAGE OUTLETS, WINDROWED BELOW THE WELL SITE, USED FOR WILDLIFE HABITAT, BURNED (AS PER WV FOREST FIRE LAWS), REMOVED FROM SITE, OR DISPOSED OF BY OTHER METHODS APPROVED BY DEP.

6) INSTALL ANY WETLAND OR STREAM CROSSINGS AS SHOWN ON THE PLANS.

7) CONVEY UPSLOPE DRAINAGE AROUND THE ACCESS ROAD AND IMPOUNDMENT AREA BY CONSTRUCTING ALL DIVERSION BERM(S) AS SHOWN ON THE PLANS.

8) CONSTRUCT THE ACCESS ROAD. DITCH RELIEF CULVERTS SHALL BE INSTALLED AT A GRADE OF 1-8% TO MINIMIZE OUTLET VELOCITIES TO THE EXTENT POSSIBLE. INSTALL OUTLET PROTECTION AS SHOWN ON PLANS. STABILIZE THE ROAD WITH STONE AND SIDE SLOPES AS SPECIFIED WITH PERMANENT SEEDING. STOCKPILE AND STABILIZE TOPSOIL ALONG THE ACCESS ROAD, AS NEEDED.

9) STRIP THE TOPSOIL FROM THE IMPOUNDMENT AREA. TOPSOIL SHALL BE STOCKPILED AND IMMEDIATELY STABILIZED.

10) GRADE THE IMPOUNDMENT AREA AS SHOWN ON THE PLAN. IMMEDIATELY STABILIZE THE OUTER AREAS OF THE IMPOUNDMENT, AS WELL AS THE WELL PAD AND ANY TURNAROUND AREAS WITH STONE AND THE SIDE SLOPES WITH EROSION CONTROL BLANKETING WHEN SLOPES ARE 3:1 OR GREATER. APPLY SEED AND MULCH ALL DISTURBED AREAS. THIS SHALL INCLUDE ALL AREAS THAT WILL NOT BE SUBJECT TO REGULAR TRAFFIC ACTIVITY (TO BE STABILIZED WITH STONE), OR ANY DISTURBED AREA THAT WILL NOT BE RE-DISTURBED BEFORE SITE RECLAMATION BEGINS.

11) INSTALL THE IMPOUNDMENT LINER SYSTEM AND PERIMETER SAFETY FENCE W/GATE AND EMERGENCY LIFE LINE AS SHOWN ON THE PLANS.

12) PREVIOUSLY DISTURBED AREAS AND IMMEDIATE DOWN SLOPE AREAS SHALL BE INSPECTED AFTER EACH RAINFALL STORM EVENT AND MONITORED WEEKLY FOR SIGNS OF ACCELERATED EROSION. IMPLEMENT ADDITIONAL BMP'S AS DEEMED NECESSARY. THESE INSPECTIONS SHALL CONTINUE DURING THE DURATION OF THE PROJECT AND SUBSEQUENT SITE RECLAMATION.

13) ONCE THE IMPOUNDMENT HAS BEEN COMPLETED, SUBMIT THE AS-BUILT CERTIFICATION FOR THE MPOUNDMENT FACILITY TO THE WVDEP OFFICE OF OIL AND GAS, PRIOR TO PLACING FLUIDS IN THE STRUCTURE.

14) COMMENCE USE OF THE CENTRALIZED FRESHWATER IMPOUNDMENT FACILITY. THE CENTRALIZED FRESHWATER IMPOUNDMENT SHALL BE MONITORED CONTINUOUSLY DURING THE INITIAL FILLING OPERATION.

15) ONCE DISTURBED AREAS HAVE BEEN RE-VEGETATED AND STABILIZED FOLLOWING RECLAMATION, THE TEMPORARY BMP'S IN THOSE AREAS MAY BE REMOVED. CONTINUE TO MONITOR THESE AREAS TO ENSURE A UNIFORM RATE OF 70% VEGETATIVE COVERAGE IS MAINTAINED. ANY AREAS FOUND TO BE DEFICIENT SHALL BE RE-SEEDED AND MULCHED.

SITE CLEANUP & RECYCLE PROGRAM

1. GARBAGE, FUELS OR ANY SUBSTANCE HARMFUL TO HUMAN, AQUATIC OR FISH LIFE, WILL BE PREVENTED FROM ENTERING SPRINGS, STREAMS, PONDS, LAKES, WETLANDS OR ANY WATER COURSE OR WATER BODY.

2. OILS, FUELS, LUBRICANTS AND COOLANTS WILL BE PLACED IN SUITABLE CONTAINERS AND DISPOSED PROPERLY.

3. ALL TRASH AND GARBAGE WILL BE COLLECTED AND DISPOSED PROPERLY.

4. ALL SEDIMENT REMOVED FROM SEDIMENT CAPTURING DEVICES SHALL BE PLACED ON THE TOPSOIL STOCKPILE, THEN SEEDED AND MULCHED, AS NECESSARY. ALTERNATIVELY, THE REMOVED SEDIMENT CAN BE TRANSPORTED TO A SITE WITH AN APPROVED PERMIT.

MAINTENANCE PROGRAM

1. BMP'S WILL BE INSPECTED ON A WEEKLY BASIS AND AFTER EACH MEASURABLE RAINFALL EVENT DURING THE ACTIVE CONSTRUCTION PHASE OF THE PROJECT.

2. ALL REVEGETATED ACCESS ROADS AND FACILITIES ARE TO BE MAINTAINED THROUGHOUT THE LIFE OF EACH STRUCTURE.

3. CULVERTS, ROAD DITCHES, BROAD-BASED DIPS, DIVERSION DITCHES, AND ROCK CHECK DAMS MUST BE MAINTAINED IN PROPER WORKING ORDER AND WILL BE CLEANED OUT, REPAIRED, OR REPLACED AS NECESSARY.

4. FILTER STRIPS AND/OR SILT FENCE WILL BE MAINTAINED.

5. ALL AREAS OF EARTH DISTURBANCE WILL BE REPAIRED WHERE SIGNS OF ACCELERATED EROSION ARE DETECTED.

6. SEEDING AND MULCHING WILL BE REPEATED IN THOSE AREAS THAT APPEAR TO BE FAILING OR HAVE FAILED.

CENTRALIZED IMPOUNDMENT CONSTRUCTION STANDARDS NOTES

THE DESIGN, CONSTRUCTION, AND REMOVAL OF EMBANKMENTS ASSOCIATED WITH CENTRALIZED IMPOUNDMENTS FOR OIL AND GAS WELLS MUST BE ACCOMPLISHED IN SUCH A MANNER AS TO PROTECT THE HEALTH AND SAFETY OF THE PEOPLE, THE NATURAL RESOURCES, AND ENVIRONMENT OF THE STATE. THE IMPOUNDMENT EMBANKMENTS SHALL BE DESIGNED, CONSTRUCTED, AND MAINTAINED TO BE STRUCTURALLY SOUND AND REASONABLY PROTECTED FROM UNAUTHORIZED ACTS OF THIRD PARTIES.

1. THE FOUNDATION FOR A CENTRALIZED IMPOUNDMENT EMBANKMENT MUST BE STRIPPED AND GRUBBED TO A MINIMUM DEPTH OF 2 FEET PRIOR TO PLACEMENT AND COMPACTION OF EARTHEN FILL MATERIAL. NO EMBANKMENT FILL SHALL BE PLACED ON FROZEN MATERIAL.

2. ANY SPRINGS ENCOUNTERED WITHIN THE FOUNDATION AREA SHALL BE DRAINED TO THE OUTSIDE/DOWNSTREAM TOE OF EMBANKMENT. CONSTRUCTED DRAIN SECTION SHALL BE AN EXCAVATED 2' x 2' TRENCH AND BACK FILLED WITH TYPE A SAND, COMPACTED BY HAND TAMPER. NO GEOTEXTILES SHALL BE USED TO LINE TRENCH. THE LAST 3' OF DRAIN AT THE DOWNSTREAM END SHALL BE CONSTRUCTED WITH AASHTO #8 MATERIAL.

3. SOILS FOR EARTHEN EMBANKMENT CONSTRUCTION SHALL BE LIMITED TO TYPES GC, GM, SC, SM, CL, OR ML (ASTMD-2487 - UNIFIED SOILS CLASSIFICATION). SOILS MUST CONTAIN A MINIMUM OF 20% OF PLUS NO. 200 SIEVE AND BE "WELL GRADED" MATERIAL WITH NO COBBLES OR BOULDER SIZE MATERIAL MIXED WITH THE CLAY. A MINIMUM OF THREE SAMPLES SHALL BE CLASSIFIED.

4. THE EARTHEN EMBANKMENT SHALL BE COMPACTED BY A VIBRATING SHEEPSFOOT ROLLER. THE LIFTS MUST BE IN HORIZONTAL LAYERS WITH A MAXIMUM LOOSE LIFT THICKNESS 12" AND MAXIMUM PARTICLE SIZE LESS THAN 6".

5. THE PLACEMENT OF ALL FILL MATERIAL SHALL BE FREE OF WOOD, STUMPS AND ROOTS, LARGE ROCKS AND BOULDERS, AND ANY OTHER NONCOMPACTABLE SOIL MATERIAL. THE EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF VISIBLE NON-MOVEMENT, HOWEVER, THE COMPACTION EFFORT SHALL NOT EXCEED THE OPTIMUM MOISTURE LIMITS.

6. THE EMBANKMENT TOP SHALL BE A MINIMUM OF 12' IN WIDTH.

7. THE MINIMUM INSIDE AND OUTSIDE SIDESLOPES SHALL BE 2H:1V, UNLESS OTHERWISE SPECIFIED.

8. ALL EXPOSED EMBANKMENT SLOPES, NOT COVERED BY COMPACTED ROCKFILL OR RIPRAP SHALL BE LIMED, FERTILIZED, SEEDED AND MULCHED. PERMANENT VEGETATIVE GROUND COVER IN COMPLIANCE WITH THE WVDEP EROSION AND SEDIMENT CONTROL FIELD MANUAL MUST BE ESTABLISHED UPON THE COMPLETION OF THE IMPOUNDMENT/PIT CONSTRUCTION. EMBANKMENTS SHALL BE MAINTAINED WITH A GRASSY VEGETATIVE COVER AND FREE OF BRUSH AND/OR TREES.

9. A MINIMUM OF 2' OF FREEBOARD SHALL BE MAINTAINED AT ALL TIMES DURING THE OPERATION OF THE IMPOUNDMENT.

10. ALL EMBANKMENT CONSTRUCTION AND COMPACTION TESTING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

CENTRALIZED IMPOUNDMENT LINER SYSTEM NOTES:

THE DESIGNED IMPOUNDMENT FACILITY SHALL BE FULLY LINED WITH A GEOSYNTHETIC LINER SYSTEM. LINERS SHALL BE INSTALLED IN ACCORDANCE TO MANUFACTURER'S SPECIFICATIONS.

1. THE SUB-BASE SHALL BEAR THE WEIGHT OF THE LINER SYSTEM, WATER, AND EQUIPMENT OPERATING ON THE IMPOUNDMENT WITHOUT CAUSING OR ALLOWING A FAILURE OF THE LINER SYSTEM.

2. THE SUB-BASE SHALL BE COMPACTED TO ACCOMMODATE POTENTIAL SETTLEMENT WITHOUT DAMAGE TO THE LINER SYSTEM.

3. THE UPPER 6" OF THE SUB-BASE SHALL BE COMPACTED TO A STANDARD PROCTOR DENSITY OF AT LEAST 95%.

4. THE SUB-BASE SHALL BE HARD, UNIFORM, SMOOTH AND FREE OF DEBRIS, ROCK FRAGMENTS, PLANT MATERIAL AND OTHER FOREIGN MATERIAL.

5. THE SUB-BASE SHALL BE COVERED WITH NON-WOVEN GEOTEXTILE FABRIC TO CUSHION THE PRIMARY LINER AND ALLOW FOR ADEQUATE VENTING BETWEEN THE PRIMARY LINER AND THE SUB-BASE TO PREVENT THE ENTRAPMENT OF GASES BENEATH THE LINER SYSTEM.

6. THE IMPOUNDMENT AREA SHALL BE DRAINED AND COMPLETELY DRY PRIOR TO THE PLACEMENT OF THE PRIMARY LINER. THE PRIMARY LINER SHALL MEET ALL WV DEP GUIDELINES FOR MINIMUM THICKNESS AND SHALL PREVENT THE MIGRATION OF WATER THROUGH THE LINER TO THE GREATEST DEGREE THAT IS TECHNOLOGICALLY POSSIBLE.

7. THE PRIMARY LINER SHALL FULLY COVER THE BOTTOM AND SIDEWALLS OF THE IMPOUNDMENT.

8. AN ANCHOR TRENCH SHALL BE EXCAVATED COMPLETELY AROUND THE PERIMETER OF THE IMPOUNDMENT/PIT AREA AT THE PLANNED ELEVATION OF THE TOP OF THE LINING. THE TRENCH SHALL BE A MINIMUM 36 INCHES DEEP AND 24 INCHES WIDE.

9. ALL ELEMENTS OF THE LINER SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS. ALL SEAMS AND SEALS AROUND ANY PROJECTIONS SHALL BE SEALED AND TESTED IN A METHOD APPROVED BY THE MANUFACTURER.

10. GAS RELIEF VENTS SHALL BE PROVIDED ALONG THE TOP OF THE LINER AND WITHIN ONE FOOT OF THE PERIMETER OF THE IMPOUNDMENT TO ALLOW GASES TO ESCAPE FROM UNDER THE GEOMEMBRANE. MAXIMUM SPACING FOR VENTS SHALL BE 30 FEET.

11. WATER LEVEL MARKINGS SHALL BE CLEARLY PAINTED (1' INCREMENTS) ON THE LINER SYSTEM TO IDENTIFY THE WATER SURFACE ELEVATION.

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PROFESSIONAL ENGINEER
12/23/2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

NOTES
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
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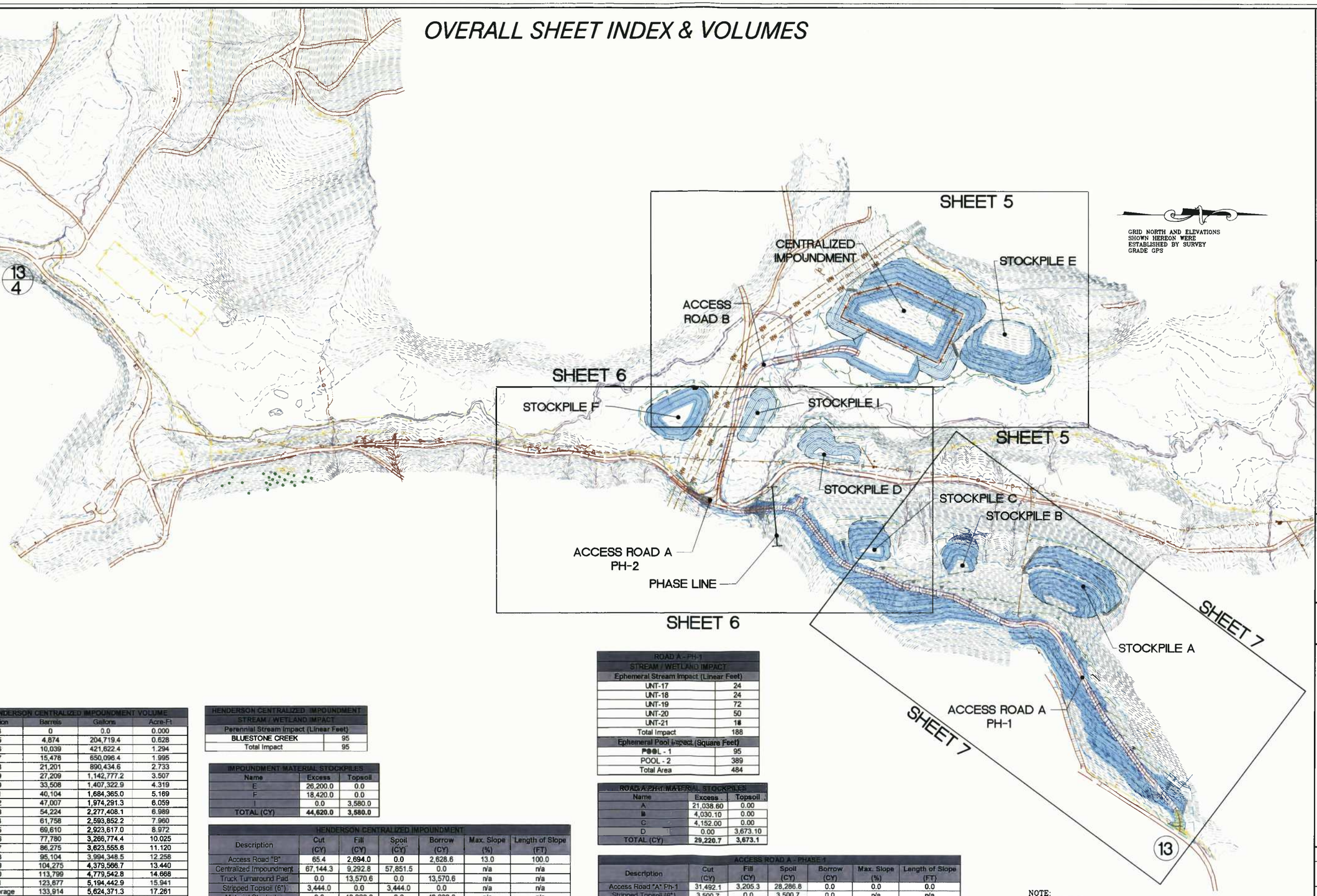
SHEET 2 OF 21

OVERALL SHEET INDEX & VOLUMES



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

HENDERSON CENTRALIZED IMPOUNDMENT VOLUME			
Elevation	Barrels	Gallons	Acre-Ft
924	0	0.0	0.000
925	4,874	204,719.4	0.628
926	10,039	421,622.4	1.294
927	15,478	650,096.4	1.995
928	21,201	890,434.6	2.733
929	27,209	1,142,777.2	3.507
930	33,508	1,407,322.9	4.319
931	40,104	1,684,365.0	5.169
932	47,007	1,974,291.3	6.059
933	54,224	2,277,408.1	6.989
934	61,758	2,593,852.2	7.960
935	69,610	2,923,617.0	8.972
936	77,780	3,266,774.4	10.025
937	86,275	3,623,555.6	11.120
938	95,104	3,994,348.5	12.258
939	104,275	4,379,566.7	13.440
940	113,799	4,779,542.8	14.668
941	123,677	5,194,442.9	15.941
942 Storage	133,914	5,624,371.3	17.261
943	144,876	6,084,786.3	18.674
944	155,530	6,532,268.2	20.047

Incised Elev.= 930.0

HENDERSON CENTRALIZED IMPOUNDMENT STREAM / WETLAND IMPACT	
Perennial Stream Impact (Linear Feet)	
BLUESTONE CREEK	95
Total Impact	95

IMPOUNDMENT MATERIAL STOCKPILES		
Name	Excess	Topsoil
E	26,200.0	0.0
F	18,420.0	0.0
I	0.0	3,580.0
TOTAL (CY)	**44,620.0**	**3,580.0**

HENDERSON CENTRALIZED IMPOUNDMENT						
Description	Cut (CY)	Fill (CY)	Spoil (CY)	Borrow (CY)	Max. Slope (%)	Length of Slope (FT)
Access Road "B"	65.4	2,694.0	0.0	2,628.6	13.0	100.0
Centralized Impoundment	67,144.3	9,292.8	57,851.5	0.0	n/a	n/a
Truck Turnaround Pad	0.0	13,570.6	0.0	13,570.6	n/a	n/a
Stripped Topsoil (6")	3,444.0	0.0	3,444.0	0.0	n/a	n/a
Material Stockpiles	0.0	48,200.0	0.0	48,200.0	n/a	n/a
Totals	70,653.7	73,757.4	61,295.5	64,399.2	n/a	n/a
	TOTAL SPOIL (CY) =		-3,103.7			

ROAD A - PH-1 STREAM / WETLAND IMPACT	
Ephemeral Stream Impact (Linear Feet)	
UNT-17	24
UNT-18	24
UNT-19	72
UNT-20	50
UNT-21	18
Total Impact	188
Ephemeral Pool Impact (Square Feet)	
POOL - 1	95
POOL - 2	389
Total Area	484

ROAD A PH-1 MATERIAL STOCKPILES		
Name	Excess	Topsoil
A	21,038.60	0.00
B	4,030.10	0.00
C	4,152.00	0.00
D	0.00	3,673.10
TOTAL (CY)	**29,220.7**	**3,673.1**

ACCESS ROAD A - PHASE 1						
Description	Cut (CY)	Fill (CY)	Spoil (CY)	Borrow (CY)	Max. Slope (%)	Length of Slope (FT)
Access Road "A" Ph-1	31,492.1	3,205.3	28,286.8	0.0	0.0	0.0
Stripped Topsoil (6")	3,500.7	0.0	3,500.7	0.0	n/a	n/a
Material Stockpiles	0.0	32,893.8	0.0	32,893.8	n/a	n/a
Totals	34,992.8	36,099.1	31,787.5	32,893.8	n/a	n/a
	TOTAL SPOIL (CY) =		-1,106.3			

NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

150 0 150
GRAPHIC SCALE

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OVERALL SHEET INDEX & VOLUMES
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: 1" = 150'
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SHEET 3 OF 21

EXISTING UTILITY LAYOUT PLAN

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EXISTING UTILITY LAYOUT PLAN
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
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DATE: 12/23/2013
SCALE: 1" = 150'
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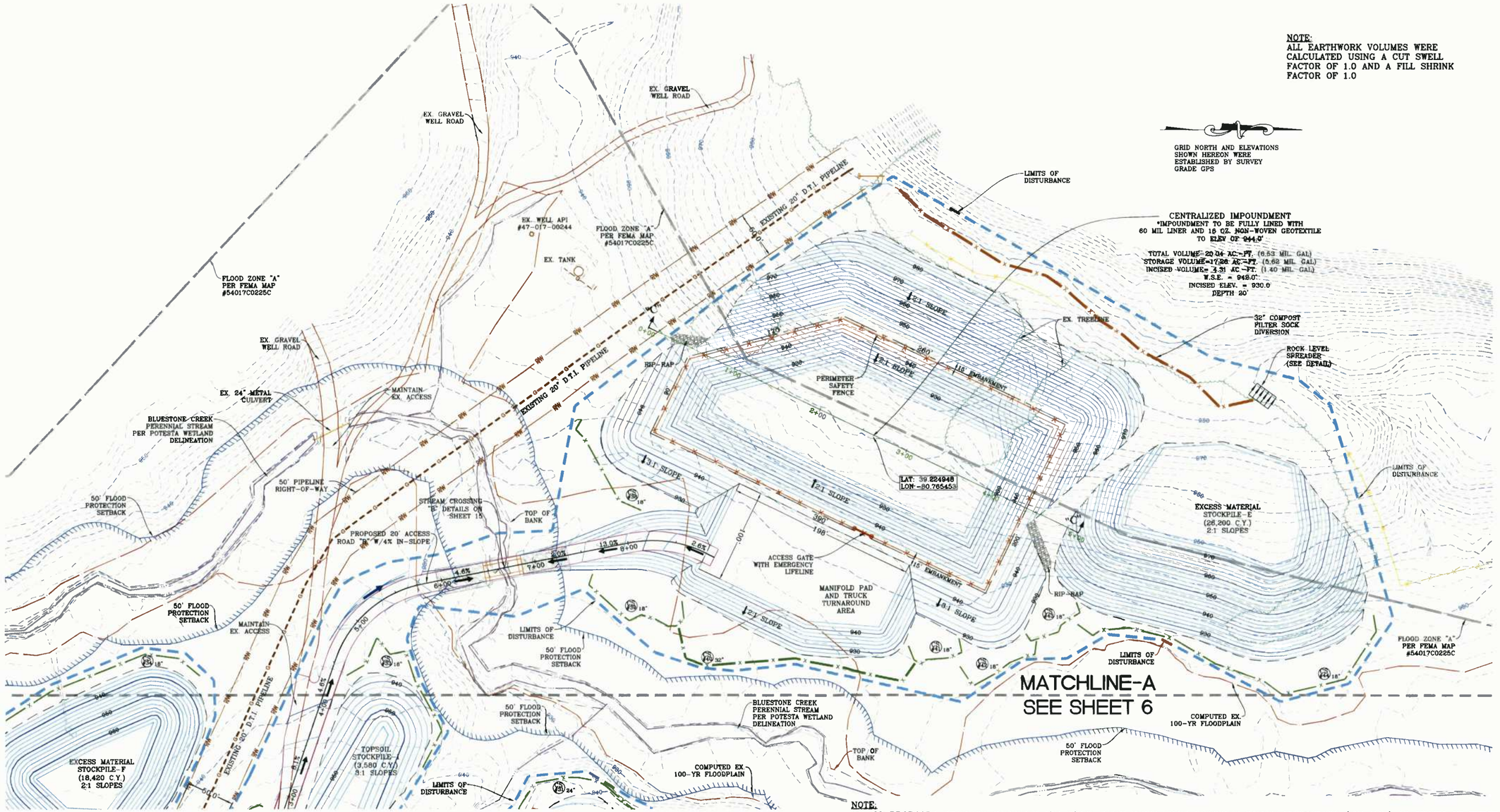
SHEET 4 OF 21

HENDERSON CENTRALIZED IMPOUNDMENT DETAILS



50 25 0 50 100

SCALE: 1" = 50'

NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

NOTE.

1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTER.
3. TOPSOIL SHALL BE STRIPPED FROM ALL STOCKPILE AREAS PRIOR TO CONSTRUCTING STOCKPILES. AFTER STOCKPILES ARE CONSTRUCTED TOPSOIL IS TO BE REAPPLIED AT A DEPTH OF 6". SLOPES SHALL BE TRACKED BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR.
4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.

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CYRUS B. KING
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9578
STATE OF
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PROFESSIONAL ENGINEER

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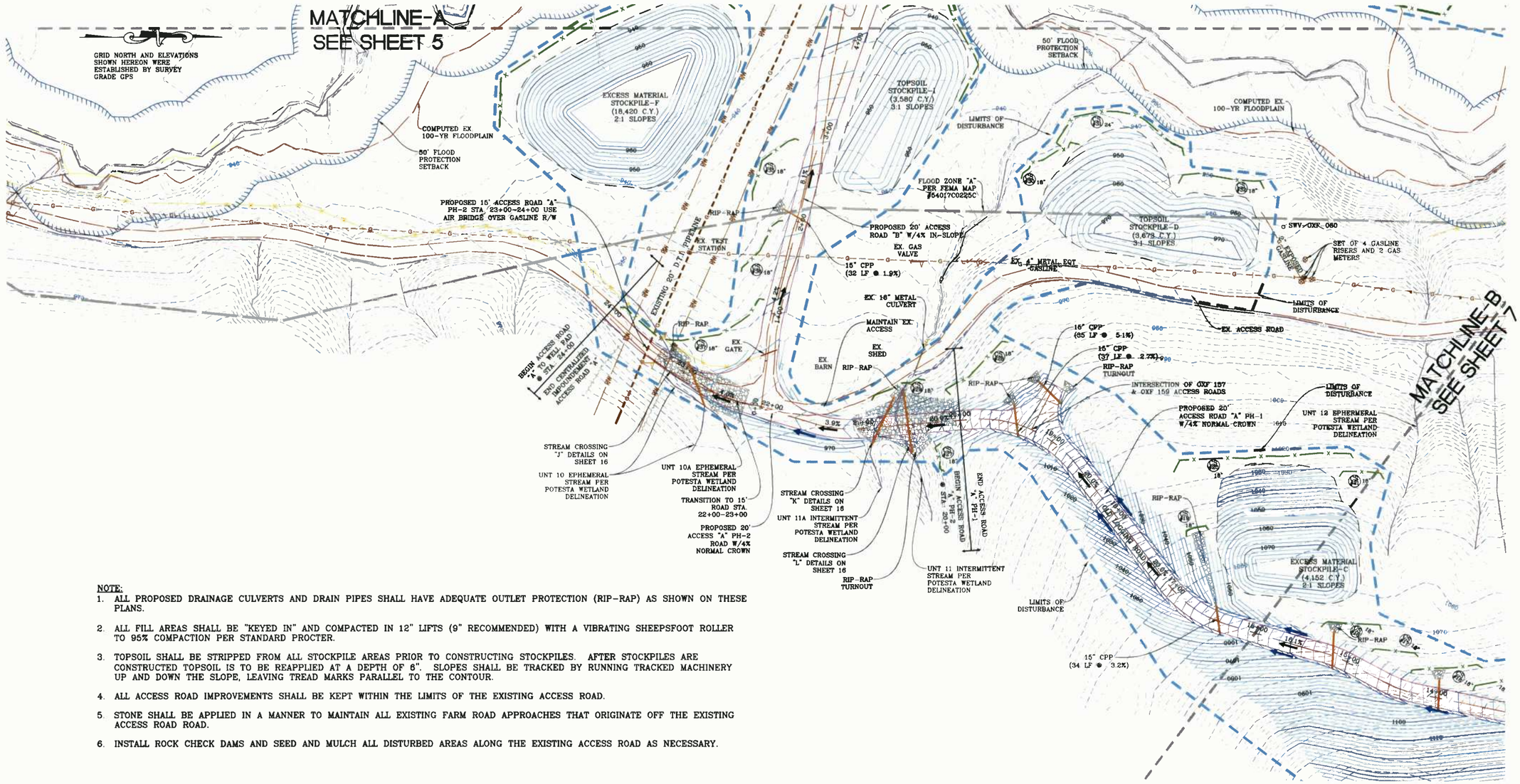
FOR: EQT PRODUCTION COMPANY

HENDERSON CENTRALIZED IMPOUNDMENT DETAILS

HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 5 OF 21

ACCESS ROAD DETAILS



NOTE:
1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTER.
3. TOPSOIL SHALL BE STRIPPED FROM ALL STOCKPILE AREAS PRIOR TO CONSTRUCTING STOCKPILES. AFTER STOCKPILES ARE CONSTRUCTED TOPSOIL IS TO BE REAPPLIED AT A DEPTH OF 6". SLOPES SHALL BE TRACKED BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR.
4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.

NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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CHRIS B. KING
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WEST VIRGINIA
PROFESSIONAL ENGINEER

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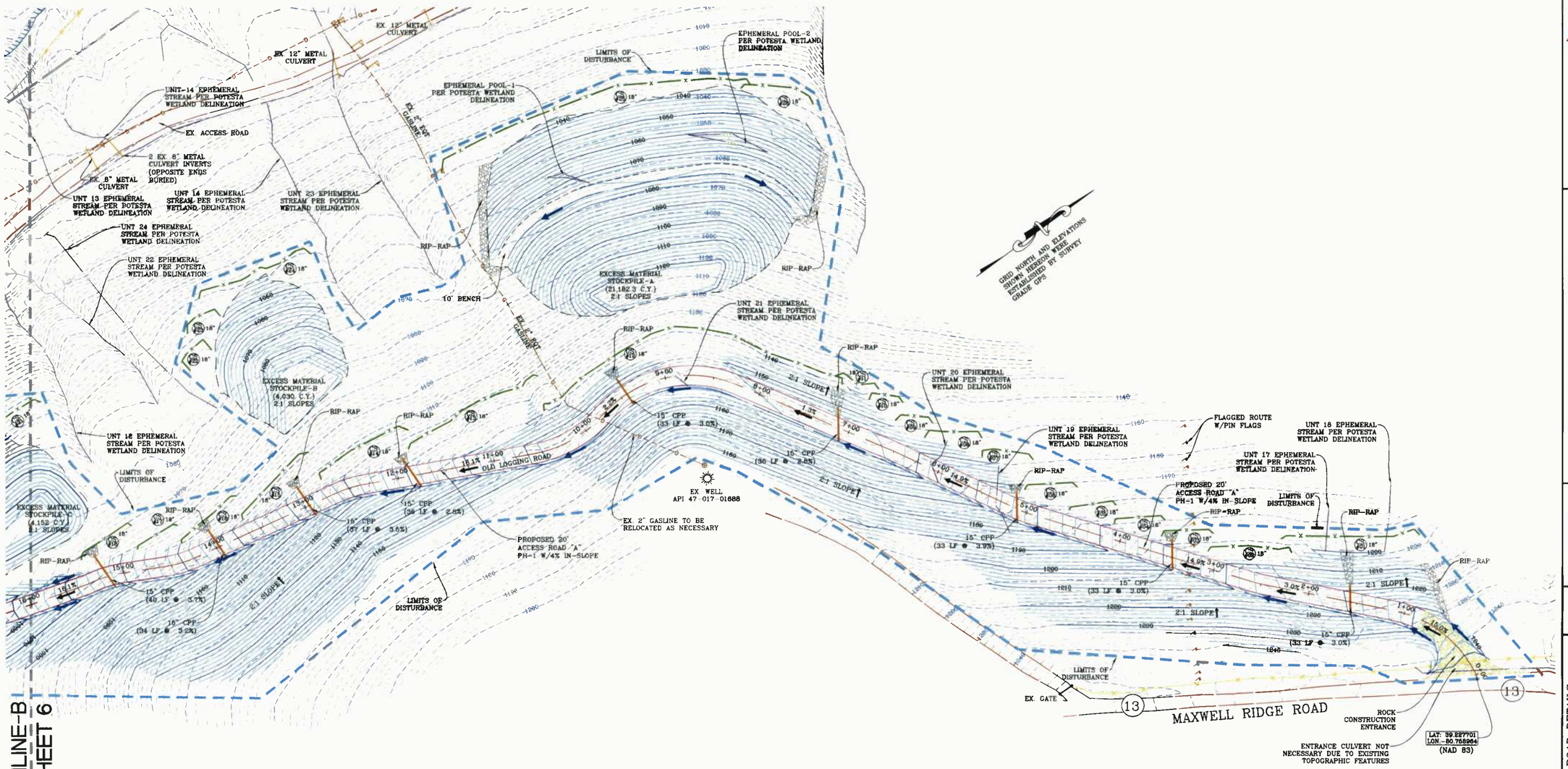
ACCESS ROAD DETAILS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 6 OF 21

ACCESS ROAD DETAILS



NOTE:
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50 25 0 50 100
SCALE: 1" = 50'

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STEVEN B. PUSHKAR
9578
REGISTERED PROFESSIONAL ENGINEER

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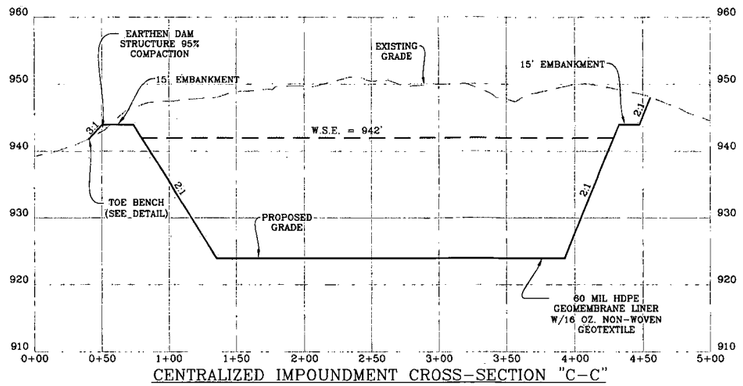
ACCESS ROAD DETAILS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

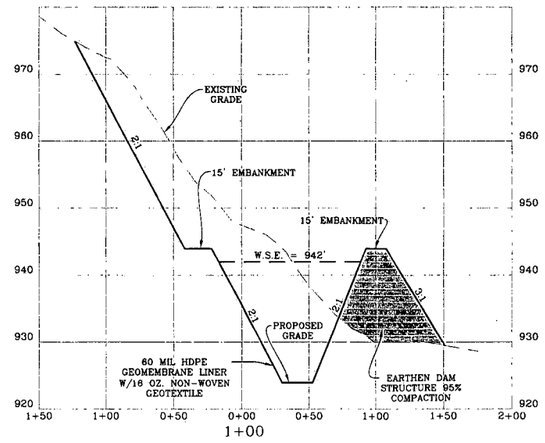
DATE: 12/23/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 7 OF 21

HENDERSON CENTRALIZED IMPOUNDMENT SECTIONS



CENTRALIZED IMPOUNDMENT CROSS-SECTION "C-C"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CENTRALIZED IMPOUNDMENT CROSS-SECTIONS ALONG BASELINE "C-C"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

NOTE:
1. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTER.

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STATE OF
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PROFESSIONAL ENGINEER
12/23/2013

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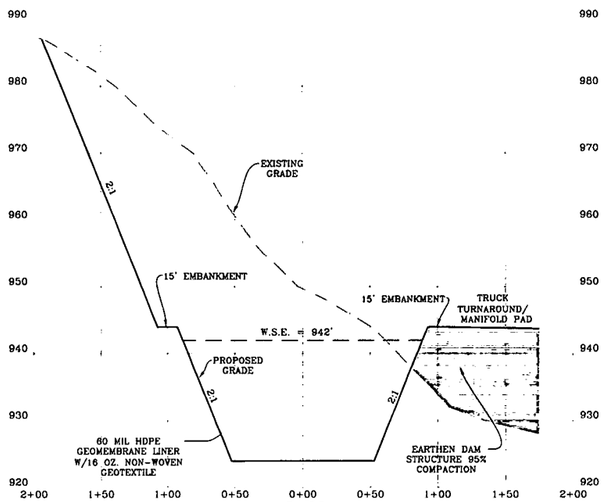
FOR: EQT PRODUCTION COMPANY

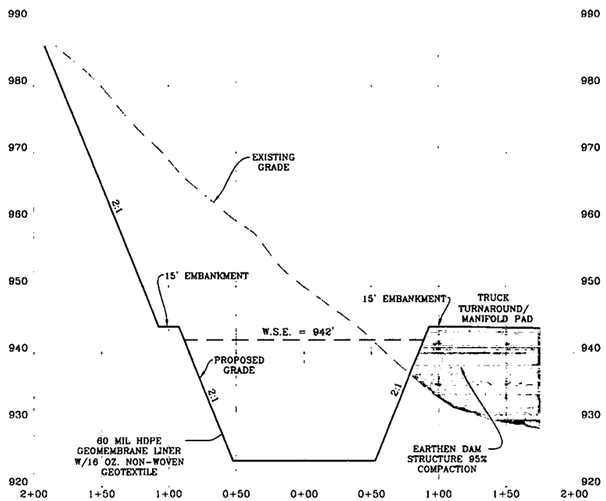
HENDERSON CENTRALIZED IMPOUNDMENT SECTIONS

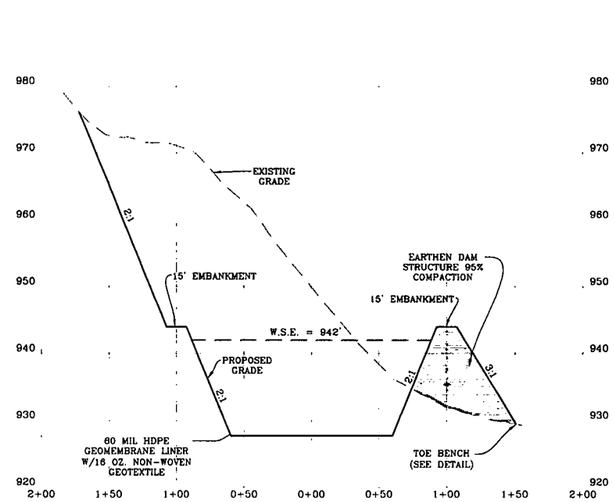
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

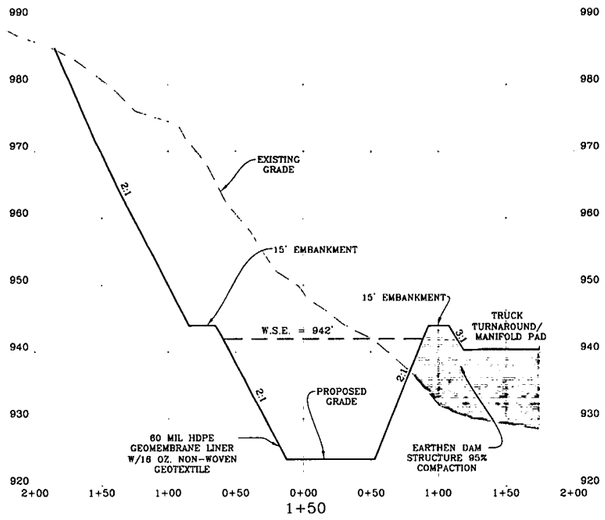
DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 8 OF 21

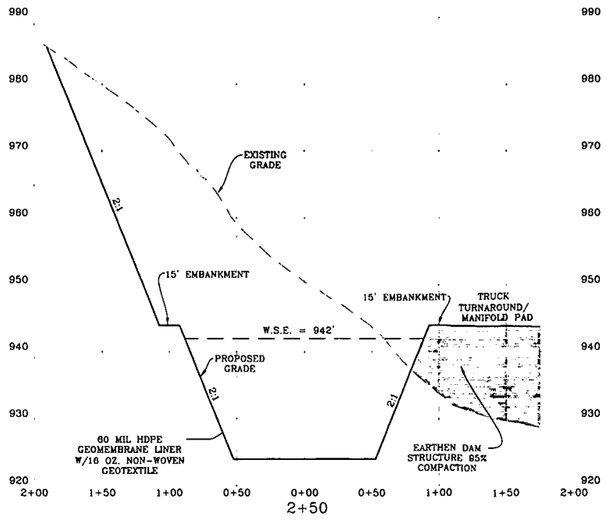
HENDERSON CENTRALIZED IMPOUNDMENT SECTIONS

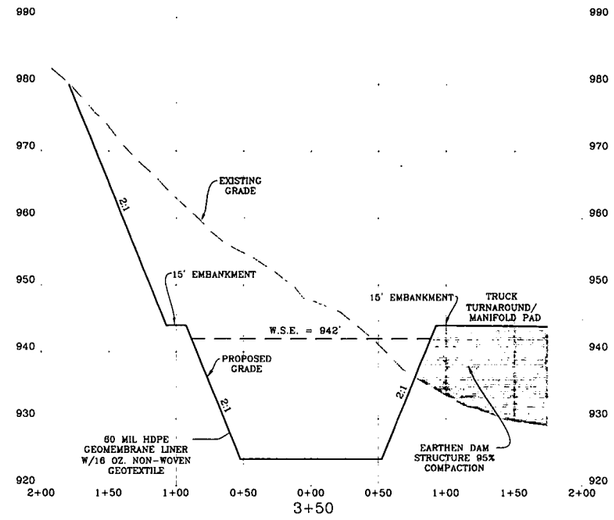












CENTRALIZED IMPOUNDMENT CROSS-SECTIONS ALONG BASELINE "C-C"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

NOTE:
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12-23-13

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FOR: EQT PRODUCTION COMPANY

HENDERSON CENTRALIZED IMPOUNDMENT SECTIONS

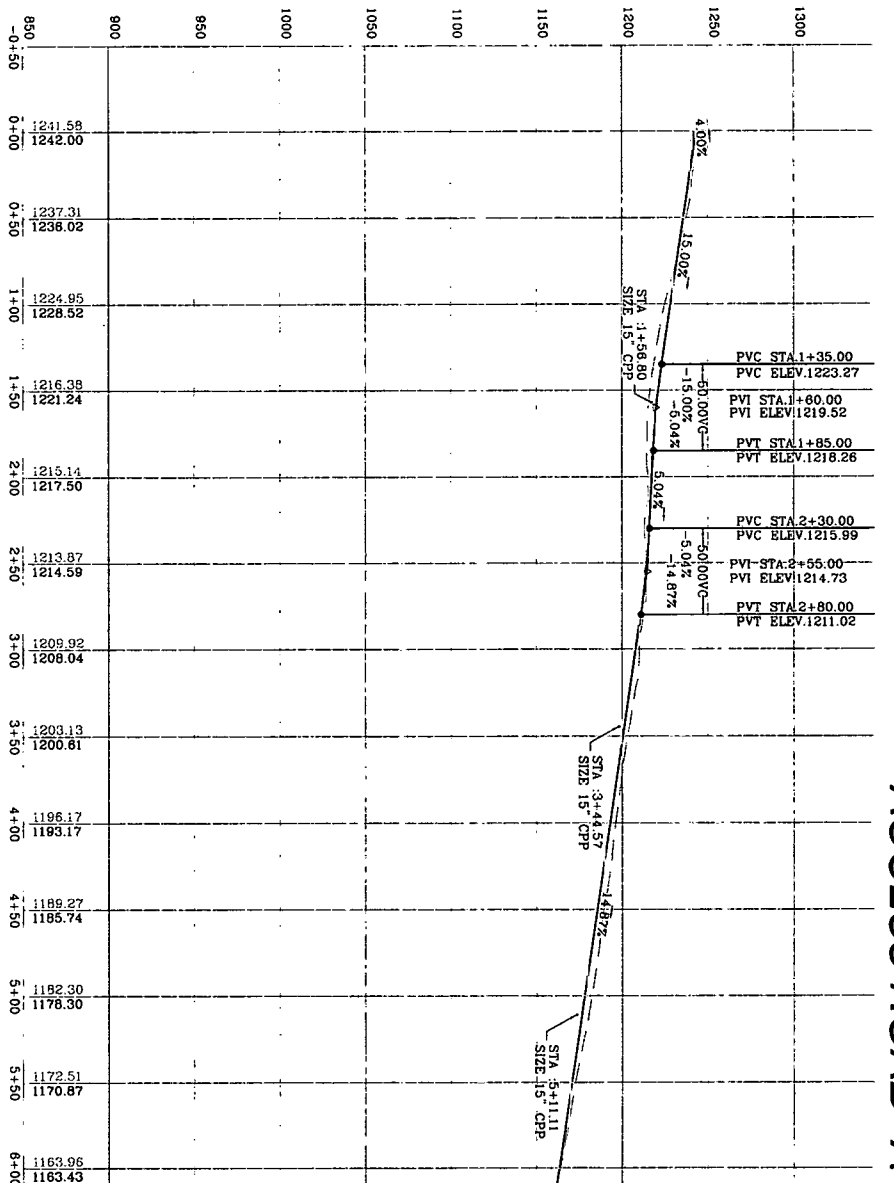
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 9 OF 21

ACCESS ROAD "A" PH-1 & PH-2 PROFILE

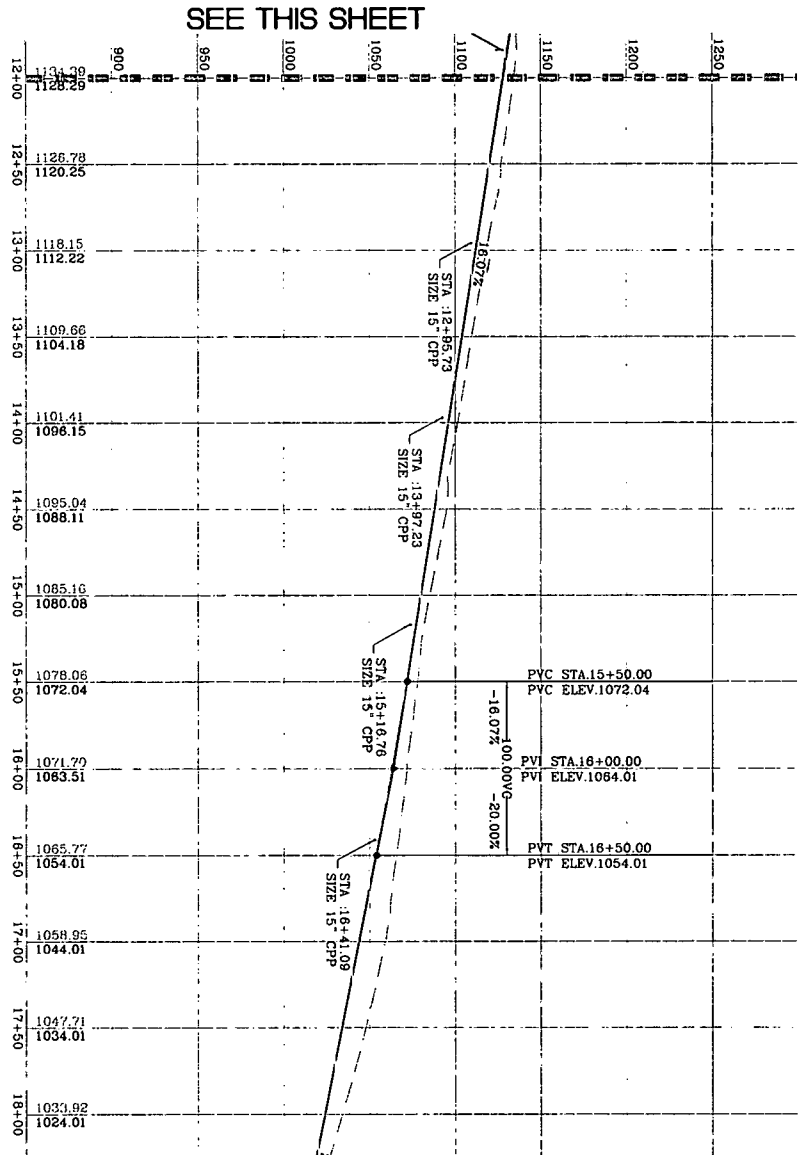
ACCESS ROAD "A" PH-1 PROFILE

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



ACCESS ROAD "A" PH-2 PROFILE

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



SCALE: 1" = 50'

DATE: 12/23/2013	ACCESS ROAD "A" PH-1 & PH-2 PROFILE
SCALE: AS SHOWN	HENDERSON
DESIGNED BY: CSK	CENTRALIZED IMPOUNDMENT
FILE NO. 7889	WEST UNION DISTRICT
SHEET 10 OF 21	DODDRIDGE COUNTY, WV

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CHRIS B. WILLIAMSON — 15578 — REGISTERED — PROFESSIONAL ENGINEER — WEST VIRGINIA — 12-23-2013

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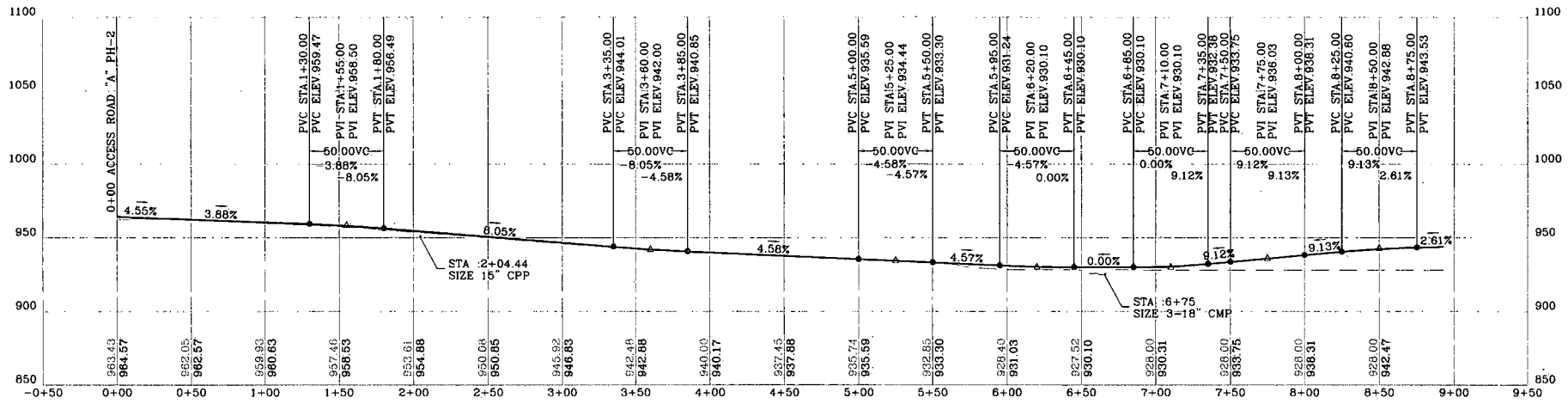
ACCESS ROAD "B" PROFILE



ACCESS ROAD "B" PROFILE
SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

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ACCESS ROAD "B" PROFILE

HENDERSON
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WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 11 OF 21

ROAD SECTIONS

ACCESS ROAD "A" PH-1 CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

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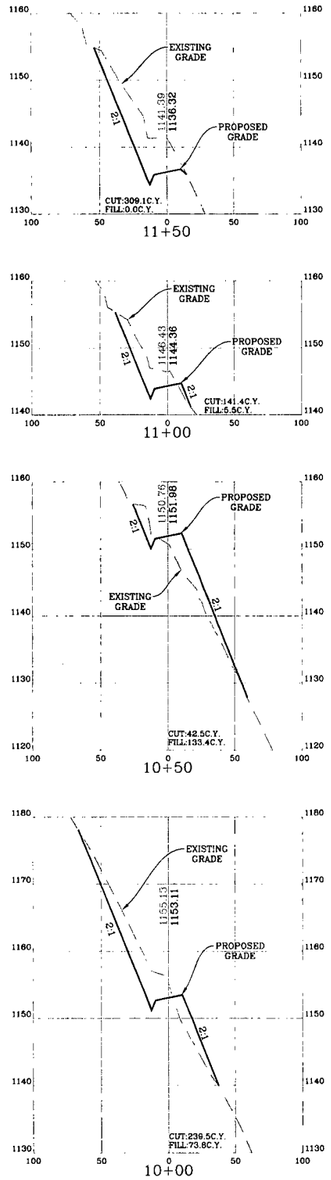
ROAD SECTIONS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

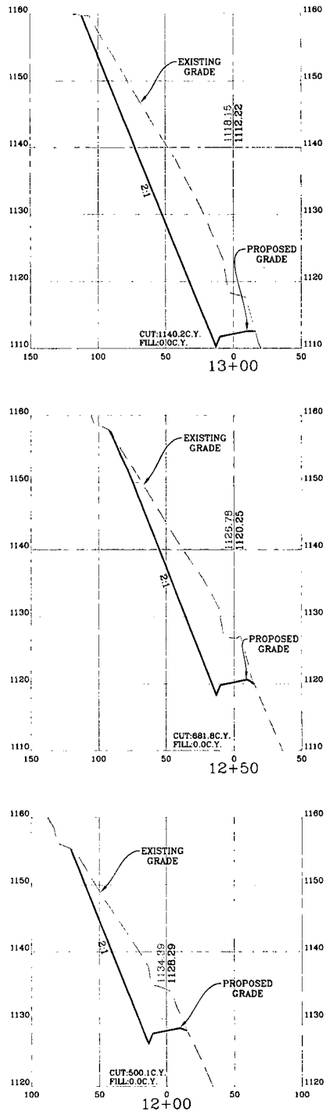
DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 12 OF 21

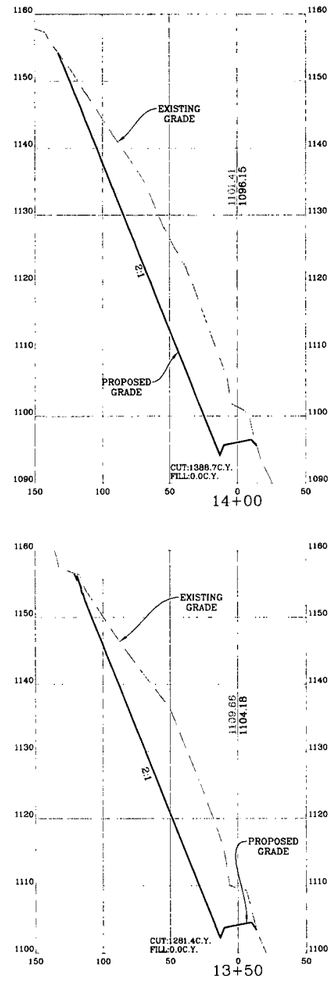
ROAD SECTIONS

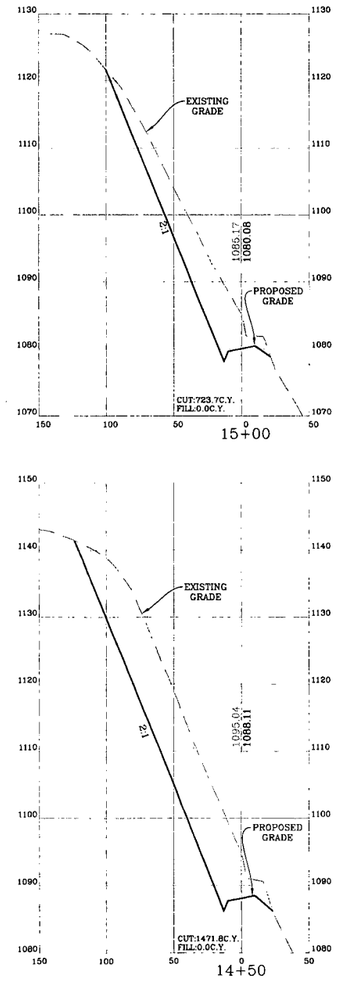
ACCESS ROAD "A" PH-1 CROSS-SECTIONS

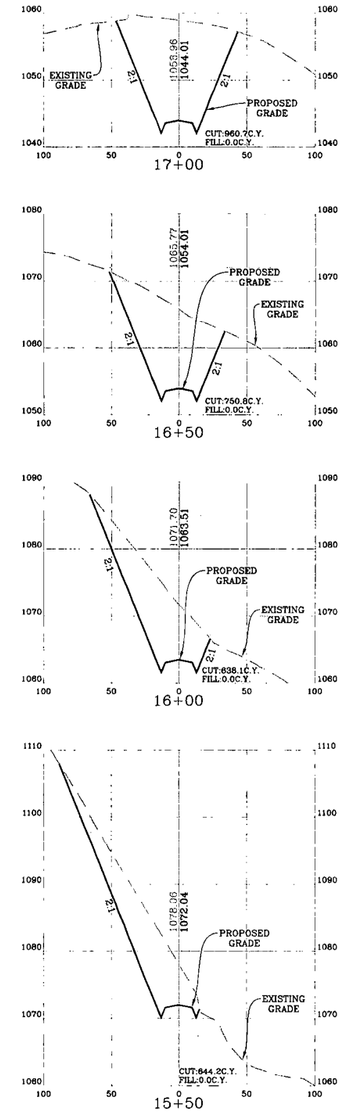
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

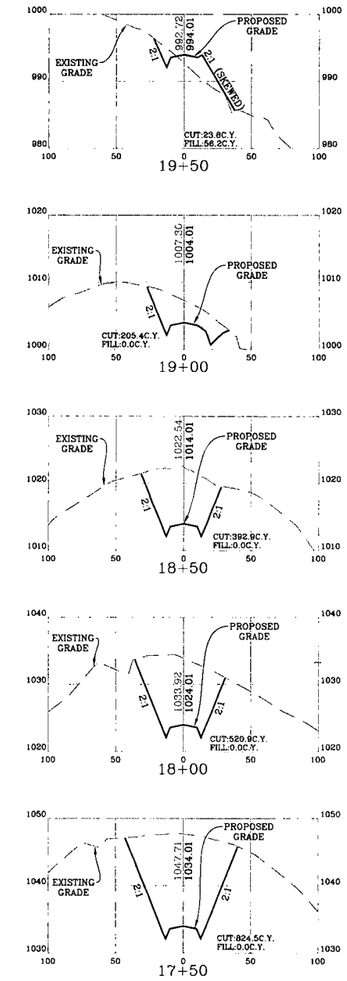












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JESSE S. KLUG
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15578
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PROFESSIONAL ENGINEER
12/23/2013

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FOR: EQT PRODUCTION COMPANY

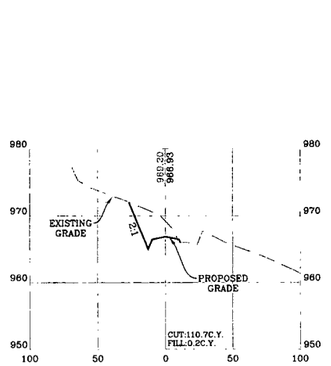
ROAD SECTIONS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

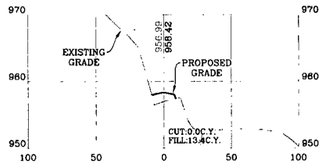
DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 13 OF 21

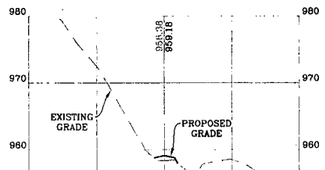
ROAD SECTIONS

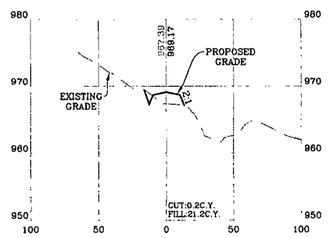
ACCESS ROAD "A" PH-2 CROSS-SECTIONS

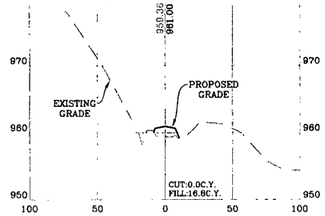
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

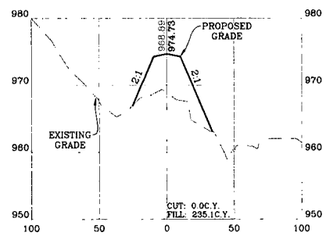


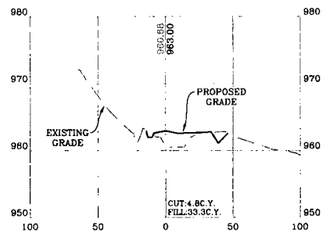


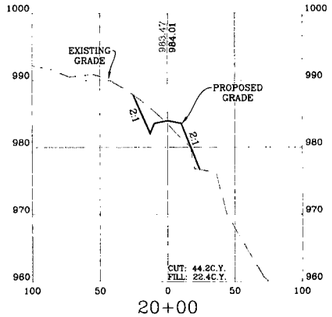


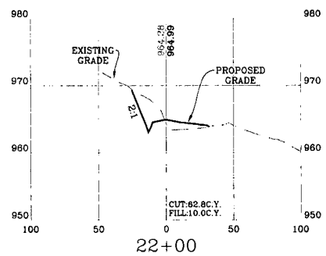






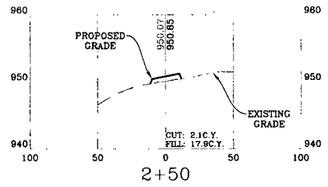


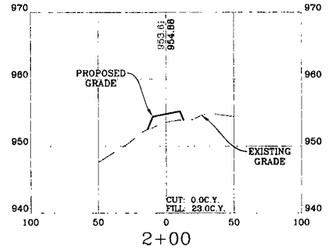


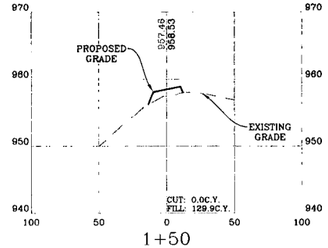


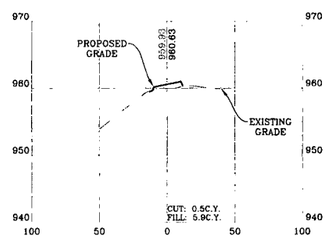
ACCESS ROAD "B" CROSS-SECTIONS

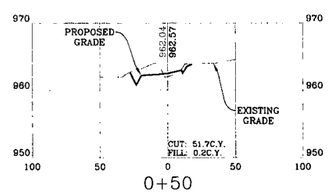
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

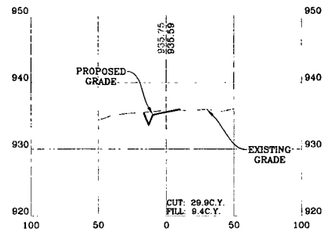


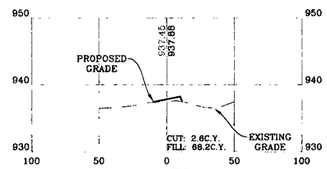


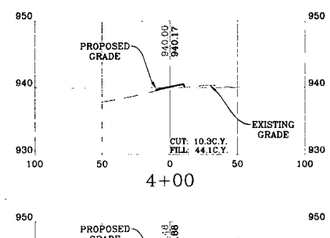


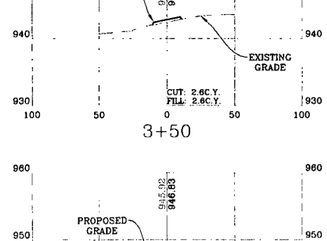


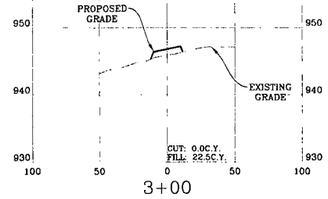


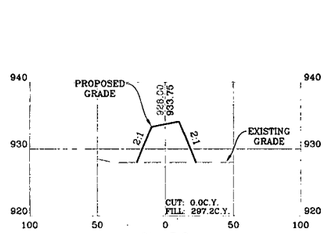


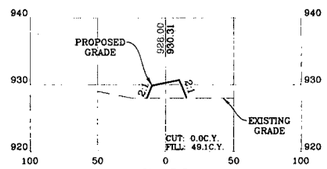


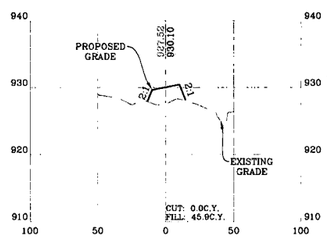


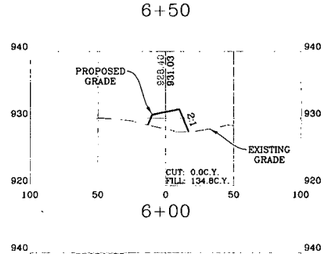


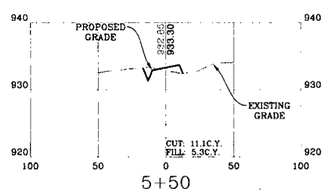


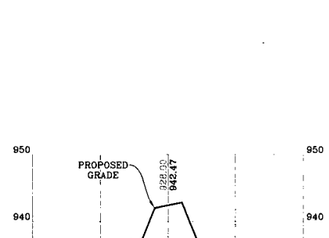


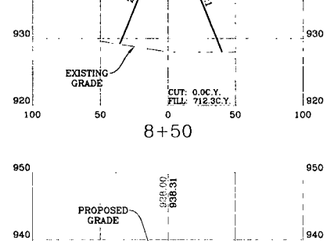












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REGISTERED
19576
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12.23.2013

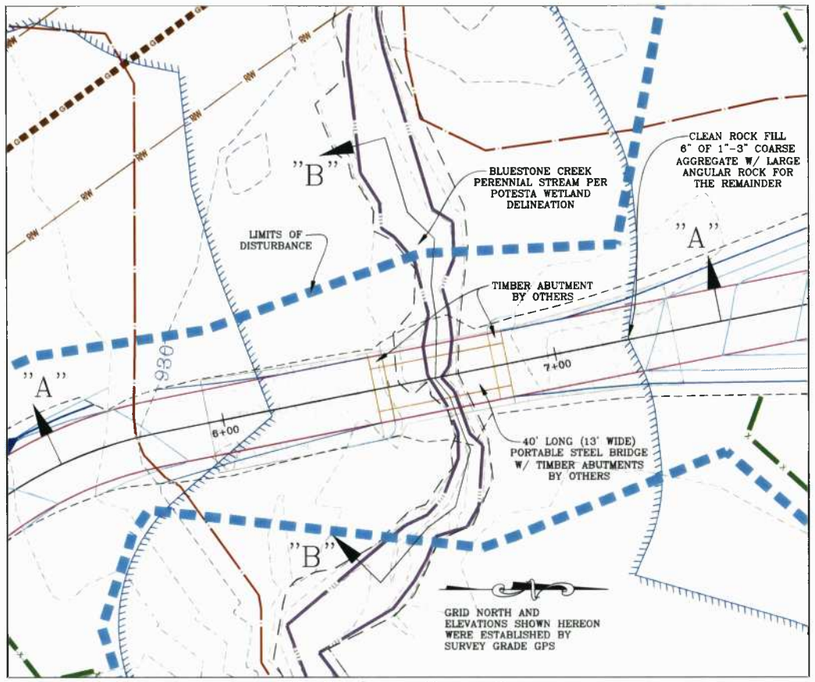
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ROAD SECTIONS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 14 OF 21

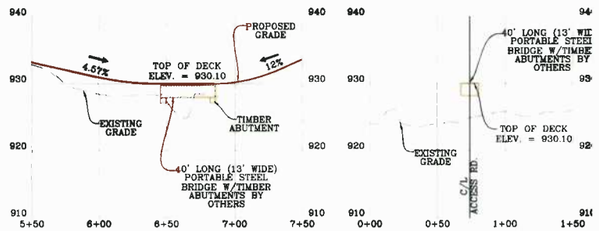
TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "B" DETAILS



SCALE: 1" = 20'

STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

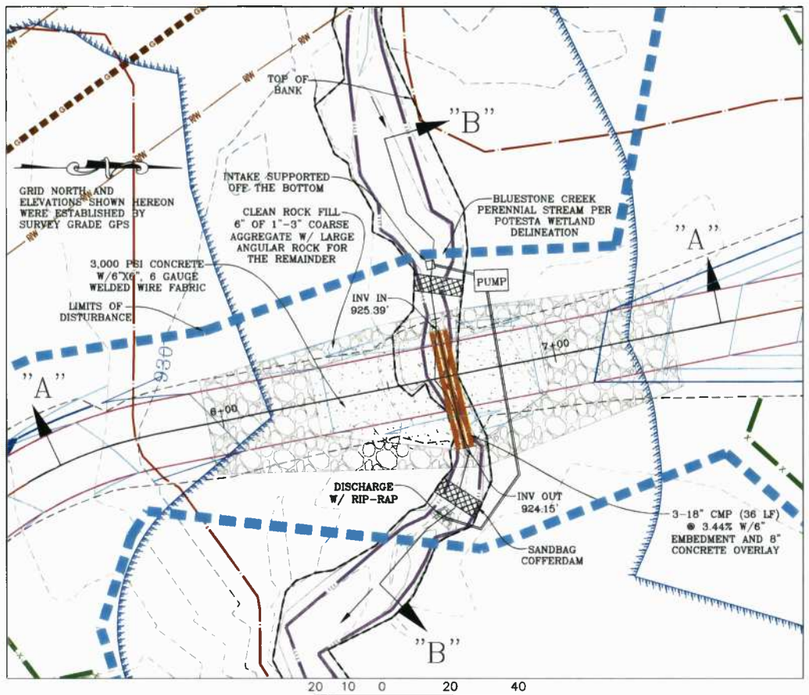
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

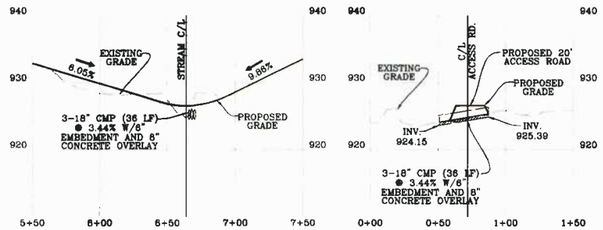
PERMANENT STREAM CROSSING DETAILS

STREAM CROSSING "B" DETAILS



SCALE: 1" = 20'

STREAM CROSSING "B" SECTIONS

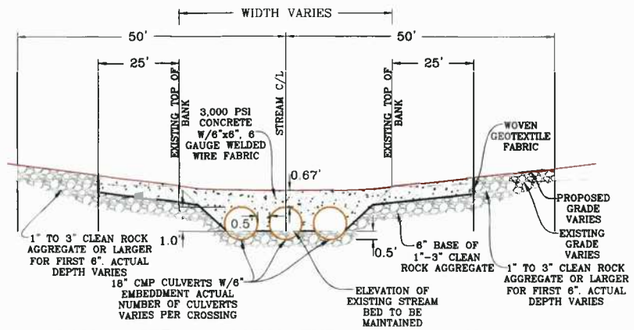


CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



LOW WATER CROSSING TYPICAL SECTION

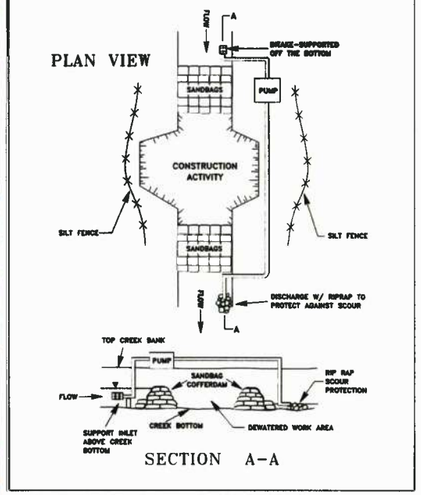
NOT TO SCALE

GENERAL STREAM CROSSING NOTES:

1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
4) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
5) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
6) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
7) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
8) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
9) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
10) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
11) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

FIGURE

PUMP AROUND



SECTION A-A

PUMP AROUND NOTES:

1) CONSTRUCTION SHOULD BE PERFORMED DURING LOW FLOW PERIODS.
2) PUMP(S) SHOULD BE SUFFICIENTLY LARGE TO PUMP THE ENTIRE STREAM FLOW AROUND THE SITE.
3) THE COFFERDAM CONSTRUCTED MUST BE IMPERVIOUS TO WATER.
4) THE INLET OF THE PUMP(S) IS TO BE SUSPENDED ABOVE THE STREAMBED IN ORDER TO PREVENT SUCKING MUD AND SEDIMENT.
5) THE DISCHARGE POINT MUST BE STABILIZED WITH ROCK TO DISPERSE THE ENERGY AND PREVENT EROSION.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "B".

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HONESTY. INTEGRITY. QUALITY.

STATUS S. KIMES REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

MAJOR STREAM CROSSING DETAILS

HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013

SCALE: AS SHOWN

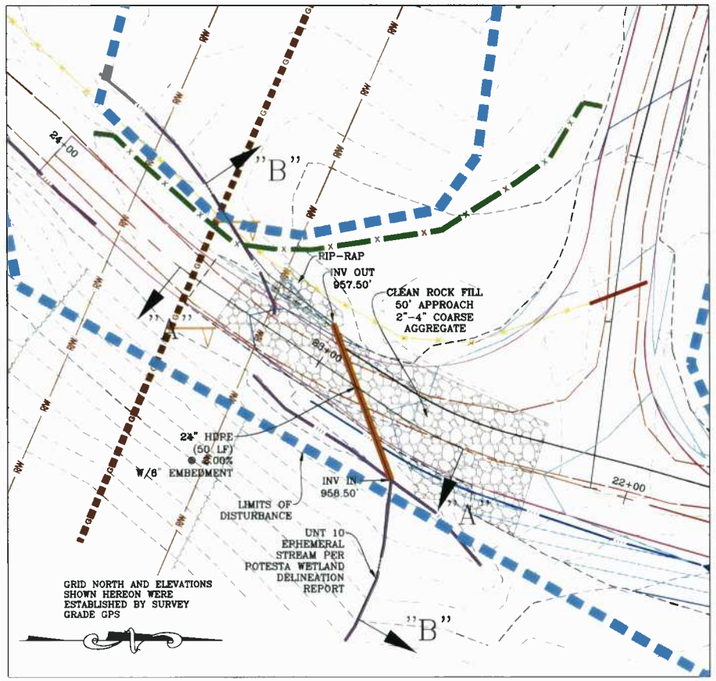
DESIGNED BY: CSK

FILE NO. 7889

SHEET 15 OF 21

STREAM CROSSING DETAILS

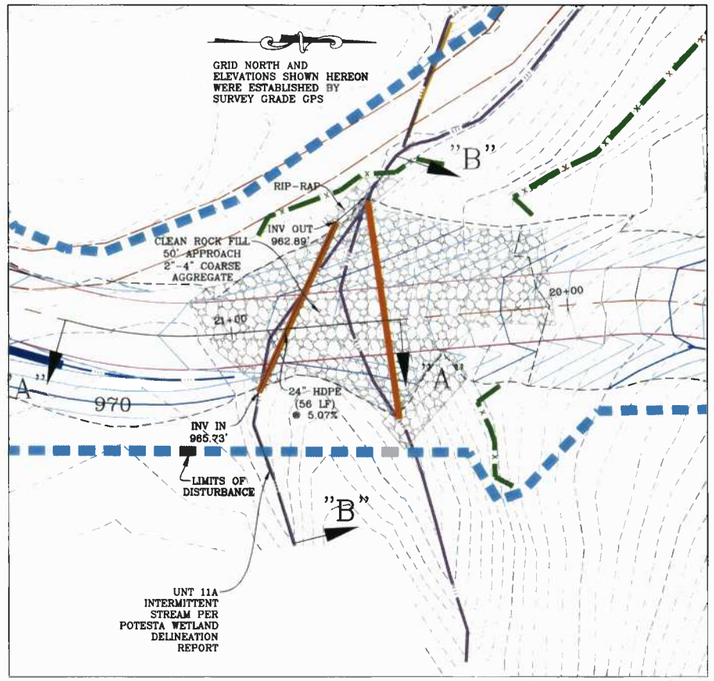
STREAM CROSSING "J" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

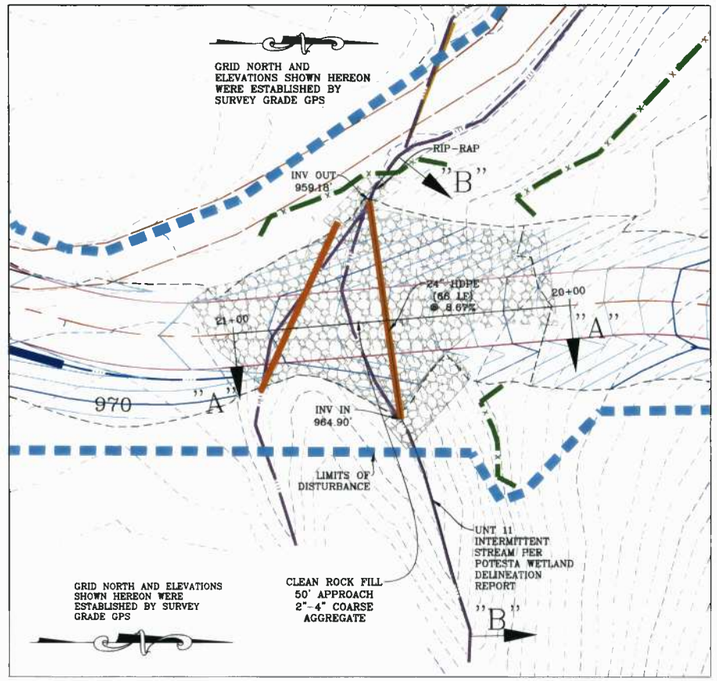
STREAM CROSSINGS "K" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

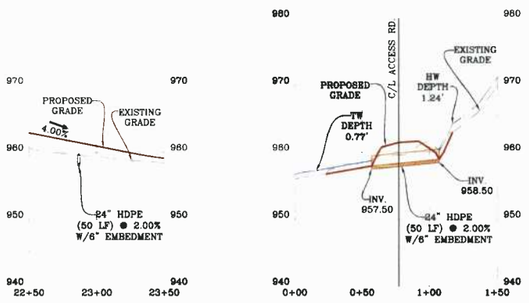
STREAM CROSSINGS "L" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

STREAM CROSSING "J" SECTIONS



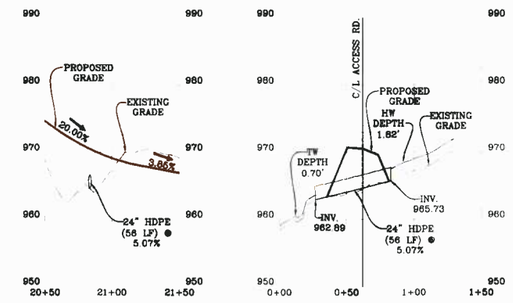
CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "K" SECTIONS



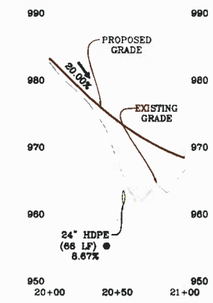
CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

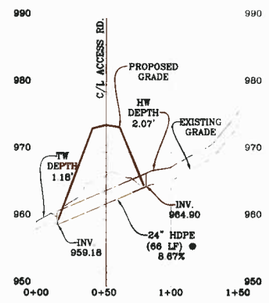
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "L" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "J", "K" & "L".

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CHRIS S. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

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MINOR STREAM CROSSING DETAILS

HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013

SCALE: AS SHOWN

DESIGNED BY: CSK

FILE NO. 7889

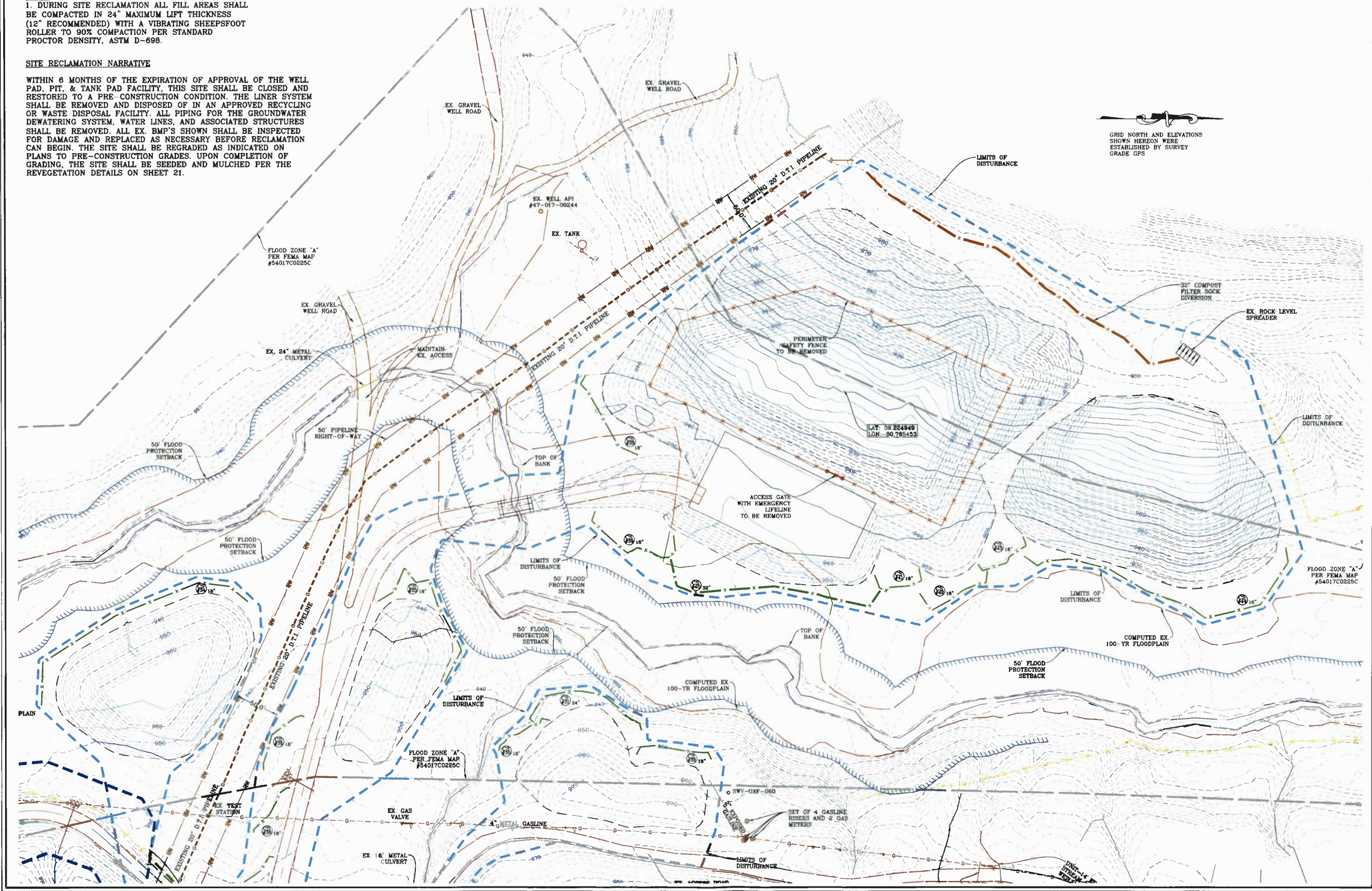
SHEET 16 OF 21

HENDERSON CENTRALIZED IMPOUNDMENT RECLAMATION PLAN

NOTE:
1. DURING SITE RECLAMATION ALL FILL AREAS SHALL BE COMPACTED IN 24" MAXIMUM LIFT THICKNESS (12" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 90% COMPACTION PER STANDARD PROCTOR DENSITY, ASTM D-698.

SITE RECLAMATION NARRATIVE

WITHIN 6 MONTHS OF THE EXPIRATION OF APPROVAL OF THE WELL PAD, PIT, & TANK PAD FACILITY, THIS SITE SHALL BE CLOSED AND RESTORED TO A PRE-CONSTRUCTION CONDITION. THE LINER SYSTEM SHALL BE REMOVED AND DISPOSED OF IN AN APPROVED RECYCLING OR WASTE DISPOSAL FACILITY. ALL PIPING FOR THE GROUNDWATER DEWATERING SYSTEM, WATER LINES, AND ASSOCIATED STRUCTURES SHALL BE REMOVED. ALL EX. BMP'S SHOWN SHALL BE INSPECTED FOR DAMAGE AND REPLACED AS NECESSARY BEFORE RECLAMATION CAN BEGIN. THE SITE SHALL BE REGRADED AS INDICATED ON PLANS TO PRE-CONSTRUCTION GRADES. UPON COMPLETION OF GRADING, THE SITE SHALL BE SEEDED AND MULCHED PER THE REVEGETATION DETAILS ON SHEET 21.



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KENTUCKY, INDIANA, OHIO

CYRUS B. KUMP
REGISTERED
No. 19576
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
2-23-2014

THIS DOCUMENT WAS PREPARED BY NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

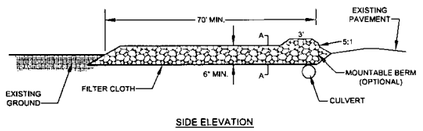
HENDERSON CENTRALIZED IMPOUNDMENT RECLAMATION PLAN

HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

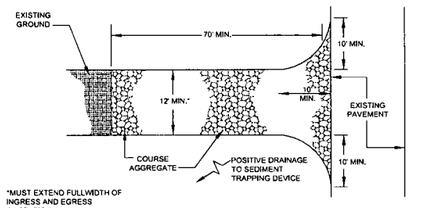
DATE:	12/23/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	17 OF 21

FIGURE 3.02.1

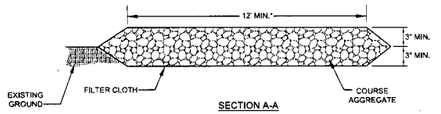
STONE CONSTRUCTION ENTRANCE



SIDE ELEVATION



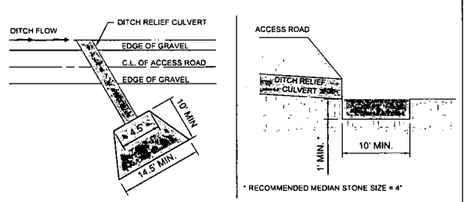
PLAN VIEW



SECTION A-A

SOURCE: ADAPTED from the 1983 Maryland Standards for Soil Erosion and Sediment Control and Va. DSWC

TYPICAL DITCH RELIEF CULVERT OUTLET TREATMENT



PLAN VIEW
NTS

* RECOMMENDED MEDIAN STONE SIZE = 4"

SECTION VIEW
NTS

NOTE:
ALL DITCH LINE PROTECTION SHALL BE INSTALLED AS RECOMMENDED IN THE WEST VIRGINIA EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE (BMP) MANUAL. DITCH LINE PROTECTION SHALL BE BASED ON THE FOLLOWING GRADES:

1. LESS THAN 3% – GRASSED
2. 3–9% – GRASS WITH ROLLED EROSION CONTROL PRODUCTS (RECP)
3. GREATER THAN 9% – RIPRAP OR EQUIVALENT GEOTEXTILE

IF HIGH EROSIVE SOILS ARE ENCOUNTERED DURING CONSTRUCTION, THE ENGINEER SHOULD BE CONTACTED FOR FURTHER EVALUATION.

Modified Figure 3.1 – Typical Roadside Ditch Section
Sump at Ditch Relief Culvert

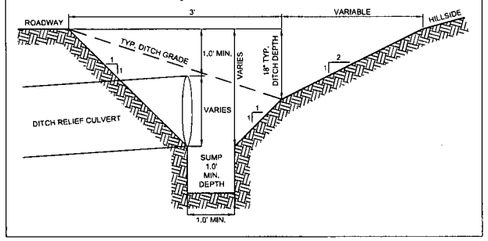
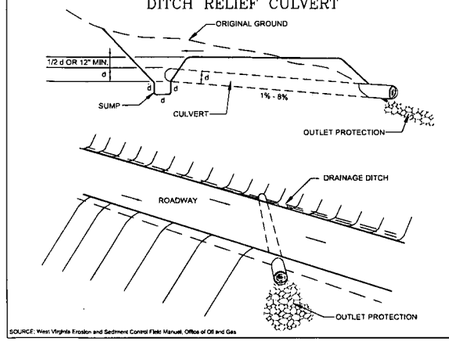


FIGURE II-4

DITCH RELIEF CULVERT



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

Table II-5

Pipe Sizes for Culverts Across Roads		
Drainage Area (Ac)	Pipe Diameter (In)	Pipe Capacity (Cfs)
10	15	5
20	18	9
30	21	12
50	24	18
80	27	24
100	30	29
300	36	60
500	42	85

Table II-6

Spacing of Culverts	
Road Grade %	Distance (Ft)
2-5	500-300
6-10	300-200
11-15	200-100
16-20	100

FIGURE 3.05.1

ROCK CHECK DAM

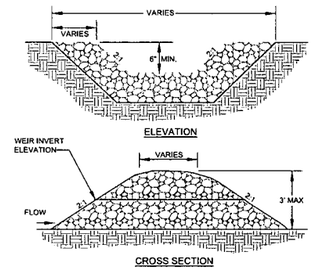
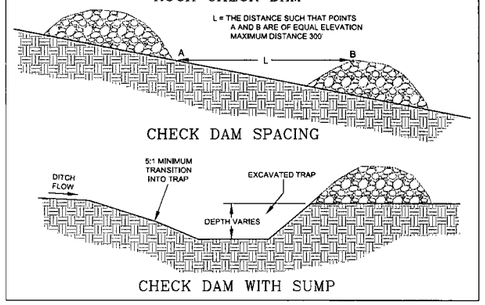
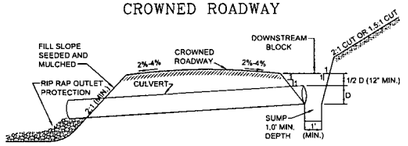


FIGURE 3.05.2

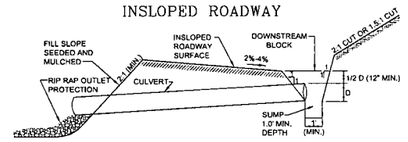
ROCK CHECK DAM



CROWNED ROADWAY



INSLOPED ROADWAY



Cut and fill slopes shall be stabilized immediately upon completion of roadway grading. These areas shall be blanketed wherever they are located within 50 feet of a surface water or within 100 feet of a surface water where a suitable vegetative filter strip does not exist.

A durable top dressing shall be provided for soils having low strength.

Roadside ditches shall be provided with adequate protective lining.

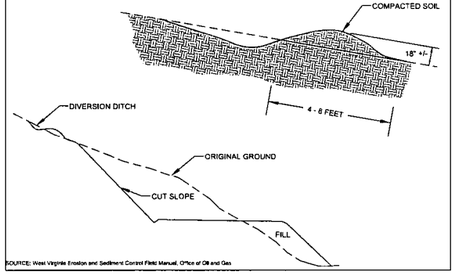
Adequately sized culverts or other suitable cross drains shall be provided at all seeps, springs, and drainageways.

Roadway shall be inspected weekly and after each runoff event. Damaged roadways, ditches, or cross drains shall be repaired immediately.

SOURCE: PA DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF OIL AND GAS MANAGEMENT 5500-FM-OG0111 APPENDIX A EMP CONSTRUCTION DETAILS (MODIFIED)

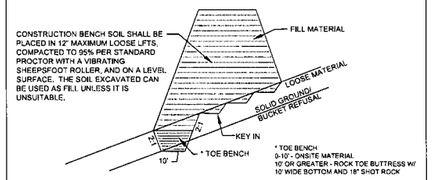
FIGURE II-3

DIVERSION DITCH – TEMPORARY



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

TOE BENCH DETAIL



TURNOUT

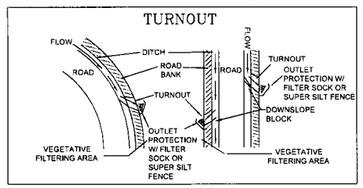
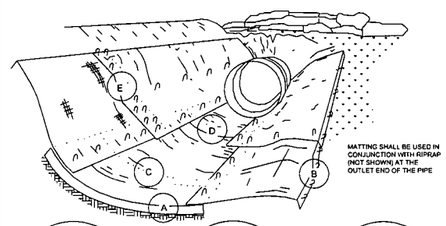
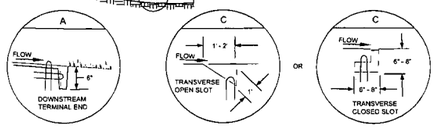


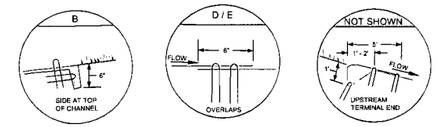
FIGURE 3.13.1

TYPICAL RECP CHANNEL INSTALLATION





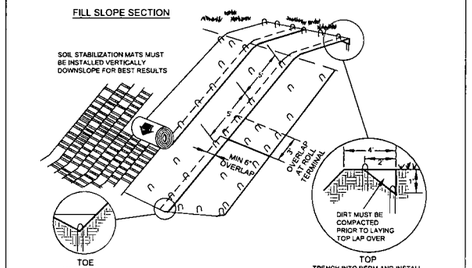
THESE CONFIGURATIONS ARE EXAMPLES ONLY. ALWAYS INSTALL PER MANUFACTURER'S RECOMMENDATIONS



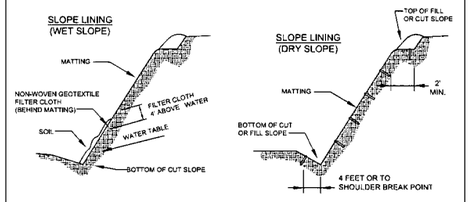
SOURCE: VA DCR-DSWC AND NORTH AMERICAN GREEN

FIGURE 3.13.2

ROLLED EROSION CONTROL PRODUCTS



NOTE: SLOPE SURFACE MUST BE SMOOTH AND FREE OF ROCKS, LUMPS, GRASS AND STICKS. MATS MUST BE PLACED FLAT ON SURFACE FOR PROPER SOIL CONTACT.



SOURCE: VDOT STANDARDS AND VA DCR-DSWC

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STEVEN S. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12-23-2013

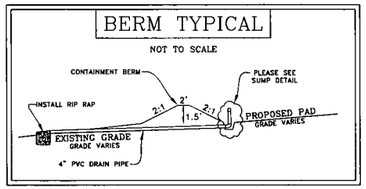
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

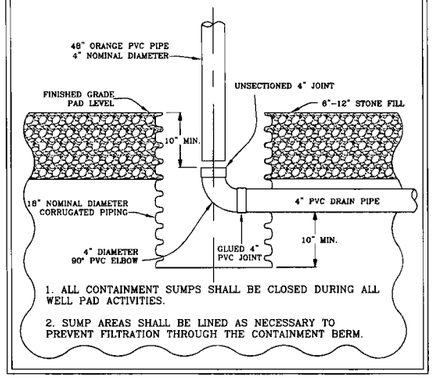
DATE: 12/23/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 18 OF 21

BERM TYPICAL

NOT TO SCALE

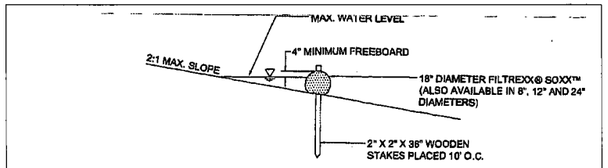


SUMP TYPICAL

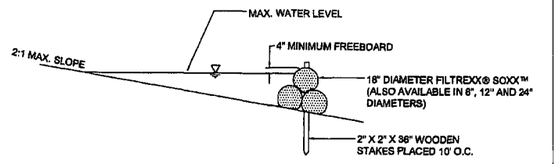


1. ALL CONTAINMENT SUMPS SHALL BE CLOSED DURING ALL WELL PAD ACTIVITIES.

2. SUMP AREAS SHALL BE LINED AS NECESSARY TO PREVENT FILTRATION THROUGH THE CONTAINMENT BERM.



SINGLE INSTALLATION SECTION
NTS

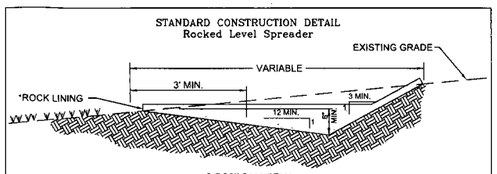


PYRAMID INSTALLATION SECTION
NTS

FILTREXX® RUNOFF DIVERSION SECTIONS

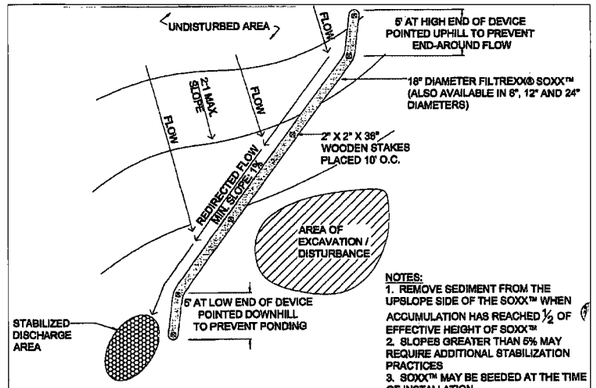
NTS

STANDARD CONSTRUCTION DETAIL
Rocked Level Spreader



SECTION VIEW
NTS

*All Level Spreader rock shall be a minimum of R4.

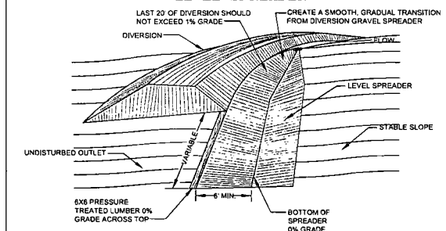


NOTES:
1. REMOVE SEDIMENT FROM THE UPSLOPE SIDE OF THE SOXX™ WHEN ACCUMULATION HAS REACHED ½ OF EFFECTIVE HEIGHT OF SOXX™
2. SLOPES GREATER THAN 6% MAY REQUIRE ADDITIONAL STABILIZATION PRACTICES
3. SOXX™ MAY BE BEEDED AT THE TIME OF INSTALLATION

FILTREXX® RUNOFF DIVERSION

FIGURE 3.02.1

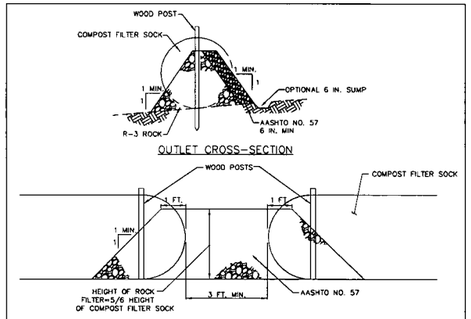
LEVEL SPREADER



PERSPECTIVE VIEW

NOTE: ALL TEMPORARY BERMS, SWALES AND LEVEL SPREADER DITCHES MUST RECEIVE TEMPORARY SEEDING AND MULCHING AFTER INSTALLATION

SOURCE: ADAPTED FROM NJC, EAS Control Planning and Design Manual and VA DEQ(C)



OUTLET CROSS-SECTION

UP-SLOPE FACE

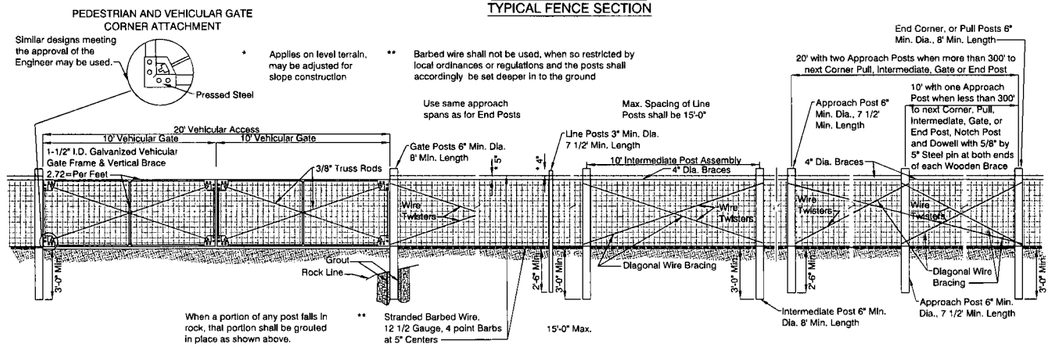
NOTES:

A ROCK FILTER OUTLET SHALL BE INSTALLED WHERE FAILURE OF A COMPOST FILTER SOCK HAS OCCURRED DUE TO CONCENTRATED FLOW.

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

ROCK FILTER OUTLET
(MODIFIED FROM PA DEP)
NOT TO SCALE

CONSTRUCTION DETAIL
TYPICAL FENCE SECTION



NOTES:

Posts and braces may be either round or square shaped. Dimensions shown on the plans are for round posts and braces only. When square posts are used, line posts shall be 3" square (min.);braces 4" square (min.); corner, end, pull, gate, approach, and intermediate posts 6" square (min.).
The positioning of the fence fabric and barbed wire on the posts, as shown on the "Typical Fence Section" detail, applies for level and gentle sloping terrain. For fence erected on slopes, the positioning may be adjusted to meet the slope conditions as long as the adjustment is continued from post to post in a uniform manner. Trenching on slopes may be warranted. On slopes, posts will continue to be erected vertically, unless otherwise directed, and the ends of the fencing fabric shall be cut on a skew as may be necessary for proper connection to the posts.

Dumped rock channel protection will be used at channel crossings when called for on the plans.

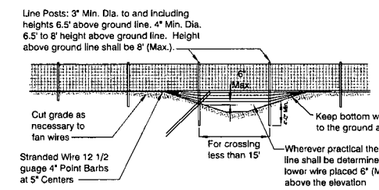
Install drainage structure terminal installation as called for on the plans and/or as shown on typical fence details.

Unless otherwise specified, or directed by the Engineer, the farm field fence may be installed with the fence fabric and barbed wire positioned on either side of the fence posts.

Hardware and miscellaneous fittings, not specifically designated herein as to type or dimensions, shall conform to the applicable requirements of Section 608 of the Specifications and shall be of good quality commerical design acceptable to the Engineer.

In lieu of the barbed wire detailed herein, the following additional types are acceptable, provided they retain the "4-point barb at 5-inch centers" requirement and provided they meet or exceed the strength and coating requirements for the standard, 12 1/2 gauge, barbed wire as called for in 712.10 of the Specifications.
(a) stranded, 15 1/2 gauge, high carbon steel barbed wire
(b) one strand, 12 gauge, steel barbed wire

Vehicular gate frames (and vertical braces) may be either galvanized steel pipe members as shown herein or may be triple-coated steel pipe members meeting the requirements specified on Standard Sheet F2. All other metal components of the gate shall be galvanized, with the exception of the die-cast aluminum corner fittings, or pressed steel corner fittings.



DETAIL SHOWING TYPICAL SECTION AT MINOR DEPRESSIONS AND WET WEATHER CROSSINGS

BRUSH PILE SEDIMENT BARRIER

FIGURE II-10

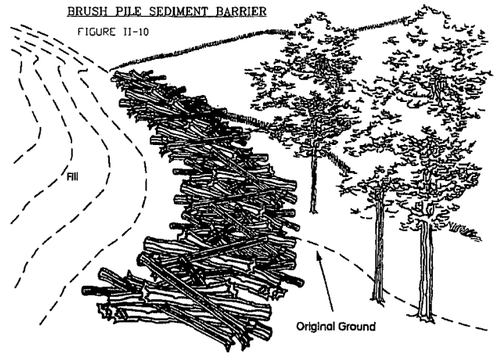
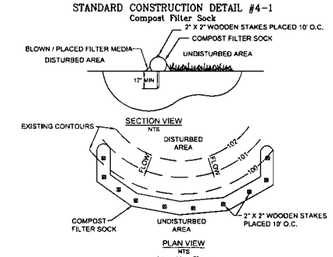


Table 4.1
Compost Sock Fabric Minimum Specifications

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" 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		25 psi	25 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 & 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.					

STANDARD CONSTRUCTION DETAIL #4-1
Compost Filter Sock



PLAN VIEW
NTS
Adapted from FBroup

Sock fabric shall meet standards of Table 4.1. Compost shall meet the following 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 Maximum

Compost Filter Sock shall be placed at existing level grade. Both ends of the sock shall be extended at least 8 feet up the slope at 45 degrees to the main sock alignment. Maximum slope length above any sock shall not exceed manufacturer's maximum permissible slope length.

Traffic shall not be permitted to cross filter socks.

Accumulated Sediment shall be removed when it reaches 1/2 the above ground 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.

In the event the ground is frozen, #5 rebar with safety caps shall be used instead of wooden stakes to anchor the filter sock. Once the ground thaws the rebar anchors shall be removed and replaced with 2" x 2" wooden stakes and installed as shown in the detail above.

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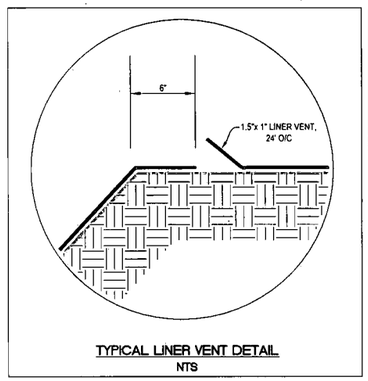
Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT MGMT. ENGINEERS ENVIRONMENTAL
228 West Main St. P.O. Box 190 Smithfield, PA 15351 (724) 564-3531
9466 Elkhorn Station Road Strongsville, OH 44257 (740) 671-9911
INTEGRITY. QUALITY.

CHRIS S. KEIM
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/23/2013

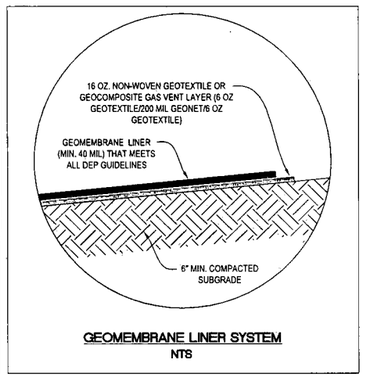
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

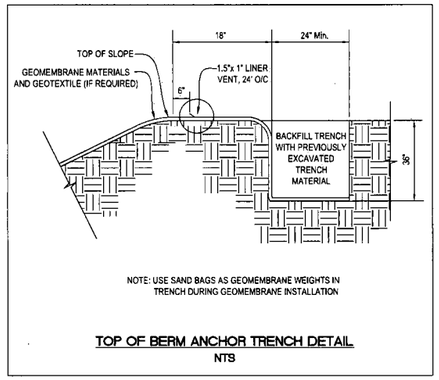
DATE: 12/23/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 19 OF 21



TYPICAL LINER VENT DETAIL
NTS

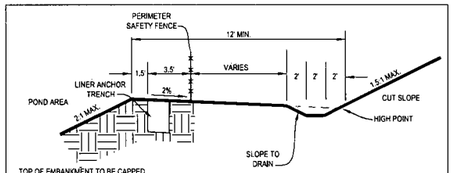


GEOMEMBRANE LINER SYSTEM
NTS

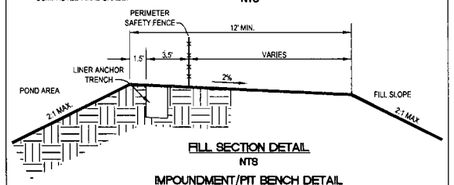


NOTE: USE SAND BAGS AS GEOMEMBRANE WEIGHTS IN TRENCH DURING GEOMEMBRANE INSTALLATION

TOP OF BERM ANCHOR TRENCH DETAIL
NTS



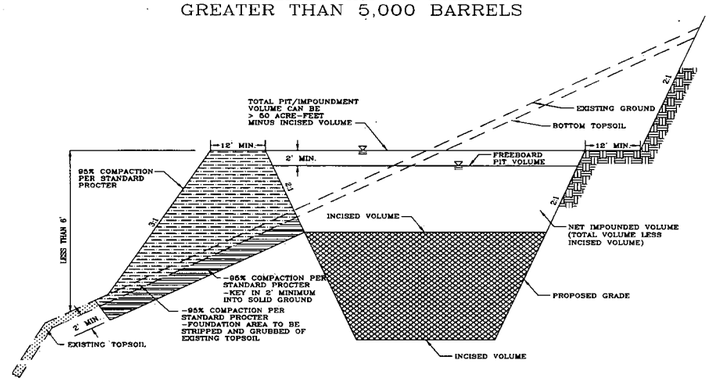
CUT SECTION DETAIL
NTS



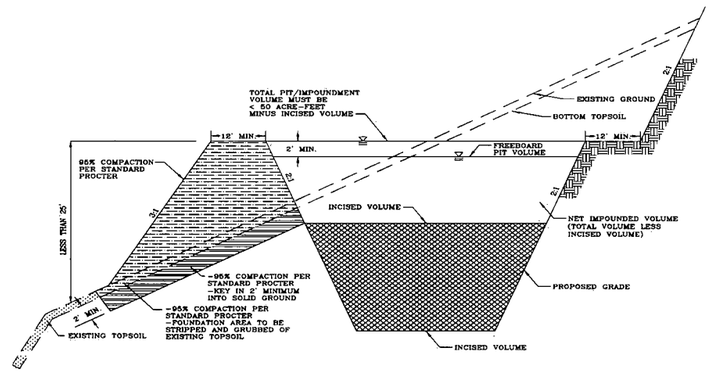
FILL SECTION DETAIL
NTS

IMPOUNDMENT/PIT BENCH DETAIL
NTS

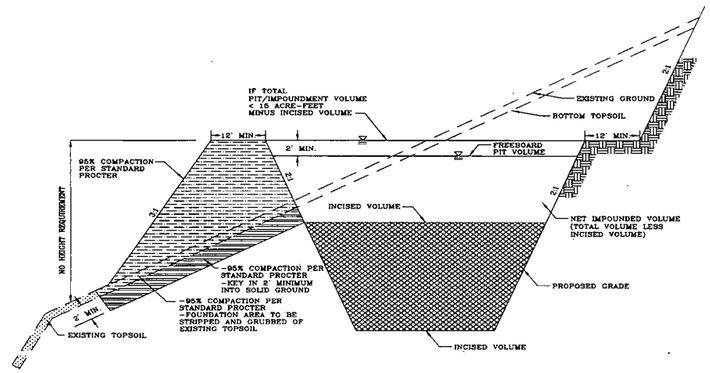
WEST VIRGINIA CODE 35 CSR 4
DESIGN AND CONSTRUCTION REQUIREMENTS FOR ASSOCIATED PITS, ASSOCIATED IMPOUNDMENTS, & CENTRALIZED IMPOUNDMENTS GREATER THAN 5,000 BARRELS



SECTION VIEW



SECTION VIEW



SECTION VIEW

NOTES:
1. ALL FILL SHOULD BE KEYED IN TO ORIGINAL GROUND EVERY 2-5 VERTICAL FEET DEPENDING ON EXISTING GROUND SLOPE

2. MINIMUM OUTSIDE AND INSIDE EMBANKMENT (FILL) SLOPES SHALL BE 2H:1V. THE INSIDE AND OUTSIDE SLOPES MUST ADD UP TO 5H:1V.

NTS

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ENERGY ENGINEERING
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HOUSTON | INTEGRITY | QUALITY

CHRIS S. KAMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/23/2013

THIS DOCUMENT WAS PREPARED BY NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 20 OF 21

REVEGETATION

Taken from the
West Virginia Erosion and Sediment Control Field Manual
West Virginia Division of Environmental Protection Office of Oil and Gas
Charleston, W.Va.
Section IV

Temporary Seeding

a. 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.

b. Seed Mixtures and Planting Dates
Refer to Tables 2 through 4 for recommended dates to establish vegetative cover and the approved lists of temporary and permanent plant species, and planting rates. Table 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.

c. Seed Application
Apply seed by broadcasting, drilling, or by hydroseed according to the rates indicates 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

a. 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.

b. 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.

c. 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 b, 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 Crownvetch 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 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.

d. 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

a. 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 seeded 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 seeded 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 seeded 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 seeded 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.

b. 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.

c. Specifications
From Table IV-6 select the type of mulch and rate of application that will best suit the conditions at the site.

d. 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 three inches.
2. Mulch netting
Follow manufacturer's recommendation when positioning and stapling the mulch netting in the soil.

Table IV-1
Recommended Seeding Dates

Planting 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 2
Acceptable Fertilization Recommendation

Species	N (lbs/ac)	P2O5 (lbs/ac)	Example Rec't (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 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
Sundangrass	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 4a
Permanent Seeding Mixture

Species/Mixture	Seeding Rate (lbs/acre)	Soil Drainage preference	pH Range
Crownvetch / Tall Fescue	10 - 15 30	Well - Mod. Well	5.0 - 7.5
Crownvetch / Perennial Ryegrass	10 - 15 20	Well - Mod. Well	5.0 - 7.5
Flatpea or Perennial Pea / Tall Fescue	**20 15**	**Well - Mod. Well**	**4.0 - 8.0**
Ladino Clover / Sericia 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 10 3	Well - Mod. Well	5.0 - 7.5
Sericia 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 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	5 12	Well - Mod. Well	6.5 - 8.0
Timothy / Birdsfoot Trefoil	5 8	Well - Poorly	5.5 - 7.5
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.

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 100 to 150 bales	Cover 75% to 90% of Surface	Subject to wind blowing or washing unless tied down
Wood Fiber Pulp Fiber Wood Cellulose Recirculated Paper	1000 to 1500 lbs	Cover all Disturbed Areas	For hydroseeding

Tables IV 1-4 taken from Natural Resources Conservation Service Manual 'Critical Area Planting'

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MONTHLY INTEGRITY QUALITY

CONSTRUCTION DETAILS
HENDERSON
CENTRALIZED IMPOUNDMENT
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

CHRIS B. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12-23-2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

DATE: 12/23/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 21 OF 21

OXF 157 SITE PLAN
EQT PRODUCTION COMPANY

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)

SITUATE ON THE WATERS OF BLUESTONE CREEK IN WEST UNION DISTRICT, DODDRIDGE COUNTY, WEST VIRGINIA.

PROJECT INFORMATION

PROJECT NAME: OXF 157 H1-H8

TAX PARCEL:
WEST UNION DISTRICT
MAP 6-1

SURFACE OWNER:
JUSTIN L. HENDERSON
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV
TOTAL PROPERTY AREA: 1,602.9 ± ACRES

OIL AND GAS ROYALTY OWNER:
LEEMAN MAXWELL HRS
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV
TOTAL PROPERTY AREA: 2,164 ± ACRES

SITE LOCATION:
THE OXF 157 SITE IS WEST OF MAXWELL RIDGE ALONG BLUESTONE CREEK OFF COUNTY ROUTE 13. THE ENTRANCE TO THE SITE IS APPROXIMATELY 3/4 MILE SOUTHWEST OF THE CO. RT. 13 AND CO. RT. 13/3 INTERSECTION.

LOCATION COORDINATES

OXF 157 SITE ENTRANCE
LATITUDE: 39.227701 LONGITUDE: -80.758964 (NAD 83)

OXF 157 H1-H8 WELL PAD ENTRANCE
LATITUDE: 39.234468 LONGITUDE: -80.764983 (NAD 83)

OXF 157 H1-H8 WELL PAD
LATITUDE: 39.236047 LONGITUDE: -80.766261 (NAD 83)

OXF 157 ASSOCIATED PIT
LATITUDE: 39.238452 LONGITUDE: -80.764291 (NAD 83)

SITE DISTURBANCE COMPUTATIONS

ROAD A PHASE I= 11.7 ± ACRES (ROAD A PHASE I & STOCKPILES A-D)
WELL PAD AREA = 9.7 ± ACRES (PAD, PORTION OF ROAD B & STOCKPILES E-F)
ASSOCIATED PIT AREA = 3.2 ± ACRES (PIT, ROAD D & STOCKPILE G)
ACCESS ROAD = 12.7 ± ACRES (ROADS B, C & STOCKPILE H)
TOTAL SITE DISTURBANCE = 37.3 ± ACRES

ENTRANCE PERMIT

EQT PRODUCTION COMPANY WILL OBTAIN AN ENCROACHMENT PERMIT (FORM MM-109) FROM THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS, PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

MISS UTILITY STATEMENT

MISS UTILITY OF WEST VIRGINIA WAS NOTIFIED FOR THE LOCATING OF UTILITIES PRIOR TO THIS PROJECT DESIGN; TICKET #1328176253.
IN ADDITION, MISS UTILITY WILL BE CONTACTED PRIOR TO START OF THE PROJECT.

FLOODPLAIN NOTE

THE PROPOSED LIMITS OF DISTURBANCE FOR THIS PROJECT IS LOCATED IN FEMA FLOOD ZONE X and A, PER THE FLOOD INSURANCE RATE MAP (FIRM) NUMBER 54017C0225C, DATED OCTOBER 4, 2011.

ENVIRONMENTAL NOTES

A WETLAND DELINEATION WAS PERFORMED ON APRIL 25-26, 2013 BY POTESTA AND ASSOCIATES, INC. 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). THE MAY 29, 2013 REPORT PROJECT # 0101-11-147-15701 WAS PREPARED BY POTESTA AND ASSOCIATES, INC. SUMMARIZES THE RESULTS OF THE FIELD DELINEATION. THE REPORT DOES NOT, IN ANY WAY, REPRESENT A JURISDICTIONAL DETERMINATION OF THE LANDWARD LIMITS OF WATERS AND WETLANDS WHICH MAY BE REGULATED BY THE USACE OR THE WVDEP. IT IS STRONGLY RECOMMENDED THAT THE AFOREMENTIONED AGENCIES BE CONSULTED IN AN EFFORT TO GAIN WRITTEN CONFIRMATION OF THE DELINEATION DESCRIBED BY THIS REPORT PRIOR TO ENGAGING CONSTRUCTION ON THE PROPERTY DESCRIBED HEREIN. THE DEVELOPER SHALL OBTAIN THE APPROPRIATE PERMITS FROM THE FEDERAL AND/OR STATE REGULATORY AGENCIES PRIOR TO ANY PROPOSED IMPACTS TO WATERS OF THE U.S., INCLUDING WETLAND FILLS AND STREAM CROSSINGS.

GENERAL DESCRIPTION

THE WELL PAD & ASSOCIATED PIT IS BEING CONSTRUCTED TO AID IN THE DEVELOPMENT OF INDIVIDUAL MARCELLUS SHALE GAS WELLS.

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!!

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

2000 0 2000
SCALE: 1" = 2000'

LIST OF DRAWINGS

LEGEND

EX. INDEX CONTOUR	PROP. INDEX CONTOUR
EX. INTERMEDIATE CONTOUR	PROP. INTERMEDIATE CONTOUR
EX. BOUNDARY LINE	PROP. GRADING LIMITS
EX. ROAD EDGE OF GRAVEL/DIRT	PROP. LIMITS OF DISTURBANCE
EX. ROAD EDGE OF PAVEMENT	PROP. WELL PAD
EX. ROAD CENTERLINE	PROP. WELL HEAD
EX. DITCHLINE	PROP. 4" PVC DRAIN PIPE
EX. CULVERT	PROP. SUMP DRAIN
EX. GUARDRAIL	PROP. CONTAINMENT BERM
EX. FENCELINE	PROP. PIT/IMPOUNDMENT CL
EX. GATE	PROP. PERIMETER SAFETY FENCE
EX. OVERHEAD UTILITY	PROP. ACCESS GATE WITH EMERGENCY LIFELINE
EX. OVERHEAD UTILITY R/W	
EX. POWER POLE	
EX. GUY WIRE	
EX. TELEPHONE LINE	
EX. GASLINE	PROP. ROCK CONSTRUCTION ENTRANCE
EX. GASLINE R/W	
EX. WATERLINE	
EX. WATER WELL	PROP. ROAD EDGE OF GRAVEL
EX. GAS WELL	PROP. ROAD CENTERLINE
EX. TREELINE	PROP. V-DITCH W/ CHECK DAMS
EX. REFERENCE TREE	PROP. DITCH RELIEF CULVERT (DRC)
EX. DELINEATED STREAM	PROP. RIP-RAP OUTLET PROTECTION
EX. DELINEATED WETLAND	PROP. GUARDRAIL
EX. BUILDING	PROP. ROCK LEVEL SPREADER
EX. BRIDGE	PROP. EARTHEN DIVERSION BERM
100' WETLAND/STREAM BUFFER	PROP. ORANGE SAFETY FENCE
	PROP. SUPER SILT FENCE
	PROP. COMPOST FILTER SOCK
	PROP. COMPOST SOCK DIVERSION
	PROP. GROUNDWATER DEWATERING TRENCH
	PROP. GROUNDWATER DEWATERING PIPE
	SECTION LINE
	MATCHLINE
	X-SECTION GRID INDEX
	X-SECTION GRID INTERMEDIATE
	X-SECTION PROPOSED GRADE
	X-SECTION EXISTING GRADE
	X-SECTION WATER SURFACE
	SPOT ELEVATION
	CENTER OF PAD

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MORRISTOWN, PA | MARKET

CHRIS S. KAMP REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

COVER SHEET
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 2000'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 1 OF 31
REV: 12/04/2013

CONSTRUCTION NOTES:

1. METHODS AND MATERIALS USED IN THE CONSTRUCTION OF THE IMPROVEMENTS HEREIN SHALL CONFORM TO THE CURRENT COUNTY CONSTRUCTION STANDARDS AND SPECIFICATIONS AND/OR CURRENT WVDEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL STANDARDS AND SPECIFICATIONS.

2. MEASURES TO CONTROL EROSION AND SILTATION, INCLUDING DETENTION PONDS SERVING AS SILT BASINS DURING CONSTRUCTION, MUST BE PROVIDED PRIOR TO ISSUANCE OF THE SITE DEVELOPMENT PERMIT. THE APPROVAL OF THESE PLANS IN NO WAY RELIEVES THE DEVELOPER OR HIS AGENT OF THE RESPONSIBILITIES CONTAINED IN THE WVDEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL.

3. AN APPROVED SET OF PLANS AND ALL APPLICABLE PERMITS MUST BE AVAILABLE AT THE CONSTRUCTION SITE. ALSO, A REPRESENTATIVE OF THE DEVELOPER MUST BE AVAILABLE AT ALL TIMES.

4. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING MUD FROM TRUCKS AND/OR OTHER EQUIPMENT PRIOR TO ENTERING PUBLIC STREETS, AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN STREETS, ALLAY DUST, AND TO TAKE WHATEVER MEASURES ARE NECESSARY TO INSURE THAT THE STREETS ARE MAINTAINED IN A CLEAN, MUD AND DUST FREE CONDITION AT ALL TIMES.

5. NOTIFICATION SHALL BE GIVEN TO THE APPROPRIATE UTILITY COMPANY PRIOR TO CONSTRUCTION OF WATER AND/OR GAS PIPE LINES. INFORMATION SHOULD ALSO BE OBTAINED FROM THE APPROPRIATE AUTHORITY CONCERNING PERMITS, CUT SHEETS, AND CONNECTIONS TO EXISTING LINES.

6. THE LOCATION OF EXISTING UTILITIES SHOWN IN THESE PLANS ARE FROM FIELD LOCATIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES AS NEEDED PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL INFORM THE ENGINEER OF ANY CONFLICTS ARISING FROM HIS EXISTING UTILITY VERIFICATION AND THE PROPOSED CONSTRUCTION.

7. THE DEVELOPER WILL BE RESPONSIBLE FOR ANY DAMAGE TO THE EXISTING STREETS AND UTILITIES WHICH OCCURS AS A RESULT OF HIS CONSTRUCTION PROJECT WITHIN OR CONTIGUOUS TO THE EXISTING RIGHT-OF-WAY.

8. WHEN GRADING IS PROPOSED WITHIN EASEMENTS OF UTILITIES, LETTERS OF PERMISSION FROM ALL INVOLVED COMPANIES MUST BE OBTAINED PRIOR TO GRADING AND/OR SITE DEVELOPMENT.

9. THE DEVELOPER WILL BE RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES WHICH IS REQUIRED AS A RESULT OF HIS PROJECT. THE RELOCATION SHOULD BE DONE PRIOR TO CONSTRUCTION.

10. THESE PLANS IDENTIFY THE LOCATION OF ALL KNOWN GRAVESITES. GRAVESITES SHOWN ON THIS PLAN WILL BE PROTECTED IN ACCORDANCE WITH STATE LAW. IN THE EVENT GRAVESITES ARE DISCOVERED DURING CONSTRUCTION, THE OWNER AND ENGINEER MUST BE NOTIFIED IMMEDIATELY.

11. THE CONTRACTOR IS TO VERIFY FIELD CONDITIONS PRIOR TO AND DURING CONSTRUCTION AND NOTIFY NAVITUS ENGINEERING AT (888) 662-4185 OR SMITH LAND SURVEYING AT (304) 462-5634 IMMEDIATELY OF ANY DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THE APPROVED PLAN.

12. CONTRACTORS SHALL NOTIFY OPERATORS WHO MAINTAIN UNDERGROUND UTILITY LINES IN THE AREA OF PROPOSED EXCAVATING OR BLASTING AT LEAST TWO (2) WORKING DAYS, BUT NOT MORE THAN TEN (10) WORKING DAYS, PRIOR TO COMMENCEMENT OF EXCAVATION OR DEMOLITION.

13. CONTRACTOR TO CONTACT OPERATOR AND ENGINEER IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION.

14. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED BY THE CONTRACTOR DAILY AND CHECKED AFTER EVERY RAINFALL. ALL DRAIN INLETS SHALL BE FREE OF SILTATION AND DEBRIS. INEFFECTIVE MEASURES SHALL BE REPLACED, AS NECESSARY.

15. THE CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR, 2 DAYS PRIOR TO THE START OF CONSTRUCTION.

FLOODPLAIN NOTES

1. NO FILL SHALL BE PERMITTED IN THE FLOODWAY.

2. ALL FILL PLACED IN FLOODPLAIN AREAS SHALL MEET OR EXCEED THE FOLLOWING STANDARDS:

   2.1. FILL SHALL BE USED ONLY TO THE EXTENT TO WHICH IT DOES NOT ADVERSELY AFFECT THE CAPACITY OF CHANNELS OR FLOODWAYS OF ANY TRIBUTARY TO THE MAIN STREAM, DRAINAGE DITCH, OR ANY OTHER DRAINAGE FACILITY OR SYSTEM.
   2.2. FILLED SITE MUST BE CONTOURED TO DRAIN PROPERLY (AVOID PONDING).
   2.3. FILL SHALL EXTEND BEYOND A STRUCTURE FOR A SUFFICIENT DISTANCE TO PROVIDE ACCEPTABLE ACCESS. FOR NONRESIDENTIAL STRUCTURES, FILL SHALL BE PLACE TO PROVIDE ACCESS ACCEPTABLE FOR INTENDED USE.
   2.4. AT GRADE ACCESS, WITH FILL EXTENDING LATERALLY FIFTEEN (15) FEET BEYOND THE BUILDING LINE SHALL BE PROVIDED TO A MINIMUM OF TWENTY-FIVE (25) PERCENT OF THE PERIMETER OF A NONRESIDENTIAL STRUCTURE.
   2.5. FILL SHALL CONSIST OF SOIL OR ROCK MATERIAL ONLY. NO TRASH OR WOODY DEBRIS SHALL BE BURIED ON SITE.
   2.6. FILL MATERIAL SHALL BE COMPACTED TO PROVIDE THE NECESSARY STABILITY AND RESISTANCE TO EROSION, SCOURING, OR SETTLING. FILL COMPACTION STANDARDS MUST BE APPROPRIATE TO PROPOSED POST FILL USE, PARTICULAR ATTENTION IS NECESSARY WHEN FILL IS BEING USED TO ELEVATE A STRUCTURE.
   2.7. FILL SLOPES SHALL BE NO STEEPER THAN (1) VERTICAL ON TWO (2) HORIZONTAL, UNLESS SUBSTANTIATING DATA JUSTIFYING STEEPER SLOPES ARE SUBMITTED TO AND APPROVED BY THE FLOODPLAIN ADMINISTRATOR.
   2.8. FILL SITE AND FILL MUST BE PROTECTED FROM EROSION. EROSION CONTROL BLANKETS OR OTHER ARMORING MATERIALS SHALL BE USED ALONG ALL EMBANKMENTS LOCATED BELOW THE 100-YR FLOODPLAIN.

3. ALL STORAGE TANKS LOCATED AT OR BELOW THE BASE FLOOD ELEVATION SHALL BE FIRMLY ANCHORED TO RESIST FLOTATION.

4. NO MATERIALS THAT ARE BUOYANT, FLAMMABLE, EXPLOSIVE, OR IN TIMES OF FLOODING COULD BE INJURIOUS TO HUMAN, ANIMAL, OR PLANT LIFE, SHALL BE STORED BELOW BASE FLOOD ELEVATION.

5. ALL EXISTING CULVERTS WITHIN LIMITS OF DISTURBANCE SHALL BE REMOVED UNLESS OTHERWISE NOTED.

CONSTRUCTION SEQUENCE

THE BMP'S SHALL BE IMPLEMENTED, MAINTAINED, AND OPERATED IN THE FOLLOWING GENERAL SEQUENCE OF CONSTRUCTION TO MITIGATE THE HAZARD OF ACCELERATED EROSION AND SEDIMENTATION TO ACCEPTABLE LEVELS. MINOR DEVIATIONS FROM THIS SEQUENCE SHALL BE EXECUTED BY THE PROJECT'S FOREMAN AS NEEDED TO ELIMINATE ANY POTENTIAL EROSIVE CONDITION THAT MAY ARISE FOR THE DURATION OF THE PROJECT. THE WVDEP OFFICE OF OIL AND GAS SHALL BE NOTIFIED OF ANY AND ALL SUCH DEVIATIONS FROM THE APPROVED PLANS.

1) STAKE THE LIMITS OF CONSTRUCTION.

2) INSTALL THE ROCK CONSTRUCTION ENTRANCE AS SHOWN ON THE PLANS.

3) INSTALL ALL ORANGE SAFETY FENCE AS SHOWN AROUND ANY DELINEATED STREAMS AND WETLANDS TO CLEARLY IDENTIFY THOSE AREAS THAT ARE NOT TO BE DISTURBED.

4) INSTALL ALL BMP'S (SUPER SILT FENCE, REINFORCED SILT FENCE, SEDIMENT TRAPS, ETC) AS SHOWN ON THE PLANS AND DETAILS.

5) CLEAR AND GRUB THE ACCESS ROAD AND PAD AND PIT AREA. ALL WOODY MATERIAL, BRUSH, TREES, STUMPS, LARGE ROOTS, BOULDERS, AND DEBRIS SHALL BE CLEARED FROM THE SITE AREA AND KEPT TO THE MINIMUM NECESSARY FOR PROPER CONSTRUCTION, INCLUDING THE INSTALLATION OF NECESSARY SEDIMENT CONTROLS. TREES SIX INCHES IN DIAMETER AND LARGER SHALL BE CUT AND LOGS STACKED. SMALLER TREES, BRUSH, & STUMPS SHALL BE CUT AND OR GRUBBED AND WINDROWED IN APPROPRIATE AREAS FOR USE AS SEDIMENT BARRIERS AT WATER DRAINAGE OUTLETS, WINDROWED BELOW THE WELL SITE, USED FOR WILDLIFE HABITAT, BURNED (AS PER WV FOREST FIRE LAWS), REMOVED FROM SITE, OR DISPOSED OF BY OTHER METHODS APPROVED BY DEP.

6) INSTALL ANY WETLAND OR STREAM CROSSINGS AS SHOWN ON THE PLANS.

7) CONVEY UPSLOPE DRAINAGE AROUND THE ACCESS ROAD AND PAD AND PIT AREA BY CONSTRUCTING ALL DIVERSION BERM(S) AS SHOWN ON THE PLANS.

8) CONSTRUCT THE ACCESS ROAD. DITCH RELIEF CULVERTS SHALL BE INSTALLED AT A GRADE OF 1-6% TO MINIMIZE OUTLET VELOCITIES TO THE EXTENT POSSIBLE. INSTALL OUTLET PROTECTION AS SHOWN ON PLANS. STABILIZE THE ROAD WITH STONE AND SIDE SLOPES AS SPECIFIED WITH PERMANENT SEEDING. STOCKPILE AND STABILIZE TOPSOIL ALONG THE ACCESS ROAD, AS NEEDED.

9) STRIP THE TOPSOIL FROM THE PAD AND PIT AREA. TOPSOIL SHALL BE STOCKPILED AND IMMEDIATELY STABILIZED.

10) GRADE THE PAD AND PIT AREA AS SHOWN ON THE PLAN. IMMEDIATELY STABILIZE THE OUTER AREAS OF THE PIT, AS WELL AS THE WELL PAD AND ANY TURNAROUND AREAS WITH STONE AND THE SIDE SLOPES WITH EROSION CONTROL BLANKETING WHEN SLOPES ARE 3:1 OR GREATER. APPLY SEED AND MULCH ALL DISTURBED AREAS. THIS SHALL INCLUDE ALL AREAS THAT WILL NOT BE SUBJECT TO REGULAR TRAFFIC ACTIVITY (TO BE STABILIZED WITH STONE), OR ANY DISTURBED AREA THAT WILL NOT BE RE-DISTURBED BEFORE SITE RECLAMATION BEGINS.

11) INSTALL THE PIT LINER SYSTEM AND PERIMETER SAFETY FENCE W/GATE AND EMERGENCY LIFE LINE AS SHOWN ON THE PLANS.

12) PREVIOUSLY DISTURBED AREAS AND IMMEDIATE DOWN SLOPE AREAS SHALL BE INSPECTED AFTER EACH RAINFALL STORM EVENT AND MONITORED WEEKLY FOR SIGNS OF ACCELERATED EROSION. IMPLEMENT ADDITIONAL BMP'S AS DEEMED NECESSARY. THESE INSPECTIONS SHALL CONTINUE DURING THE DURATION OF THE PROJECT AND SUBSEQUENT SITE RECLAMATION.

13) ONCE THE PIT HAS BEEN COMPLETED, SUBMIT THE AS-BUILT CERTIFICATION FOR EACH PIT/IMPOUNDMENT FACILITY TO THE WVDEP OFFICE OF OIL AND GAS, PRIOR TO PLACING FLUIDS IN EITHER STRUCTURE.

14) COMMENCE THE DRILLING ACTIVITY.

15) ONCE DISTURBED AREAS HAVE BEEN RE-VEGETATED AND STABILIZED FOLLOWING RECLAMATION, THE TEMPORARY BMP'S IN THOSE AREAS MAY BE REMOVED. CONTINUE TO MONITOR THESE AREAS TO ENSURE A UNIFORM RATE OF 70% VEGETATIVE COVERAGE IS MAINTAINED. ANY AREAS FOUND TO BE DEFICIENT SHALL BE RE-SEEDED AND MULCHED.

SITE CLEANUP & RECYCLE PROGRAM

1. GARBAGE, FUELS OR ANY SUBSTANCE HARMFUL TO HUMAN, AQUATIC OR FISH LIFE, WILL BE PREVENTED FROM ENTERING SPRINGS, STREAMS, PONDS, LAKES, WETLANDS OR ANY WATER COURSE OR WATER BODY.

2. OILS, FUELS, LUBRICANTS AND COOLANTS WILL BE PLACED IN SUITABLE CONTAINERS AND DISPOSED PROPERLY.

3. ALL TRASH AND GARBAGE WILL BE COLLECTED AND DISPOSED PROPERLY.

4. ALL SEDIMENT REMOVED FROM SEDIMENT CAPTURING DEVICES SHALL BE PLACED ON THE TOPSOIL STOCKPILE, THEN SEEDED AND MULCHED, AS NECESSARY. ALTERNATIVELY, THE REMOVED SEDIMENT CAN BE TRANSPORTED TO A SITE WITH AN APPROVED PERMIT.

MAINTENANCE PROGRAM

1. BMP'S WILL BE INSPECTED ON A WEEKLY BASIS AND AFTER EACH MEASURABLE RAINFALL EVENT DURING THE ACTIVE CONSTRUCTION PHASE OF THE PROJECT.

2. ALL REVEGETATED ACCESS ROADS AND FACILITIES ARE TO BE MAINTAINED THROUGHOUT THE LIFE OF EACH STRUCTURE.

3. CULVERTS, ROAD DITCHES, BROAD-BASED DIPS, DIVERSION DITCHES, AND ROCK CHECK DAMS MUST BE MAINTAINED IN PROPER WORKING ORDER AND WILL BE CLEANED OUT, REPAIRED, OR REPLACED AS NECESSARY.

4. FILTER STRIPS AND/OR SILT FENCE WILL BE MAINTAINED.

5. ALL AREAS OF EARTH DISTURBANCE WILL BE REPAIRED WHERE SIGNS OF ACCELERATED EROSION ARE DETECTED.

6. SEEDING AND MULCHING WILL BE REPEATED IN THOSE AREAS THAT APPEAR TO BE FAILING OR HAVE FAILED.

ASSOCIATED PIT CONSTRUCTION STANDARD NOTES

THE DESIGN, CONSTRUCTION, AND REMOVAL OF EMBANKMENTS ASSOCIATED WITH ASSOCIATED PITS FOR OIL AND GAS WELLS MUST BE ACCOMPLISHED IN SUCH A MANNER AS TO PROTECT THE HEALTH AND SAFETY OF THE PEOPLE, THE NATURAL RESOURCES, AND ENVIRONMENT OF THE STATE. THE PIT EMBANKMENTS SHALL BE DESIGNED, CONSTRUCTED, AND MAINTAINED TO BE STRUCTURALLY SOUND AND REASONABLY PROTECTED FROM UNAUTHORIZED ACTS OF THIRD PARTIES.

1. THE FOUNDATION FOR A ASSOCIATED PIT EMBANKMENT MUST BE STRIPPED AND GRUBBED TO A MINIMUM DEPTH OF 2 FEET PRIOR TO PLACEMENT AND COMPACTION OF EARTHEN FILL MATERIAL. NO EMBANKMENT FILL SHALL BE PLACED ON FROZEN MATERIAL.

2. ANY SPRINGS ENCOUNTERED WITHIN THE FOUNDATION AREA SHALL BE DRAINED TO THE OUTSIDE/DOWNSTREAM TOE OF EMBANKMENT. CONSTRUCTED DRAIN SECTION SHALL BE AN EXCAVATED 2' x 2' TRENCH AND BACK FILLED WITH TYPE A SAND, COMPACTED BY HAND TAMPER. NO GEOTEXTILES SHALL BE USED TO LINE TRENCH. THE LAST 3' OF DRAIN AT THE DOWNSTREAM END SHALL BE CONSTRUCTED WITH AASHTO #8 MATERIAL.

3. SOILS FOR EARTHEN EMBANKMENT CONSTRUCTION SHALL BE LIMITED TO TYPES GC, GM, SC, SM, CL, OR ML (ASTMD-2487 – UNIFIED SOILS CLASSIFICATION). SOILS MUST CONTAIN A MINIMUM OF 20% OF PLUS NO. 200 SIEVE AND BE "WELL GRADED" MATERIAL WITH NO COBBLES OR BOULDER SIZE MATERIAL MIXED WITH THE CLAY. A MINIMUM OF THREE SAMPLES SHALL BE CLASSIFIED.

4. THE EARTHEN EMBANKMENT SHALL BE COMPACTED BY A VIBRATING SHEEPSFOOT ROLLER. THE LIFTS MUST BE IN HORIZONTAL LAYERS WITH A MAXIMUM LOOSE LIFT THICKNESS 12" AND MAXIMUM PARTICLE SIZE LESS THAN 6".

5. THE PLACEMENT OF ALL FILL MATERIAL SHALL BE FREE OF WOOD, STUMPS AND ROOTS, LARGE ROCKS AND BOULDERS, AND ANY OTHER NONCOMPACTABLE SOIL MATERIAL. THE EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF VISIBLE NON-MOVEMENT, HOWEVER, THE COMPACTION EFFORT SHALL NOT EXCEED THE OPTIMUM MOISTURE LIMITS.

6. THE EMBANKMENT TOP SHALL BE A MINIMUM OF 12' IN WIDTH.

7. THE MINIMUM INSIDE AND OUTSIDE SIDESLOPES SHALL BE 2H:1V, UNLESS OTHERWISE SPECIFIED.

8. ALL EXPOSED EMBANKMENT SLOPES, NOT COVERED BY COMPACTED ROCKFILL OR RIPRAP SHALL BE LIMED, FERTILIZED, SEEDED AND MULCHED. PERMANENT VEGETATIVE GROUND COVER IN COMPLIANCE WITH THE WVDEP EROSION AND SEDIMENT CONTROL FIELD MANUAL MUST BE ESTABLISHED UPON THE COMPLETION OF THE IMPOUNDMENT/PIT CONSTRUCTION. EMBANKMENTS SHALL BE MAINTAINED WITH A GRASSY VEGETATIVE COVER AND FREE OF BRUSH AND/OR TREES.

9. A MINIMUM OF 2' OF FREEBOARD SHALL BE MAINTAINED AT ALL TIMES DURING THE OPERATION OF THE IMPOUNDMENT.

10. ALL EMBANKMENT CONSTRUCTION AND COMPACTION TESTING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

ASSOCIATED PIT LINER SYSTEM NOTES:

THE DESIGNED PIT FACILITY SHALL BE FULLY LINED WITH A GEOSYNTHETIC LINER SYSTEM. LINERS SHALL BE INSTALLED IN ACCORDANCE TO MANUFACTURER'S SPECIFICATIONS.

1. THE SUB-BASE SHALL BEAR THE WEIGHT OF THE LINER SYSTEM, WATER, AND EQUIPMENT OPERATING ON THE PIT WITHOUT CAUSING OR ALLOWING A FAILURE OF THE LINER SYSTEM.

2. THE SUB-BASE SHALL BE COMPACTED TO ACCOMMODATE POTENTIAL SETTLEMENT WITHOUT DAMAGE TO THE LINER SYSTEM.

3. THE UPPER 6" OF THE SUB-BASE SHALL BE COMPACTED TO A STANDARD PROCTOR DENSITY OF AT LEAST 95%.

4. THE SUB-BASE SHALL BE HARD, UNIFORM, SMOOTH AND FREE OF DEBRIS, ROCK FRAGMENTS, PLANT MATERIAL AND OTHER FOREIGN MATERIAL.

5. THE SUB-BASE SHALL BE COVERED WITH NON-WOVEN GEOTEXTILE FABRIC TO CUSHION THE PRIMARY LINER AND ALLOW FOR ADEQUATE VENTING BETWEEN THE PRIMARY LINER AND THE SUB-BASE TO PREVENT THE ENTRAPMENT OF GASES BENEATH THE LINER SYSTEM.

6. THE PIT AREA SHALL BE DRAINED AND COMPLETELY DRY PRIOR TO THE PLACEMENT OF THE PRIMARY LINER. THE PRIMARY LINER SHALL MEET ALL WV DEP GUIDELINES FOR MINIMUM THICKNESS AND SHALL PREVENT THE MIGRATION OF WATER THROUGH THE LINER TO THE GREATEST DEGREE THAT IS TECHNOLOGICALLY POSSIBLE.

7. THE PRIMARY LINER SHALL FULLY COVER THE BOTTOM AND SIDEWALLS OF THE PIT.

8. AN ANCHOR TRENCH SHALL BE EXCAVATED COMPLETELY AROUND THE PERIMETER OF THE PIT AREA AT THE PLANNED ELEVATION OF THE TOP OF THE LINING. THE TRENCH SHALL BE A MINIMUM 36 INCHES DEEP AND 24 INCHES WIDE.

9. ALL ELEMENTS OF THE LINER SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS. ALL SEAMS AND SEALS AROUND ANY PROJECTIONS SHALL BE SEALED AND TESTED IN A METHOD APPROVED BY THE MANUFACTURER.

10. GAS RELIEF VENTS SHALL BE PROVIDED ALONG THE TOP OF THE LINER AND WITHIN ONE FOOT OF THE PERIMETER OF THE IMPOUNDMENT TO ALLOW GASES TO ESCAPE FROM UNDER THE GEOMEMBRANE. MAXIMUM SPACING FOR VENTS SHALL BE 30 FEET.

11. WATER LEVEL MARKINGS SHALL BE CLEARLY PAINTED (1' INCREMENTS) ON THE LINER SYSTEM TO IDENTIFY THE WATER SURFACE ELEVATION.

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CHRIS S. KEY
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/04/2013

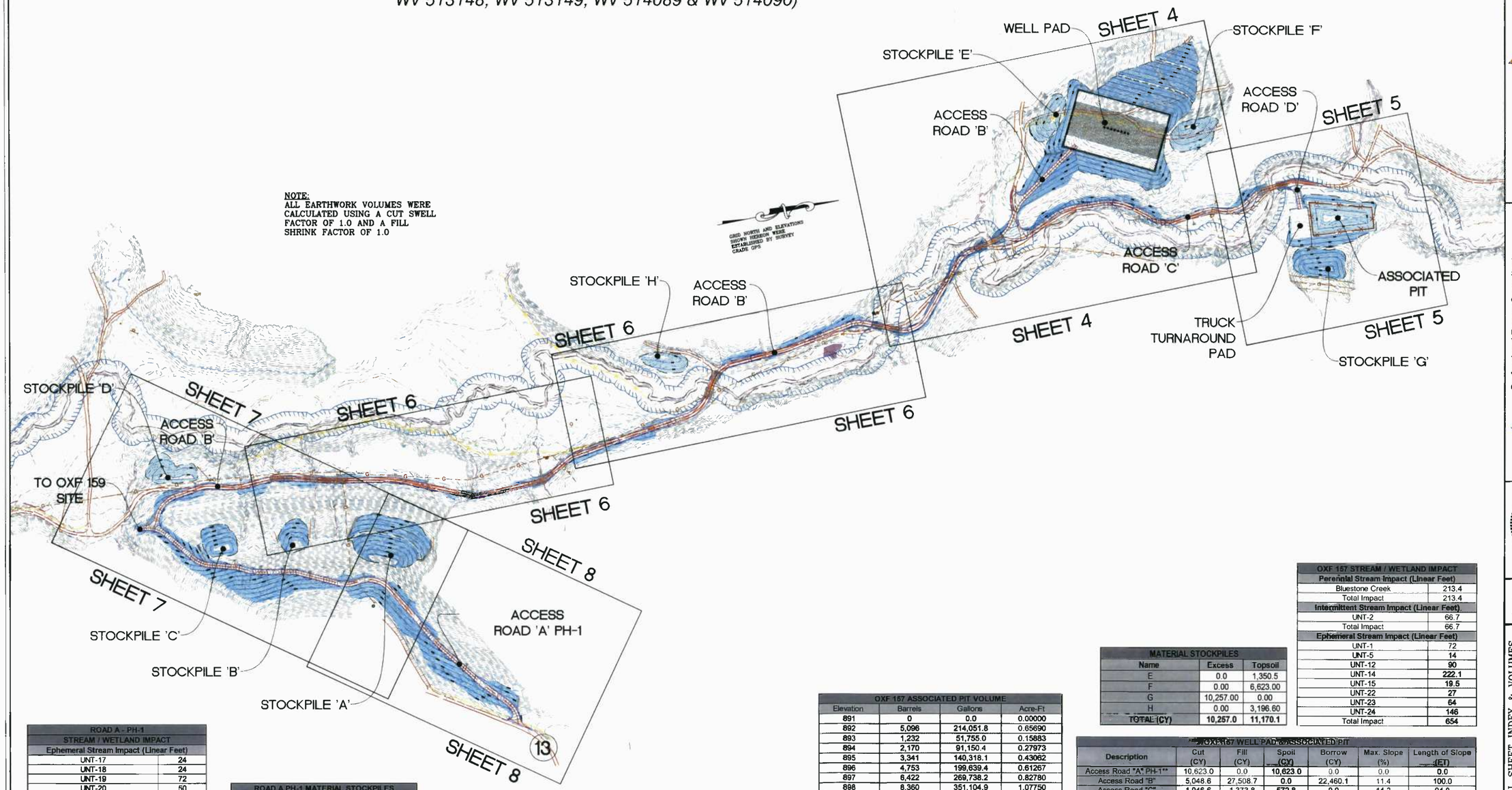
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

NOTES
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 2 OF 31
REV: 12/04/2013

OVERALL SHEET INDEX & VOLUMES

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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

ROAD A- PH-1 STREAM / WETLAND IMPACT	
Ephemeral Stream Impact (Linear Feet)	
UNT-17	24
UNT-18	24
UNT-19	72
UNT-20	50
UNT-21	18
Total Impact	188
Ephemeral Pool Impact (Square Feet)	
POOL - 1	95
POOL - 2	389
Total Area	484

ROAD A PH-1 MATERIAL STOCKPILES		
Name	Excess	Topsoil
A	21,036.60	0.00
B	4,030.10	0.00
C	4,152.00	0.00
D	0.00	3,673.10
TOTAL (CY)	29,220.7	3,673.1

OXF 159 ACCESS ROAD A - PHASE 1						
Description	Cut (CY)	Fill (CY)	Spoil (CY)	Borrow (CY)	Max. Slope (%)	Length of Slope (FT)
Access Road "A" Ph-1	31,492.1	3,205.3	28,286.8	0.0	0.0	0.0
Stripped Topsoil (6")	3,500.7	0.0	3,500.7	0.0	n/a	n/a
Material Stockpiles	0.0	32,893.8	0.0	32,893.8	n/a	n/a
Totals	34,992.8	36,099.1	31,787.5	32,893.8	n/a	n/a
	TOTAL SPOIL (CY) =		-1,106.3			

OXF 157 ASSOCIATED PIT VOLUME			
Elevation	Barrels	Gallons	Acre-Ft
891	0	0.0	0.00000
892	5,096	214,051.8	0.65690
893	1,232	51,755.0	0.15883
894	2,170	91,150.4	0.27973
895	3,341	140,318.1	0.43062
896	4,753	199,639.4	0.61267
897	6,422	269,738.2	0.82780
898	8,360	351,104.9	1.07750
899	10,582	444,425.5	1.36389
900	13,097	550,079.5	1.68813
901	15,922	668,741.6	2.05229
902	19,066	800,757.0	2.45743
903	22,546	946,927.4	2.90601
904 Storage	26,371	1,107,591.7	3.39907
905	30,559	1,283,466.8	3.93881
906	35,131	1,475,497.5	4.52813

Incised Elev. = 898.0

MATERIAL STOCKPILES		
Name	Excess	Topsoil
E	0.0	1,350.5
F	0.00	6,623.00
G	10,257.00	0.00
H	0.00	3,196.60
TOTAL (CY)	10,257.0	11,170.1

OXF 157 WELL PAD & ASSOCIATED PIT						
Description	Cut (CY)	Fill (CY)	Spoil (CY)	Borrow (CY)	Max. Slope (%)	Length of Slope (FT)
Access Road "A" PH-1**	10,623.0	0.0	10,623.0	0.0	0.0	0.0
Access Road "B"	5,048.6	27,508.7	0.0	22,460.1	11.4	100.0
Access Road "C"	1,946.6	1,373.8	572.8	0.0	14.2	94.9
Access Road "D"	10.0	381.5	0.0	371.5	0.0	0.0
Well Pad	66,659.0	55,022.3	11,636.7	0.0	n/a	n/a
Well Pad Containment Berm	0.0	373.0	0.0	373.0	n/a	n/a
Associated Pit	13,513.5	2,615.1	10,898.4	0.0	n/a	n/a
Truck Turnaround Pad	2,853.4	72.2	2,781.2	0.0	n/a	n/a
Stripped Topsoil (6")	11,075.3	0.0	11,075.3	0.0	n/a	n/a
Material Stockpiles	0.0	21,427.1	0.0	21,427.1	n/a	n/a
Totals	111,729.4	108,773.7	47,587.4	44,631.7	n/a	n/a
	TOTAL SPOIL (CY) =		2,956.7			

OXF 157 STREAM / WETLAND IMPACT	
Perennial Stream Impact (Linear Feet)	
Bluestone Creek	213.4
Total Impact	213.4
Intermittent Stream Impact (Linear Feet)	
UNT-2	66.7
Total Impact	66.7
Ephemeral Stream Impact (Linear Feet)	
UNT-1	72
UNT-5	14
UNT-12	90
UNT-14	222.1
UNT-15	19.5
UNT-22	27
UNT-23	64
UNT-24	146
Total Impact	654

**NOTE:
MATERIAL SHALL BE BORROWED FROM THE ACCESS ROAD "A" PH-1 IN ORDER TO CONSTRUCT THE ACCESS ROAD "B" TO THE OXF 157 WELL PAD.

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Honesty, Integrity, Quality

CHRIS S. KUNC REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

OVERALL SHEET INDEX & VOLUMES
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

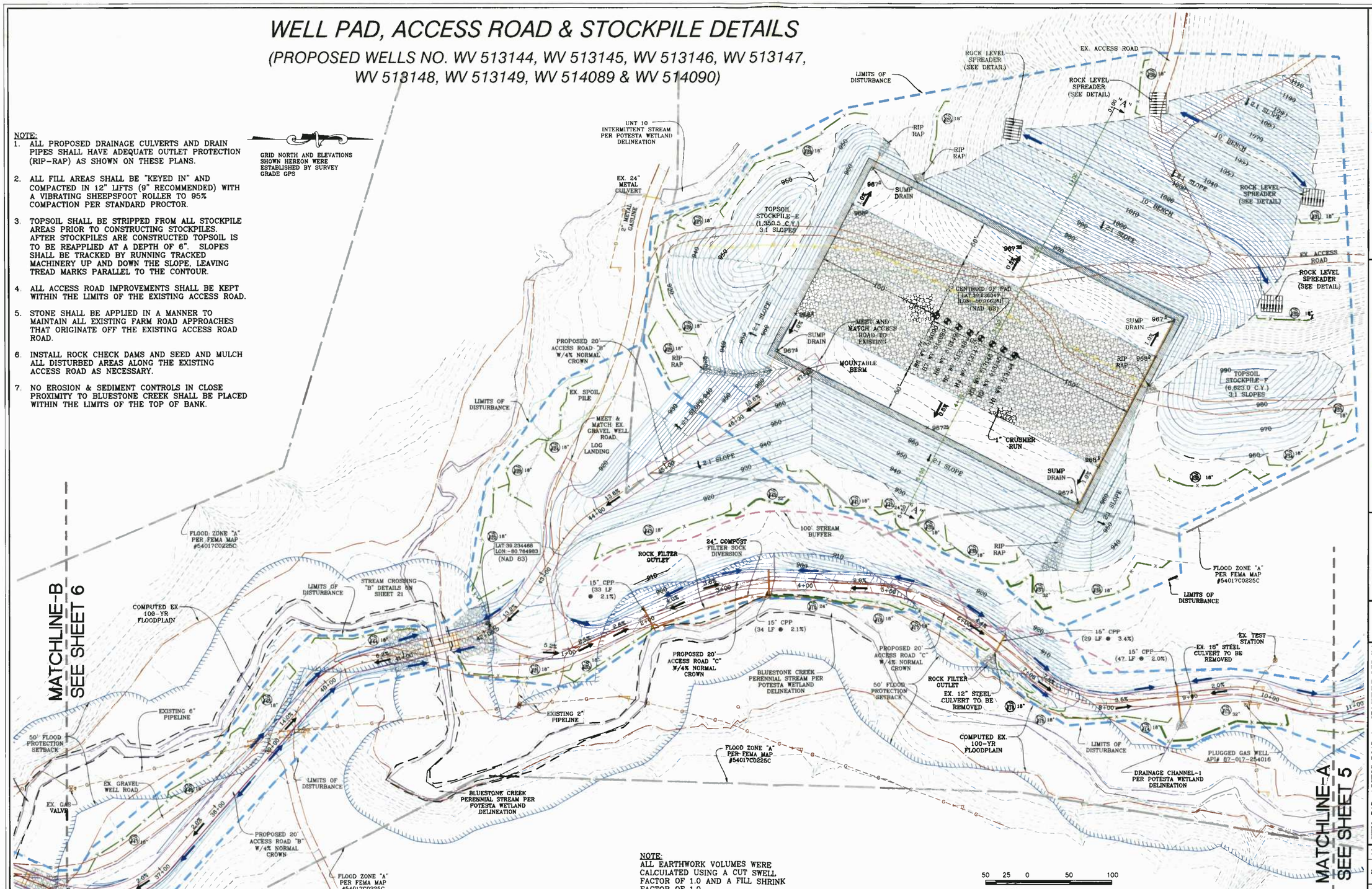
DATE: 11/04/2013
SCALE: 1" = 100'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 3 OF 31
REV: 12/04/2013

WELL PAD, ACCESS ROAD & STOCKPILE DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)

NOTE:
1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR.
3. TOPSOIL SHALL BE STRIPPED FROM ALL STOCKPILE AREAS PRIOR TO CONSTRUCTING STOCKPILES. AFTER STOCKPILES ARE CONSTRUCTED TOPSOIL IS TO BE REAPPLIED AT A DEPTH OF 6". SLOPES SHALL BE TRACKED BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR.
4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.
7. NO EROSION & SEDIMENT CONTROLS IN CLOSE PROXIMITY TO BLUESTONE CREEK SHALL BE PLACED WITHIN THE LIMITS OF THE TOP OF BANK.

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



NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

SCALE: 1" = 50'

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HONESTY, INTEGRITY, QUALITY

CYRUS B. KUHN — 0576 — REGISTERED — STATE OF WEST VIRGINIA — PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

WELL PAD, ACCESS ROAD & STOCKPILE DETAILS

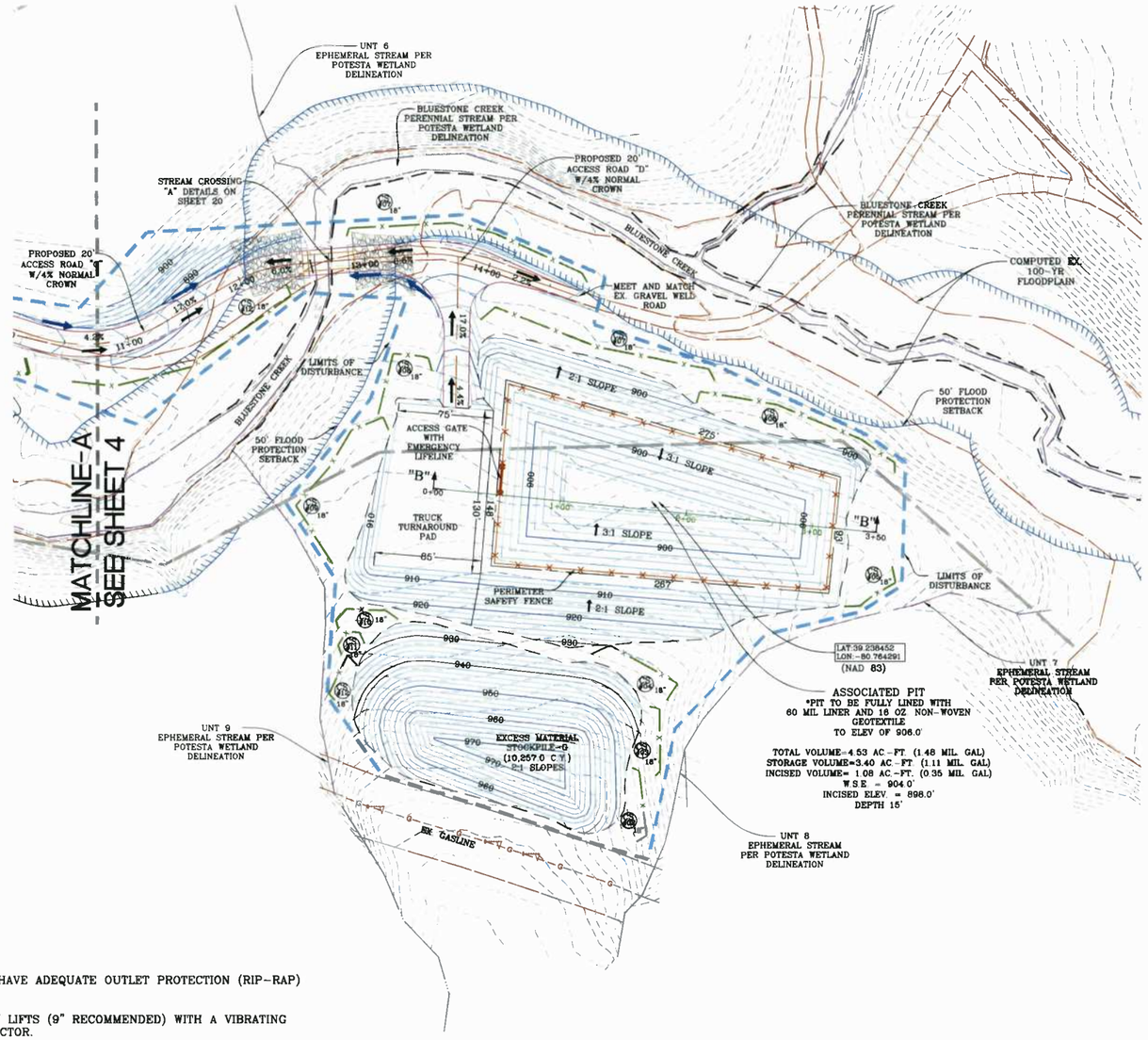
OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 4 OF 31
REV: 12/04/2013

ASSOCIATED PIT, ACCESS ROAD & STOCKPILE DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



NOTE:

1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR.
3. TOPSOIL SHALL BE STRIPPED FROM ALL STOCKPILE AREAS PRIOR TO CONSTRUCTING STOCKPILES. AFTER STOCKPILES ARE CONSTRUCTED TOPSOIL IS TO BE REAPPLIED AT A DEPTH OF 6". SLOPES SHALL BE TRACKED BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR.
4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.
7. NO EROSION & SEDIMENT CONTROLS IN CLOSE PROXIMITY TO BLUESTONE CREEK SHALL BE PLACED WITHIN THE LIMITS OF THE TOP OF BANK.

50 25 0 50 100

SCALE: 1" = 50'

NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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CHRIS S. KUHN
REGISTERED
9578
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

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FOR: EQT PRODUCTION COMPANY

PIT, ACCESS ROAD & STOCKPILE DETAILS

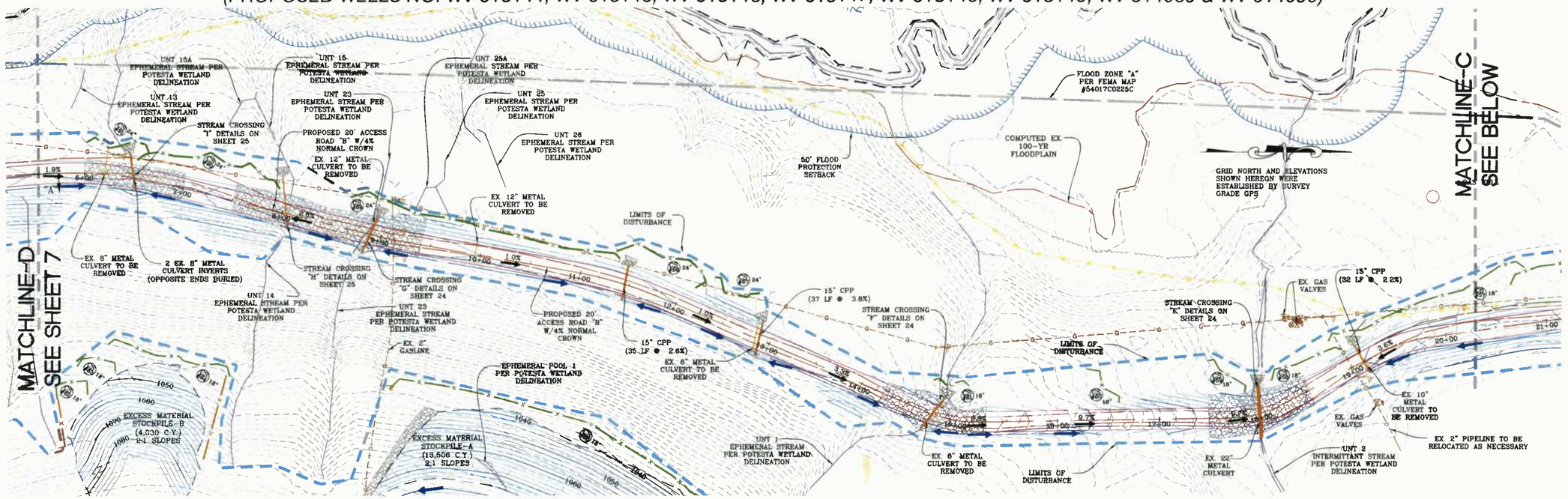
OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 5 OF 31
REV: 12/04/2013

ACCESS ROAD DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



SCALE: 1" = 50'

NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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39060 Little Bridge Road Suite 1 Chester, OH 45720 (740) 671-9911
HONESTY, INTEGRITY, QUALITY

CHRIS S. KING
REGISTERED
21578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

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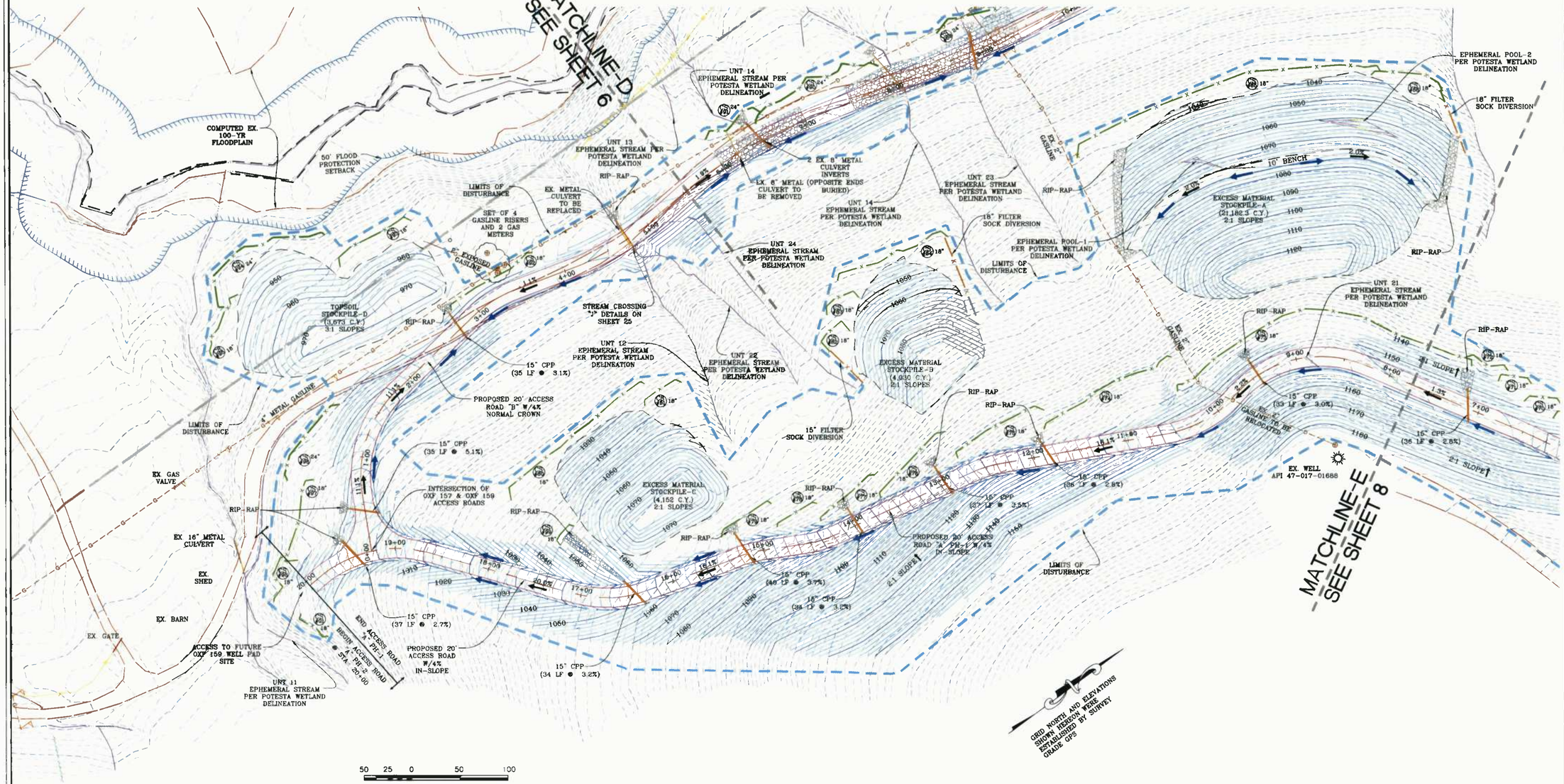
FOR: EQT PRODUCTION COMPANY

ACCESS ROAD DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7689
SHEET	6 OF 31
REV:	12/04/2013

ACCESS ROAD AND STOCKPILE DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

NOTE:

1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR.
3. TOPSOIL SHALL BE STRIPPED FROM ALL STOCKPILE AREAS PRIOR TO CONSTRUCTING STOCKPILES. AFTER STOCKPILES ARE CONSTRUCTED TOPSOIL IS TO BE REAPPLIED AT A DEPTH OF 6". SLOPES SHALL BE TRACKED BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR.
4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.
7. NO EROSION & SEDIMENT CONTROLS IN CLOSE PROXIMITY TO BLUESTONE CREEK SHALL BE PLACED WITHIN THE LIMITS OF THE TOP OF BANK.

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228 West Main St.
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Salem, WV 26426
(304) 782-3231
(304) 462-5634

CHRIS S. KUHN
REGISTERED
PS 678
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

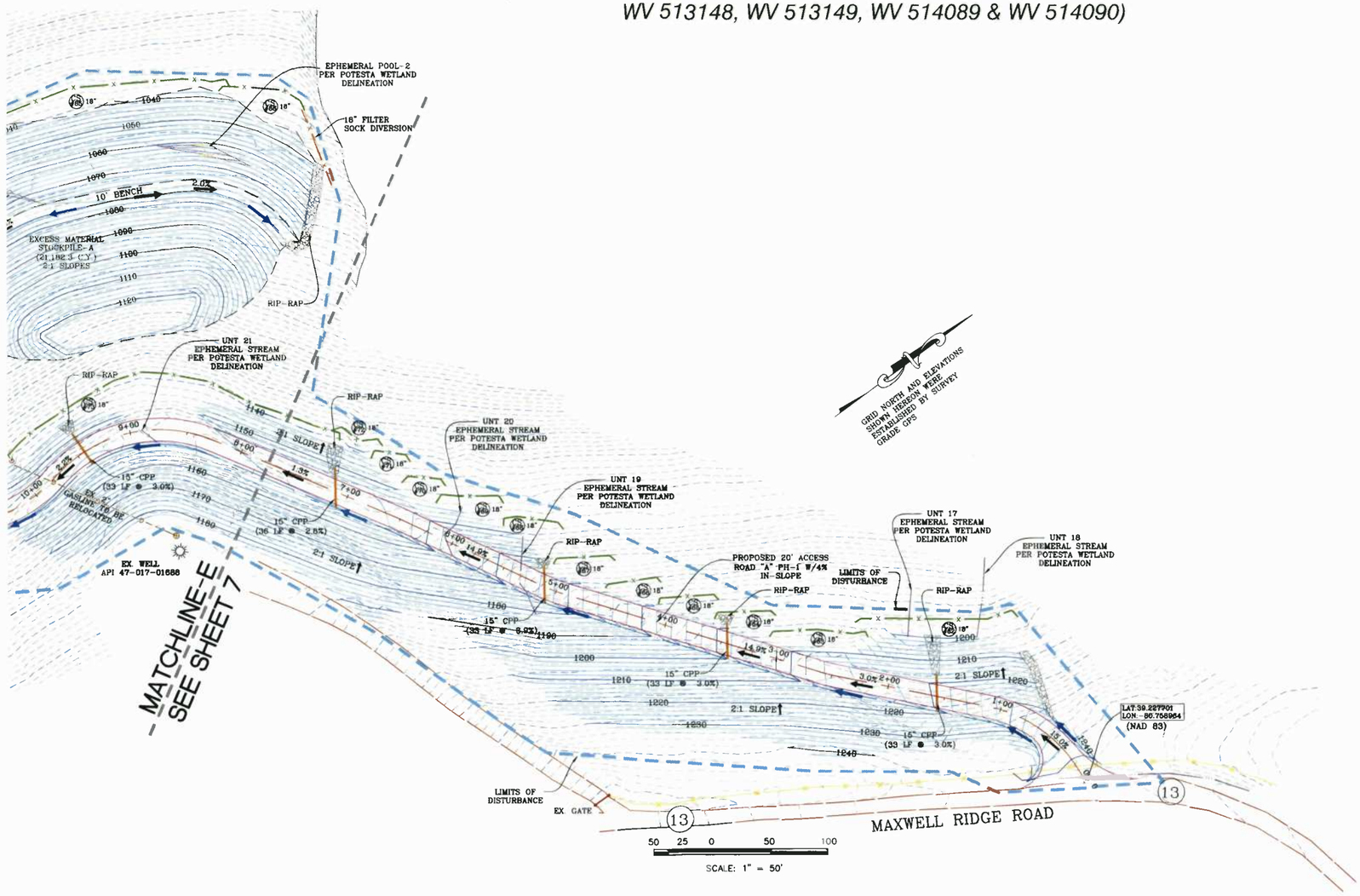
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ACCESS ROAD & STOCKPILE DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE	11/04/2013
SCALE	1" = 50'
DESIGNED BY	CSK
FILE NO.	7889
SHEET	7 OF 31
REV:	12/04/2013

ACCESS ROAD DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



NOTE:
1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR.
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NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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25806 Duff Drainage Road Harrisville, OH 45745 (740) 877-9911
HORIZONTAL DATUM NAD 83

CHRIS S. KELLY REGISTERED 9575 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

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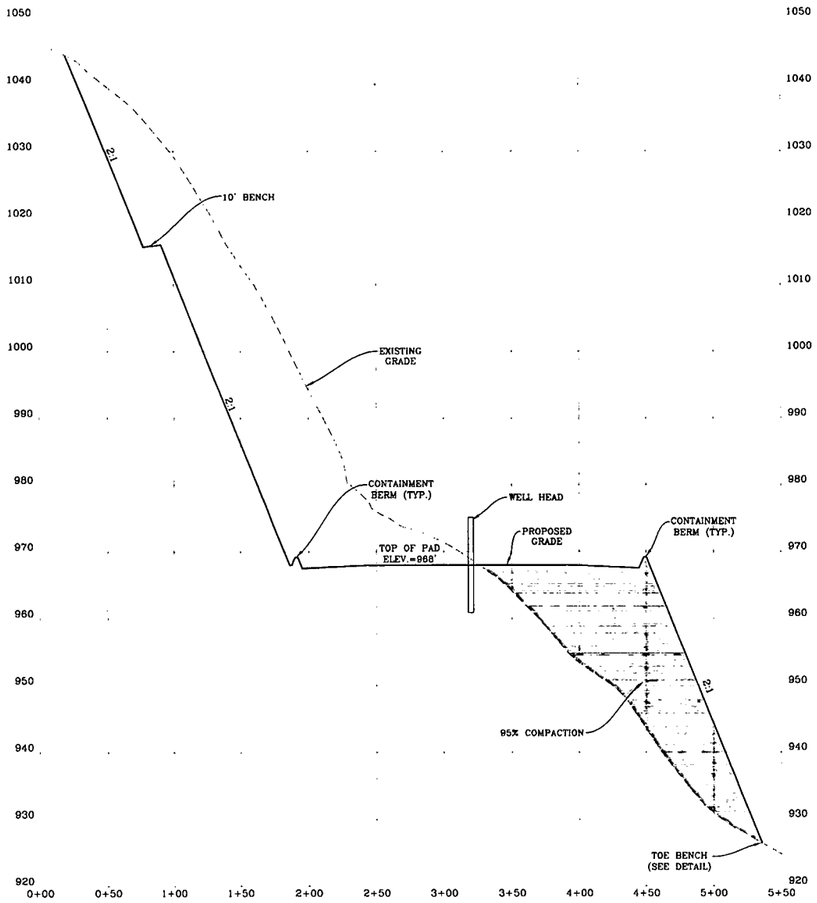
FOR: EQT PRODUCTION COMPANY

ACCESS ROAD DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

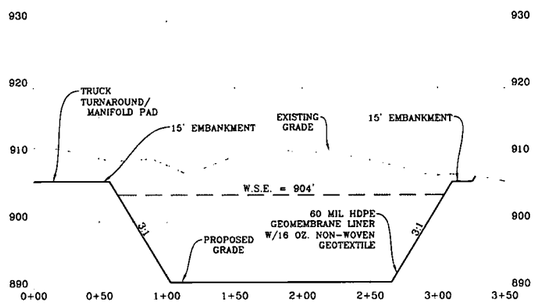
DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 8 OF 31
REV: 12/04/2013

WELL PAD & ASSOCIATED PIT SECTIONS



WELL PAD CROSS-SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

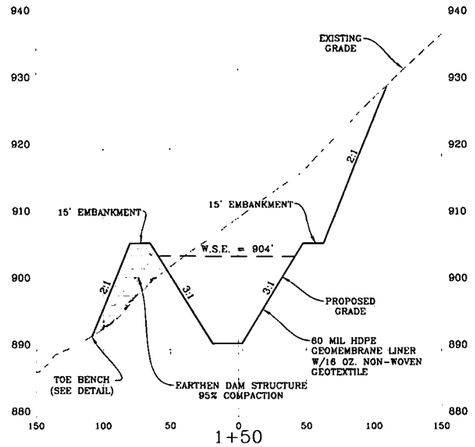


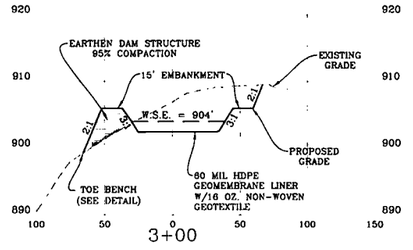
ASSOCIATED PIT CROSS-SECTION "B-B"

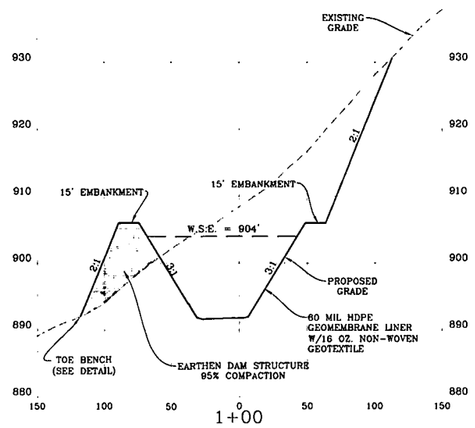
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

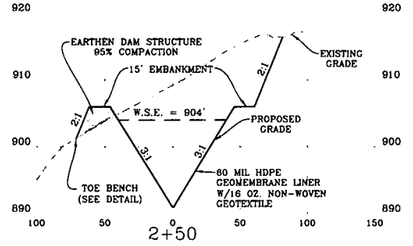
ASSOCIATED PIT CROSS-SECTIONS ALONG BASELINE "B-B"

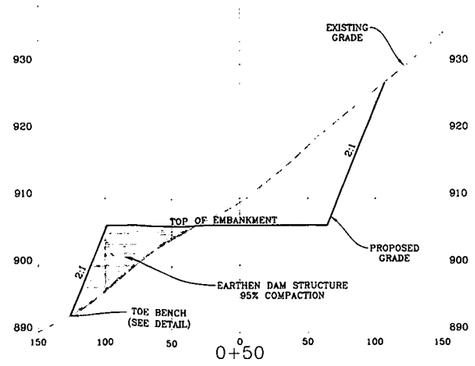
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

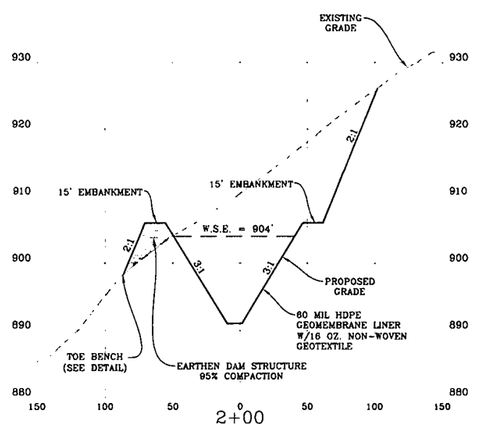












NOTE:
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(304) 462-8834
HORIZONTAL DIRECTIONAL DRILLING

STATUS B. KING
REGISTERED
No. 19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

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FOR: EQT PRODUCTION COMPANY

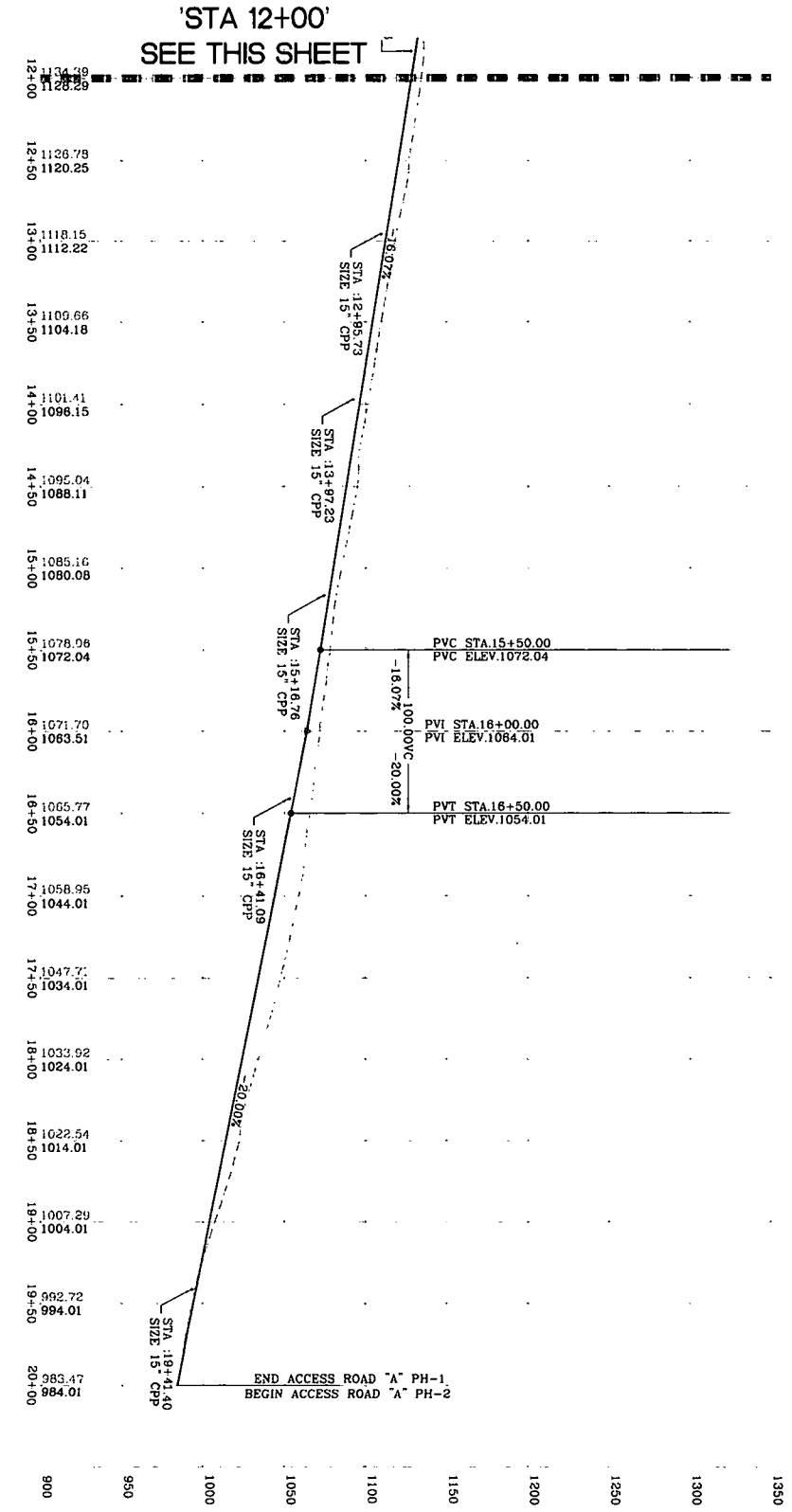
WELL PAD & ASSOCIATED PIT SECTIONS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

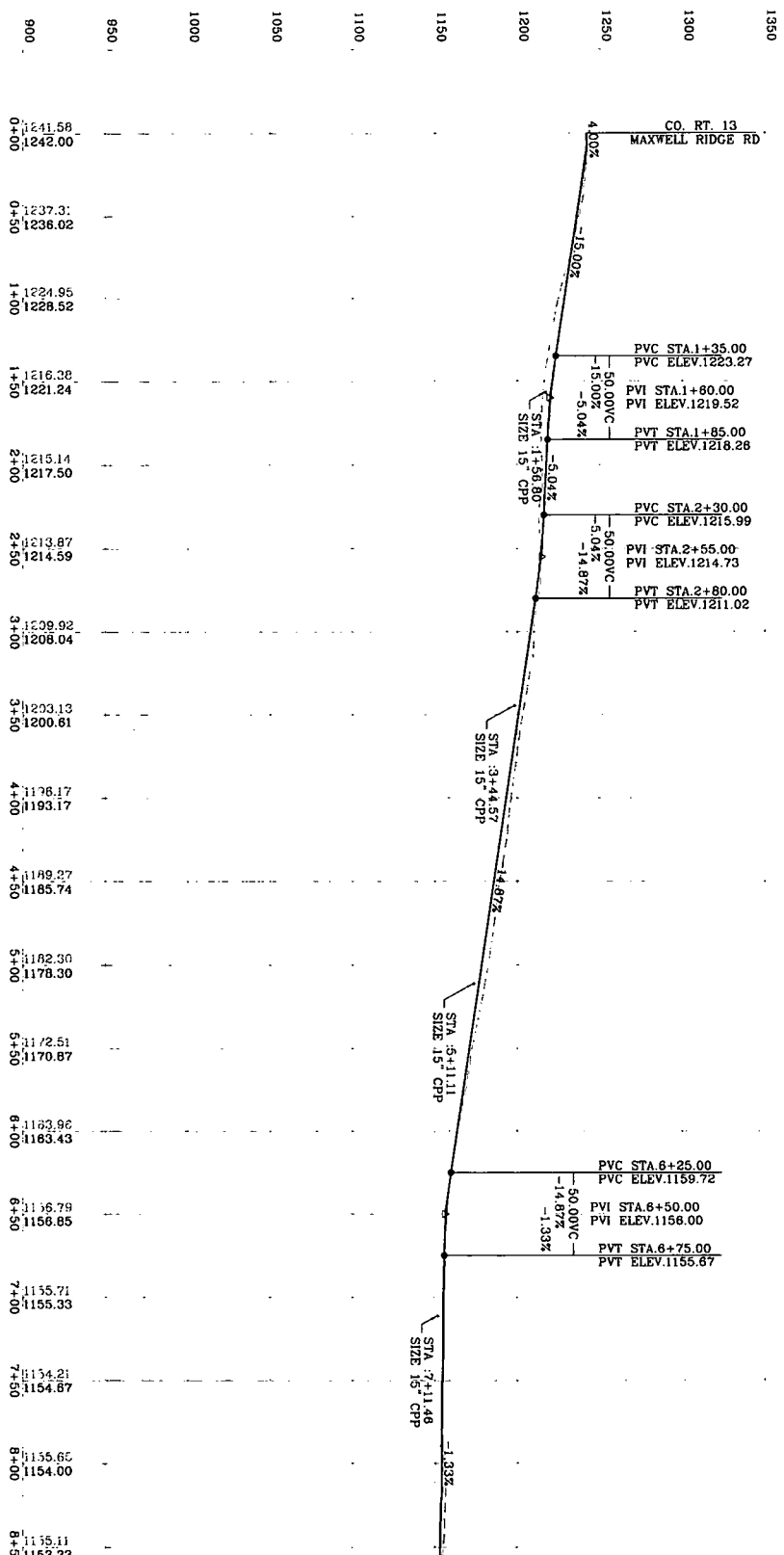
DATE:	11/04/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	9 OF 31
REV:	12/04/2013

ACCESS ROAD "A" PH-1 PROFILE



ACCESS ROAD "A" PH-1 PROFILE

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



SCALE: 1" = 50'

50 25 0 50 100

ACCESS ROAD "A" PH-1 PROFILE

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

CHRIS B. KYLE REGISTERED PROFESSIONAL ENGINEER STATE OF WEST VIRGINIA 15678

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(740) 671-9911
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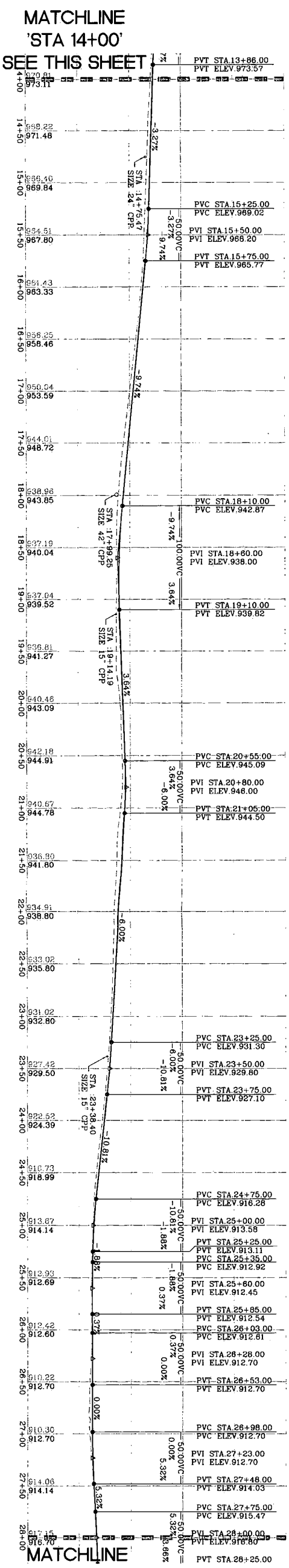
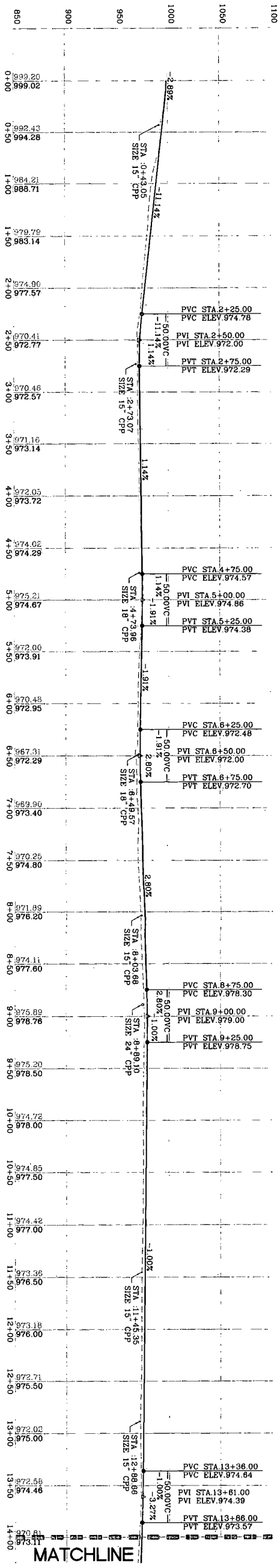
DATE:	11/04/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	10 OF 31
REV:	12/04/2013

ACCESS ROAD "B" PROFILE





ACCESS ROAD "B" PROFILE

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

DATE:	11/04/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	11 OF 31
REV:	12/04/2013

ACCESS ROAD "B" PROFILE

OXF 157

WEST UNION DISTRICT

DODDRIDGE COUNTY, WV

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

CHRIS B. KOCH, 19578, REGISTERED, PROFESSIONAL ENGINEER, STATE OF WEST VIRGINIA

12/04/2013

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55085 Dilles Bottom Road Shadyside, OH 43947 (740) 671-9911
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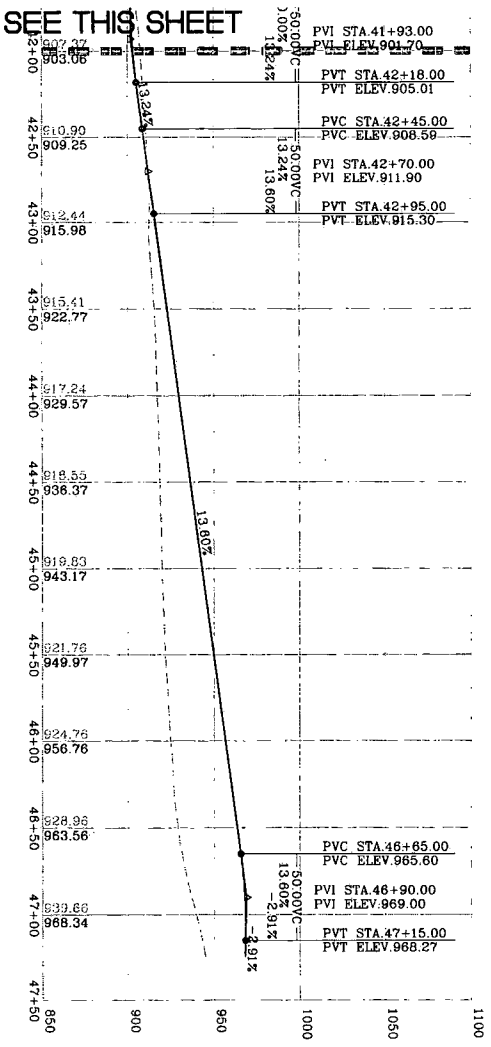
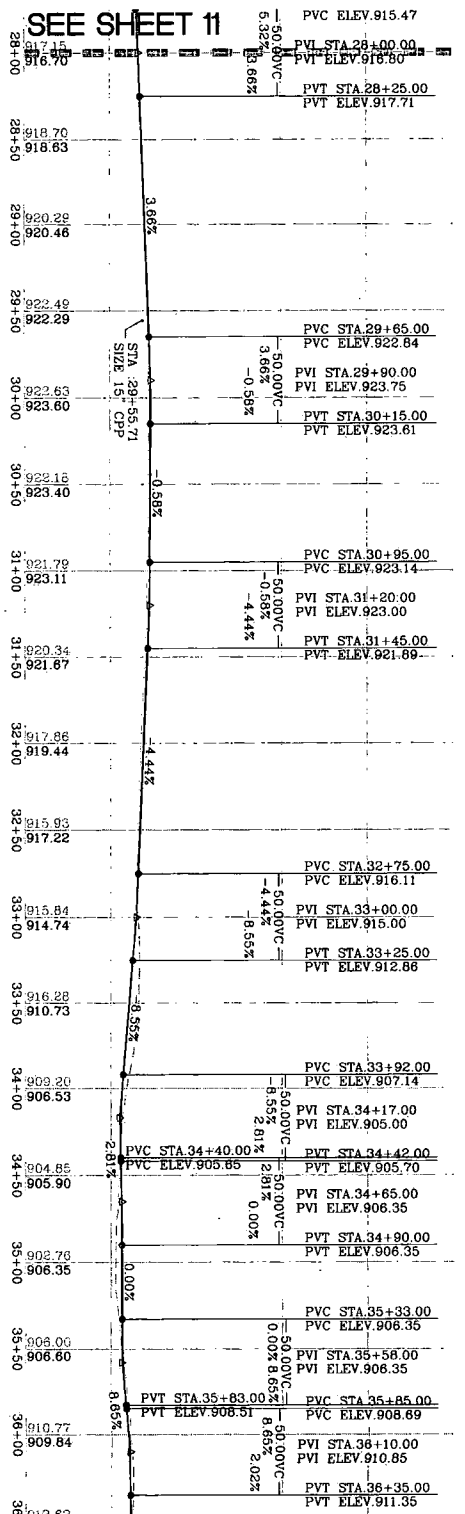
NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

MATCHLINE
'STA 42+00'
SEE THIS SHEET



MATCHLINE
'STA 28+00'
SEE SHEET 11



MATCHLINE
'STA 42+00'
SEE THIS SHEET

ACCESS ROAD "B" PROFILE

ACCESS ROAD "B" PROFILE

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

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CHRIS B. HOOD — 15278 — REGISTERED PROFESSIONAL ENGINEER — STATE OF WEST VIRGINIA

12/04/2013

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(304) 462-5634
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(740) 671-9911
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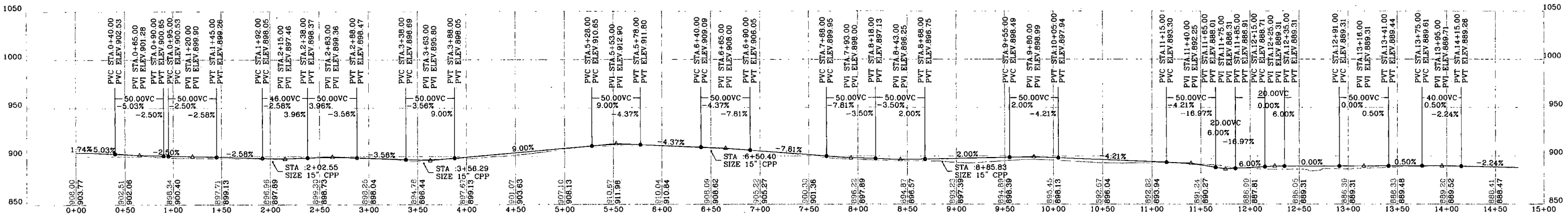
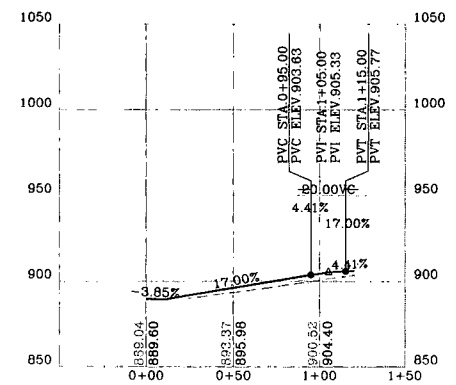
DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 12 OF 31
REV: 12/04/2013

ACCESS ROADS "C" & "D" PROFILE



ACCESS ROAD "C" PROFILE

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



ACCESS ROAD "D" PROFILE

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

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Ghent, WV 25843
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LOUIS S. KLIMA
REGISTERED
8678
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
12/04/2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ACCESS ROADS "C" & "D" PROFILE
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7869
SHEET 13 OF 31
REV: 12/04/2013

ROAD SECTIONS

ACCESS ROAD "A" PH-1 CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

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CHAS S. KING
REGISTERED
9578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

12/04/2013

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

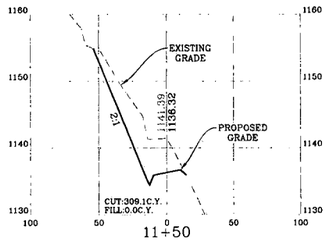
ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

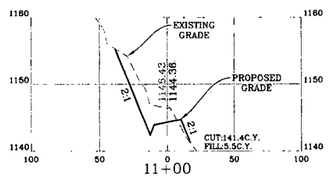
DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 14 OF 31
REV: 12/04/2013

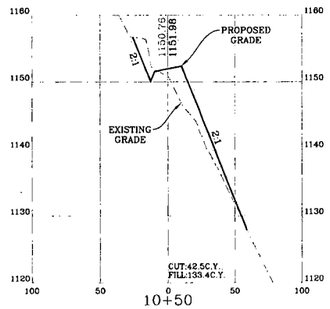
ROAD SECTIONS

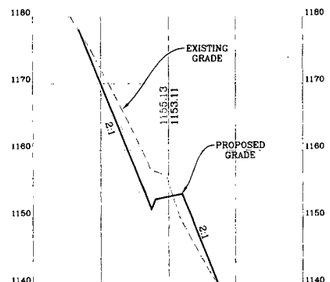
ACCESS ROAD "A" PH-1 CROSS-SECTIONS

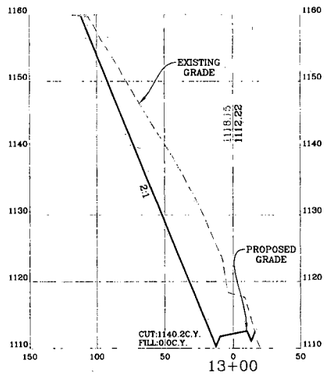
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

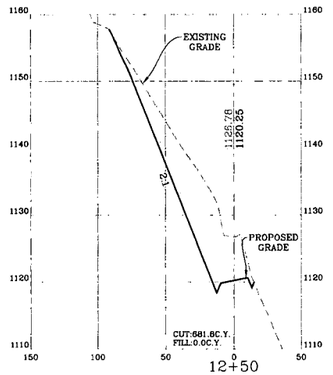


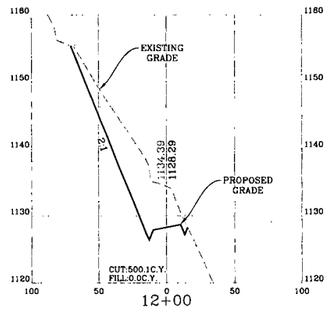


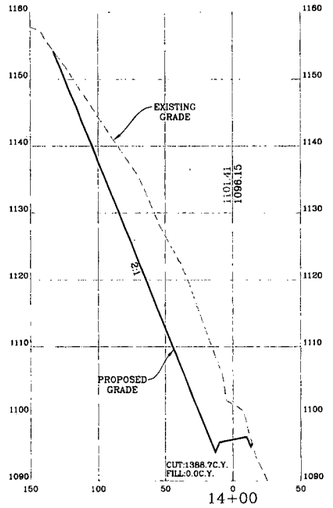


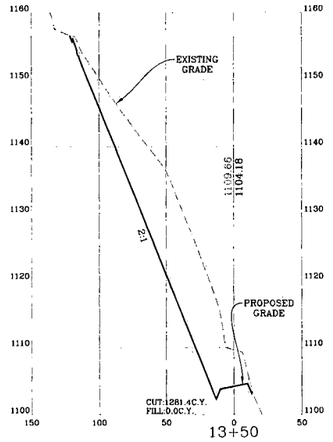


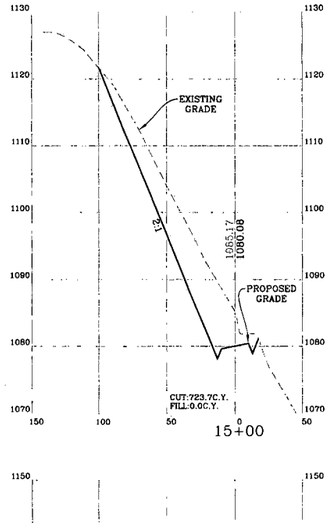


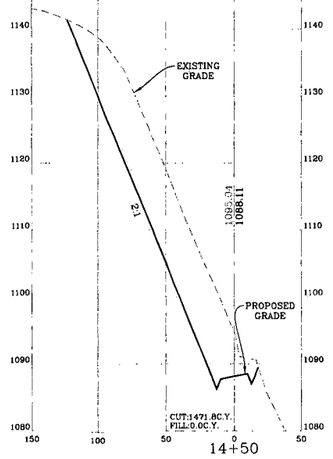


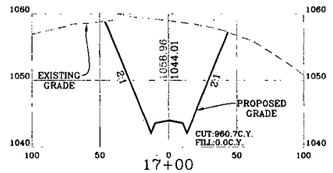


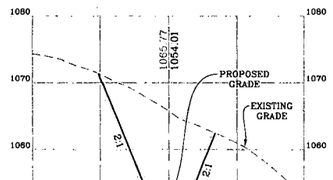


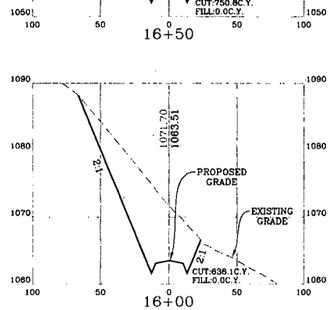


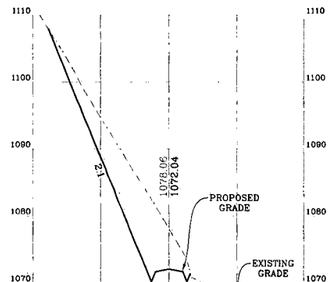


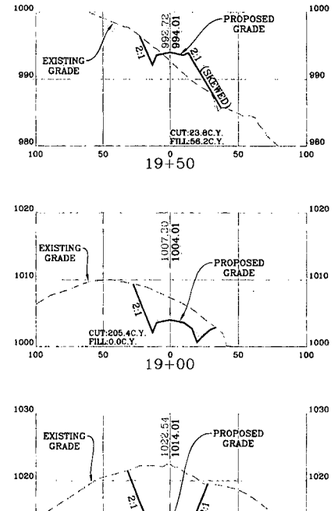


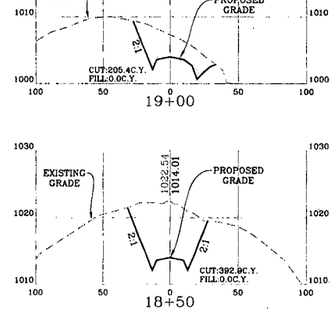


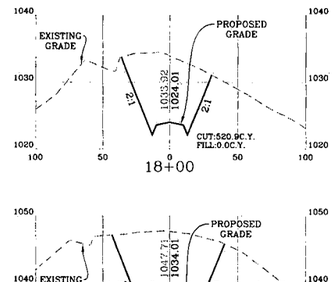












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PROFESSIONAL ENGINEER
12/04/2013

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ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 15 OF 31
REV: 12/04/2013

ROAD SECTIONS

ACCESS ROAD "B" CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

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ACCESS ROAD "B" CROSS-SECTIONS

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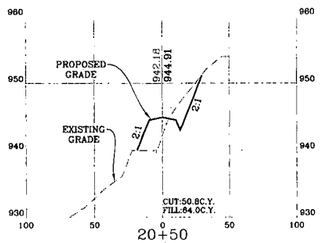

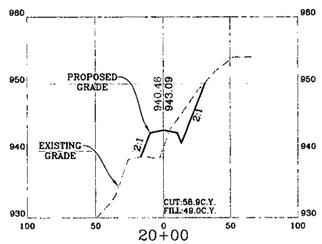

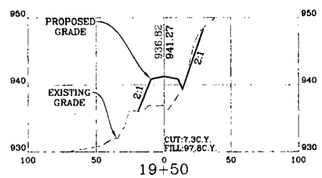

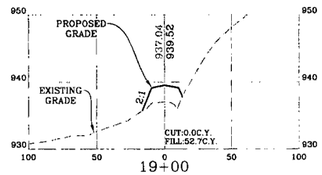

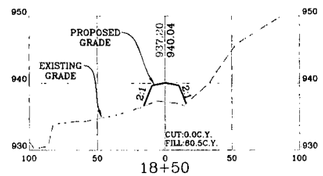

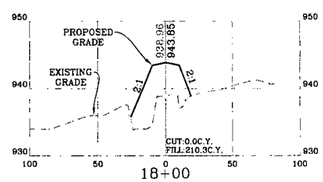

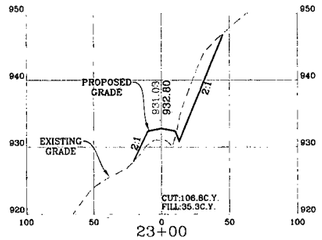

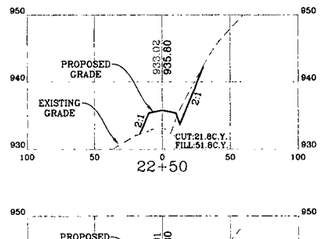

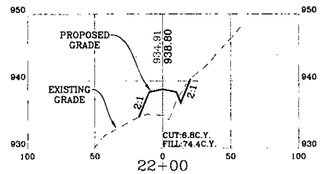

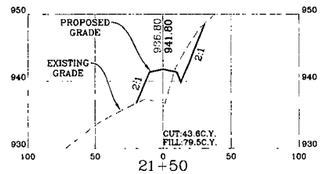

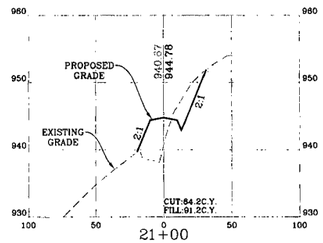

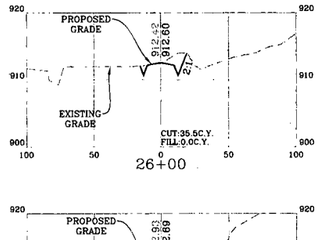

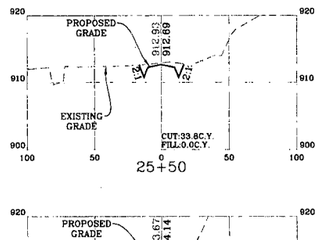

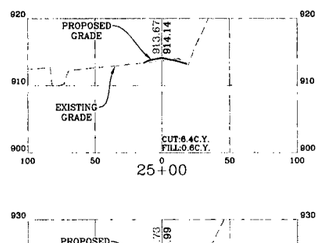

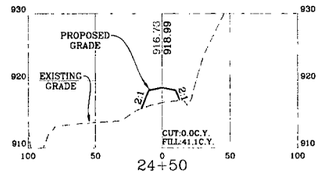

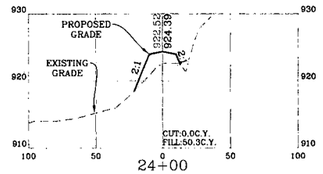

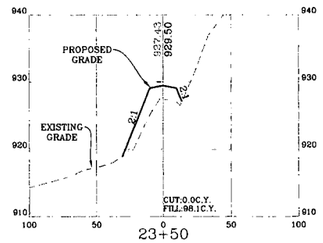

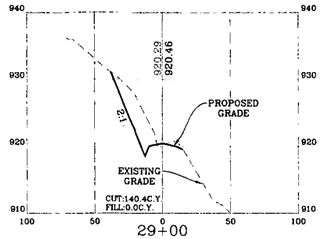

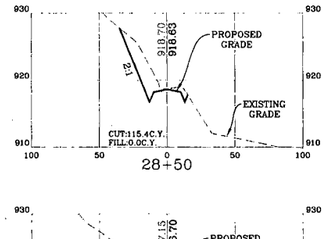

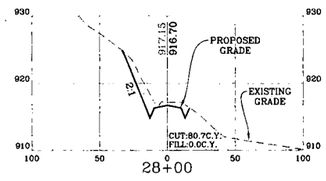

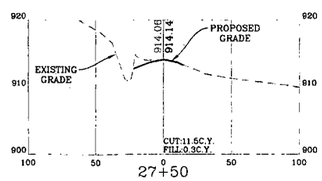

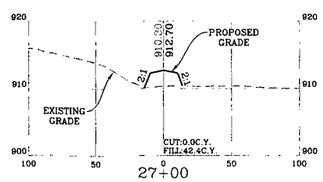

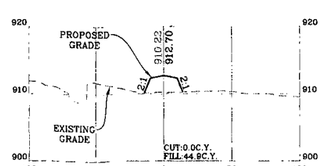

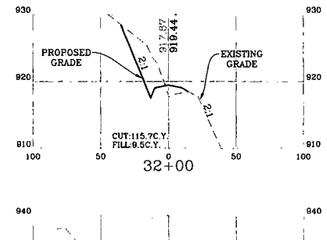

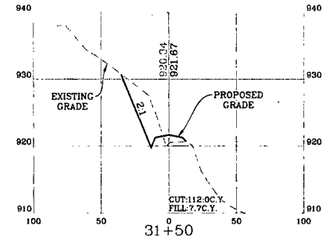

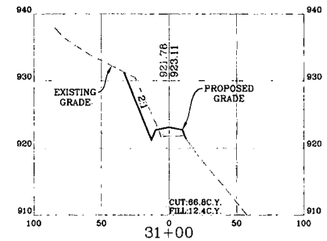

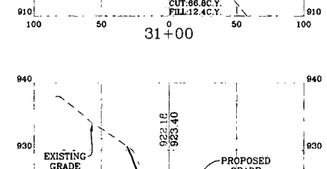

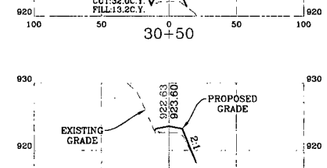

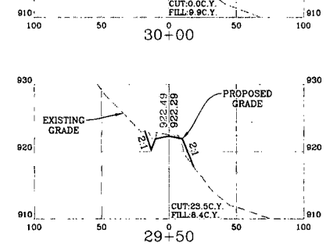

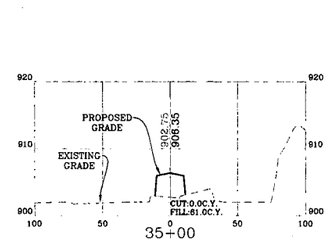

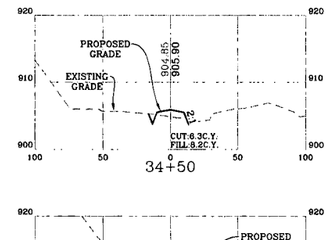

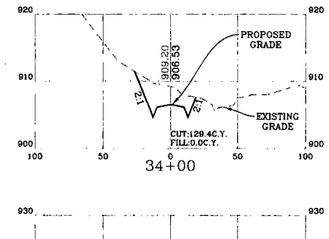

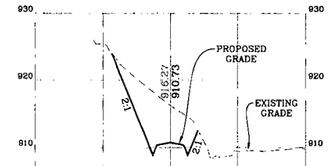

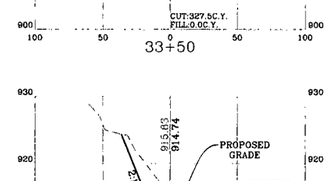

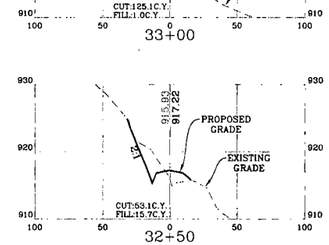

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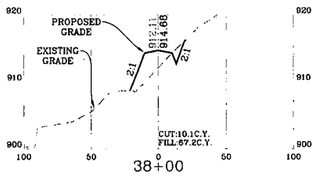

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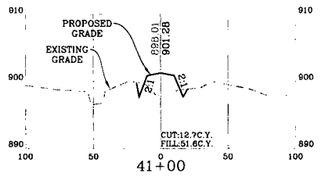

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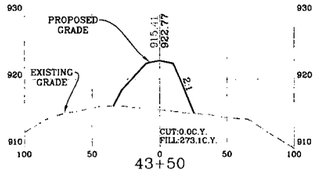

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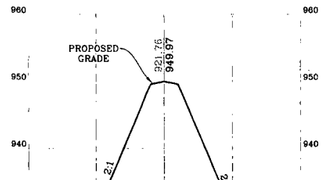

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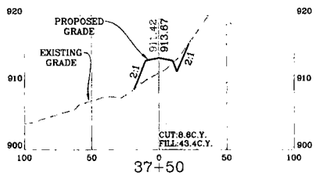

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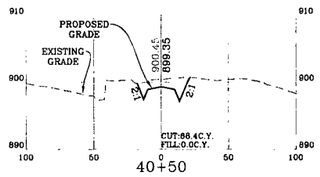

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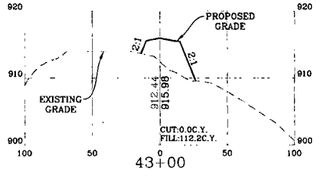

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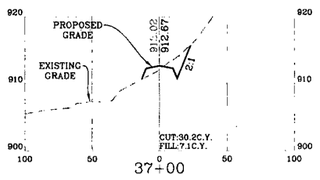

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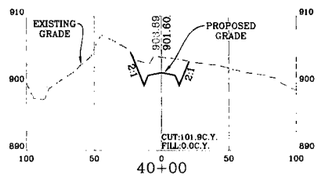

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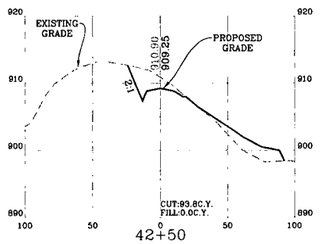

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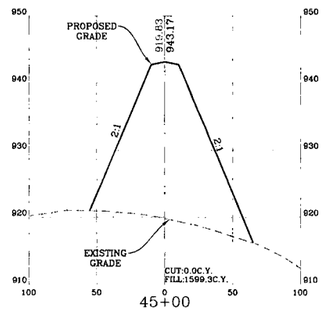

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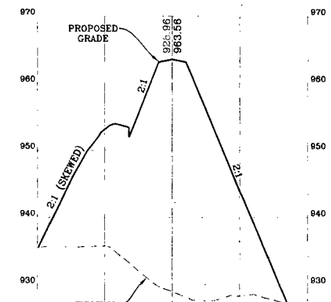

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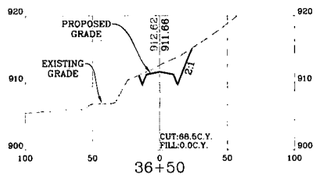

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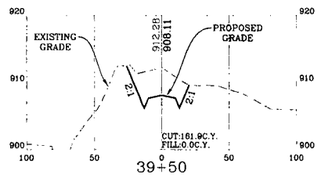

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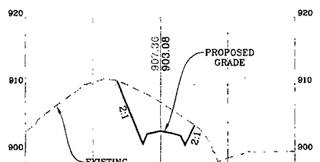

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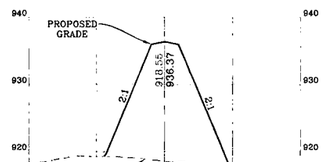

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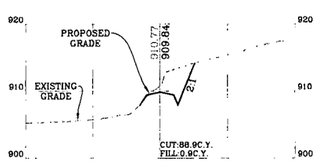

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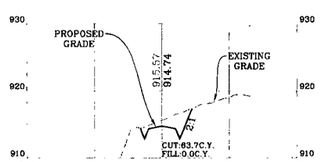

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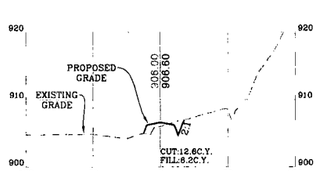

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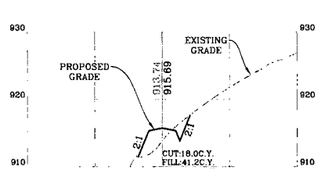

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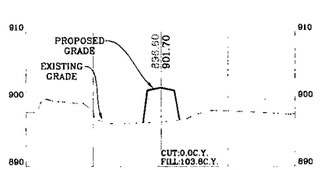

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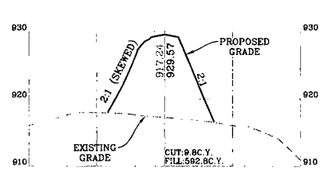

44+00

46+00

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CHRIS S. KUNZ
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/04/2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

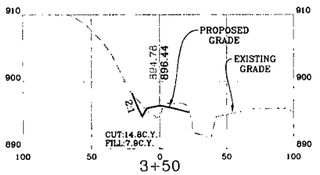
ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

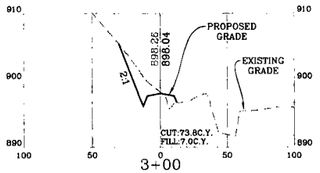
DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7669
SHEET 18 OF 31
REV: 12/04/2013

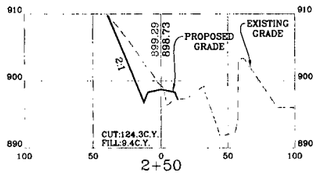
ROAD SECTIONS

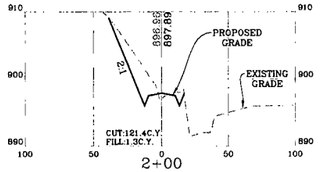
ACCESS ROAD "C" CROSS-SECTIONS

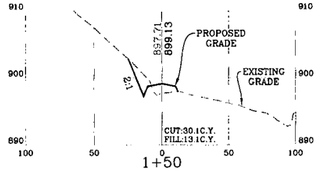
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

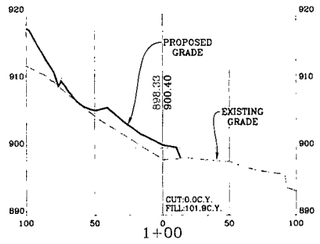


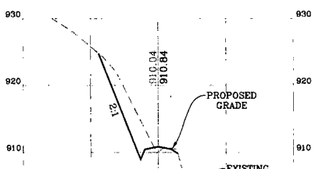


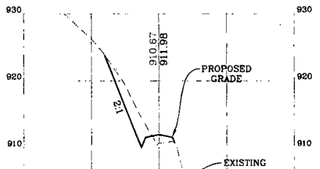


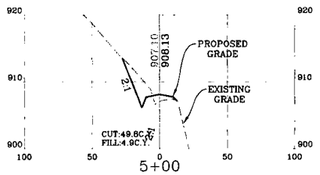


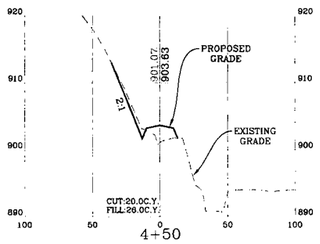


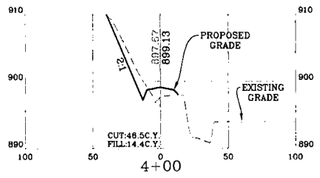


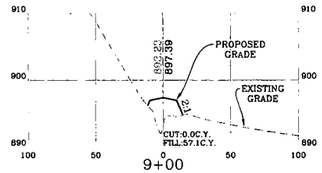


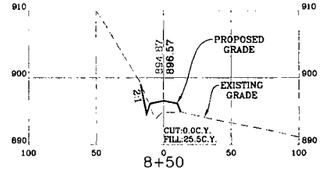


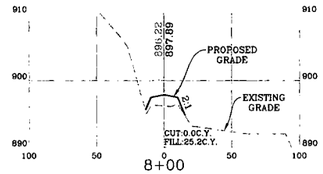


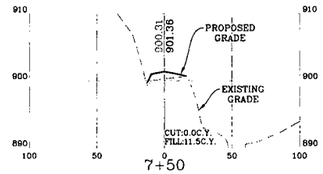


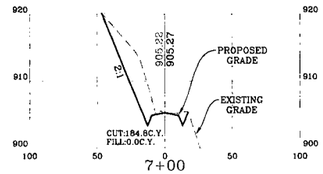


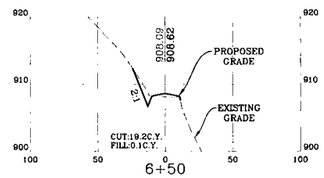


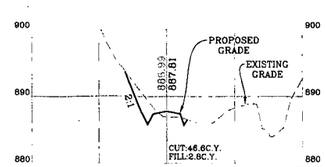


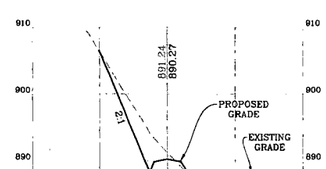


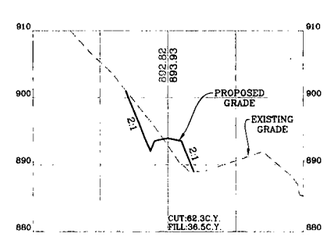


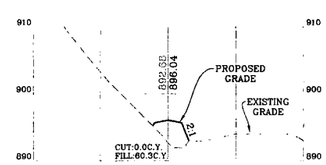


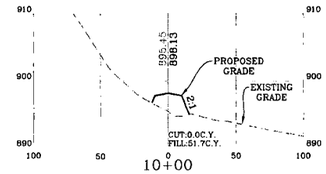


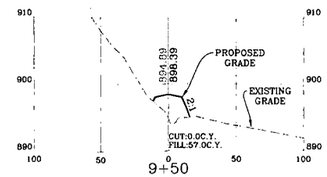


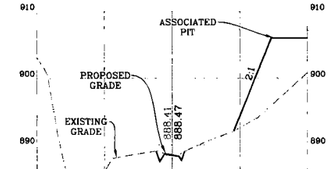


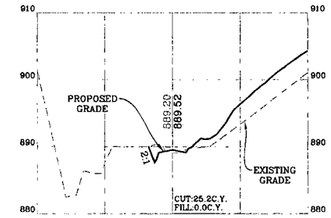


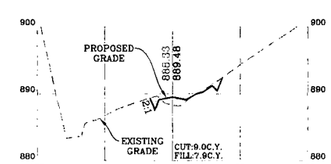


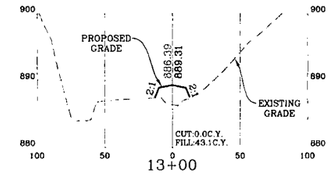


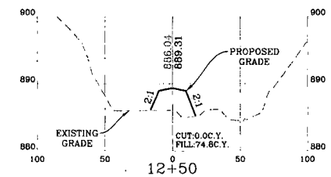






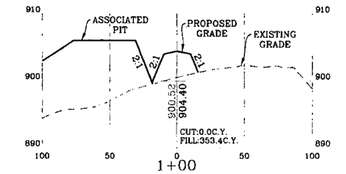


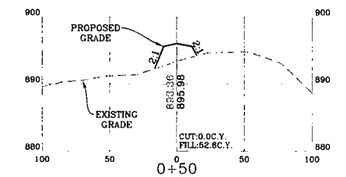




ACCESS ROAD "D" CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'





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JUSTUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/04/2013

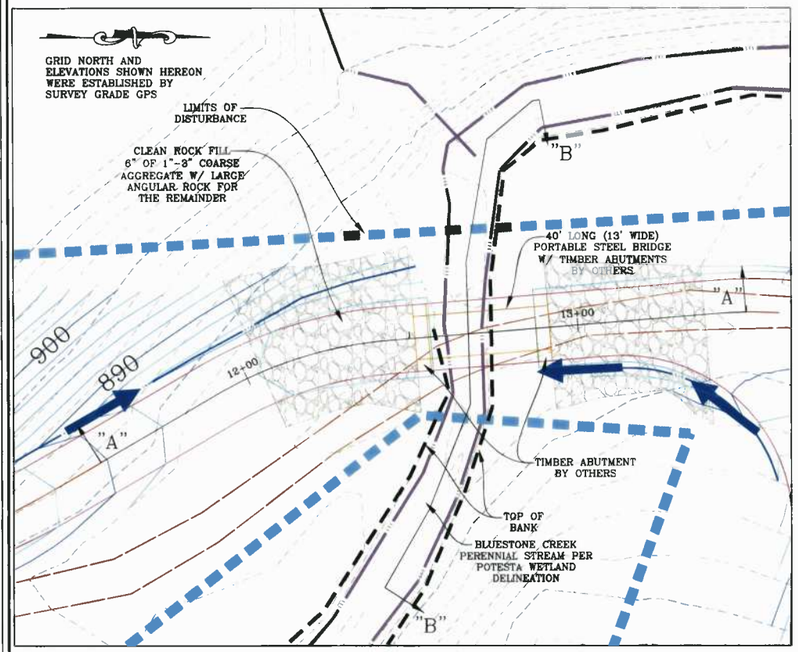
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC
FOR: EQT PRODUCTION COMPANY

ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 19 OF 31
REV: 12/04/2013

TEMPORARY STREAM CROSSING DETAILS

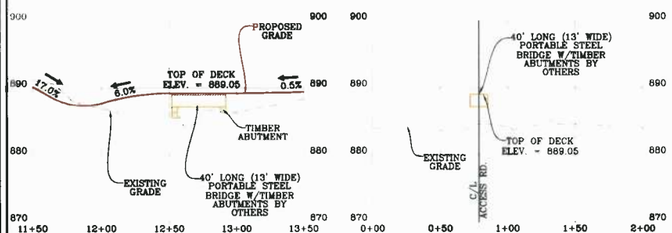
STREAM CROSSING "A" DETAILS



NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "A".

20 10 0 20 40
SCALE: 1" = 20'

STREAM CROSSING "A" SECTIONS



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

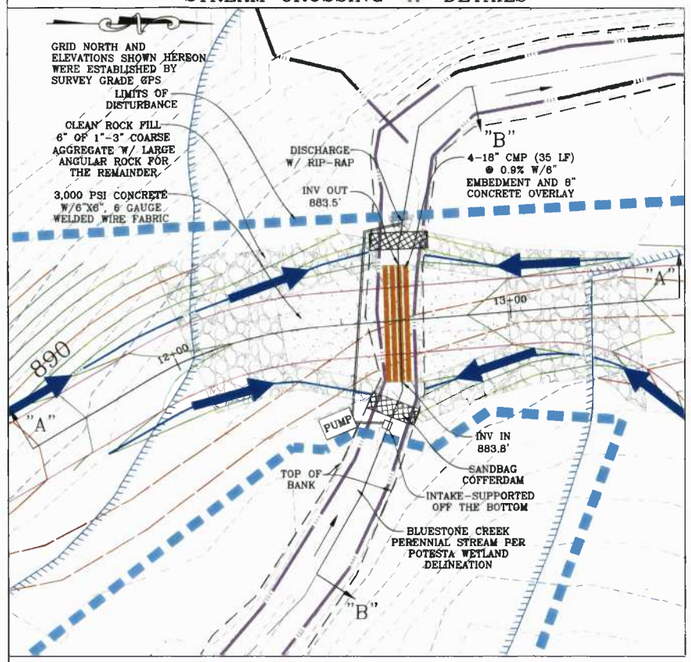
CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

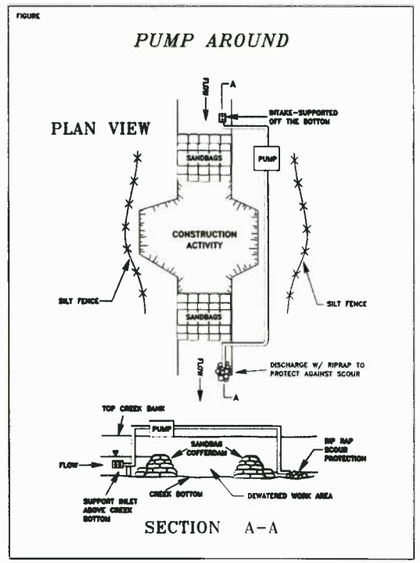
1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

STREAM CROSSING "A" DETAILS



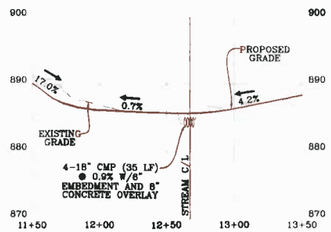
20 10 0 20 40
SCALE: 1" = 20'



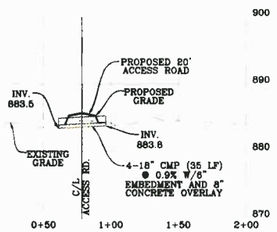
PUMP AROUND NOTES:

1) CONSTRUCTION SHOULD BE PERFORMED DURING LOW FLOW PERIODS.
2) PUMP(S) SHOULD BE SUFFICIENTLY LARGE TO PUMP THE ENTIRE STREAM FLOW AROUND THE SITE.
3) THE COFFERDAM CONSTRUCTED MUST BE IMPERVIOUS TO WATER.
4) THE INLET OF THE PUMP(S) IS TO BE SUSPENDED ABOVE THE STREAMBED IN ORDER TO PREVENT SUCKING MUD AND SEDIMENT.
5) THE DISCHARGE POINT MUST BE STABILIZED WITH ROCK TO DISPERSE THE ENERGY AND PREVENT EROSION.

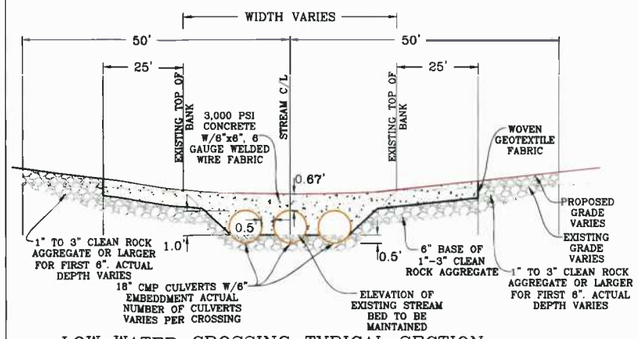
STREAM CROSSING "A" SECTIONS



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



CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



LOW WATER CROSSING TYPICAL SECTION
NOT TO SCALE

GENERAL STREAM CROSSING NOTES:

1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
2) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
3) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
4) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
8) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
9) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
10) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

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3604 Ohio Avenue Road
Steubenville, OH 43952
(740) 571-0911
HOMESITE, INTERIOR, PLANTS

CHRIS S. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

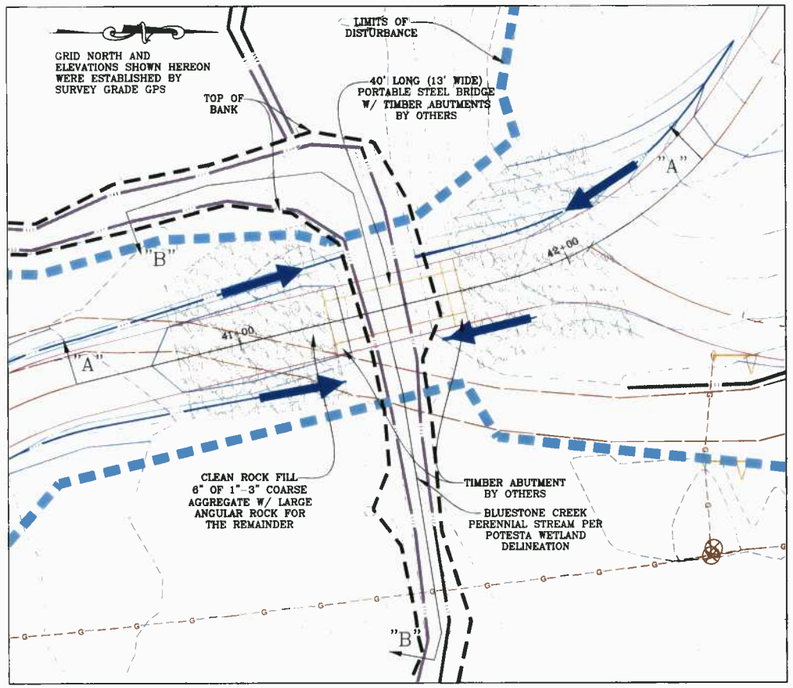
THIS DOCUMENT WAS PREPARED BY NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7869
SHEET	20 OF 31
REV:	12/04/2013

TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "B" DETAILS

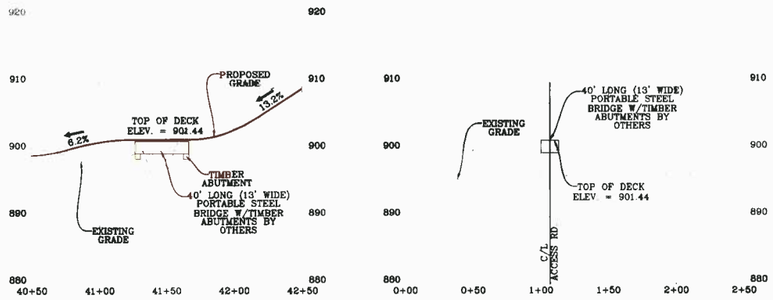


20 10 0 20 40

SCALE: 1" = 20'

NOTE:
1) SEE SHEET 20 FOR PUMP AROUND NOTES AND DETAILS
2) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
3) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "B".

STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

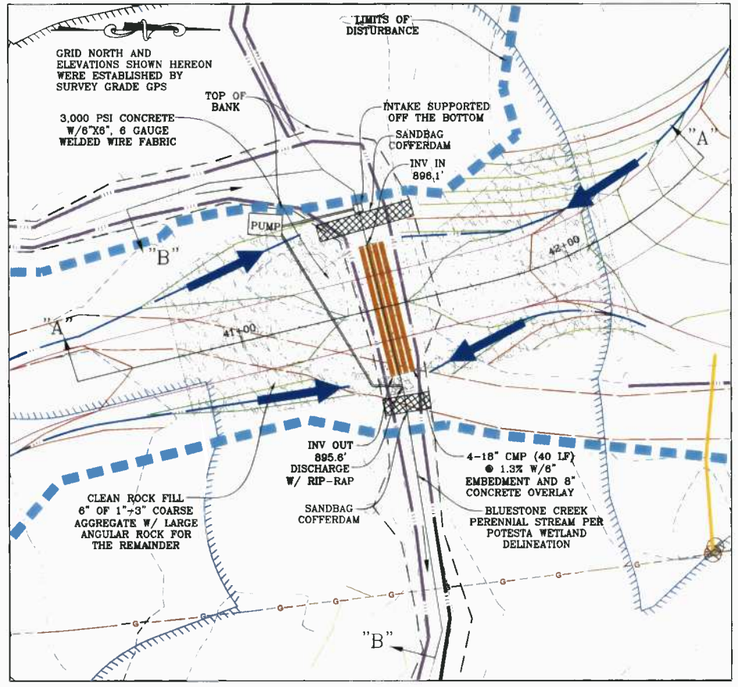
CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:
1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

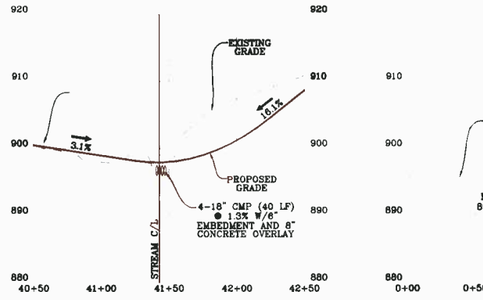
STREAM CROSSING "B" DETAILS



20 10 0 20 40

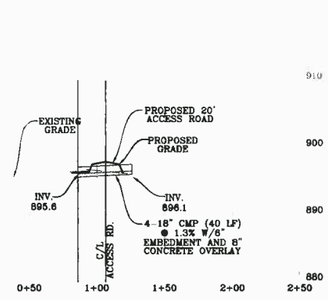
SCALE: 1" = 20'

STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:
1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
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3) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
4) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
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7) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
8) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
9) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
10) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

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(740) 671-0911
HONESTY-INTEGRITY-QUALITY

CYRUS B. KUMP
REGISTERED
19578
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

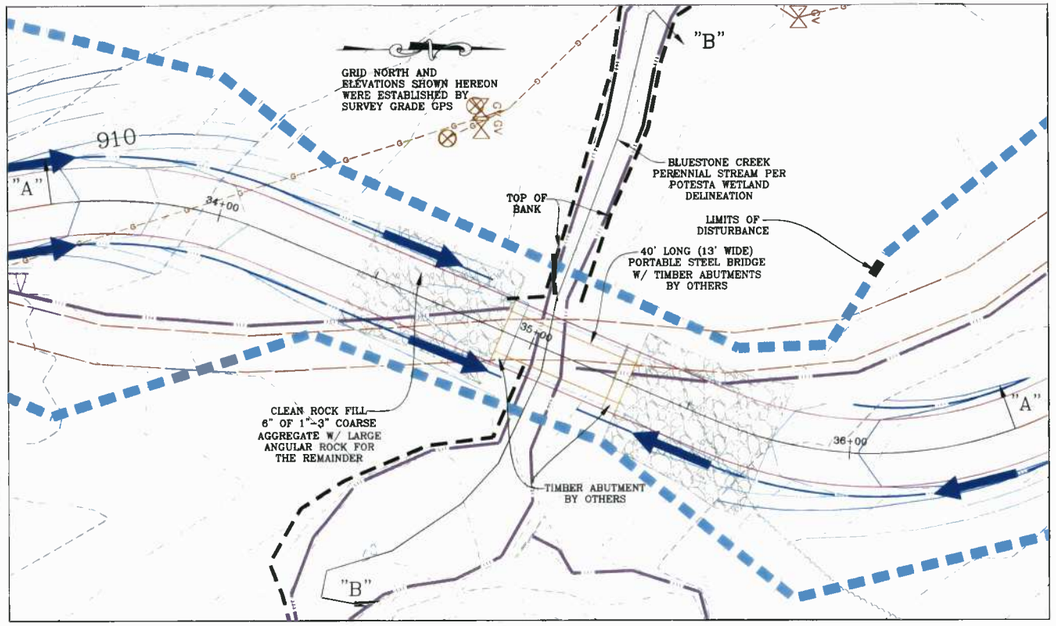
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 21 OF 31
REV: 12/04/2013

TEMPORARY STREAM CROSSING DETAILS

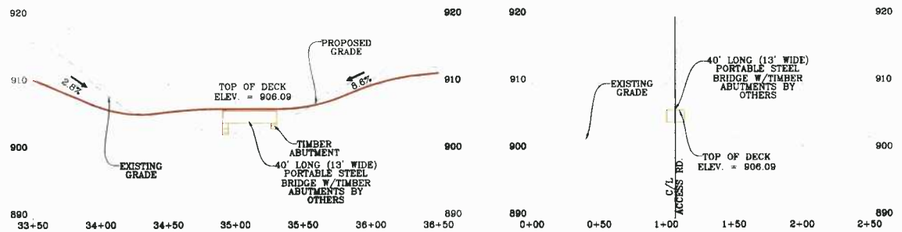
STREAM CROSSING "C" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

STREAM CROSSING "C" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
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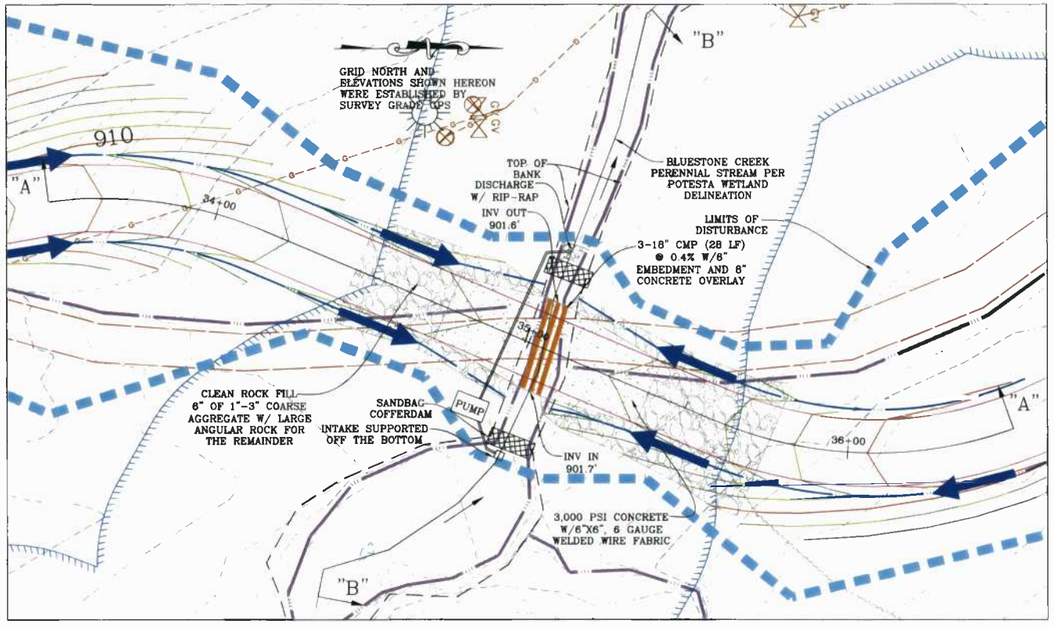
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

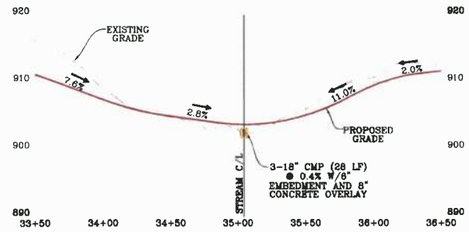
STREAM CROSSING "C" DETAILS



20 10 0 20 40

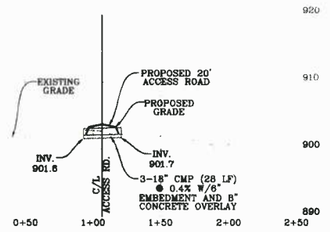
SCALE: 1" = 20'

STREAM CROSSING "C" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

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GENERAL STREAM CROSSING NOTES:

1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
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3) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
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8) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
9) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
10) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

NOTE:

1) SEE SHEET 20 FOR PUMP AROUND NOTES AND DETAILS
2) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
3) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "B".

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SLS
225 West Main St. P.O. Box 190 Salem, WV 26426
4424 Ohio Pomeroy Road Shadyside, OH 43947 (740) 877-9911
(304) 782-3634 HORIZONTAL INTERVALS: 2' OR 10'

CYRUS S. FUMO REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013

SCALE: N/A

DESIGNED BY: CSK

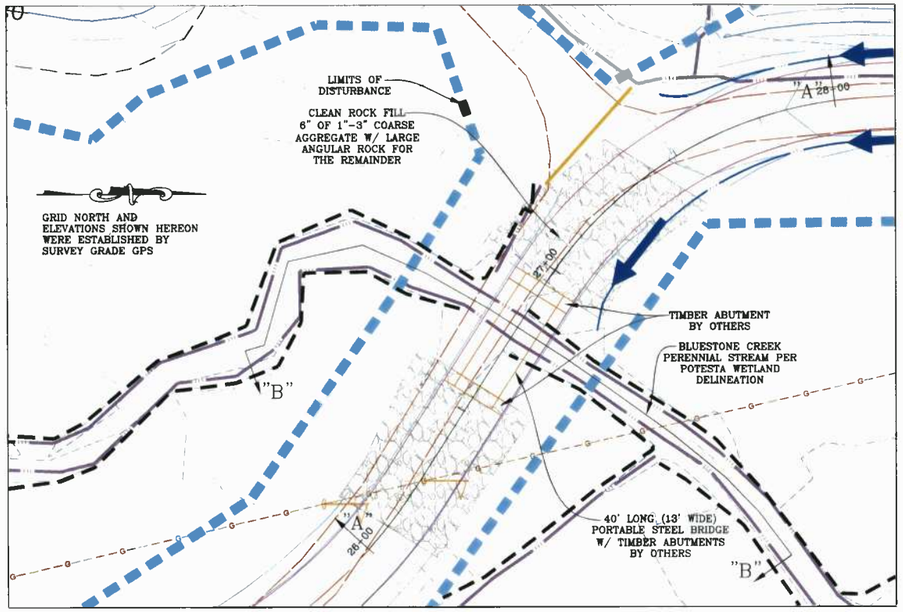
FILE NO. 7869

SHEET 22 OF 31

REV: 12/04/2013

TEMPORARY STREAM CROSSING DETAILS

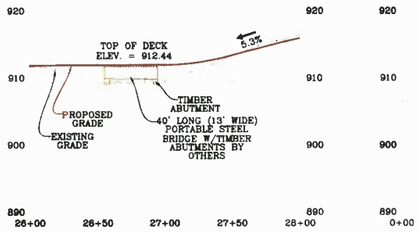
STREAM CROSSING "D" DETAILS



20 10 0 20 40

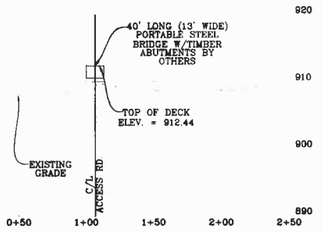
SCALE: 1" = 20'

STREAM CROSSING "D" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

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GENERAL TEMPORARY STREAM CROSSING NOTES:

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6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
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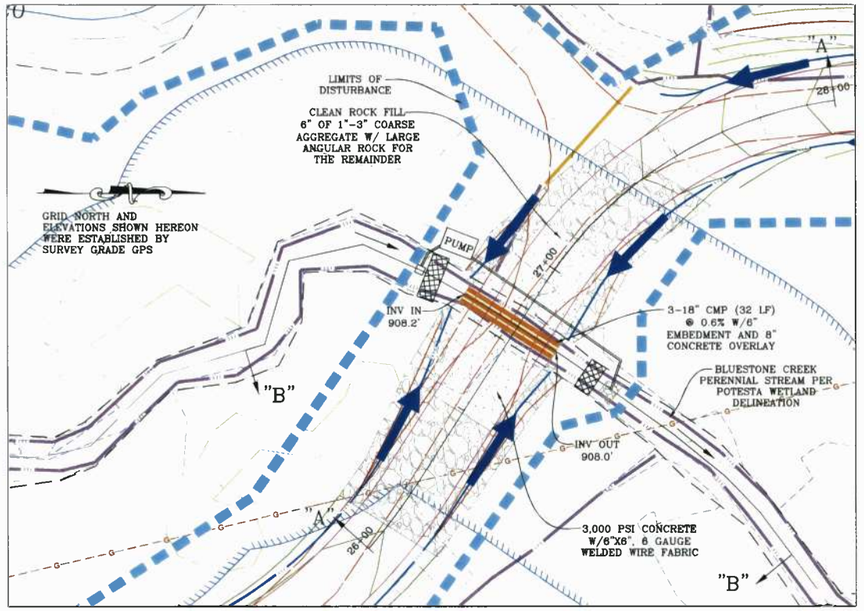
PERMANENT STREAM CROSSING DETAILS

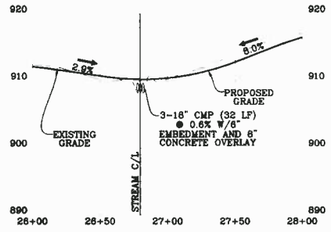
STREAM CROSSING "D" DETAILS



20 10 0 20 40

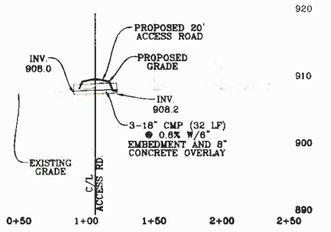
SCALE: 1" = 20'

STREAM CROSSING "D" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

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9) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
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NOTE:

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(740) 671-9911
HOUSTON, PATTERSON, QUALITY

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STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS

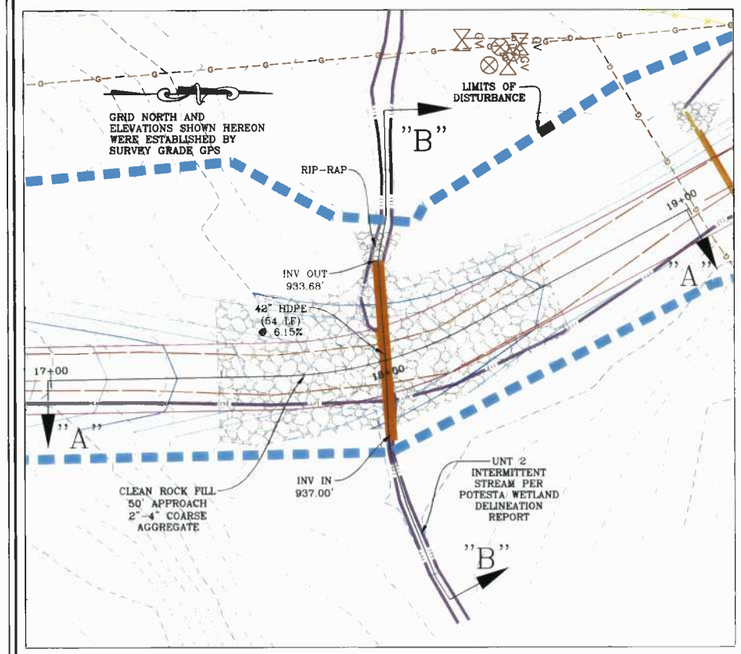
OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 23 OF 31
REV: 12/04/2013

STREAM CROSSING DETAILS

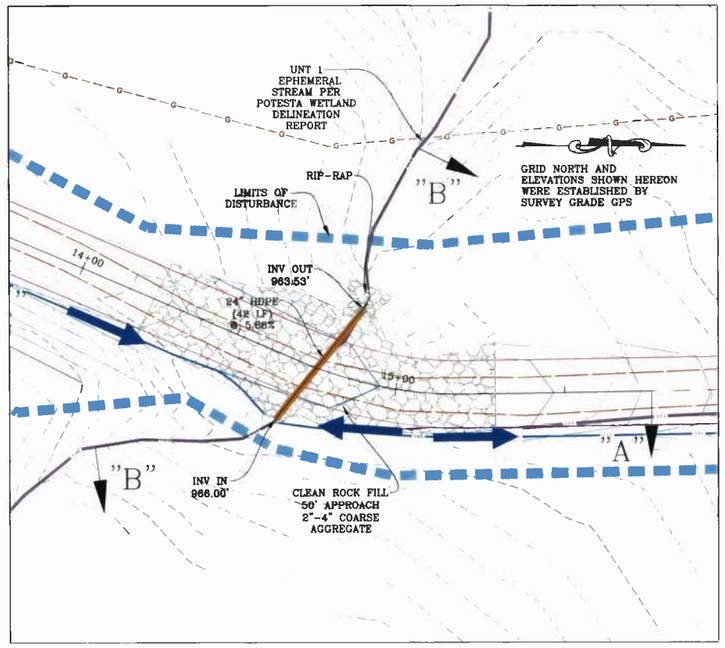
STREAM CROSSING "E" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

STREAM CROSSING "F" DETAILS



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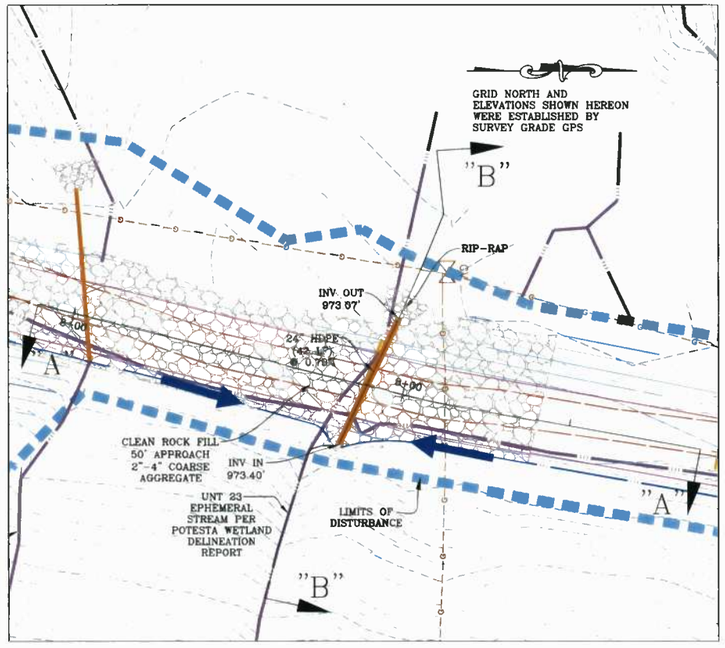
SCALE: 1" = 20'

STREAM CROSSING "G" DETAILS



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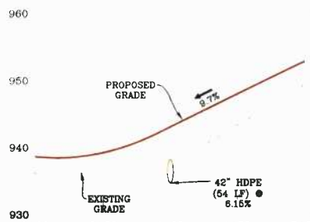
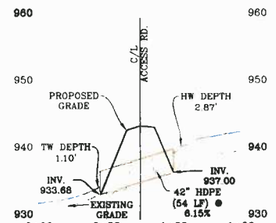
SCALE: 1" = 20'

STREAM CROSSING "E" SECTIONS



CROSS SECTION "A-A"

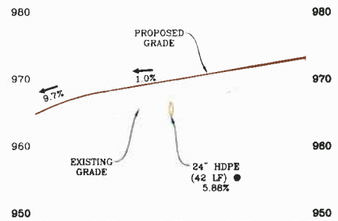
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

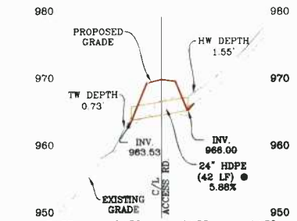
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "F" SECTIONS



CROSS SECTION "A-A"

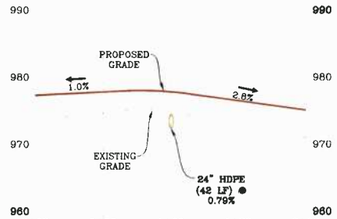
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

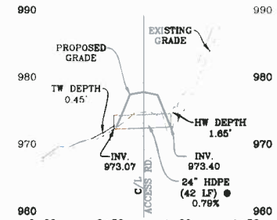
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "G" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
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12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "E", "F" & "G".

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HOBBS, INTERSTATE, PLUM CT.
220 West Main St.
P.O. Box 189
New Martinsville, WV 26155
(304) 462-8834

CHRIS B. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

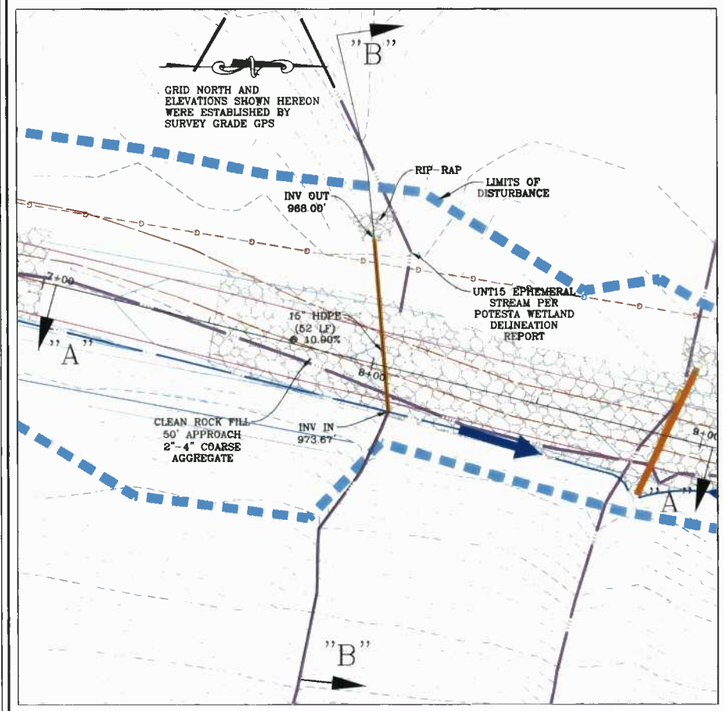
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 24 OF 31
REV: 12/04/2013

STREAM CROSSING DETAILS

STREAM CROSSING "H" DETAILS



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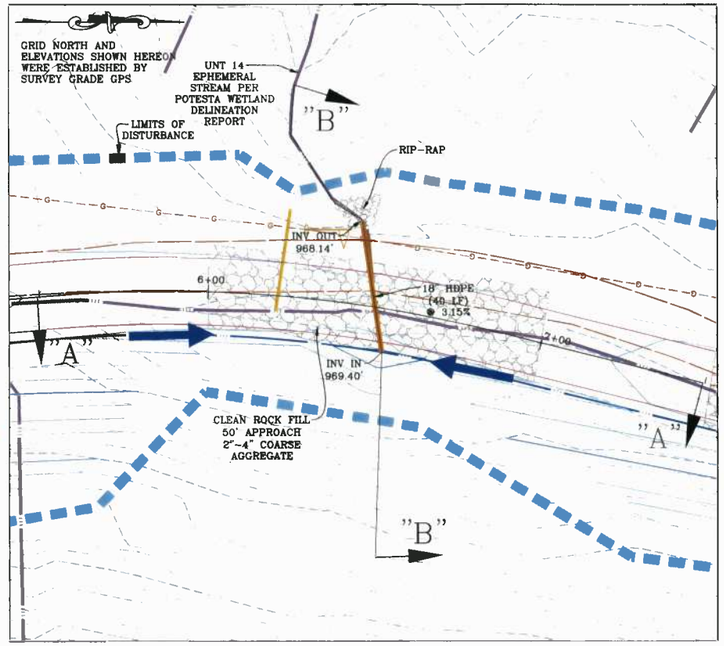
SCALE: 1" = 20'

STREAM CROSSING "I" DETAILS



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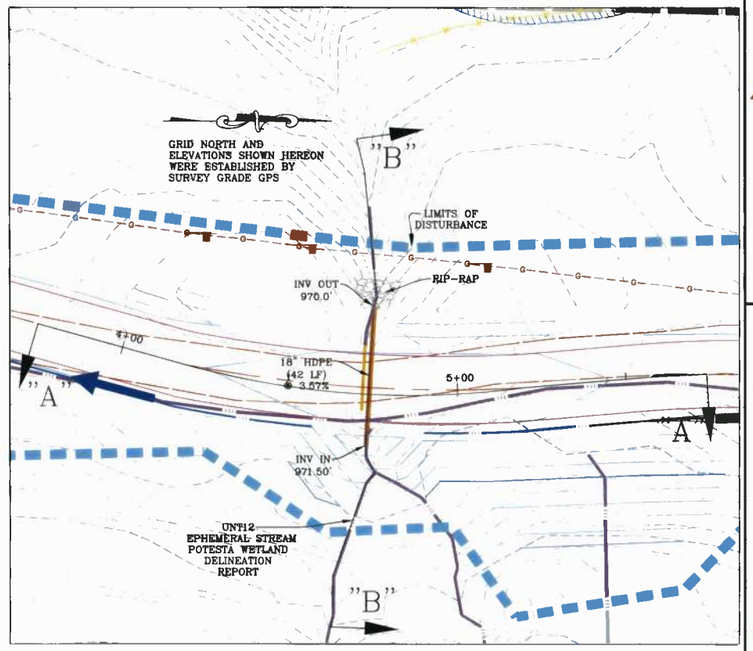
SCALE: 1" = 20'

STREAM CROSSING "J" DETAILS



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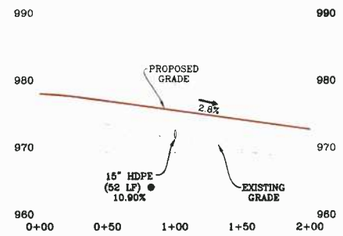
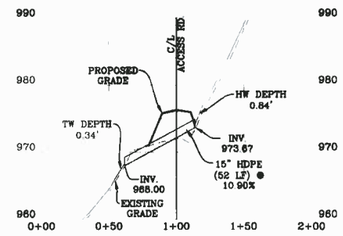
SCALE: 1" = 20'

STREAM CROSSING "H" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

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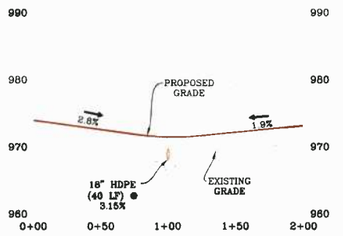

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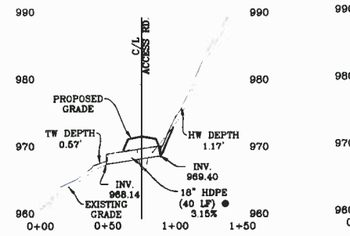

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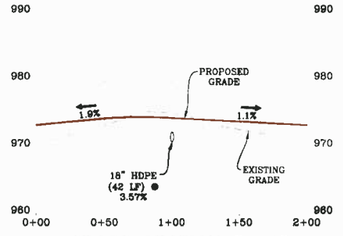

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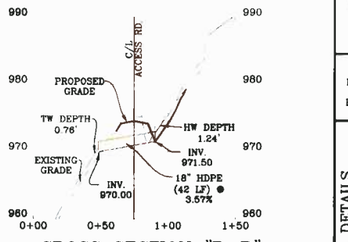

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Telephone: (888) 662-4185 | www.NavitusEng.com

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229 West Main St. P.O. Box 190 Buckhannon, WV 26201 (304) 472-3614
3565 Elliott Bottom Road Shinnston, OH 43967 (740) 671-8811
HORIZONTAL DATUM NAD 27

CYRUS B. KING REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	25 OF 31
REV:	12/04/2013

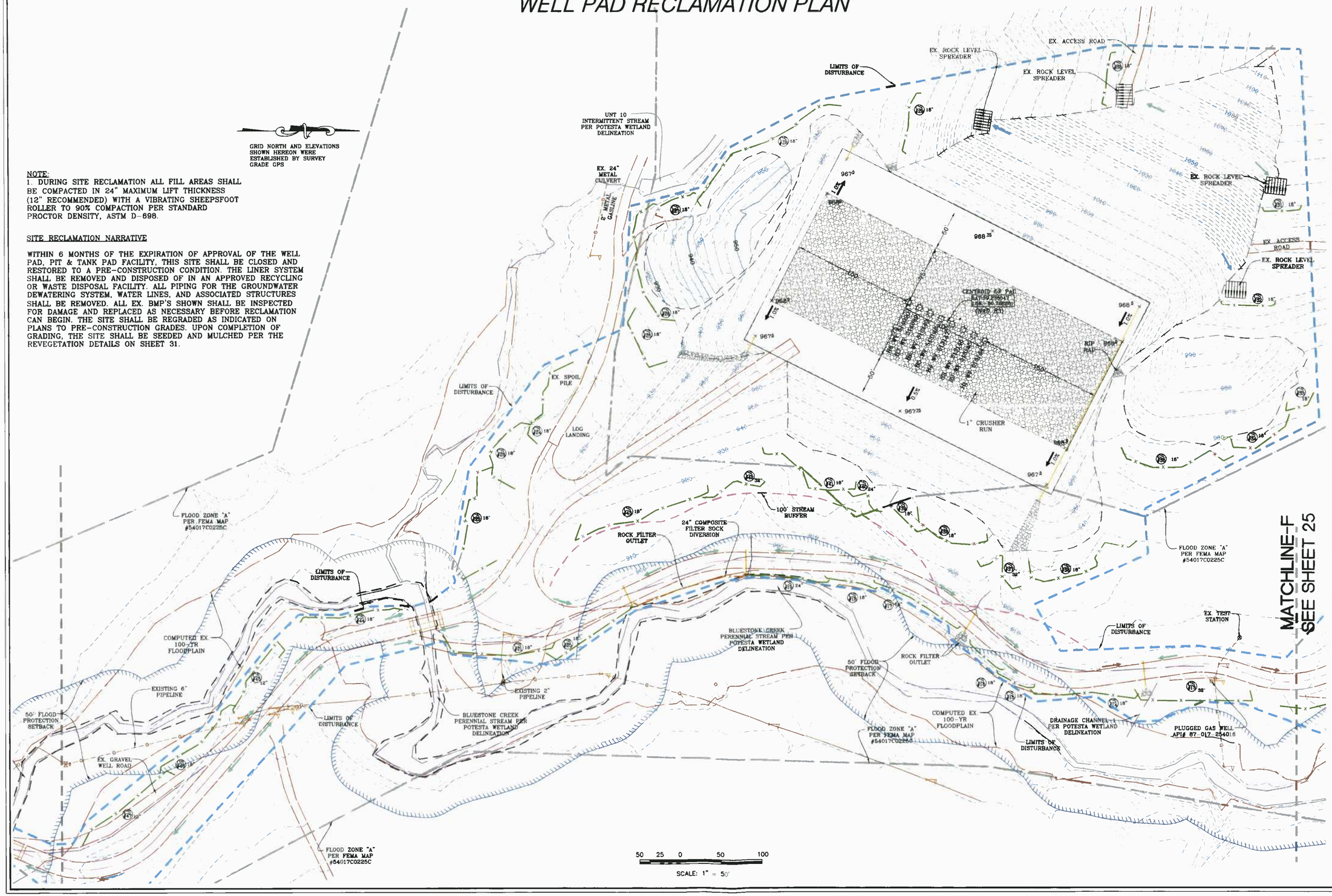
WELL PAD RECLAMATION PLAN

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

NOTE:
1. DURING SITE RECLAMATION ALL FILL AREAS SHALL BE COMPACTED IN 24" MAXIMUM LIFT THICKNESS (12" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 90% COMPACTION PER STANDARD PROCTOR DENSITY, ASTM D-698.

SITE RECLAMATION NARRATIVE

WITHIN 6 MONTHS OF THE EXPIRATION OF APPROVAL OF THE WELL PAD, PIT & TANK PAD FACILITY, THIS SITE SHALL BE CLOSED AND RESTORED TO A PRE-CONSTRUCTION CONDITION. THE LINER SYSTEM SHALL BE REMOVED AND DISPOSED OF IN AN APPROVED RECYCLING OR WASTE DISPOSAL FACILITY. ALL PIPING FOR THE GROUNDWATER DEWATERING SYSTEM, WATER LINES, AND ASSOCIATED STRUCTURES SHALL BE REMOVED. ALL EX. BMP'S SHOWN SHALL BE INSPECTED FOR DAMAGE AND REPLACED AS NECESSARY BEFORE RECLAMATION CAN BEGIN. THE SITE SHALL BE REGRADED AS INDICATED ON PLANS TO PRE-CONSTRUCTION GRADES. UPON COMPLETION OF GRADING, THE SITE SHALL BE SEEDED AND MULCHED PER THE REVEGETATION DETAILS ON SHEET 31.



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225 West Main St.
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Buckhannon, WV 26201
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56061 Dues Bottom Road
Staubpike, OH 43947
(740) 971-9911
HORIZONTAL DATUM NAD83

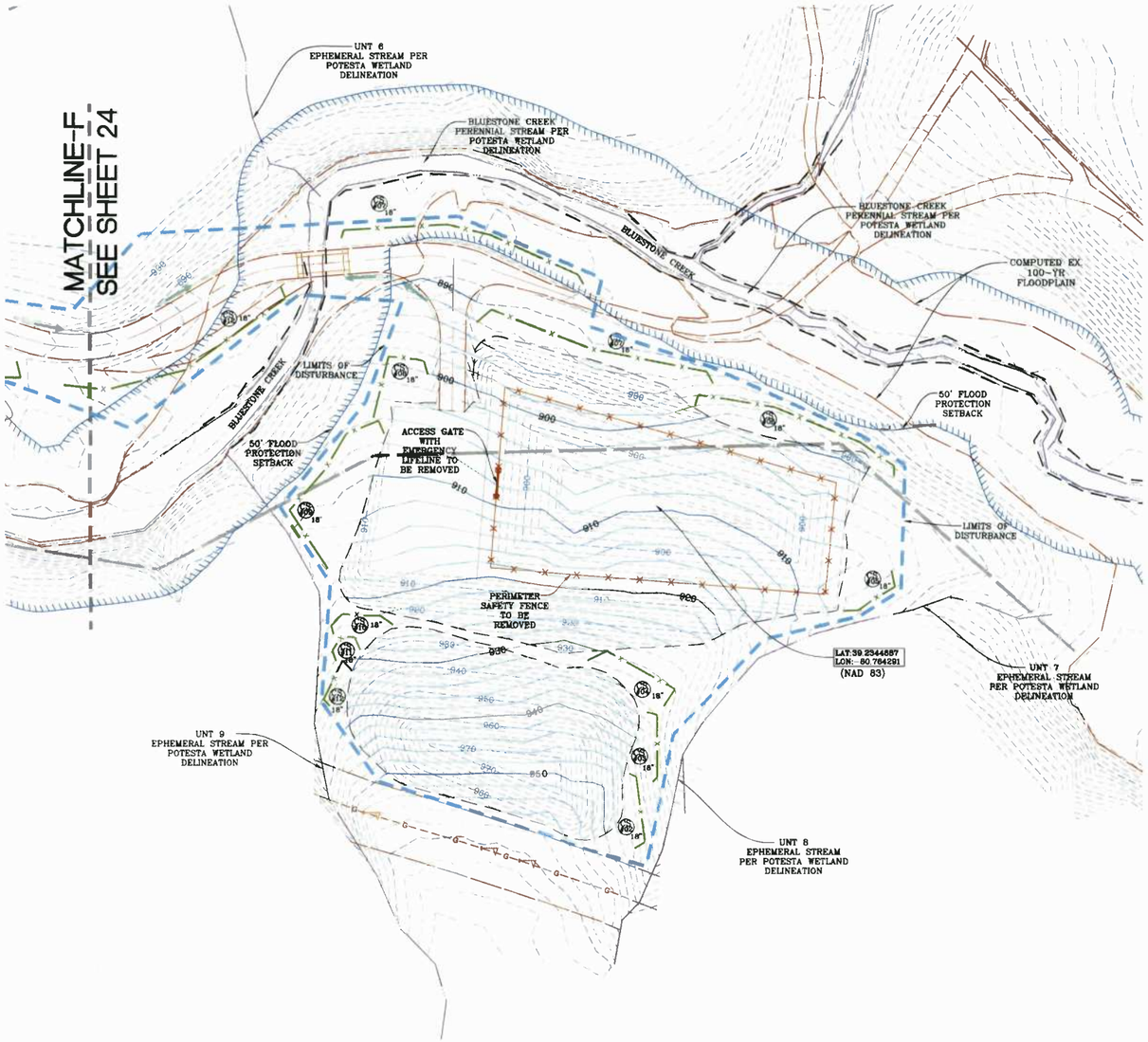
REGISTERED 19576 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

WELL PAD RECLAMATION PLAN
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7689
SHEET 26 OF 31
REV: 12/04/2013

ASSOCIATED PIT RECLAMATION PLAN



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5606 Dillon Bottom Road
Shadyside, OH 43947
(740) 671-0611
MONROE, INTERNET, CHARLESTON

CRAIG S. KIMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

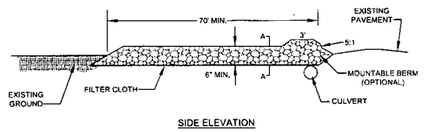
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ASSOCIATED PIT RECLAMATION PLAN
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

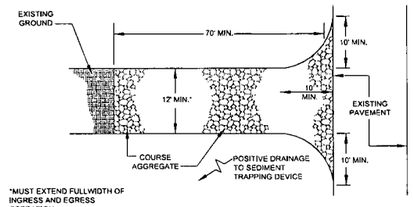
DATE	11/04/2013
SCALE	N/A
DESIGNED BY	CSK
FILE NO.	7889
SHEET	27 OF 31
REV:	12/04/2013

FIGURE 3.02.1

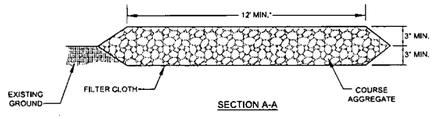
STONE CONSTRUCTION ENTRANCE



SIDE ELEVATION



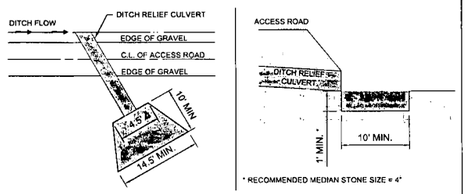
PLAN VIEW



SECTION A-A

SOURCE: ADAPTED from the 1983 Maryland Standards for Soil Erosion and Sediment Control and Va. DSWC

TYPICAL DITCH RELIEF CULVERT OUTLET TREATMENT



PLAN VIEW NTS

SECTION VIEW NTS

NOTE:
ALL DITCH LINE PROTECTION SHALL BE INSTALLED AS RECOMMENDED IN THE WEST VIRGINIA EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE (BMP) MANUAL. DITCH LINE PROTECTION SHALL BE BASED ON THE FOLLOWING GRADES:

1. LESS THAN 3% – GRASSED
2. 3–8% – GRASS WITH ROLLED EROSION CONTROL PRODUCTS (RECP)
3. GREATER THAN 9% – RIPRAP OR EQUIVALENT GEOTEXTILE

IF HIGH EROSIVE SOILS ARE ENCOUNTERED DURING CONSTRUCTION, THE ENGINEER SHOULD BE CONTACTED FOR FURTHER EVALUATION.

Modified Figure 3.1 – Typical Roadside Ditch Section Sump at Ditch Relief Culvert

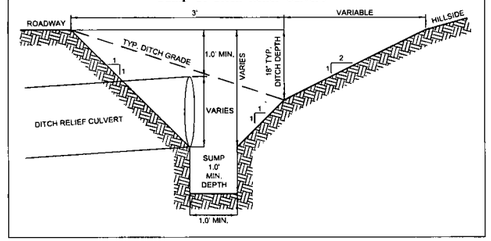
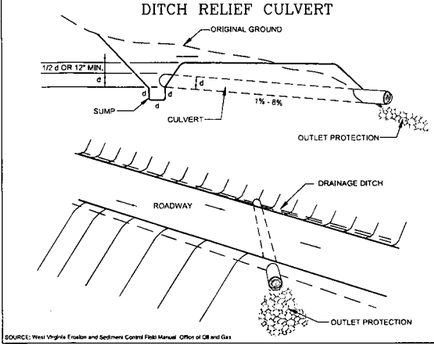


FIGURE II-4

DITCH RELIEF CULVERT



SOURCE: West Virginia Erosion and Sediment Control Field Manual. Office of Oil and Gas

Table II-5

Pipe Sizes for Culverts Across Roads		
Drainage Area (Ac)	Pipe Diameter (In)	Pipe Capacity (Cfs)
10	15	5
20	18	9
30	21	12
50	24	18
80	27	24
100	30	29
300	36	60
500	42	85

Table II-6

Spacing of Culverts	
Road Grade %	Distance (Ft)
2-5	500-300
6-10	300-200
11-15	200-100
16-20	100

FIGURE 3.05.1

ROCK CHECK DAM

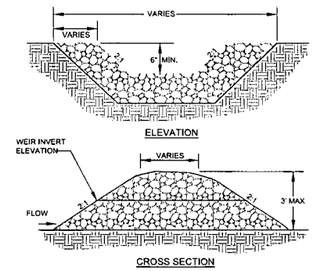
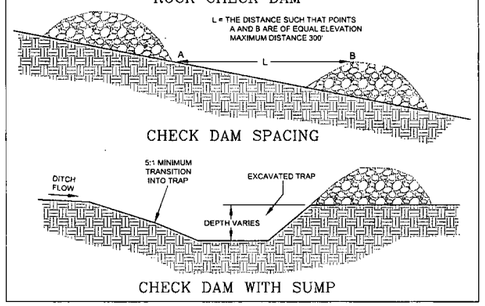
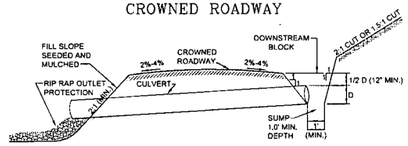


FIGURE 3.05.2

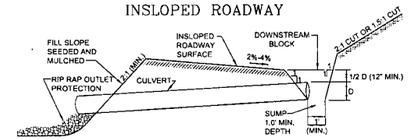
ROCK CHECK DAM



CROWNED ROADWAY



INSLOPED ROADWAY



Cut and fill slopes shall be stabilized immediately upon completion of roadway grading. These areas shall be blanketed wherever they are located within 50 feet of a surface water or within 100 feet of a surface water where a suitable vegetative filter strip does not exist.

A durable top dressing shall be provided for soils having low strength.

Roadside ditches shall be provided with adequate protective lining.

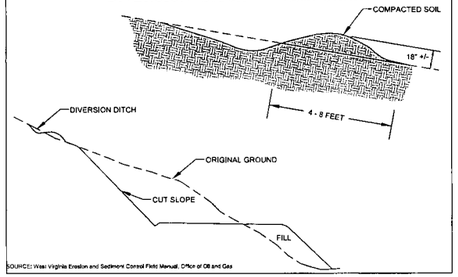
Adequately sized culverts or other suitable cross drains shall be provided at all seeps, springs, and drainageways.

Roadway shall be inspected weekly and after each runoff event. Damaged roadways, ditches, or cross drains shall be repaired immediately.

SOURCE: PA DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF OIL AND GAS MANAGEMENT, 550-0300-001(11) APPENDIX 4 BMP CONSTRUCTION DETAILS (MODIFIED)

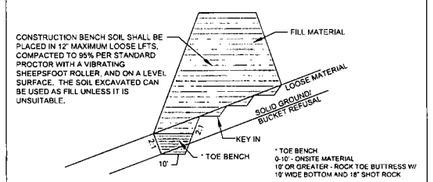
FIGURE II-3

DIVERSION DITCH – TEMPORARY



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

TOE BENCH DETAIL



TURNOUT

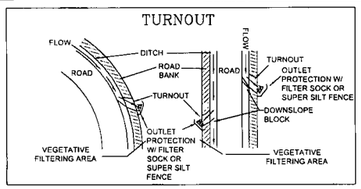
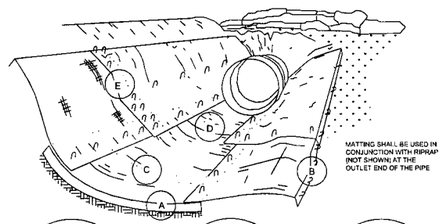
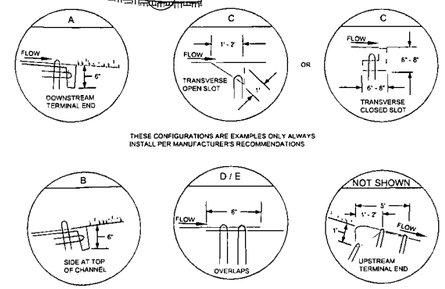


FIGURE 3.13.1

TYPICAL RECP CHANNEL INSTALLATION



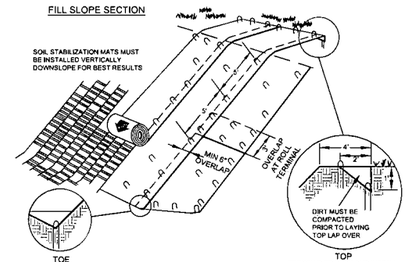


SOURCE: VA DCR-DSWC AND NORTH AMERICAN GREEN

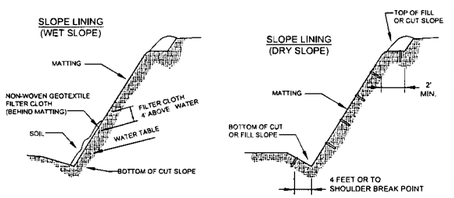
FIGURE 3.13.2

ROLLED EROSION CONTROL PRODUCTS

FILL SLOPE SECTION



NOTE: SLOPE SURFACE MUST BE SMOOTH AND FREE OF ROCKS, LUMPS, GRASS AND STICKS. MATS MUST BE PLACED FLAT ON SURFACE FOR PROPER SOIL CONTACT.



SOURCE: VDOT STANDARDS AND VA DCR-DSWC

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REGISTERED
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STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/04/2013

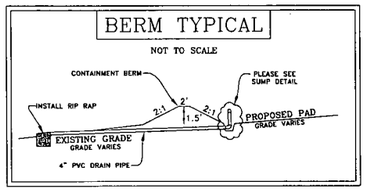
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

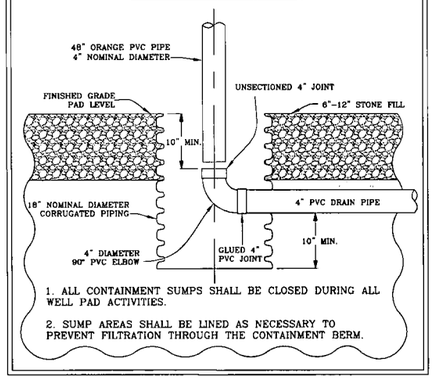
DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7689
SHEET 28 OF 31
REV: 12/04/2013

BERM TYPICAL

NOT TO SCALE

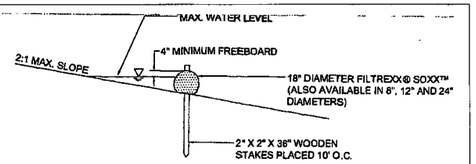


SUMP TYPICAL

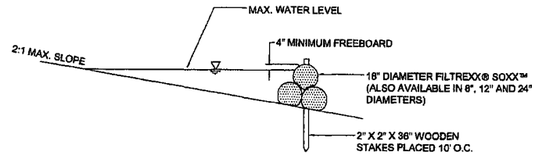


1. ALL CONTAINMENT SUMPS SHALL BE CLOSED DURING ALL WELL PAD ACTIVITIES.

2. SUMP AREAS SHALL BE LINED AS NECESSARY TO PREVENT FILTRATION THROUGH THE CONTAINMENT BERM.



SINGLE INSTALLATION SECTION
NTS

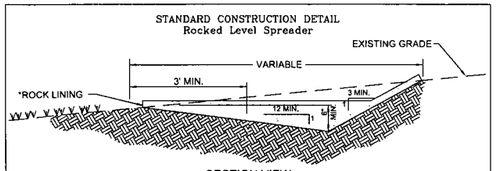


PYRAMID INSTALLATION SECTION
NTS

FILTREXX® RUNOFF DIVERSION SECTIONS

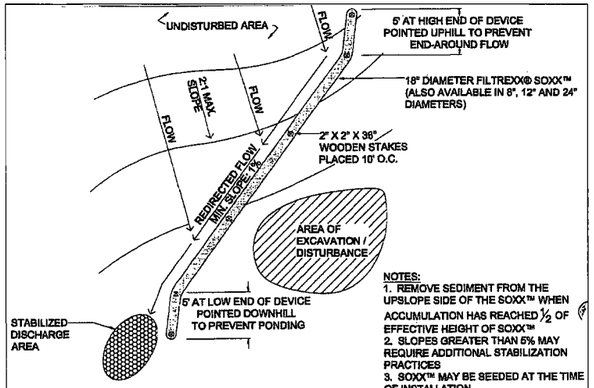
NTS

STANDARD CONSTRUCTION DETAIL
Rocked Level Spreader



SECTION VIEW
NTS

*All Level Spreader rock shall be a minimum of R4.

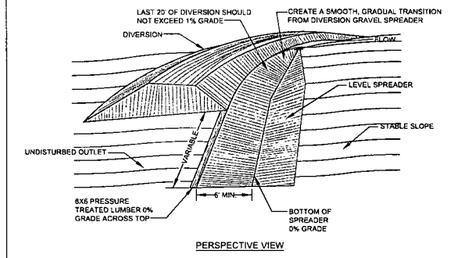


NOTES:
1. REMOVE SEDIMENT FROM THE UPSLOPE SIDE OF THE SOXX™ WHEN ACCUMULATION HAS REACHED ½ OF EFFECTIVE HEIGHT OF SOXX™
2. SLOPES GREATER THAN 5% MAY REQUIRE ADDITIONAL STABILIZATION PRACTICES
3. SOXX™ MAY BE SEEDED AT THE TIME OF INSTALLATION

FILTREXX® RUNOFF DIVERSION

FIGURE 3.02.1

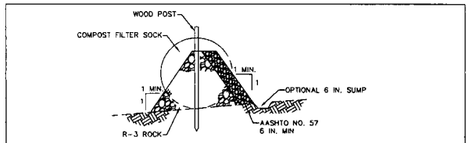
LEVEL SPREADER



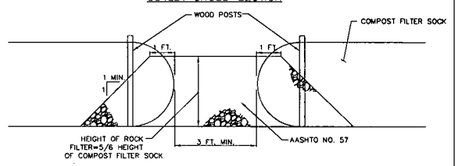
PERSPECTIVE VIEW

NOTE: ALL TEMPORARY BERMS, SWALES AND LEVEL SPREADER DITCHES MUST RECEIVE TEMPORARY SEEDING AND MULCHING AFTER INSTALLATION

SOURCE: ADAPTED FROM N.C. DEP Control Planning and Design Manual and VA DCSC



OUTLET CROSS-SECTION



UP-SLOPE FACE

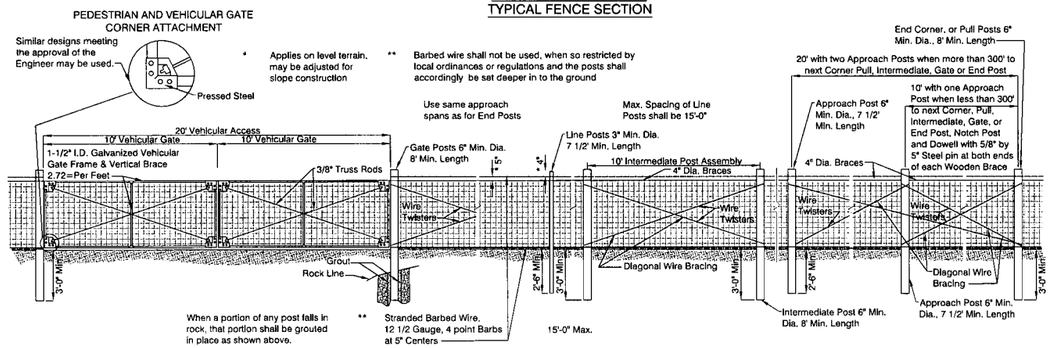
NOTES:

A ROCK FILTER OUTLET SHALL BE INSTALLED WHERE FAILURE OF A COMPOST FILTER SOCK HAS OCCURRED DUE TO CONCENTRATED FLOW.

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

ROCK FILTER OUTLET
(MODIFIED FROM PA DEP)
NOT TO SCALE

CONSTRUCTION DETAIL
TYPICAL FENCE SECTION



NOTES:

Posts and braces may be either round or square shaped. Dimensions shown on the plans are for round posts and braces only. When square posts are used, line posts shall be 3" square (min.);braces 4" square (min.); corner, end, pull, gate, approach, and intermediate posts 6" square (min.).

The positioning of the fence fabric and barbed wire on the posts, as shown on the "Typical Fence Section" detail, applies for level and gentle sloping terrain. For fence erected on slopes, the positioning may be adjusted to meet the slope conditions as long as the adjustment is continued from post to post in a uniform manner. Trenching on slopes may be warranted. On slopes, posts will continue to be erected vertically, unless otherwise directed, and the ends of the fencing fabric shall be cut on a skew as may be necessary for proper connection to the posts.

Dumped rock channel protection will be used at channel crossings when called for on the plans.

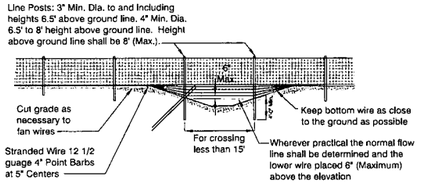
Install drainage structure terminal installation as called for on the plans and/or as shown on typical fence details.

Unless otherwise specified, or directed by the Engineer, the farm field fence may be installed with the fence fabric and barbed wire positioned on either side of the fence posts.

Hardware and miscellaneous fittings, not specifically designated herein as to type or dimensions, shall conform to the applicable requirements of Section 608 of the Specifications and shall be of good quality commerical design acceptable to the Engineer.

In lieu of the barbed wire detailed herein, the following additional types are acceptable, provided they retain the "4-point barb at 5-inch centers" requirement and provided they meet or exceed the strength and coating requirements for the standard, 12 1/2 gauge, barbed wire as called for in 712.10 of the Specifications.
(a) stranded, 15 1/2 gauge, high carbon steel barbed wire
(b) one strand, 12 gauge, steel barbed wire

Vehicular gate frames (and vertical braces) may be either galvanized steel pipe members as shown herein or may be triple-coated steel pipe members meeting the requirements specified on Standard Sheet F2. All other metal components of the gate shall be galvanized, with the exception of the die-cast aluminum corner fittings, or pressed steel corner fittings.



DETAIL SHOWING TYPICAL SECTION AT MINOR DEPRESSIONS AND WET WEATHER CROSSINGS

BRUSH PILE SEDIMENT BARRIER

FIGURE II-10

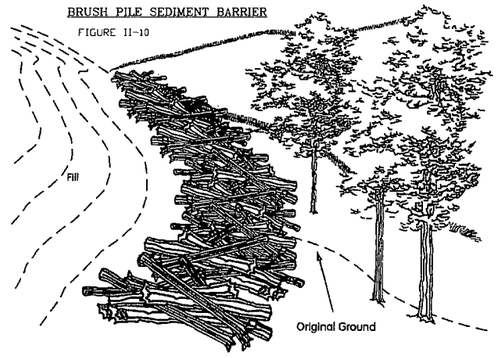
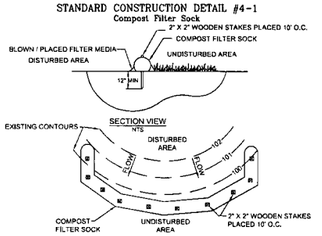


Table 4.1
Compost Sock Fabric Minimum Specifications

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" 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		25 psi	25 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 & 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					

STANDARD CONSTRUCTION DETAIL #4-1
Compost Filter Sock



PLAN VIEW
NTS
Adapted from FiltrexX

Sock fabric shall meet standards of Table 4.1. Compost shall meet the following 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 Maximum

Compost Filter Sock shall be placed at existing level grade. Both ends of the sock shall be extended at least 8 feet up the slope at 45 degrees to the main sock alignment. Maximum slope length above any sock shall not exceed manufacturer's maximum permissible slope length.

Traffic shall not be permitted to cross filter socks.

Accumulated Sediment shall be removed when it reaches 1/2 the above ground 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.

In the event the ground is frozen, #5 rebar with safety caps shall be used instead of wooden stakes to anchor the filter sock. Once the ground thaws the rebar anchors shall be removed and replaced with 2" x 2" wooden stakes and installed as shown in the detail above.

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REGISTERED
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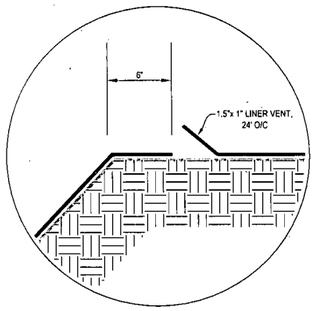
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/04/2013

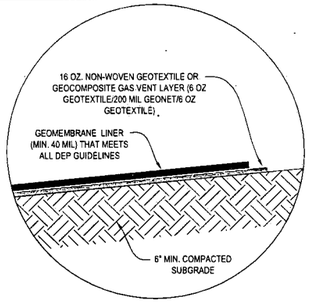
THIS DOCUMENT WAS PREPARED BY NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

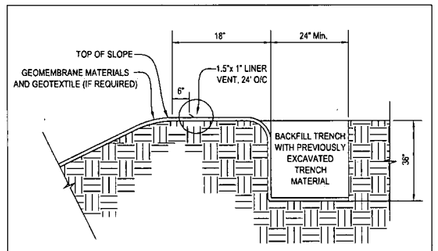
DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7669
SHEET 29 OF 31
REV: 12/04/2013



TYPICAL LINER VENT DETAIL
NTS

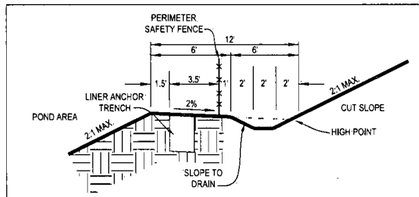


GEOMEMBRANE LINER SYSTEM
NTS

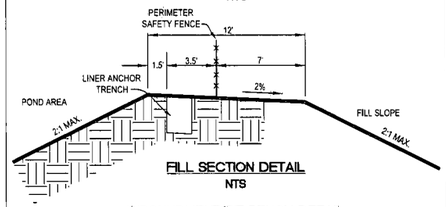


NOTE: USE SAND BAGS AS GEOMEMBRANE WEIGHTS IN TRENCH DURING GEOMEMBRANE INSTALLATION

TOP OF BERM ANCHOR TRENCH DETAIL
NTS



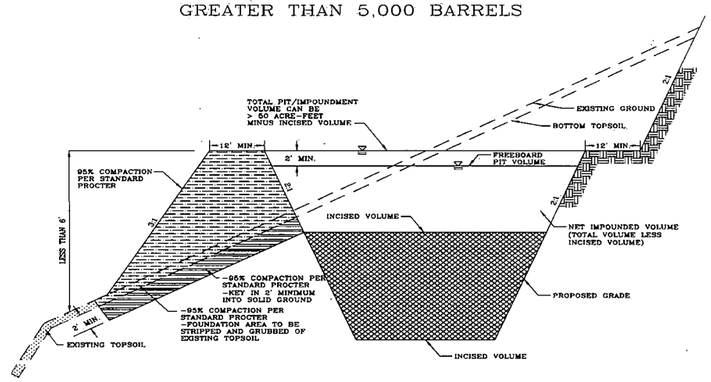
CUT SECTION DETAIL
NTS



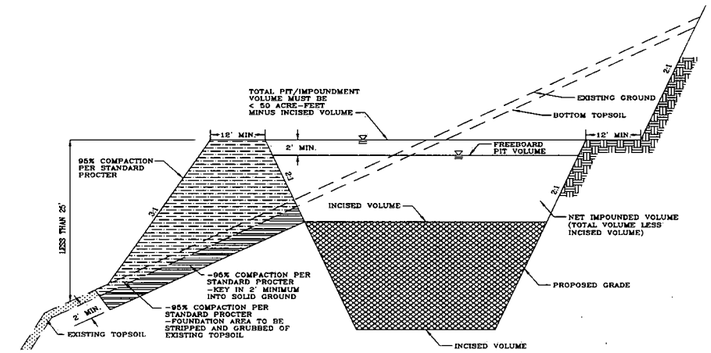
FILL SECTION DETAIL
NTS

IMPOUNDMENT/PIT BENCH DETAIL
NTS

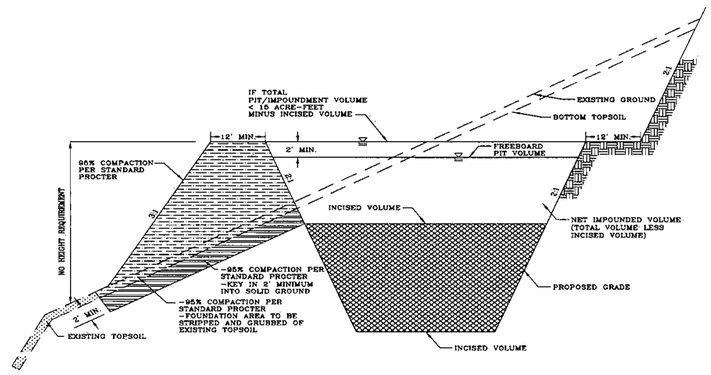
WEST VIRGINIA CODE 35 CSR 4
DESIGN AND CONSTRUCTION REQUIREMENTS FOR ASSOCIATED PITS, ASSOCIATED IMPOUNDMENTS, & CENTRALIZED IMPOUNDMENTS GREATER THAN 5,000 BARRELS



SECTION VIEW



SECTION VIEW



SECTION VIEW

NOTES:
1. ALL FILL SHOULD BE KEYED IN TO ORIGINAL GROUND EVERY 2-5 VERTICAL FEET DEPENDING ON EXISTING GROUND SLOPE

2. MINIMUM OUTSIDE AND INSIDE EMBANKMENT (FILL) SLOPES SHALL BE 2H:1V. THE INSIDE AND OUTSIDE SLOPES MUST ADD UP TO 5H:1V.

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HORIZONTAL / VERTICAL / AS-BUILT

CHRIS S. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/04/2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 30 OF 31
REV: 12/04/2013

REVEGETATION

Taken from the
West Virginia Erosion and Sediment Control Field Manual
West Virginia Division of Environmental Protection Office of Oil and Gas
Charleston, W.Va.
Section IV

Temporary Seeding

a. 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.

b. Seed Mixtures and Planting Dates
Refer to Tables 2 through 4 for recommended dates to establish vegetative cover and the approved lists of temporary and permanent plant species, and planting rates. Table 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.

c. Seed Application
Apply seed by broadcasting, drilling, or by hydroseed according to the rates indicates 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

a. 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.

b. 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.

c. 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 b, 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 Crownvetch 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 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.

d. 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

a. 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 seeded 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 seeded 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 seeded 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 seeded 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.

b. 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.

c. Specifications
From Table IV-6 select the type of mulch and rate of application that will best suit the conditions at the site.

d. 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 three inches.
2. Mulch netting
Follow manufacturer's recommendation when positioning and stapling the mulch netting in the soil.

Table IV-1
Recommended Seeding Dates

Planting 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 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 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
Sundangrass	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 4a
Permanent Seeding Mixture

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

** '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 4b
Wildlife and Farm Friendly Seed Mixtures

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

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 100 to 150 bales	Cover 75% to 90% of Surface	Subject to wind blowing or washing unless tied down
Wood Fiber Pulp Fiber Wood - Cellulose Recirculated Paper	1000 to 1500 lbs	Cover all Disturbed Areas	For hydroseeding

Tables IV 1-4 taken from Natural Resources Conservation Service Manual 'Critical Area Planting'

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A DIVISION OF SMITH LAND SURVEYING
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CORPORATE INTEGRITY. QUALITY.
228 West Main St.
P.O. Box 187
St. Clairsville, OH 43950
(740) 457-3834

CERTIFICATE OF AUTHORIZATION
REGISTERED
1957B
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEERS

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 31 OF 31
REV: 12/04/2013

OXF 159 SITE PLAN
EQT PRODUCTION COMPANY

(PROPOSED WELLS NO. WV 513153, WV 513154, WV 513155, WV 513156, WV 513157, WV 514095, WV 514096 & WV 514097)

SITUATE ON THE WATERS OF BLUESTONE CREEK IN WEST UNION AND SOUTHWEST DISTRICT, DODDRIDGE COUNTY, WEST VIRGINIA.

PROJECT INFORMATION

PROJECT NAME: OXF 159 H1-H8

TAX PARCEL:
WEST UNION DISTRICT
MAP 6-1

SURFACE OWNER:
JUSTIN L. HENDERSON
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV
TOTAL PROPERTY AREA: 1,602.9 ± ACRES

OIL AND GAS ROYALTY OWNER:
LEEMAN MAXWELL HRS
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV
TOTAL PROPERTY AREA: 2,164 ± ACRES

SITE LOCATION:
THE OXF 159 SITE IS WEST OF MAXWELL RIDGE ALONG BLUESTONE CREEK OFF COUNTY ROUTE 13. THE ENTRANCE TO THE SITE IS APPROXIMATELY 1 & 3/4 MILE SOUTHWEST OF THE CO. RT. 13 AND CO. RT. 13/3 INTERSECTION.

LOCATION COORDINATES

OXF 159 H1-H8 WELL PAD ENTRANCE
LATITUDE: 39.227701 LONGITUDE: -80.758964 (NAD 83)

OXF 159 H1-H8 WELL PAD
LATITUDE: 39.218621 LONGITUDE: -80.766744 (NAD 83)

OXF 159 ASSOCIATED PIT
LATITUDE: 39.216627 LONGITUDE: -80.767649 (NAD 83)

SITE DISTURBANCE COMPUTATIONS

ROAD A PHASE 1 & 2= 17.20 ± ACRES (ROAD A PHASE 1, 2 & STOCKPILES A-D)
WELL PAD AREA = 11.67 ± ACRES (PAD, ROAD C & STOCKPILES E & G)
ASSOCIATED PIT AREA = 4.93 ± ACRES (PIT, ROAD B & STOCKPILE F)
TOTAL SITE DISTURBANCE = 33.80 ± ACRES

ENTRANCE PERMIT

EQT PRODUCTION COMPANY WILL OBTAIN AN ENCROACHMENT PERMIT (FORM MM-109) FROM THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS, PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

MISS UTILITY STATEMENT

MISS UTILITY OF WEST VIRGINIA WAS NOTIFIED FOR THE LOCATING OF UTILITIES PRIOR TO THIS PROJECT DESIGN; TICKET #1328176253. IN ADDITION, MISS UTILITY WILL BE CONTACTED PRIOR TO START OF THE PROJECT.

FLOODPLAIN NOTE

THE PROPOSED LIMITS OF DISTURBANCE FOR THIS PROJECT IS LOCATED IN FEMA FLOOD ZONE X AND A, PER THE FLOOD INSURANCE RATE MAP (FIRM) NUMBER 54017C0225C, DATED OCTOBER 4, 2011.

FOR A DETAILED ANALYSIS OF THE DEVELOPMENT WITHIN THE FEMA FLOOD ZONE "A", SEE THE REPORT BY NAVITUS ENGINEERING ENTITLED "FLOODPLAIN ANALYSIS OF BLUESTONE CREEK" DATED DECEMBER 4, 2013.

ENVIRONMENTAL NOTES

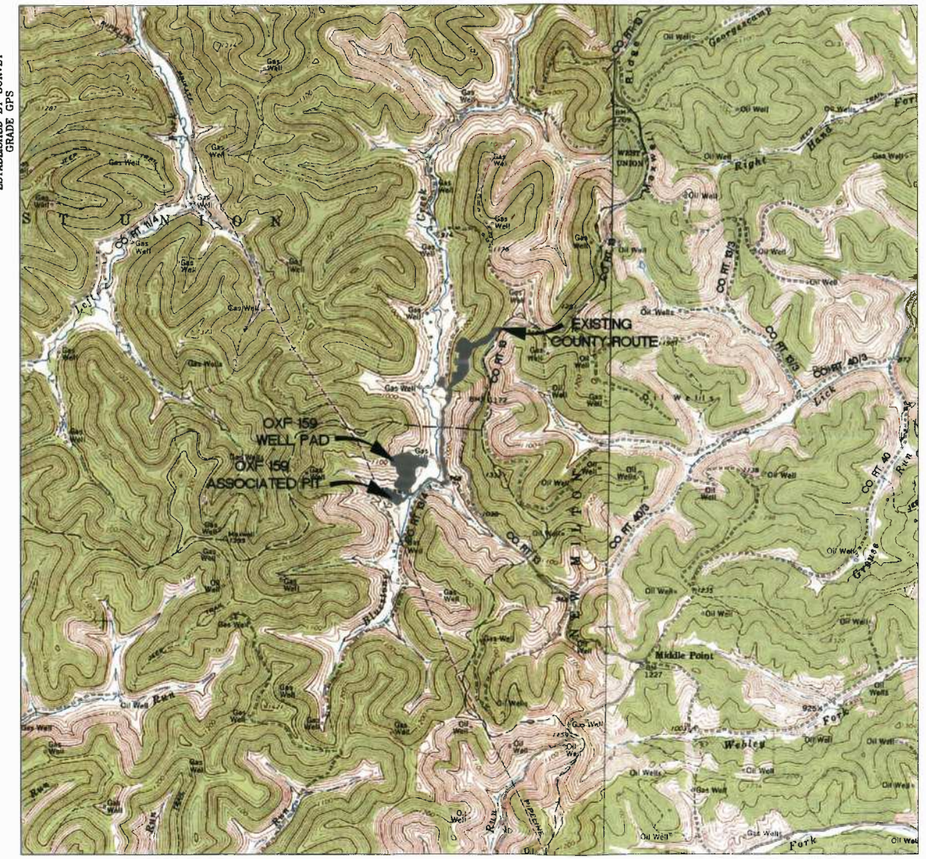
A WETLAND DELINEATION WAS PERFORMED ON APRIL 25-26, 2013 BY POTESTA AND ASSOCIATES, INC. TO REVIEW THE SITE FOR WATERS AND WETLANDS THAT ARE MOST LIKELY WITHIN THE REGULATORY PURVIEW OF THE U.S. ARMY CORPS OF ENGINEERS (USACE) AND/OR THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (WVDEP). THE MAY 29, 2013 REPORT PROJECT # 0101-11-147-15701 WAS PREPARED BY POTESTA AND ASSOCIATES, INC. SUMMARIZES THE RESULTS OF THE FIELD DELINEATION. THE REPORT DOES NOT, IN ANY WAY, REPRESENT A JURISDICTIONAL DETERMINATION OF THE LANDWARD LIMITS OF WATERS AND WETLANDS WHICH MAY BE REGULATED BY THE USACE OR THE WVDEP. IT IS STRONGLY RECOMMENDED THAT THE AFOREMENTIONED AGENCIES BE CONSULTED IN AN EFFORT TO GAIN WRITTEN CONFIRMATION OF THE DELINEATION DESCRIBED BY THIS REPORT PRIOR TO ENGAGING CONSTRUCTION ON THE PROPERTY DESCRIBED HEREIN. THE DEVELOPER SHALL OBTAIN THE APPROPRIATE PERMITS FROM THE FEDERAL AND/OR STATE REGULATORY AGENCIES PRIOR TO ANY PROPOSED IMPACTS TO WATERS OF THE U.S., INCLUDING WETLAND FILLS AND STREAM CROSSINGS.

GENERAL DESCRIPTION

THE WELL PAD & ASSOCIATED PIT ARE BEING CONSTRUCTED TO AID IN THE DEVELOPMENT OF INDIVIDUAL MARCELLUS SHALE GAS WELLS.

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!!

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



OXFORD QUAD NEW MILTON QUAD

2000 0 2000
SCALE: 1" = 2000'

LIST OF DRAWINGS

LEGEND

EX. INDEX CONTOUR	PROP. INDEX CONTOUR
EX. INTERMEDIATE CONTOUR	PROP. INTERMEDIATE CONTOUR
EX. BOUNDARY LINE	PROP. GRADING LIMITS
EX. ROAD EDGE OF GRAVEL/DIRT	PROP. LIMITS OF DISTURBANCE
EX. ROAD EDGE OF PAVEMENT	PROP. WELL PAD
EX. ROAD CENTERLINE	PROP. WELL HEAD
EX. DITCHLINE	PROP. 4" PVC DRAIN PIPE
EX. CULVERT	PROP. SUMP DRAIN
EX. GUARDRAIL	PROP. CONTAINMENT BERM
EX. FENCELINE	PROP. PIT/IMPOUNDMENT CL
EX. GATE	PROP. PERIMETER SAFETY FENCE
EX. OVERHEAD UTILITY	PROP. ACCESS GATE WITH EMERGENCY LIFELINE
EX. OVERHEAD UTILITY R/W	
EX. POWER POLE	
EX. GUY WIRE	
EX. TELEPHONE LINE	
EX. GASLINE	
EX. GASLINE R/W	PROP. ROCK CONSTRUCTION ENTRANCE
EX. WATERLINE	
EX. WATER WELL	
EX. GAS WELL	PROP. ROAD EDGE OF GRAVEL
EX. TREELINE	PROP. ROAD CENTERLINE
EX. REFERENCE TREE	PROP. V-DITCH W/ CHECK DAMS
EX. DELINEATED STREAM	PROP. DITCH RELIEF CULVERT (DRC)
EX. DELINEATED WETLAND	PROP. RIP-RAP OUTLET PROTECTION
EX. BUILDING	PROP. GUARDRAIL
EX. BRIDGE	PROP. ROCK LEVEL SPREADER
100' WETLAND/STREAM BUFFER	PROP. EARTHEN DIVERSION BERM
	PROP. ORANGE SAFETY FENCE
	PROP. SUPER SILT FENCE
	PROP. COMPOST FILTER SOCK
	PROP. COMPOST SOCK DIVERSION
	PROP. GROUNDWATER DEWATERING TRENCH
	PROP. GROUNDWATER DEWATERING PIPE
	SECTION LINE
	MATCHLINE
	X-SECTION GRID INDEX
	X-SECTION GRID INTERMEDIATE
	X-SECTION PROPOSED GRADE
	X-SECTION EXISTING GRADE
	X-SECTION WATER SURFACE
	SPOT ELEVATION
	CENTER OF PAD

OPERATOR

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(740) 671-9911

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

COVER SHEET
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: 1" = 2000'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 1 OF 28

CONSTRUCTION NOTES:

1. METHODS AND MATERIALS USED IN THE CONSTRUCTION OF THE IMPROVEMENTS HEREIN SHALL CONFORM TO THE CURRENT COUNTY CONSTRUCTION STANDARDS, AND SPECIFICATIONS AND/OR CURRENT WVDEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL STANDARDS AND SPECIFICATIONS.

2. MEASURES TO CONTROL EROSION AND SILTATION, INCLUDING DETENTION PONDS SERVING AS SILT BASINS DURING CONSTRUCTION, MUST BE PROVIDED PRIOR TO ISSUANCE OF THE SITE DEVELOPMENT PERMIT. THE APPROVAL OF THESE PLANS IN NO WAY RELIEVES THE DEVELOPER OR HIS AGENT OF THE RESPONSIBILITIES CONTAINED IN THE WVDEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL.

3. AN APPROVED SET OF PLANS AND ALL APPLICABLE PERMITS MUST BE AVAILABLE AT THE CONSTRUCTION SITE. ALSO, A REPRESENTATIVE OF THE DEVELOPER MUST BE AVAILABLE AT ALL TIMES.

4. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING MUD FROM TRUCKS AND/OR OTHER EQUIPMENT PRIOR TO ENTERING PUBLIC STREETS, AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN STREETS, ALLAY DUST, AND TO TAKE WHATEVER MEASURES ARE NECESSARY TO INSURE THAT THE STREETS ARE MAINTAINED IN A CLEAN, MUD AND DUST FREE CONDITION AT ALL TIMES.

5. NOTIFICATION SHALL BE GIVEN TO THE APPROPRIATE UTILITY COMPANY PRIOR TO CONSTRUCTION OF WATER AND/OR GAS PIPE LINES. INFORMATION SHOULD ALSO BE OBTAINED FROM THE APPROPRIATE AUTHORITY CONCERNING PERMITS, CUT SHEETS, AND CONNECTIONS TO EXISTING LINES.

6. THE LOCATION OF EXISTING UTILITIES SHOWN IN THESE PLANS ARE FROM FIELD LOCATIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES AS NEEDED PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL INFORM THE ENGINEER OF ANY CONFLICTS ARISING FROM HIS EXISTING UTILITY VERIFICATION AND THE PROPOSED CONSTRUCTION.

7. THE DEVELOPER WILL BE RESPONSIBLE FOR ANY DAMAGE TO THE EXISTING STREETS AND UTILITIES WHICH OCCURS AS A RESULT OF HIS CONSTRUCTION PROJECT WITHIN OR CONTIGUOUS TO THE EXISTING RIGHT-OF-WAY.

8. WHEN GRADING IS PROPOSED WITHIN EASEMENTS OF UTILITIES, LETTERS OF PERMISSION FROM ALL INVOLVED COMPANIES MUST BE OBTAINED PRIOR TO GRADING AND/OR SITE DEVELOPMENT.

9. THE DEVELOPER WILL BE RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES WHICH IS REQUIRED AS A RESULT OF HIS PROJECT. THE RELOCATION SHOULD BE DONE PRIOR TO CONSTRUCTION.

10. THESE PLANS IDENTIFY THE LOCATION OF ALL KNOWN GRAVESITES. GRAVESITES SHOWN ON THIS PLAN WILL BE PROTECTED IN ACCORDANCE WITH STATE LAW. IN THE EVENT GRAVESITES ARE DISCOVERED DURING CONSTRUCTION, THE OWNER AND ENGINEER MUST BE NOTIFIED IMMEDIATELY.

11. THE CONTRACTOR IS TO VERIFY FIELD CONDITIONS PRIOR TO AND DURING CONSTRUCTION AND NOTIFY NAVITUS ENGINEERING AT (888) 662-4185 OR SMITH LAND SURVEYING AT (304) 462-5634 IMMEDIATELY OF ANY DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THE APPROVED PLAN.

12. CONTRACTORS SHALL NOTIFY OPERATORS WHO MAINTAIN UNDERGROUND UTILITY LINES IN THE AREA OF PROPOSED EXCAVATING OR BLASTING AT LEAST TWO (2) WORKING DAYS, BUT NOT MORE THAN TEN (10) WORKING DAYS, PRIOR TO COMMENCEMENT OF EXCAVATION OR DEMOLITION.

13. CONTRACTOR TO CONTACT OPERATOR AND ENGINEER IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION.

14. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED BY THE CONTRACTOR DAILY AND CHECKED AFTER EVERY RAINFALL. ALL DRAIN INLETS SHALL BE FREE OF SILTATION AND DEBRIS. INEFFECTIVE MEASURES SHALL BE REPLACED, AS NECESSARY.

15. THE CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR, 2 DAYS PRIOR TO THE START OF CONSTRUCTION.

CONSTRUCTION SEQUENCE

THE BMP'S SHALL BE IMPLEMENTED, MAINTAINED, AND OPERATED IN THE FOLLOWING GENERAL SEQUENCE OF CONSTRUCTION TO MITIGATE THE HAZARD OF ACCELERATED EROSION AND SEDIMENTATION TO ACCEPTABLE LEVELS. MINOR DEVIATIONS FROM THIS SEQUENCE SHALL BE EXECUTED BY THE PROJECT'S FOREMAN AS NEEDED TO ELIMINATE ANY POTENTIAL EROSIVE CONDITION THAT MAY ARISE FOR THE DURATION OF THE PROJECT. THE WVDEP OFFICE OF OIL AND GAS SHALL BE NOTIFIED OF ANY AND ALL SUCH DEVIATIONS FROM THE APPROVED PLANS.

1) STAKE THE LIMITS OF CONSTRUCTION.

2) INSTALL THE ROCK CONSTRUCTION ENTRANCE AS SHOWN ON THE PLANS.

3) INSTALL ALL ORANGE SAFETY FENCE AS SHOWN AROUND ANY DELINEATED STREAMS AND WETLANDS TO CLEARLY IDENTIFY THOSE AREAS THAT ARE NOT TO BE DISTURBED.

4) INSTALL ALL BMP'S (SUPER SILT FENCE, REINFORCED SILT FENCE, SEDIMENT TRAPS, ETC) AS SHOWN ON THE PLANS AND DETAILS.

5) CLEAR AND GRUB THE ACCESS ROAD AND PAD/PIT AREA. ALL WOODY MATERIAL, BRUSH, TREES, STUMPS, LARGE ROOTS, BOULDERS, AND DEBRIS SHALL BE CLEARED FROM THE SITE AREA AND KEPT TO THE MINIMUM NECESSARY FOR PROPER CONSTRUCTION, INCLUDING THE INSTALLATION OF NECESSARY SEDIMENT CONTROLS. TREES SIX INCHES IN DIAMETER AND LARGER SHALL BE CUT AND LOGS STACKED. SMALLER TREES, BRUSH, & STUMPS SHALL BE CUT AND OR GRUBBED AND WINDROWED IN APPROPRIATE AREAS FOR USE AS SEDIMENT BARRIERS AT WATER DRAINAGE OUTLETS, WINDROWED BELOW THE WELL SITE, USED FOR WILDLIFE HABITAT, BURNED (AS PER WV FOREST FIRE LAWS), REMOVED FROM SITE, OR DISPOSED OF BY OTHER METHODS APPROVED BY DEP.

6) INSTALL ANY WETLAND OR STREAM CROSSINGS AS SHOWN ON THE PLANS.

7) CONVEY UPSLOPE DRAINAGE AROUND THE ACCESS ROAD AND PAD/PIT AREA BY CONSTRUCTING ALL DIVERSION BERM(S) AS SHOWN ON THE PLANS.

8) CONSTRUCT THE ACCESS ROAD. DITCH RELIEF CULVERTS SHALL BE INSTALLED AT A GRADE OF 1-8% TO MINIMIZE OUTLET VELOCITIES TO THE EXTENT POSSIBLE. INSTALL OUTLET PROTECTION AS SHOWN ON PLANS. STABILIZE THE ROAD WITH STONE AND SIDE SLOPES AS SPECIFIED WITH PERMANENT SEEDING. STOCKPILE AND STABILIZE TOPSOIL ALONG THE ACCESS ROAD, AS NEEDED.

9) STRIP THE TOPSOIL FROM THE PAD/PIT AREA. TOPSOIL SHALL BE STOCKPILED AND IMMEDIATELY STABILIZED.

10) GRADE THE PAD/PIT AREA AS SHOWN ON THE PLAN. IMMEDIATELY STABILIZE THE OUTER AREAS OF THE PIT/IMPOUNDMENT, AS WELL AS THE WELL PAD AND ANY TURNAROUND AREAS WITH STONE AND THE SIDE SLOPES WITH EROSION CONTROL BLANKETING WHEN SLOPES ARE 3:1 OR GREATER. APPLY SEED AND MULCH ALL DISTURBED AREAS. THIS SHALL INCLUDE ALL AREAS THAT WILL NOT BE SUBJECT TO REGULAR TRAFFIC ACTIVITY (TO BE STABILIZED WITH STONE), OR ANY DISTURBED AREA THAT WILL NOT BE RE-DISTURBED BEFORE SITE RECLAMATION BEGINS.

11) INSTALL THE PIT LINER SYSTEM AND PERIMETER SAFETY FENCE W/GATE AND EMERGENCY LIFE LINE AS SHOWN ON THE PLANS.

12) PREVIOUSLY DISTURBED AREAS AND IMMEDIATE DOWN SLOPE AREAS SHALL BE INSPECTED AFTER EACH RAINFALL STORM EVENT AND MONITORED WEEKLY FOR SIGNS OF ACCELERATED EROSION. IMPLEMENT ADDITIONAL BMP'S AS DEEMED NECESSARY. THESE INSPECTIONS SHALL CONTINUE DURING THE DURATION OF THE PROJECT AND SUBSEQUENT SITE RECLAMATION.

13) ONCE THE PIT HAVE BEEN COMPLETED, SUBMIT THE AS-BUILT CERTIFICATION FOR THE PIT FACILITY TO THE WVDEP OFFICE OF OIL AND GAS, PRIOR TO PLACING FLUIDS IN THE STRUCTURE.

14) COMMENCE WELL DRILLING ACTIVITY AND USE OF THE ASSOCIATED PIT FACILITY. THE ASSOCIATED PIT SHALL BE MONITORED CONTINUOUSLY DURING THE INITIAL FILLING OPERATION.

15) ONCE DISTURBED AREAS HAVE BEEN RE-VEGETATED AND STABILIZED FOLLOWING RECLAMATION, THE TEMPORARY BMP'S IN THOSE AREAS MAY BE REMOVED. CONTINUE TO MONITOR THESE AREAS TO ENSURE A UNIFORM RATE OF 70% VEGETATIVE COVERAGE IS MAINTAINED. ANY AREAS FOUND TO BE DEFICIENT SHALL BE RE-SEEDED AND MULCHED.

SITE CLEANUP & RECYCLE PROGRAM

1. GARBAGE, FUELS OR ANY SUBSTANCE HARMFUL TO HUMAN, AQUATIC OR FISH LIFE, WILL BE PREVENTED FROM ENTERING SPRINGS, STREAMS, PONDS, LAKES, WETLANDS OR ANY WATER COURSE OR WATER BODY.

2. OILS, FUELS, LUBRICANTS AND COOLANTS WILL BE PLACED IN SUITABLE CONTAINERS AND DISPOSED PROPERLY.

3. ALL TRASH AND GARBAGE WILL BE COLLECTED AND DISPOSED PROPERLY.

4. ALL SEDIMENT REMOVED FROM SEDIMENT CAPTURING DEVICES SHALL BE PLACED ON THE TOPSOIL STOCKPILE, THEN SEEDED AND MULCHED, AS NECESSARY. ALTERNATIVELY, THE REMOVED SEDIMENT CAN BE TRANSPORTED TO A SITE WITH AN APPROVED PERMIT.

MAINTENANCE PROGRAM

1. BMP'S WILL BE INSPECTED ON A WEEKLY BASIS AND AFTER EACH MEASURABLE RAINFALL EVENT DURING THE ACTIVE CONSTRUCTION PHASE OF THE PROJECT.

2. ALL REVEGETATED ACCESS ROADS AND FACILITIES ARE TO BE MAINTAINED THROUGHOUT THE LIFE OF EACH STRUCTURE.

3. CULVERTS, ROAD DITCHES, BROAD-BASED DIPS, DIVERSION DITCHES, AND ROCK CHECK DAMS MUST BE MAINTAINED IN PROPER WORKING ORDER AND WILL BE CLEANED OUT, REPAIRED, OR REPLACED AS NECESSARY.

4. FILTER STRIPS AND/OR SILT FENCE WILL BE MAINTAINED.

5. ALL AREAS OF EARTH DISTURBANCE WILL BE REPAIRED WHERE SIGNS OF ACCELERATED EROSION ARE DETECTED.

6. SEEDING AND MULCHING WILL BE REPEATED IN THOSE AREAS THAT APPEAR TO BE FAILING OR HAVE FAILED.

ASSOCIATED PIT CONSTRUCTION STANDARDS NOTES

THE DESIGN, CONSTRUCTION, AND REMOVAL OF EMBANKMENTS ASSOCIATED WITH CENTRALIZED IMPOUNDMENTS/ASSOCIATED PITS FOR OIL AND GAS WELLS MUST BE ACCOMPLISHED IN SUCH A MANNER AS TO PROTECT THE HEALTH AND SAFETY OF THE PEOPLE, THE NATURAL RESOURCES, AND ENVIRONMENT OF THE STATE. THE IMPOUNDMENT/PIT EMBANKMENTS SHALL BE DESIGNED, CONSTRUCTED, AND MAINTAINED TO BE STRUCTURALLY SOUND AND REASONABLY PROTECTED FROM UNAUTHORIZED ACTS OF THIRD PARTIES.

1. THE FOUNDATION FOR A ASSOCIATED PIT EMBANKMENT MUST BE STRIPPED AND GRUBBED TO A MINIMUM DEPTH OF 2 FEET PRIOR TO PLACEMENT AND COMPACTION OF EARTHEN FILL MATERIAL. NO EMBANKMENT FILL SHALL BE PLACED ON FROZEN MATERIAL.

2. ANY SPRINGS ENCOUNTERED WITHIN THE FOUNDATION AREA SHALL BE DRAINED TO THE OUTSIDE/DOWNSTREAM TOE OF EMBANKMENT. CONSTRUCTED DRAIN SECTION SHALL BE AN EXCAVATED 2' x 2' TRENCH AND BACK FILLED WITH TYPE A SAND, COMPACTED BY HAND TAMPER. NO GEOTEXTILES SHALL BE USED TO LINE TRENCH. THE LAST 3' OF DRAIN AT THE DOWNSTREAM END SHALL BE CONSTRUCTED WITH AASHTO #8 MATERIAL.

3. SOILS FOR EARTHEN EMBANKMENT CONSTRUCTION SHALL BE LIMITED TO TYPES GC, GM, SC, SM, CL, OR ML (ASTMD-2487 - UNIFIED SOILS CLASSIFICATION). SOILS MUST CONTAIN A MINIMUM OF 20% OF PLUS NO. 200 SIEVE AND BE "WELL GRADED" MATERIAL WITH NO COBBLES OR BOULDER SIZE MATERIAL MIXED WITH THE CLAY. A MINIMUM OF THREE SAMPLES SHALL BE CLASSIFIED.

4. THE EARTHEN EMBANKMENT SHALL BE COMPACTED BY A VIBRATING SHEEPSFOOT ROLLER. THE LIFTS MUST BE IN HORIZONTAL LAYERS WITH A MAXIMUM LOOSE LIFT THICKNESS 12" AND MAXIMUM PARTICLE SIZE LESS THAN 6".

5. THE PLACEMENT OF ALL FILL MATERIAL SHALL BE FREE OF WOOD, STUMPS AND ROOTS, LARGE ROCKS AND BOULDERS, AND ANY OTHER NONCOMPACTABLE SOIL MATERIAL. THE EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF VISIBLE NON-MOVEMENT, HOWEVER, THE COMPACTION EFFORT SHALL NOT EXCEED THE OPTIMUM MOISTURE LIMITS.

6. THE EMBANKMENT TOP SHALL BE A MINIMUM OF 12' IN WIDTH.

7. THE MINIMUM INSIDE AND OUTSIDE SIDESLOPES SHALL BE 2H:1V, UNLESS OTHERWISE SPECIFIED.

8. ALL EXPOSED EMBANKMENT SLOPES, NOT COVERED BY COMPACTED ROCKFILL OR RIPRAP SHALL BE LIMED, FERTILIZED, SEEDED AND MULCHED. PERMANENT VEGETATIVE GROUND COVER IN COMPLIANCE WITH THE WVDEP EROSION AND SEDIMENT CONTROL FIELD MANUAL MUST BE ESTABLISHED UPON THE COMPLETION OF THE IMPOUNDMENT/PIT CONSTRUCTION. EMBANKMENTS SHALL BE MAINTAINED WITH A GRASSY VEGETATIVE COVER AND FREE OF BRUSH AND/OR TREES.

9. A MINIMUM OF 2' OF FREEBOARD SHALL BE MAINTAINED AT ALL TIMES DURING THE OPERATION OF THE IMPOUNDMENT.

10. ALL EMBANKMENT CONSTRUCTION AND COMPACTION TESTING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

ASSOCIATED PIT LINER SYSTEM NOTES:

THE DESIGNED PIT FACILITY SHALL BE FULLY LINED WITH A GEOSYNTHETIC LINER SYSTEM. LINERS SHALL BE INSTALLED IN ACCORDANCE TO MANUFACTURER'S SPECIFICATIONS.

1. THE SUB-BASE SHALL BEAR THE WEIGHT OF THE LINER SYSTEM, WATER, AND EQUIPMENT OPERATING ON THE IMPOUNDMENT/PIT WITHOUT CAUSING OR ALLOWING A FAILURE OF THE LINER SYSTEM.

2. THE SUB-BASE SHALL BE COMPACTED TO ACCOMMODATE POTENTIAL SETTLEMENT WITHOUT DAMAGE TO THE LINER SYSTEM.

3. THE UPPER 6" OF THE SUB-BASE SHALL BE COMPACTED TO A STANDARD PROCTOR DENSITY OF AT LEAST 95%.

4. THE SUB-BASE SHALL BE HARD, UNIFORM, SMOOTH AND FREE OF DEBRIS, ROCK FRAGMENTS, PLANT MATERIAL AND OTHER FOREIGN MATERIAL.

5. THE SUB-BASE SHALL BE COVERED WITH NON-WOVEN GEOTEXTILE FABRIC TO CUSHION THE PRIMARY LINER AND ALLOW FOR ADEQUATE VENTING BETWEEN THE PRIMARY LINER AND THE SUB-BASE TO PREVENT THE ENTRAPMENT OF GASES BENEATH THE LINER SYSTEM.

6. THE PIT AREA SHALL BE DRAINED AND COMPLETELY DRY PRIOR TO THE PLACEMENT OF THE PRIMARY LINER. THE PRIMARY LINER SHALL MEET ALL WV DEP GUIDELINES FOR MINIMUM THICKNESS AND SHALL PREVENT THE MIGRATION OF WATER THROUGH THE LINER TO THE GREATEST DEGREE THAT IS TECHNOLOGICALLY POSSIBLE.

7. THE PRIMARY LINER SHALL FULLY COVER THE BOTTOM AND SIDEWALLS OF THE PIT.

8. AN ANCHOR TRENCH SHALL BE EXCAVATED COMPLETELY AROUND THE PERIMETER OF THE PIT AREA AT THE PLANNED ELEVATION OF THE TOP OF THE LINING. THE TRENCH SHALL BE A MINIMUM 36 INCHES DEEP AND 24 INCHES WIDE.

9. ALL ELEMENTS OF THE LINER SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS. ALL SEAMS AND SEALS AROUND ANY PROJECTIONS SHALL BE SEALED AND TESTED IN A METHOD APPROVED BY THE MANUFACTURER.

10. GAS RELIEF VENTS SHALL BE PROVIDED ALONG THE TOP OF THE LINER AND WITHIN ONE FOOT OF THE PERIMETER TO ALLOW GASES TO ESCAPE FROM UNDER THE GEOMEMBRANE. MAXIMUM SPACING FOR VENTS SHALL BE 30 FEET.

11. WATER LEVEL MARKINGS SHALL BE CLEARLY PAINTED (1' INCREMENTS) ON THE LINER SYSTEM TO IDENTIFY THE WATER SURFACE ELEVATION.

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CYRUS B. KIMES
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PROFESSIONAL ENGINEER
12/23/2013

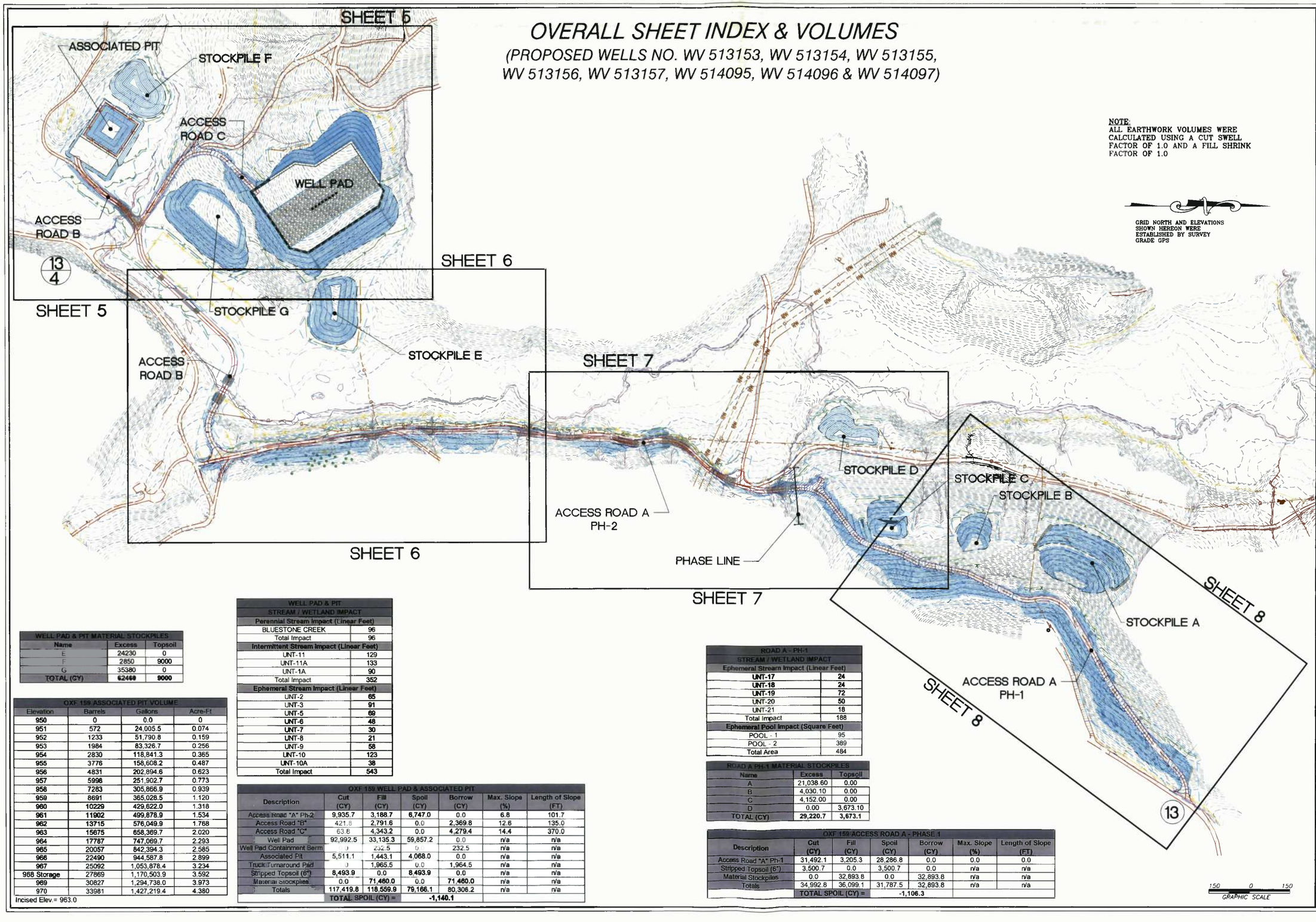
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

NOTES
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 2 OF 28

OVERALL SHEET INDEX & VOLUMES

(PROPOSED WELLS NO. WV 513153, WV 513154, WV 513155, WV 513156, WV 513157, WV 514095, WV 514096 & WV 514097)



NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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

WELL PAD & PIT MATERIAL STOCKPILES		
Name	Excess	Topsoil
E	24230	0
F	2850	9000
G	35380	0
TOTAL (CY)	62460	9000

OXF 159 ASSOCIATED PIT VOLUME			
Elevation	Barrels	Gallons	Acre-Ft
950	0	0.0	0
951	572	24,005.5	0.074
952	1233	51,790.8	0.159
953	1984	83,326.7	0.256
954	2830	118,841.3	0.365
955	3776	158,608.2	0.487
956	4831	202,894.6	0.623
957	5998	251,902.7	0.773
958	7283	305,866.9	0.939
959	8691	365,028.5	1.120
960	10229	429,622.0	1.318
961	11902	499,878.9	1.534
962	13715	576,049.9	1.768
963	15675	658,369.7	2.020
964	17787	747,069.7	2.293
965	20057	842,394.3	2.585
966	22490	944,587.8	2.899
967	25092	1,053,878.4	3.234
968 Storage	27869	1,170,503.9	3.592
969	30827	1,294,738.0	3.973
970	33981	1,427,219.4	4.380

Incised Elev.= 963.0

WELL PAD & PIT STREAM / WETLAND IMPACT	
Perennial Stream Impact (Linear Feet)	
BLUESTONE CREEK	96
Total Impact	96
Intermittent Stream Impact (Linear Feet)	
UNT-11	129
UNT-11A	133
UNT-1A	90
Total Impact	352
Ephemeral Stream Impact (Linear Feet)	
UNT-2	65
UNT-3	91
UNT-5	69
UNT-6	48
UNT-7	30
UNT-8	21
UNT-9	58
UNT-10	123
UNT-10A	38
Total Impact	543

OXF 159 WELL PAD & ASSOCIATED PIT						
Description	Cut (CY)	Fill (CY)	Spoil (CY)	Borrow (CY)	Max. Slope (%)	Length of Slope (FT)
Access Road "A" Ph-2	9,935.7	3,188.7	6,747.0	0.0	6.8	101.7
Access Road "B"	421.8	2,791.6	0.0	2,369.8	12.6	135.0
Access Road "C"	63.8	4,343.2	0.0	4,279.4	14.4	370.0
Well Pad	92,992.5	33,135.3	59,857.2	0.0	n/a	n/a
Well Pad Containment Berm	0.0	232.5	0.0	232.5	n/a	n/a
Associated Pit	5,511.1	1,443.1	4,068.0	0.0	n/a	n/a
Truck Turnaround Pad	0.0	1,965.5	0.0	1,964.5	n/a	n/a
Stripped Topsoil (6")	8,493.9	0.0	8,493.9	0.0	n/a	n/a
Material Stockpiles	0.0	71,460.0	0.0	71,460.0	n/a	n/a
Totals	117,419.8	118,559.9	79,166.1	80,306.2	n/a	n/a
	TOTAL SPOIL (CY) =		-1,140.1			

ROAD A - PH-1 STREAM / WETLAND IMPACT	
Ephemeral Stream Impact (Linear Feet)	
UNT-17	24
UNT-18	24
UNT-19	72
UNT-20	50
UNT-21	18
Total Impact	188
Ephemeral Pool Impact (Square Feet)	
POOL - 1	95
POOL - 2	389
Total Area	484

ROAD A PH-1 MATERIAL STOCKPILES		
Name	Excess	Topsoil
A	21,038.60	0.00
B	4,030.10	0.00
C	4,152.00	0.00
D	0.00	3,673.10
TOTAL (CY)	29,220.7	3,673.1

OXF 159 ACCESS ROAD A - PHASE 1						
Description	Cut (CY)	Fill (CY)	Spoil (CY)	Borrow (CY)	Max. Slope (%)	Length of Slope (FT)
Access Road "A" Ph-1	31,492.1	3,205.3	28,286.8	0.0	0.0	0.0
Stripped Topsoil (6")	3,500.7	0.0	3,500.7	0.0	n/a	n/a
Material Stockpiles	0.0	32,893.8	0.0	32,893.8	n/a	n/a
Totals	34,992.8	36,099.1	31,787.5	32,893.8	n/a	n/a
	TOTAL SPOIL (CY) =		-1,106.3			

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HONESTY. INTEGRITY. QUALITY.

CHRIS S. KING REGISTERED 9578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

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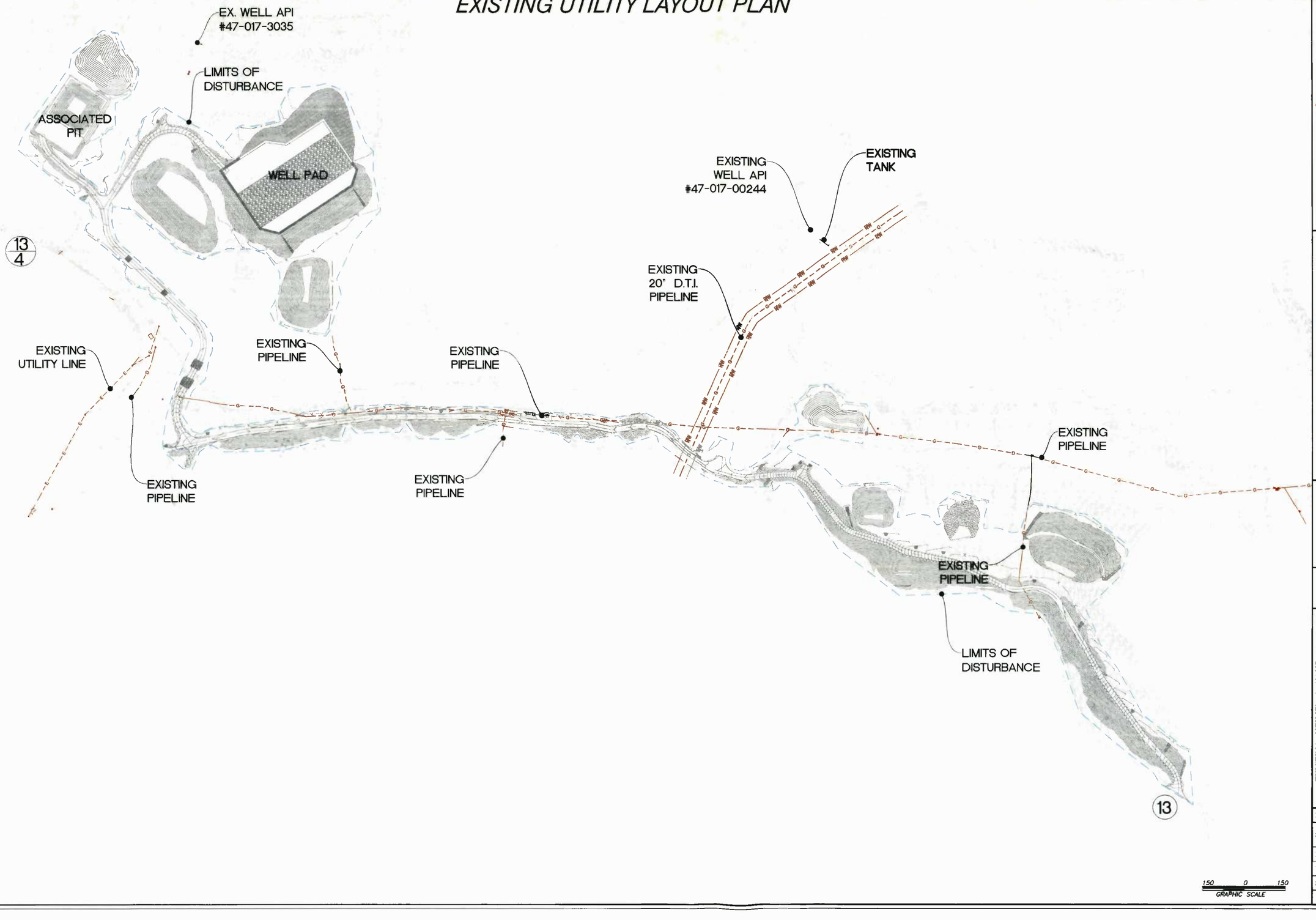
FOR: EQT PRODUCTION COMPANY

OVERALL SHEET INDEX & VOLUMES
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: 1" = 150'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 3 OF 28

EXISTING UTILITY LAYOUT PLAN



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CHRIS B. KLINE
REGISTERED
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EXISTING UTILITY LAYOUT PLAN
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: 1" = 150'
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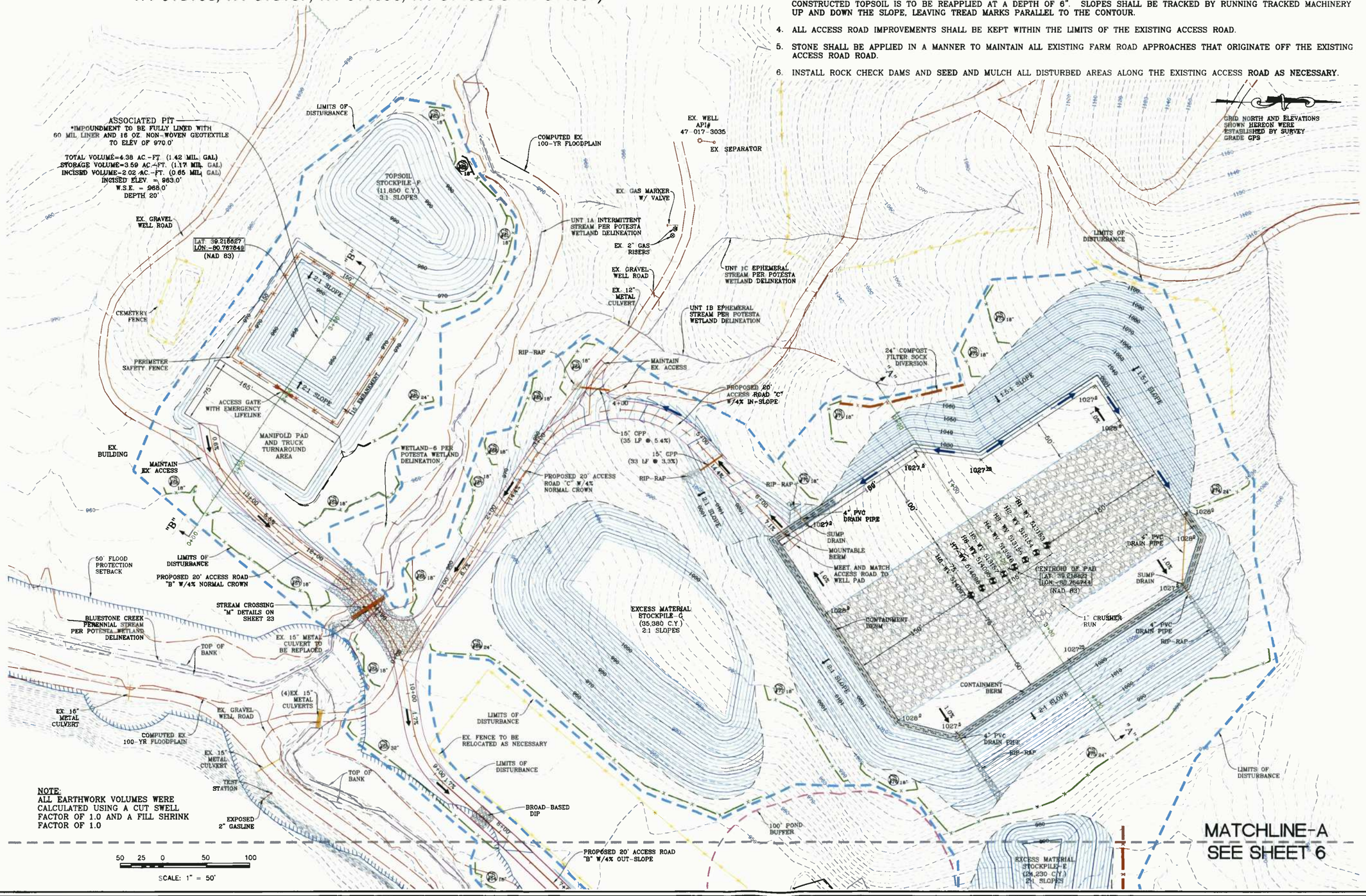
SHEET 4 OF 26

WELL PAD & ASSOCIATED PIT DETAILS

(PROPOSED WELLS NO. WV 513153, WV 513154, WV 513155, WV 513156, WV 513157, WV 514095, WV 514096 & WV 514097)



NOTE:

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2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTER.
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5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
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NOTE:
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WELL PAD & ASSOCIATED PIT DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE:	12/23/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	5 OF 28

ACCESS ROAD DETAILS

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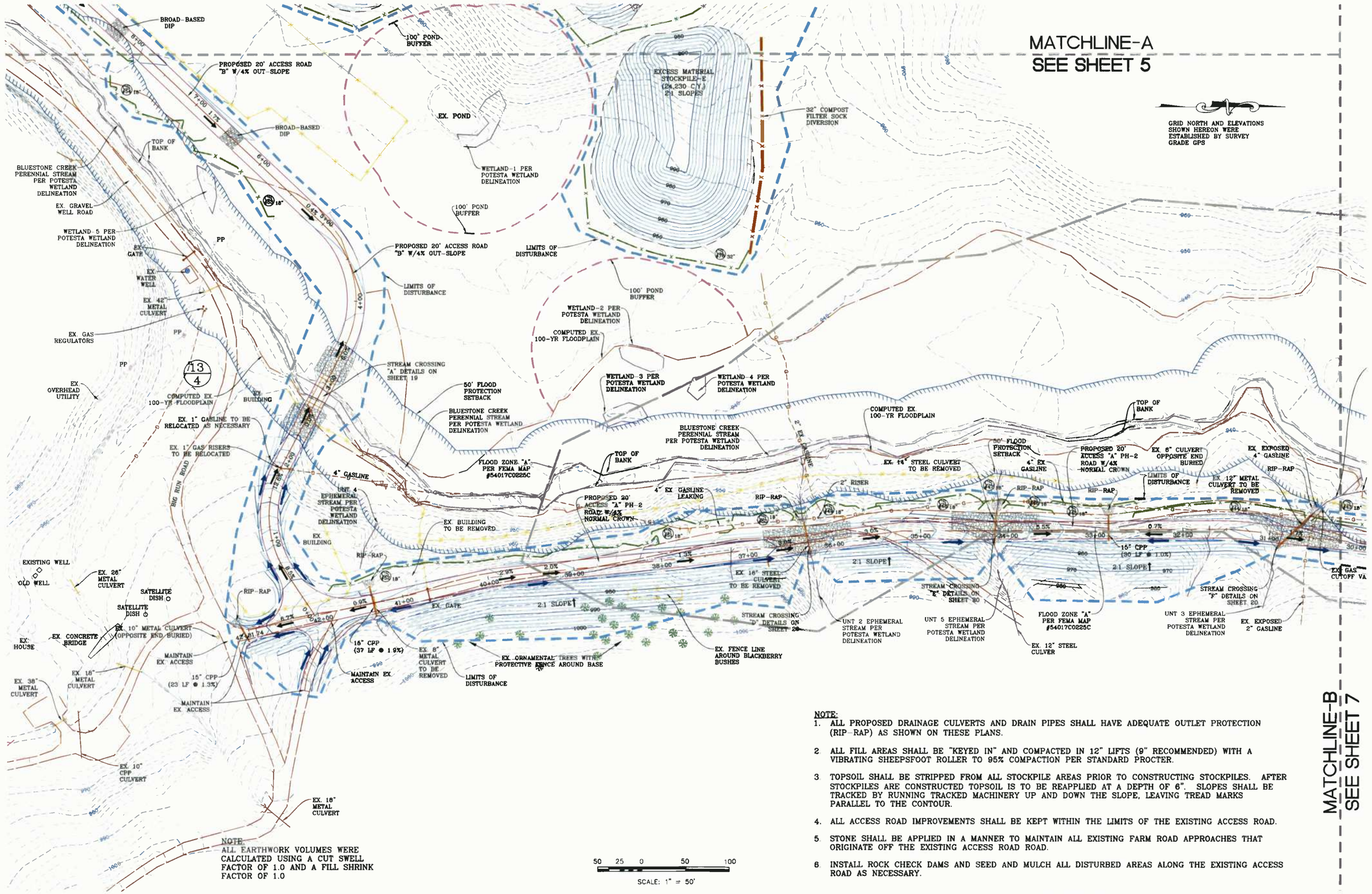

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ACCESS ROAD DETAILS
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WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

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SHEET	6 OF 28

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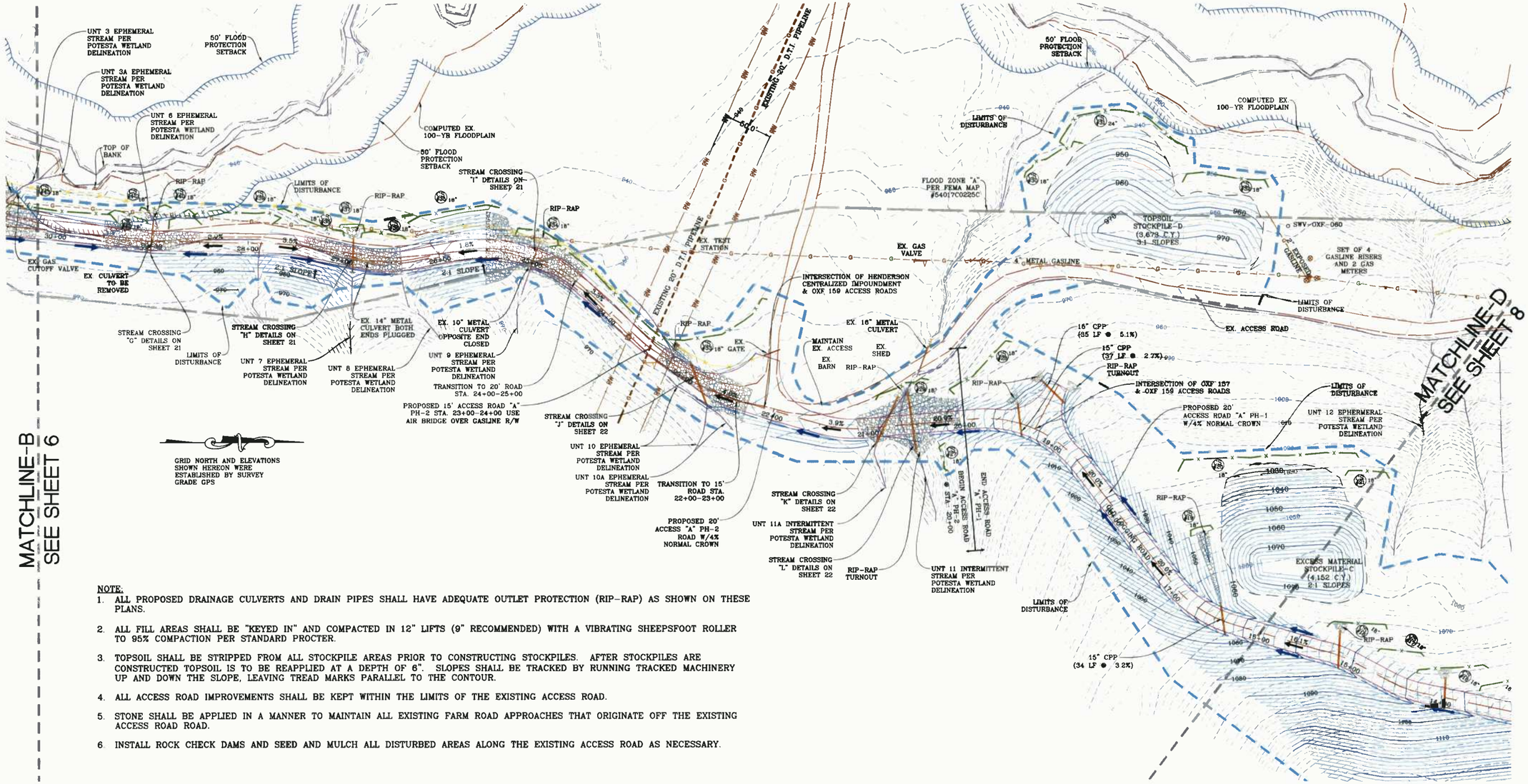

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6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.

NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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PROJECT MGMT.
SLS
2456 Dive Bottom Road
Shadyside, OH 43947
(740) 671-9911
HORIZONTAL DATUM NAD 83

CERTIFICATE NO. 19578
CERTIFICATE OF REGISTERED PROFESSIONAL ENGINEER
STATE OF WEST VIRGINIA
CERTIFICATE NO. 19578
CERTIFICATE OF REGISTERED PROFESSIONAL ENGINEER
STATE OF WEST VIRGINIA

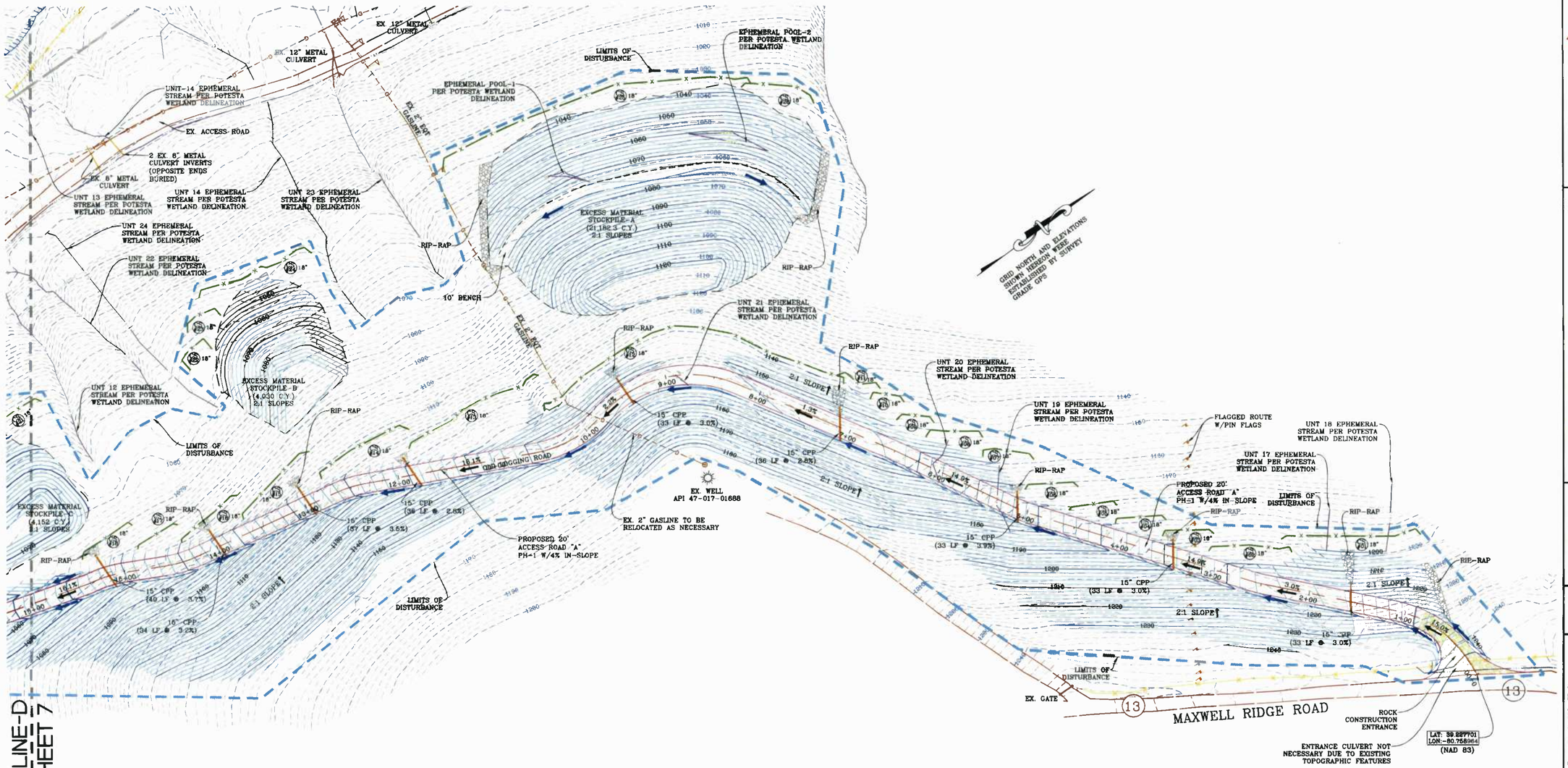
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ACCESS ROAD DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 7 OF 28

ACCESS ROAD DETAILS

(PROPOSED WELLS NO. WV 513153, WV 513154, WV 513155, WV 513156, WV 513157, WV 514095, WV 514096 & WV 514097)



NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

50 25 0 50 100
SCALE: 1" = 50'

NOTE:

1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTER.
3. TOPSOIL SHALL BE STRIPPED FROM ALL STOCKPILE AREAS PRIOR TO CONSTRUCTING STOCKPILES. AFTER STOCKPILES ARE CONSTRUCTED TOPSOIL IS TO BE REAPPLIED AT A DEPTH OF 6". SLOPES SHALL BE TRACKED BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR.
4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.

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3606 Ellins Station Road Bridgeport, OH 43947 (740) 671-9911

CHRIS B. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

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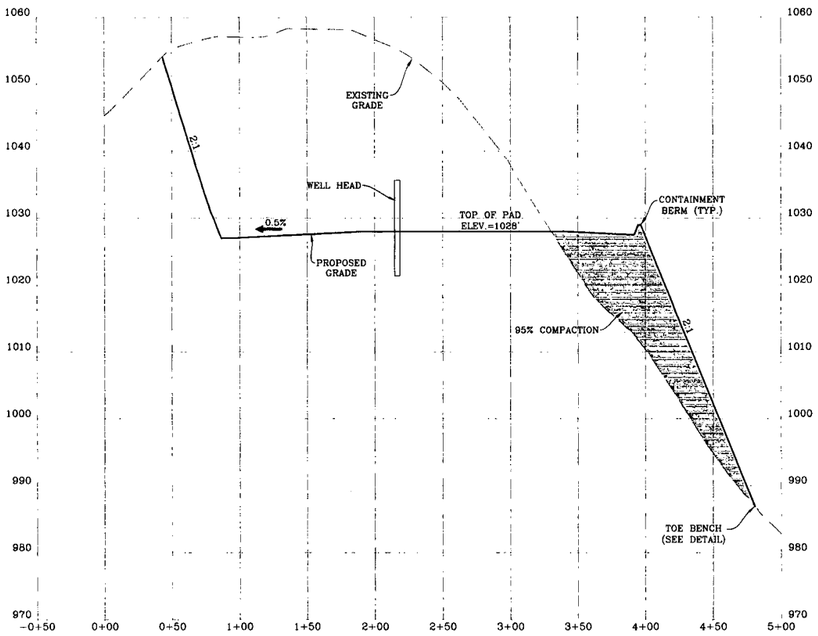
ACCESS ROAD DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

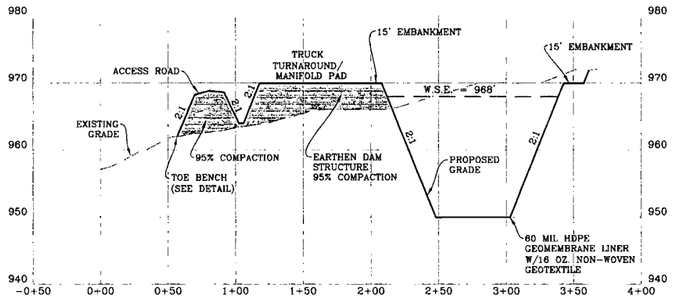
DATE: 12/23/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 8 OF 28

WELL PAD & ASSOCIATED PIT SECTIONS



WELL PAD CROSS-SECTION "A-A"

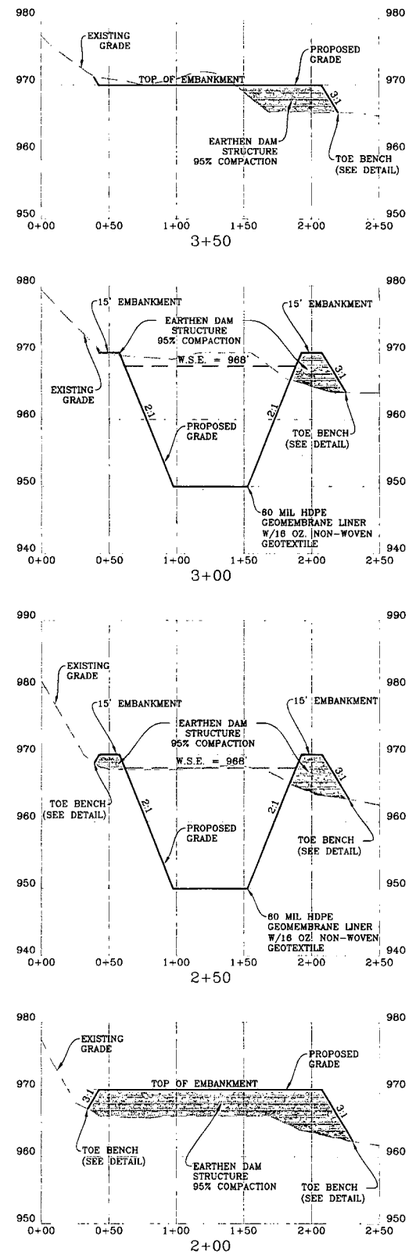
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



ASSOCIATED PIT CROSS-SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

NOTE:
1. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTER.



ASSOCIATED PIT CROSS-SECTIONS ALONG BASELINE "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

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(740) 671-9911
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STATUS & FUNCTION
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
2.25.2015

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

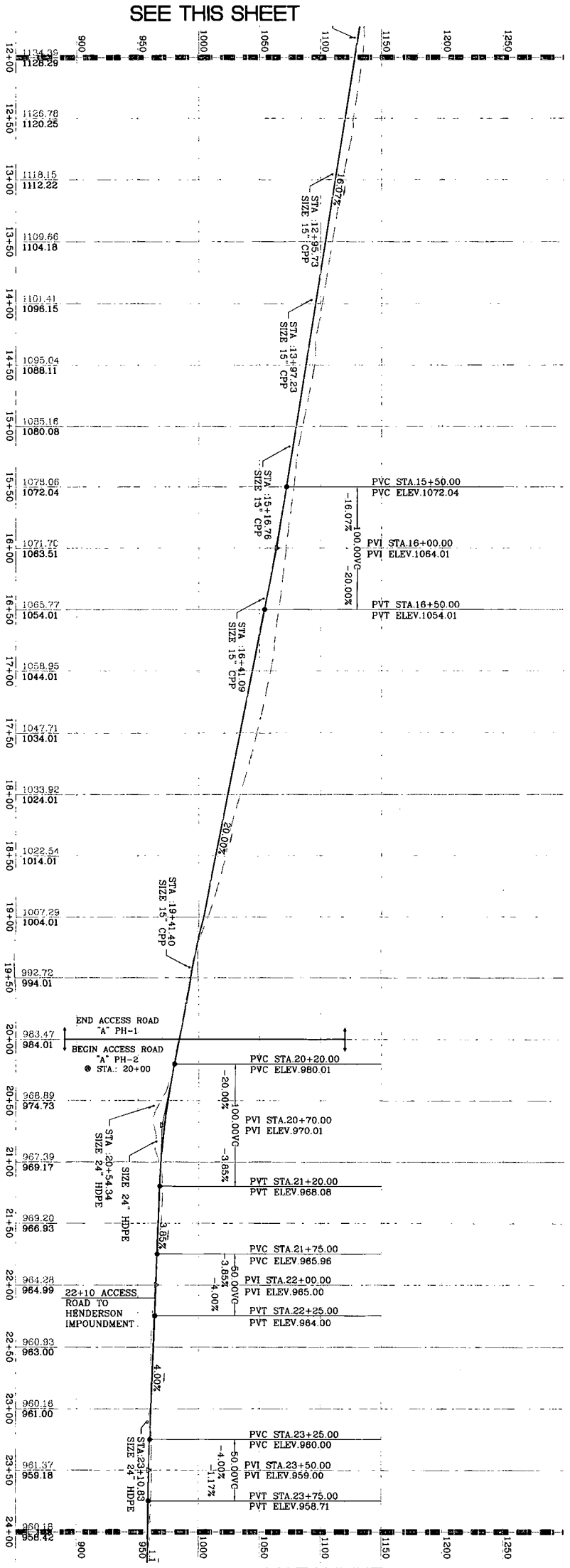
WELL PAD & ASSOCIATED PIT SECTIONS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 9 OF 28

ACCESS ROAD "A" PH-1 & PH-2 PROFILE

ACCESS ROAD "A" PH-1 PROFILE

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



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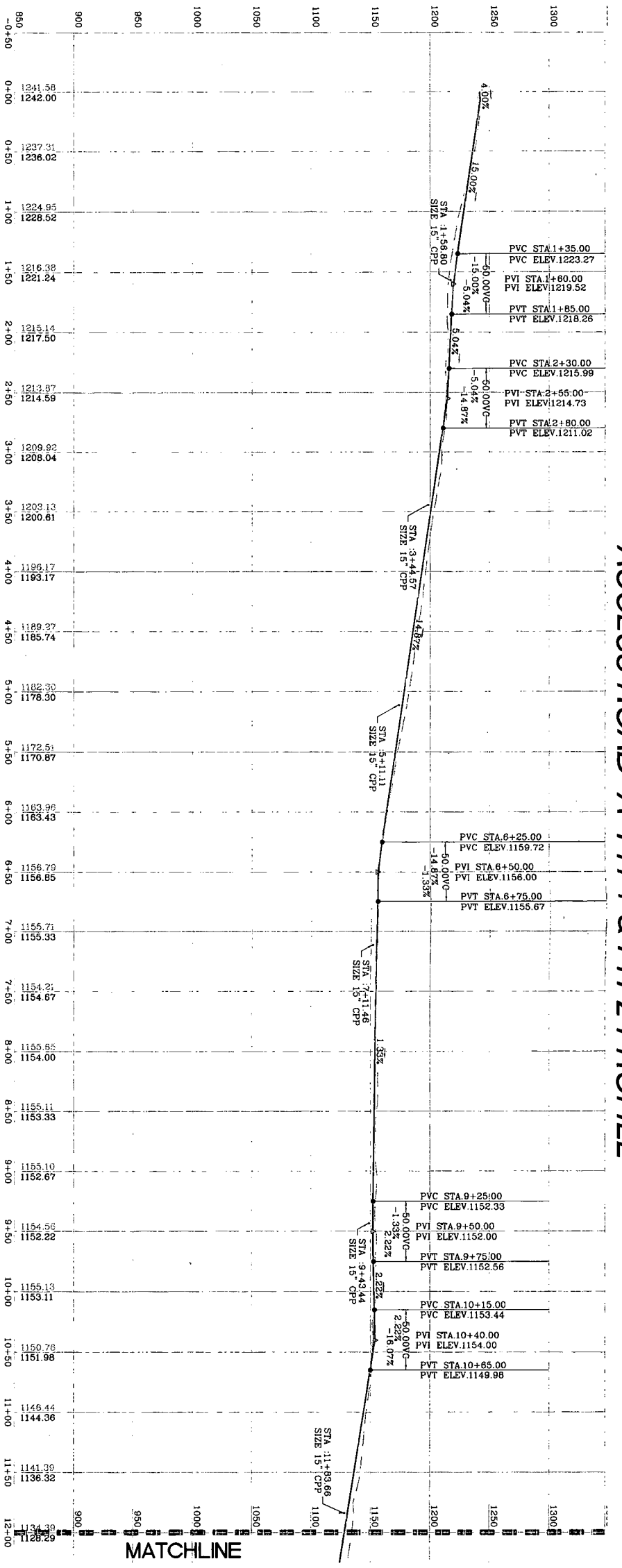

SCALE: 1" = 50'

DATE:	12/23/2013
SCALE:	AS SHOWN
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	10 OF 28

ACCESS ROAD "A" PH-1 & PH-2 PROFILE

OXF 159

WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

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CRAIG S. [illegible] REGISTERED PROFESSIONAL ENGINEER STATE OF WEST VIRGINIA 12-23-2013

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A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT MGMT. SLS ENGINEERS ENVIRONMENTAL
226 West Main St. P.O. Box 150 Glenville, WV 26351 (304) 462-5634
56065 Dilles Bottom Road Shadyside, OH 43947 (740) 671-9911
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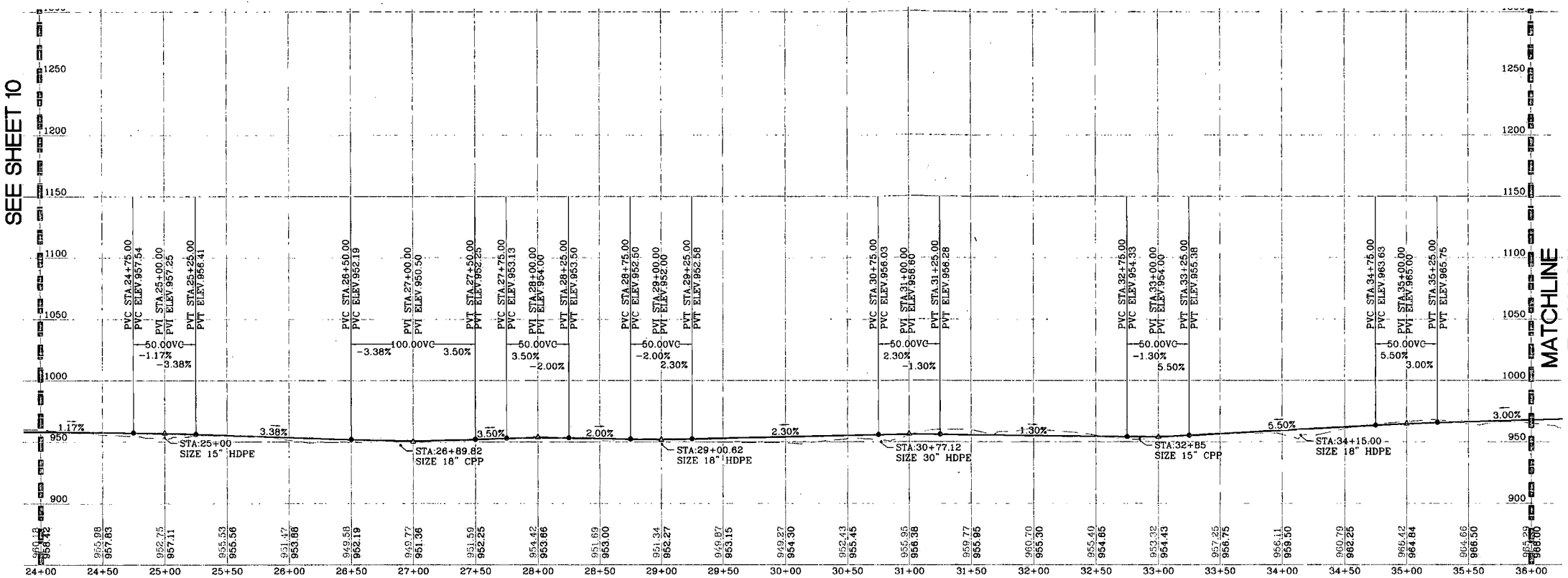
ACCESS ROAD "A" PH-1 & PH-2 PROFILE

MATCHLINE
'STA 24+00'
SEE SHEET 10



MATCHLINE
'STA 36+00'
SEE THIS SHEET

ACCESS ROAD "A" PH-2 PROFILE

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

MATCHLINE
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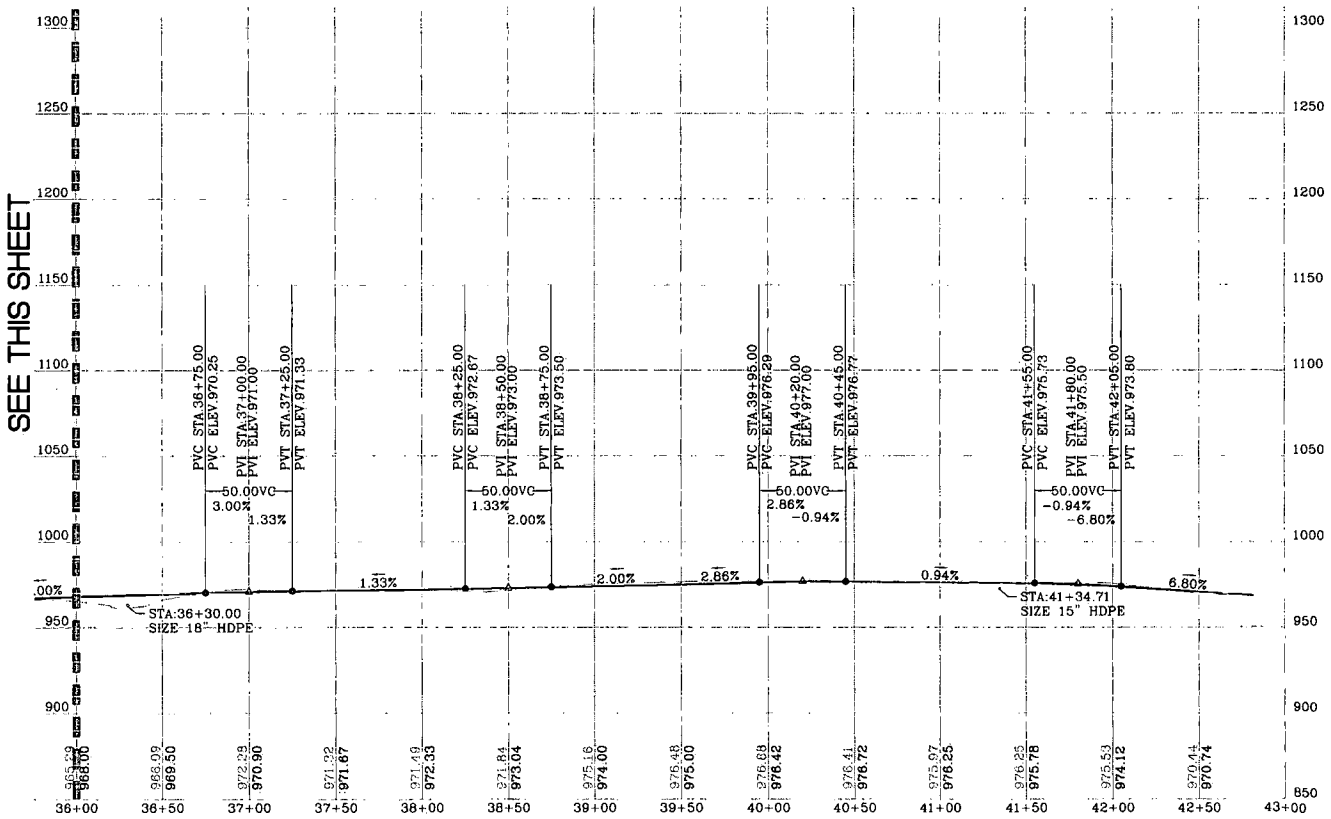
SEE THIS SHEET



ACCESS ROAD "A" PH-2 PROFILE

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

50 25 0 50 100

SCALE: 1" = 50'

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STEVE E. KING
REGISTERED
No. 19376
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/23/2013

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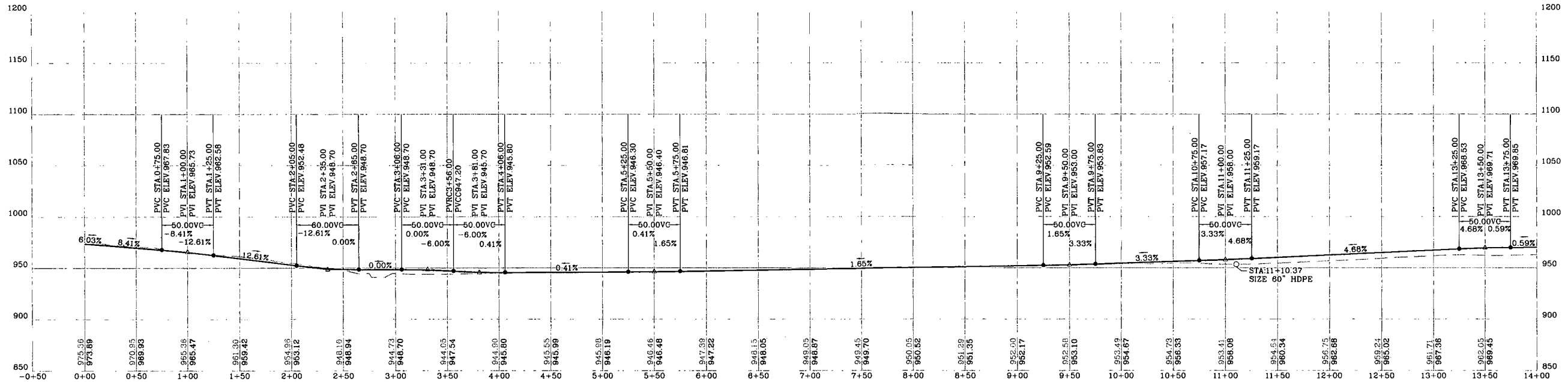
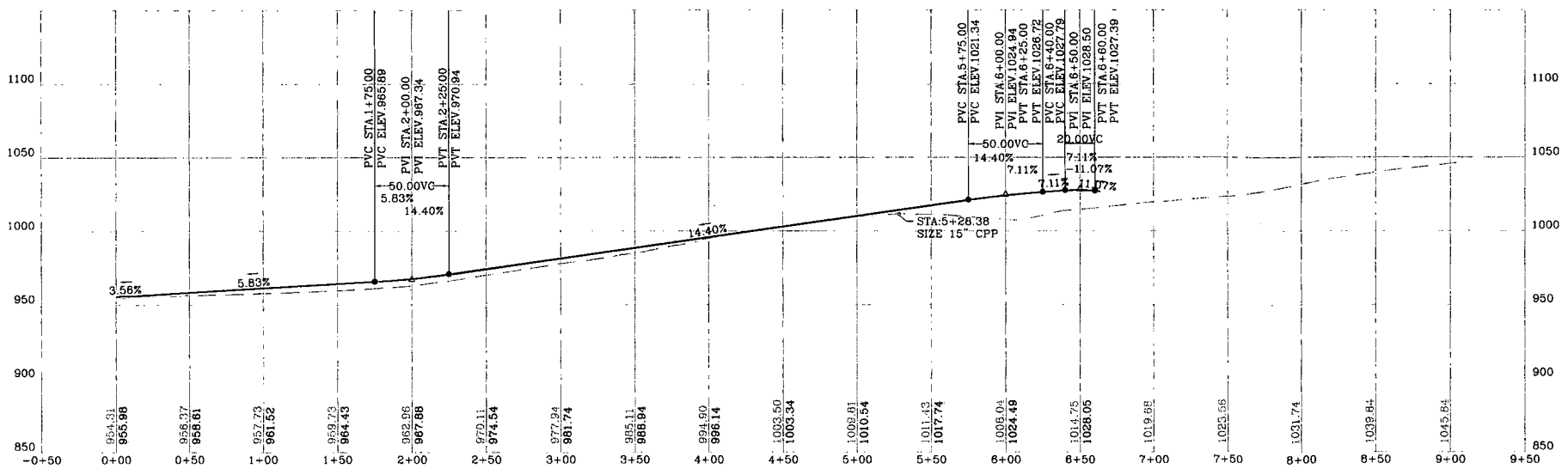
ACCESS ROAD "A" PH-1 & PH-2 PROFILE
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 11 OF 28

ACCESS ROADS "B" & "C" PROFILE



ACCESS ROAD "B" PROFILE
SCALE: HORIZ. 1" = 50' VERT. 1" = 50'



ACCESS ROAD "C" PROFILE
SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

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STEVE S. KIMES
REGISTERED
19578
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PROFESSIONAL ENGINEER
12/23/2013

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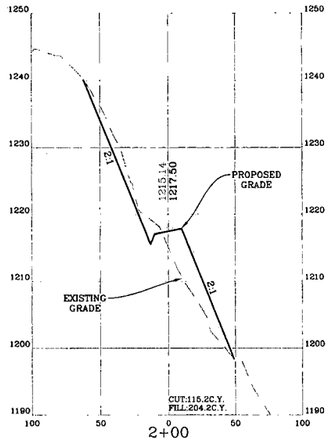
ACCESS ROADS "B" & "C" PROFILE
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 12 OF 28

ROAD SECTIONS

ACCESS ROAD "A" PH-1 CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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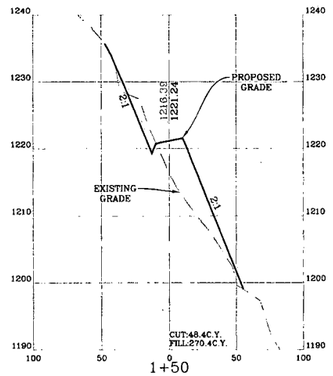

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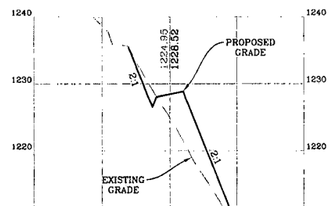

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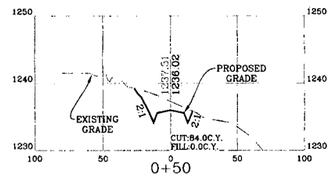

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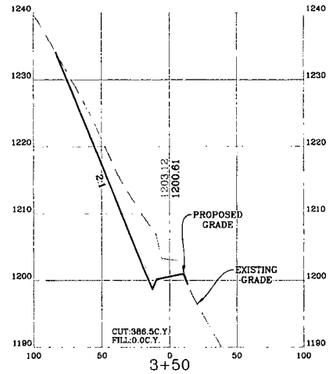

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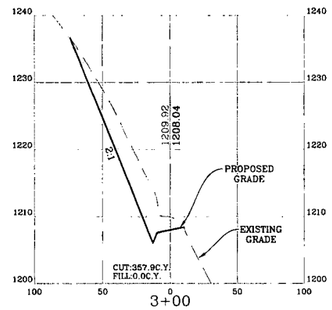

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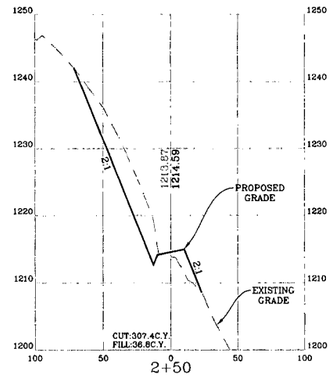

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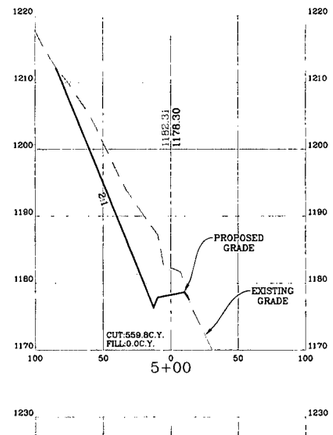

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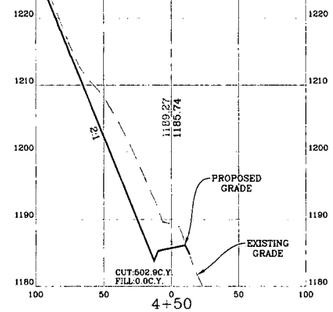

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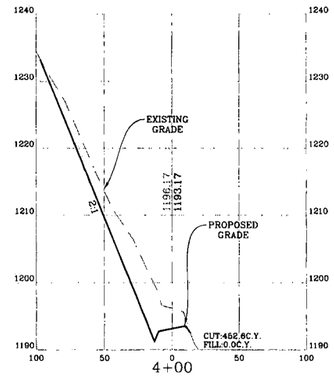

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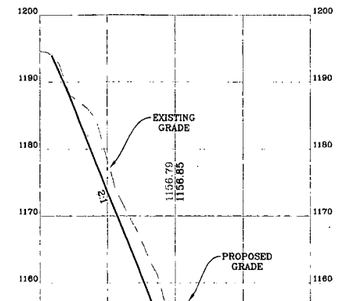

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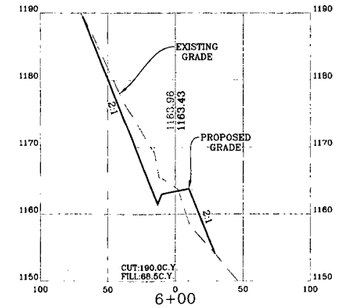

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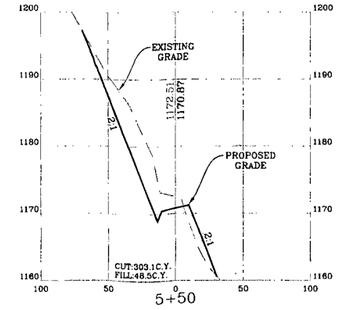

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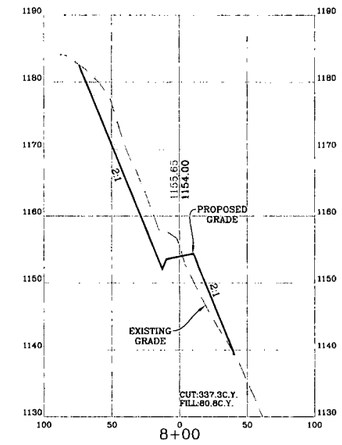

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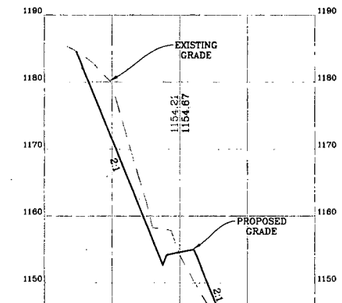

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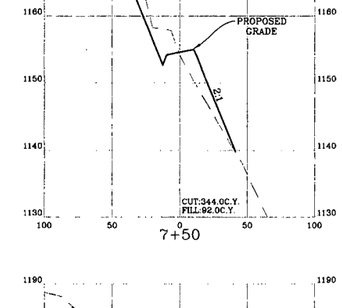

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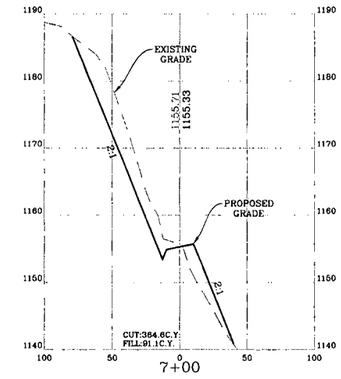

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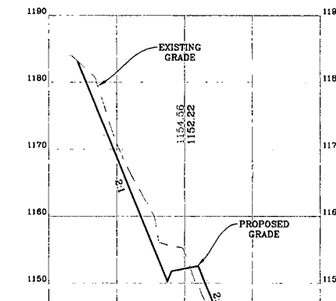

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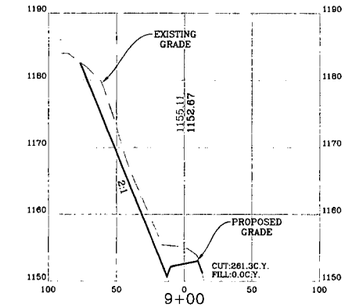

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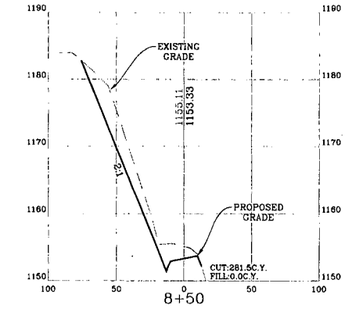

8+50

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STEVEN B. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/23/2013

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

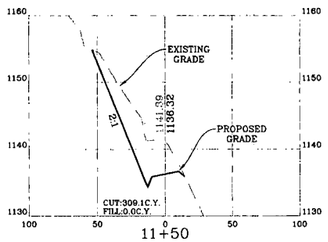
ROAD SECTIONS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE:	12/23/2013
SCALE:	AS SHOWN
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	13 OF 28

ROAD SECTIONS

ACCESS ROAD "A" PH-1 CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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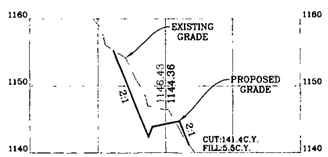

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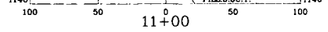

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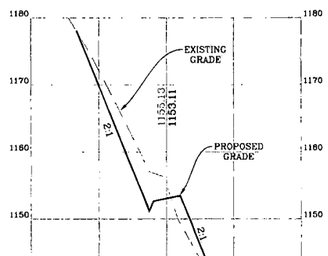

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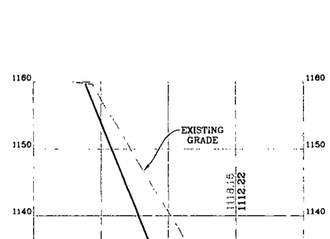

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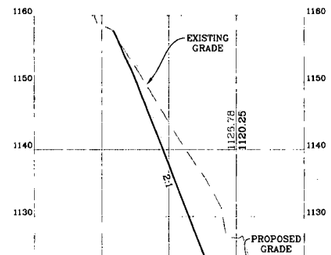

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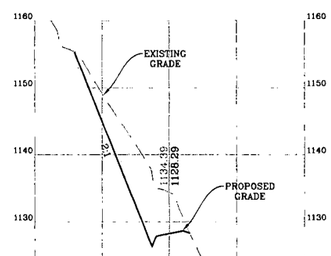

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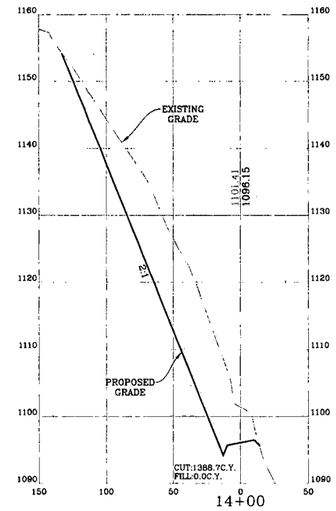

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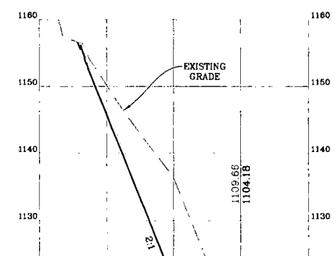

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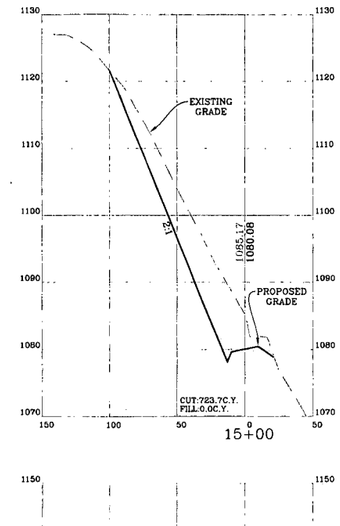

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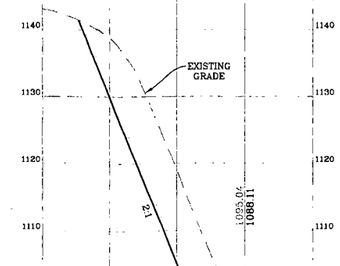

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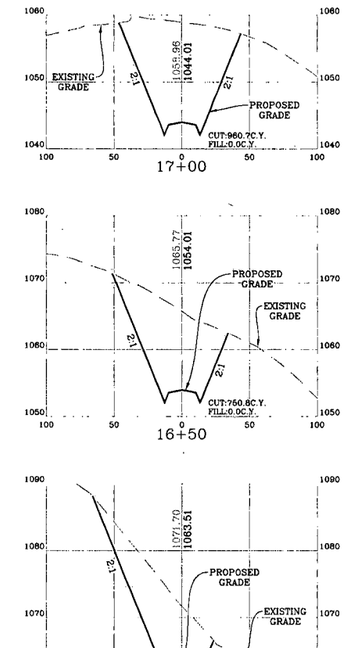

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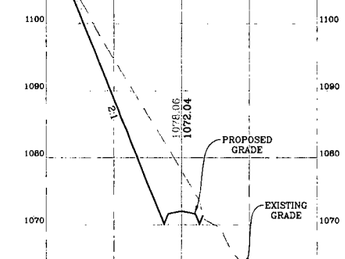

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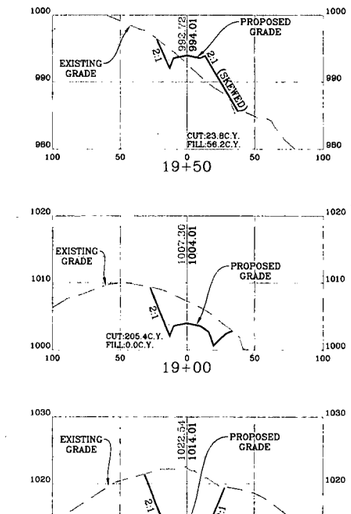

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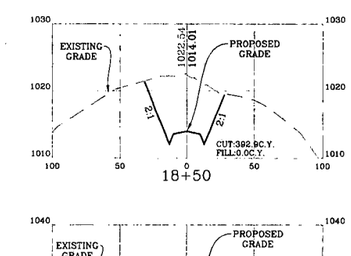

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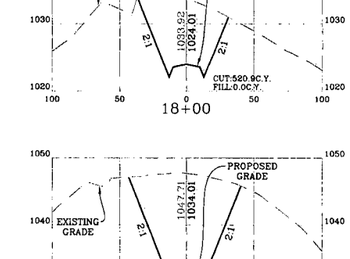

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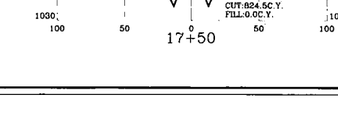

17+50

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PROFESSIONAL ENGINEER
12/23/2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

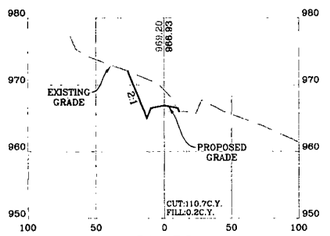
ROAD SECTIONS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 14 OF 28

ROAD SECTIONS

ACCESS ROAD "A" PH-2 CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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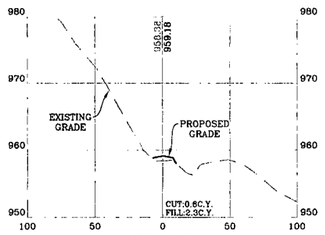

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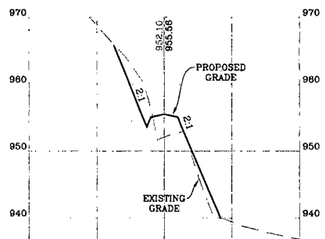

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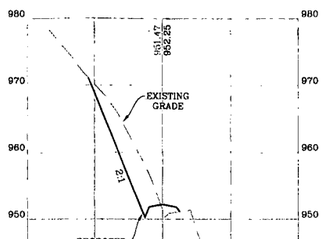

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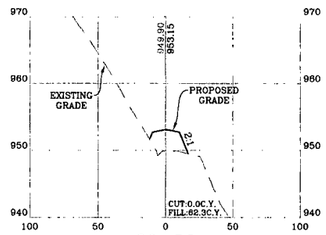

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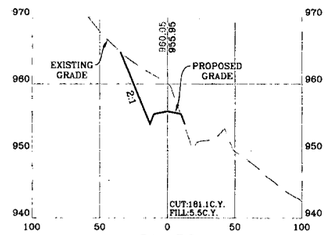

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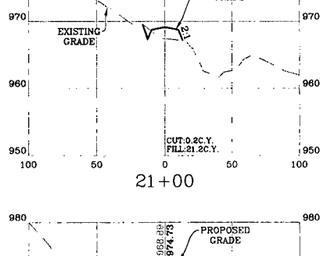

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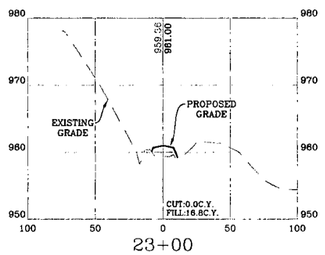

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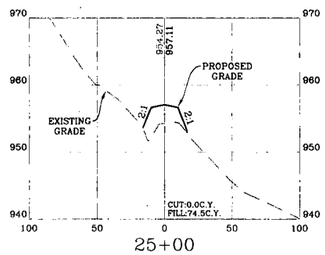

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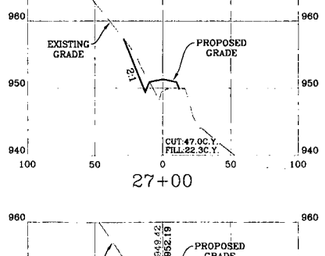

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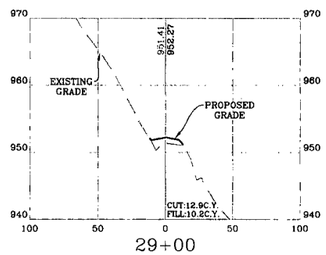

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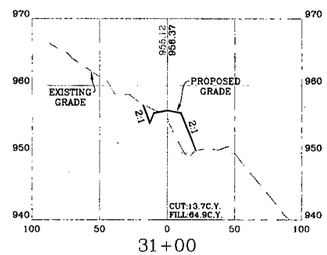

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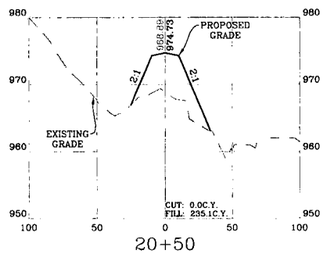

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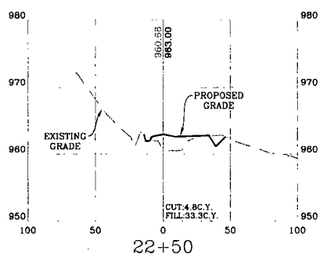

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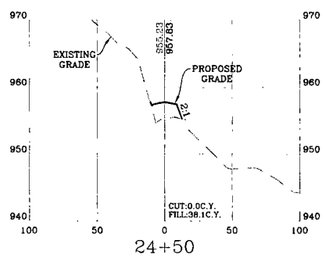

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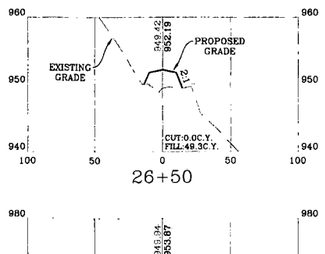

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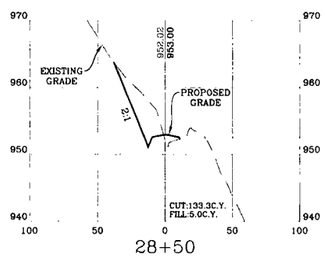

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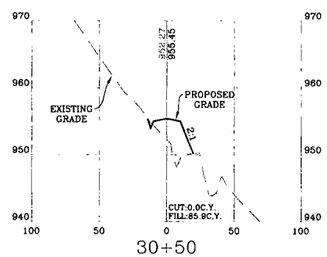

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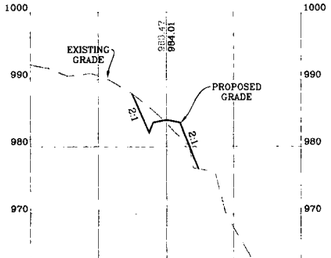

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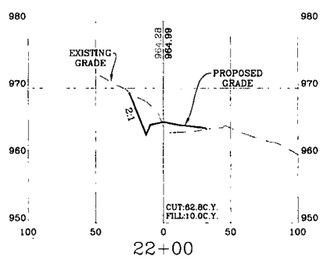

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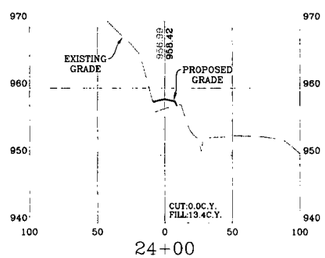

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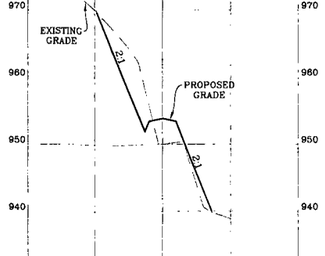

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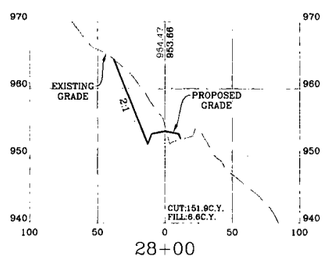

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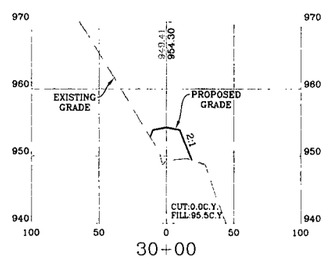

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PROFESSIONAL ENGINEER
12-23-2013

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

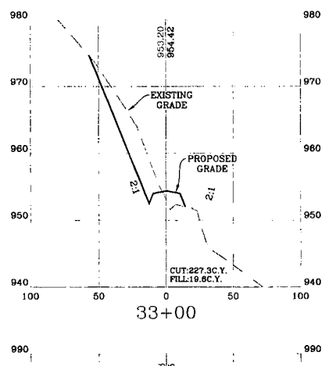
ROAD SECTIONS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

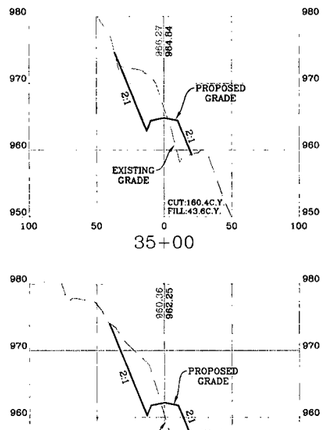
DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 15 OF 28

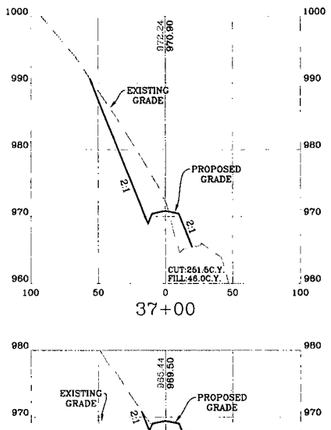
ROAD SECTIONS

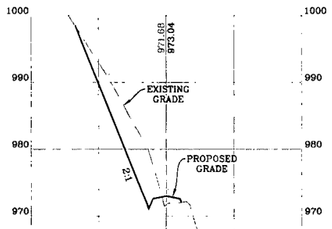
ACCESS ROAD "A" PH-2 CROSS-SECTIONS

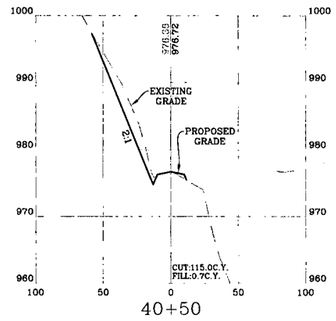
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

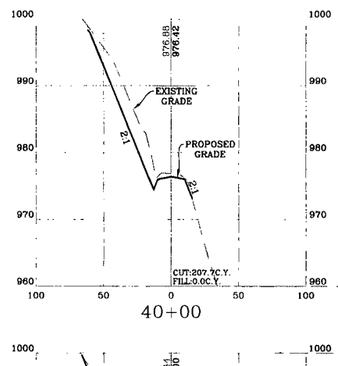


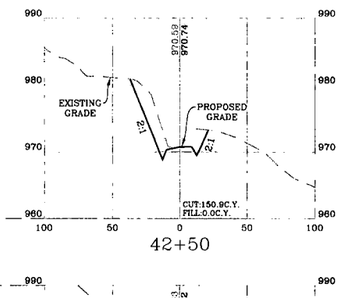


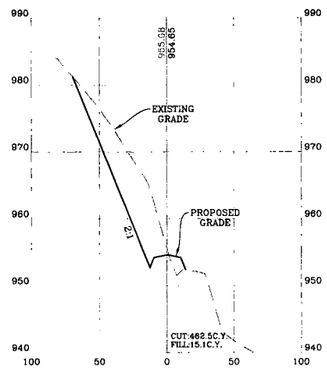


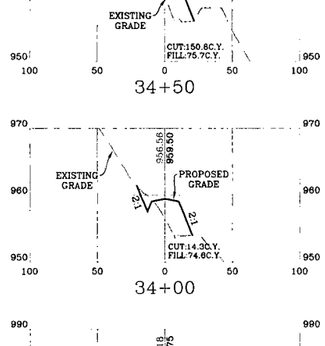


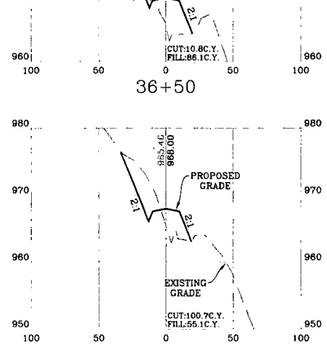


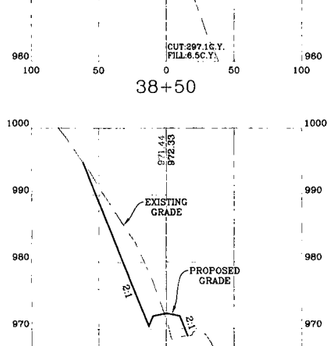


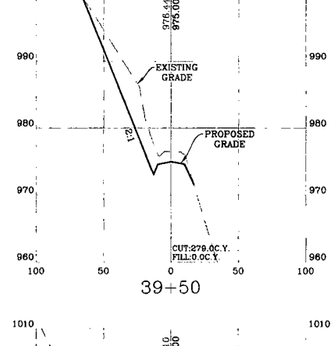


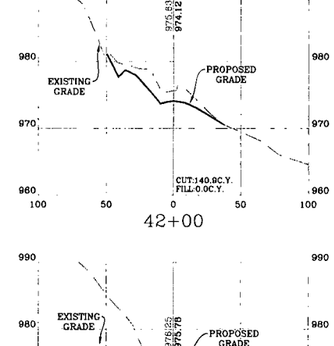


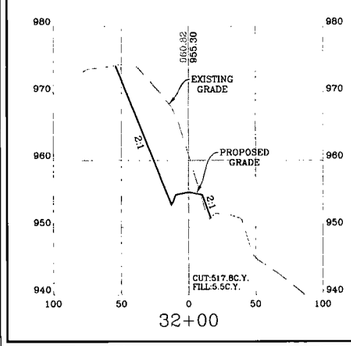


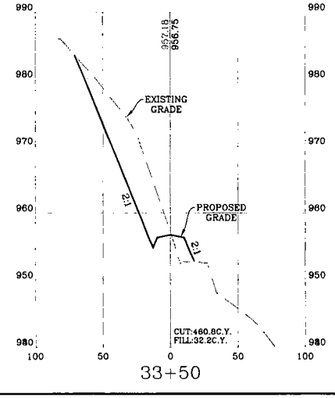


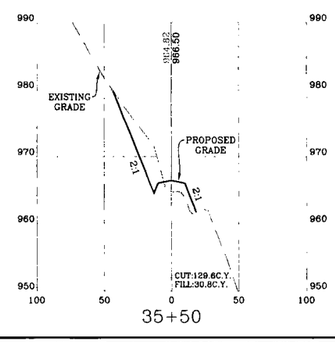


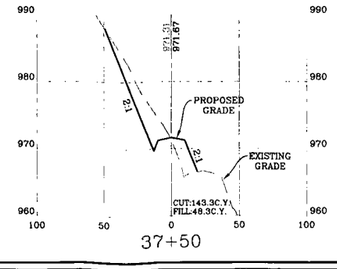


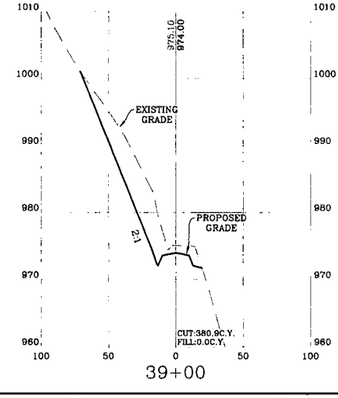


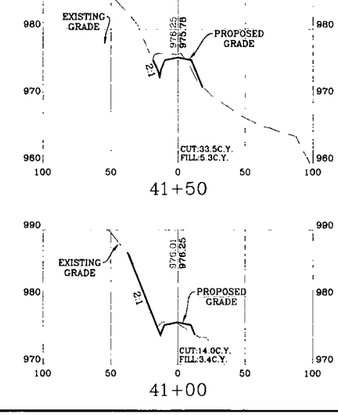












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CRAIG S. KNAPP
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DODDRIDGE COUNTY, WV

DATE: 12/23/2013
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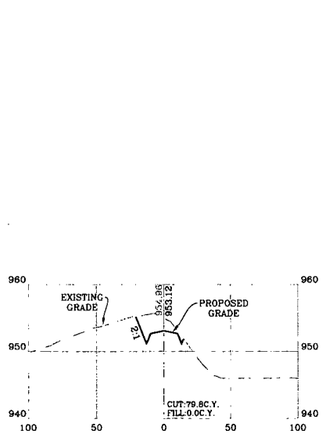
DESIGNED BY: CSK
FILE NO. 7889
SHEET 16 OF 28

ROAD SECTIONS

ACCESS ROAD "B" CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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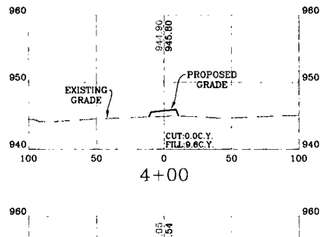

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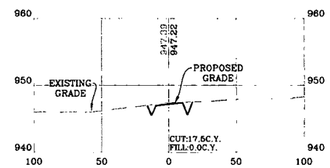

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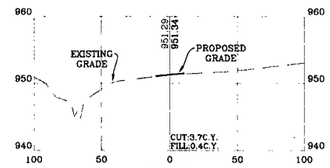

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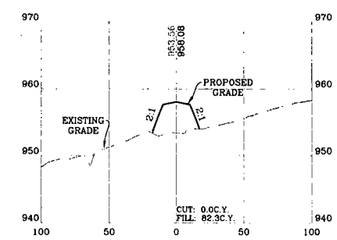

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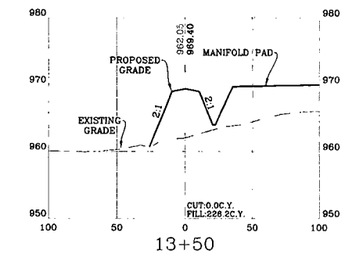

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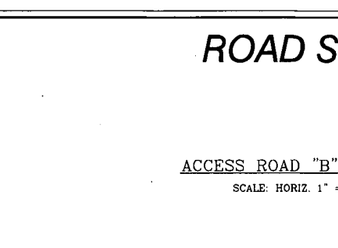

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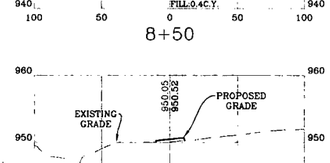

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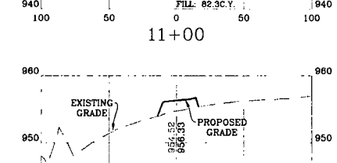

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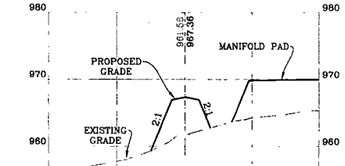

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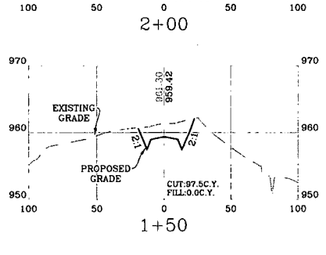

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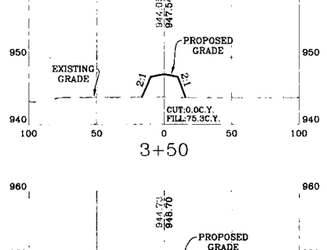

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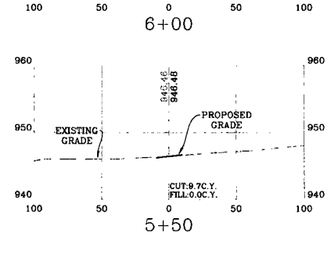

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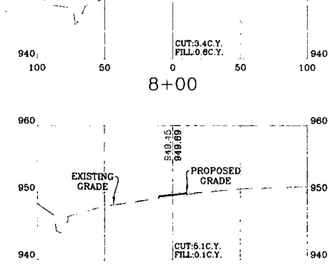

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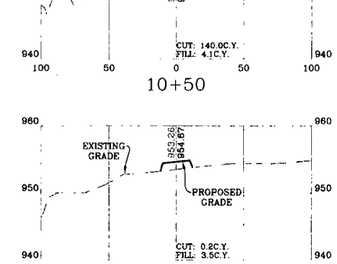

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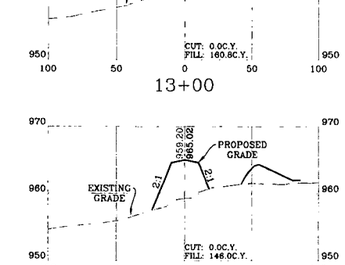

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CHRIS S. KAISER
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/23/2013

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

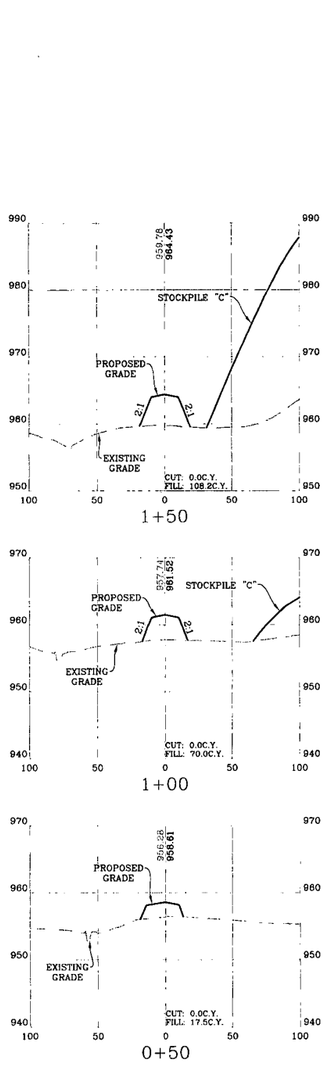
ROAD SECTIONS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7689
SHEET 17 OF 28

ROAD SECTIONS

ACCESS ROAD "C" CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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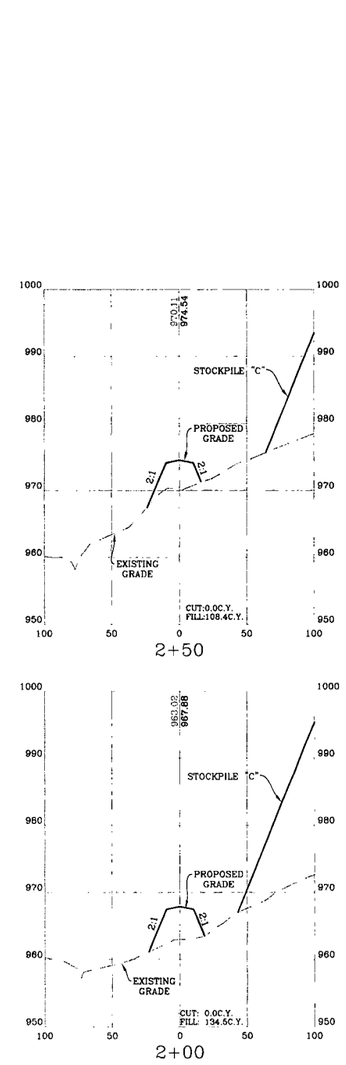

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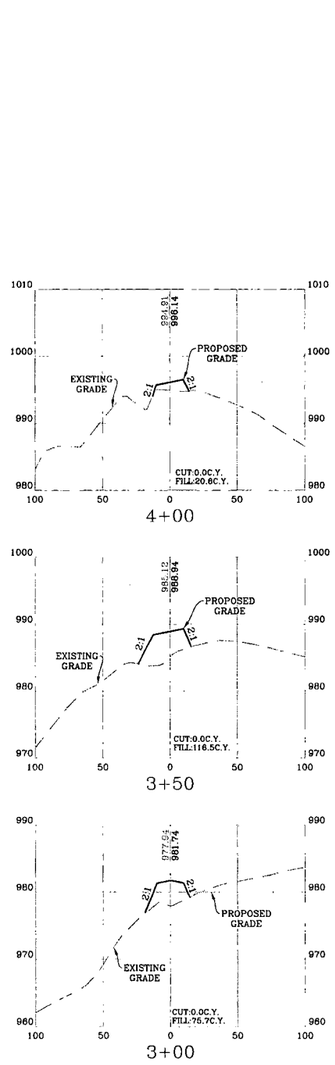

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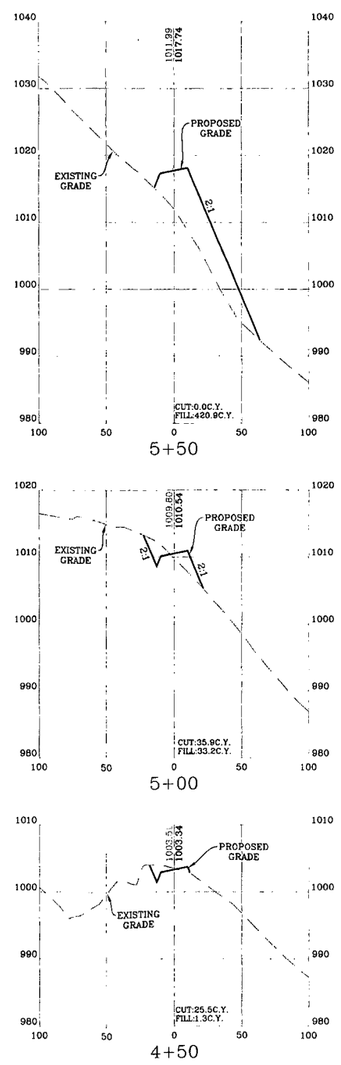

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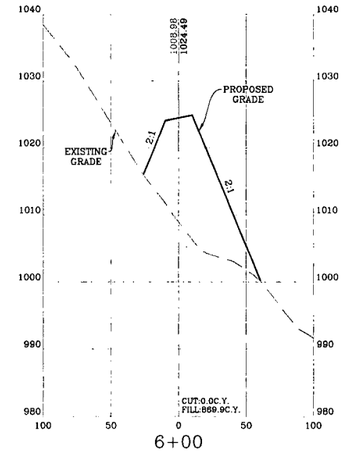

6+00

0+50

2+00

3+00

4+50

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WEST VIRGINIA
PROFESSIONAL ENGINEER
12-23-2013

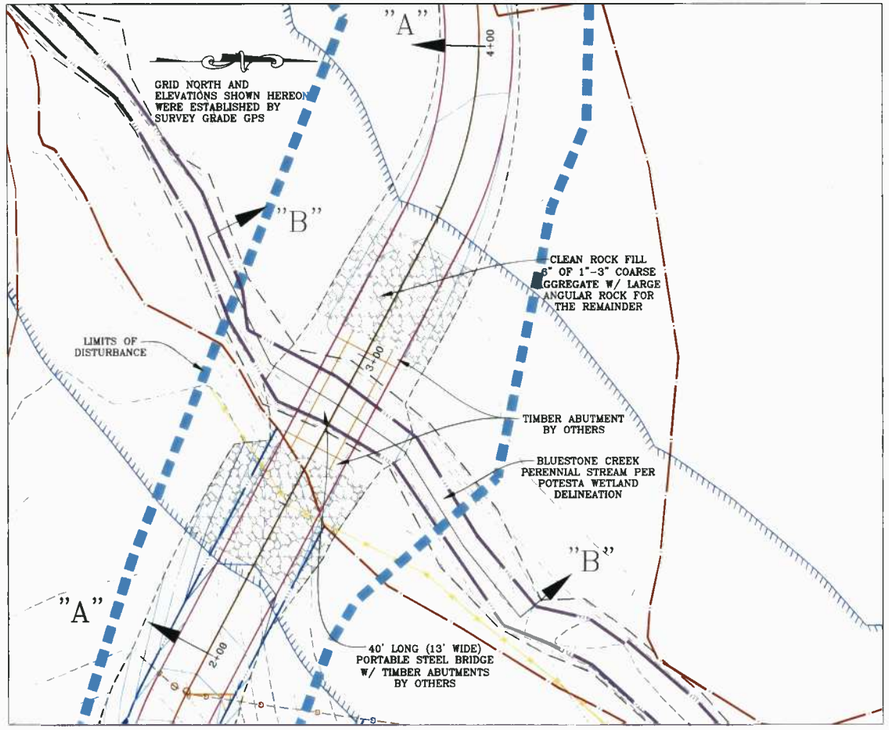
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ROAD SECTIONS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 18 OF 28

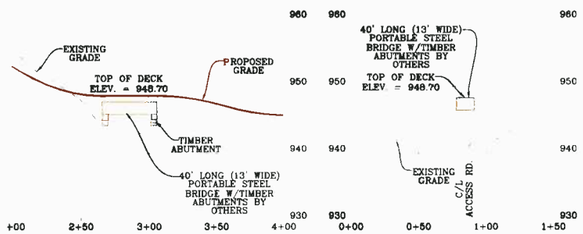
TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "A" DETAILS



SCALE: 1" = 20'

STREAM CROSSING "A" SECTIONS



CROSS SECTION "A–A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

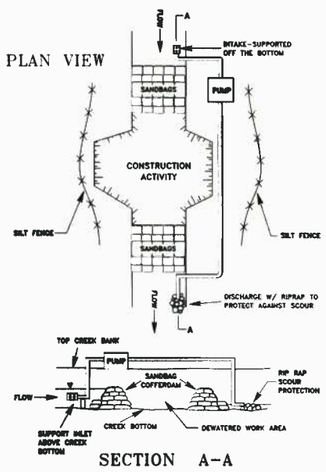
CROSS SECTION "B–B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

FIGURE

PUMP AROUND



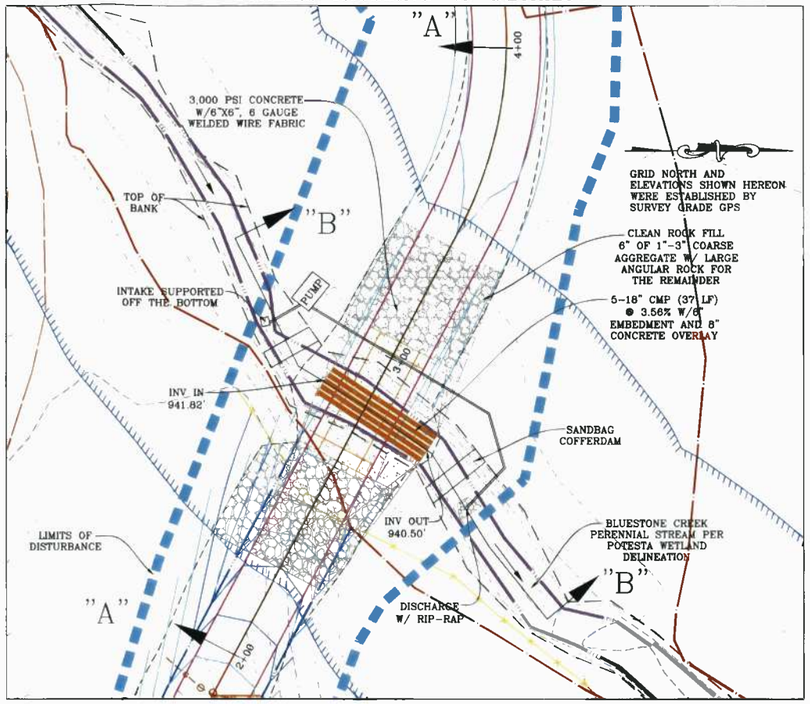
SECTION A-A

PUMP AROUND NOTES:

1) CONSTRUCTION SHOULD BE PERFORMED DURING LOW FLOW PERIODS.
2) PUMP(S) SHOULD BE SUFFICIENTLY LARGE TO PUMP THE ENTIRE STREAM FLOW AROUND THE SITE.
3) THE COFFERDAM CONSTRUCTED MUST BE IMPERVIOUS TO WATER.
4) THE INLET OF THE PUMP(S) IS TO BE SUSPENDED ABOVE THE STREAMBED IN ORDER TO PREVENT SUCKING MUD AND SEDIMENT.
5) THE DISCHARGE POINT MUST BE STABILIZED WITH ROCK TO DISPERSE THE ENERGY AND PREVENT EROSION.

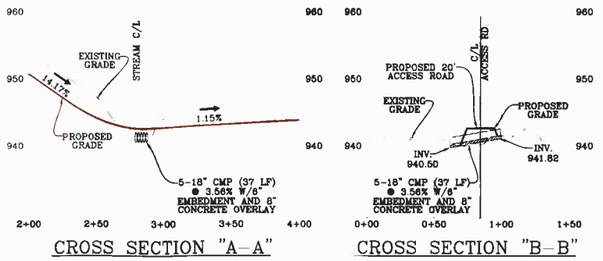
PERMANENT STREAM CROSSING DETAILS

STREAM CROSSING "A" DETAILS



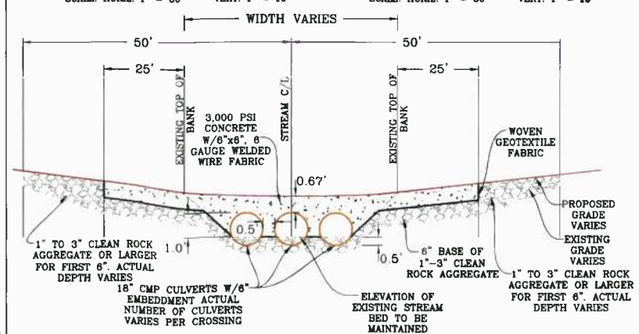
SCALE: 1" = 20'

STREAM CROSSING "A" SECTIONS



CROSS SECTION "A–A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B–B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



LOW WATER CROSSING TYPICAL SECTION
NOT TO SCALE

GENERAL STREAM CROSSING NOTES:

1) 1" TO 3" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
4) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
5) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
6) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
7) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
8) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
9) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
10) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
11) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "A".

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CRAIG B. KUHL
REGISTERED
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STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
2-25-21

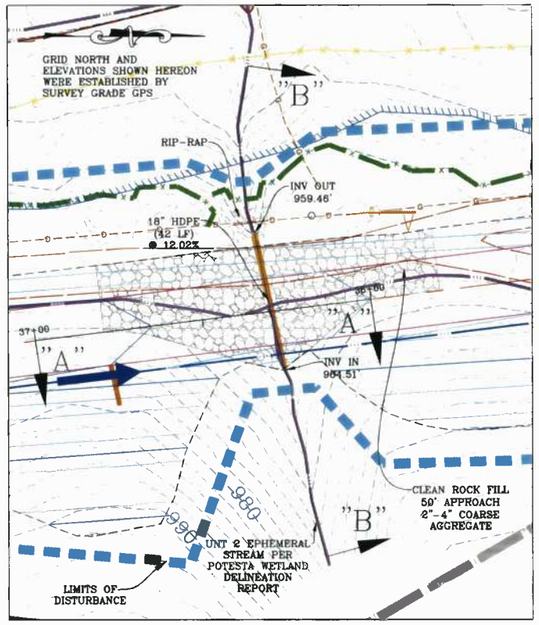
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

MAJOR STREAM CROSSING DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 19 OF 28

STREAM CROSSING DETAILS

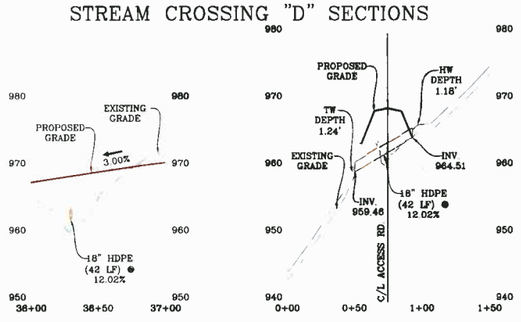
STREAM CROSSING "D" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

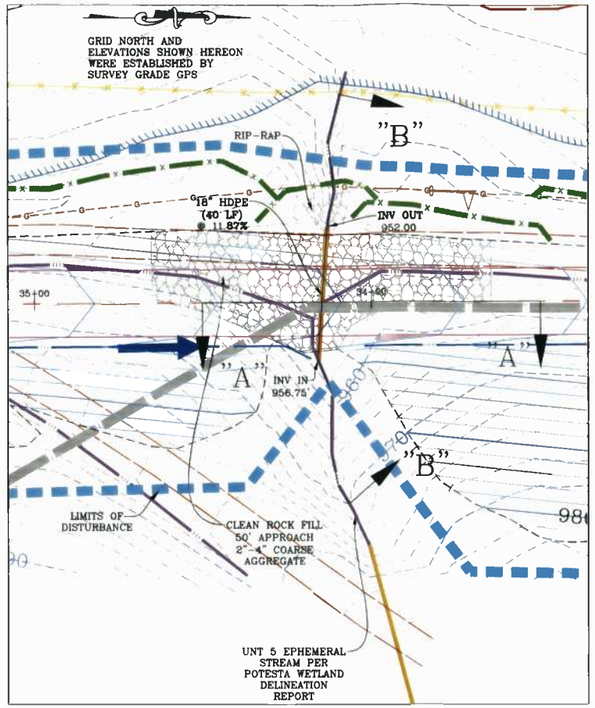
STREAM CROSSING "D" SECTIONS



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

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

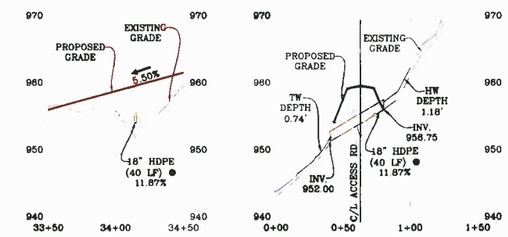
STREAM CROSSING "E" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

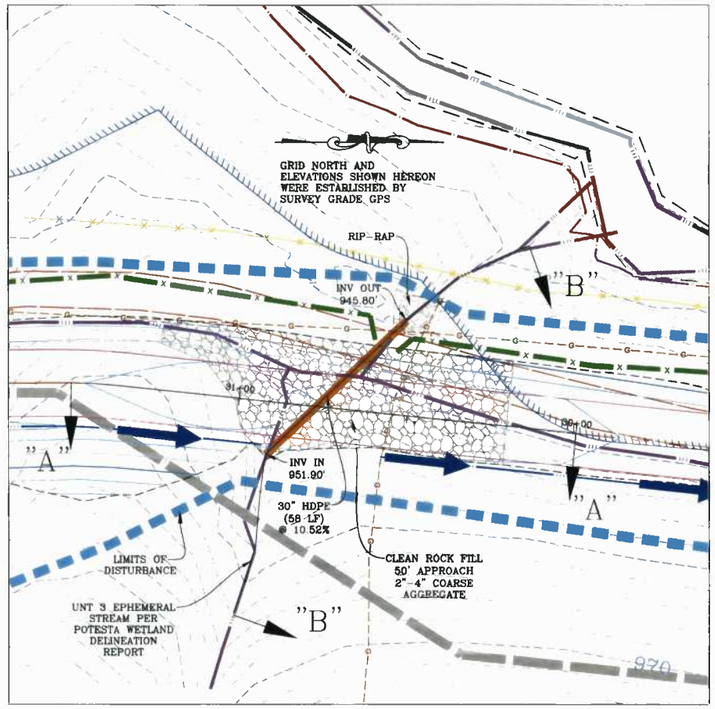
STREAM CROSSING "E" SECTIONS



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

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

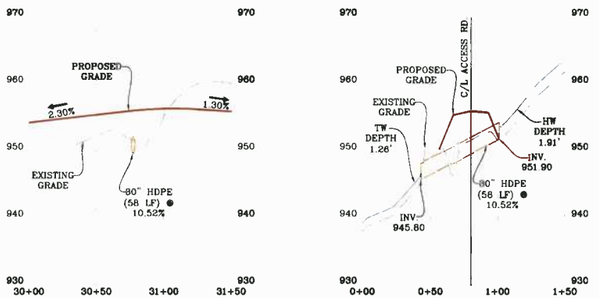
STREAM CROSSING "F" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

STREAM CROSSING "F" SECTIONS



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

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "D", "E" & "F".

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PROFESSIONAL ENGINEER

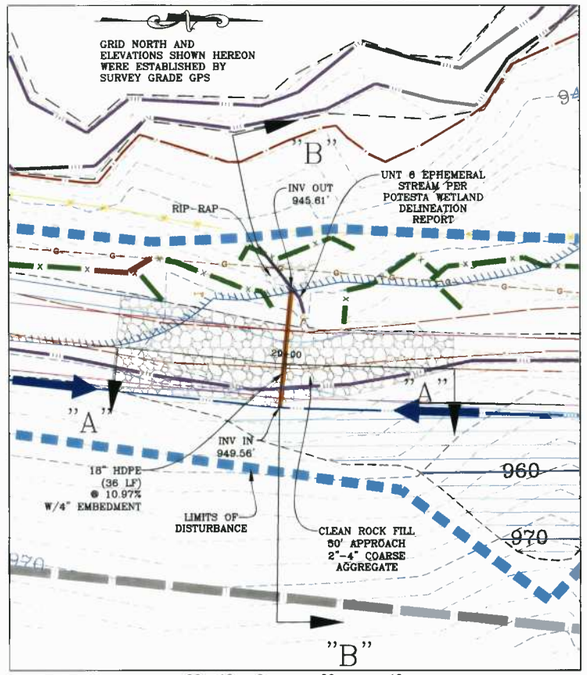
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

MINOR STREAM CROSSING DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 20 OF 28

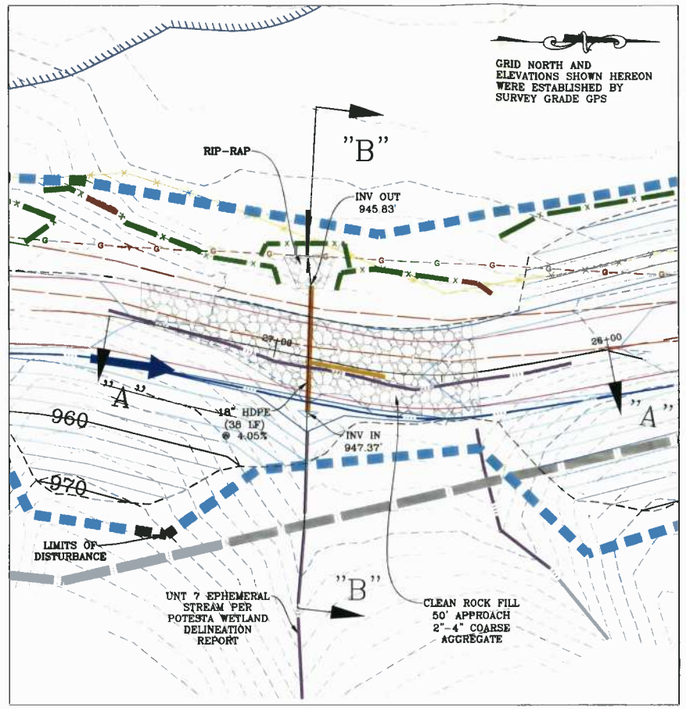
STREAM CROSSING DETAILS

STREAM CROSSING "G" DETAILS



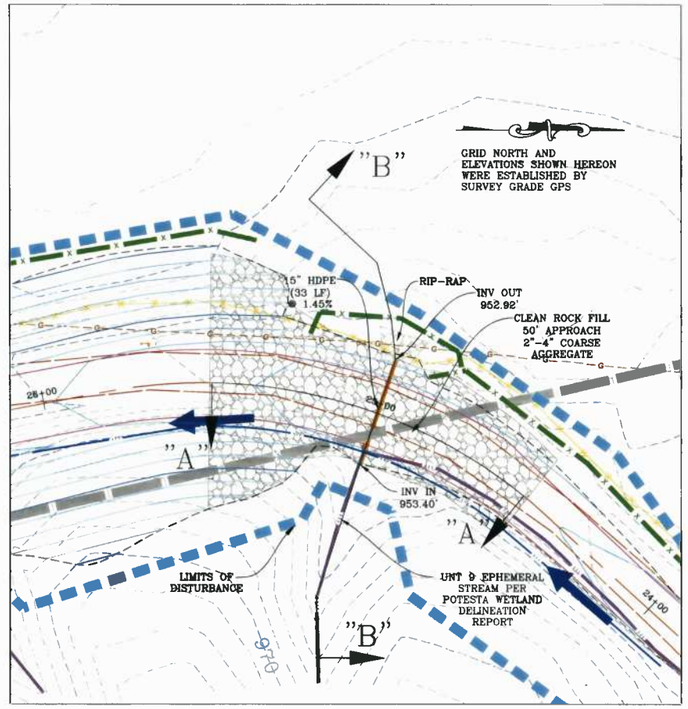
SCALE: 1" = 20'

STREAM CROSSING "H" DETAILS



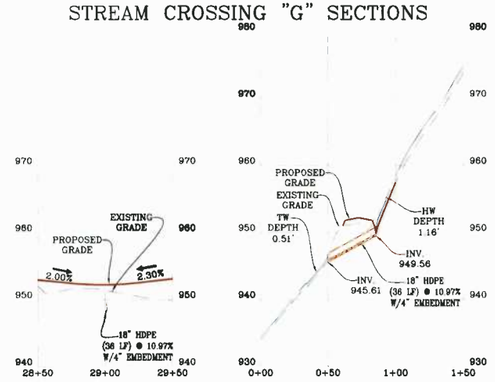
SCALE: 1" = 20'

STREAM CROSSING "I" DETAILS



SCALE: 1" = 20'

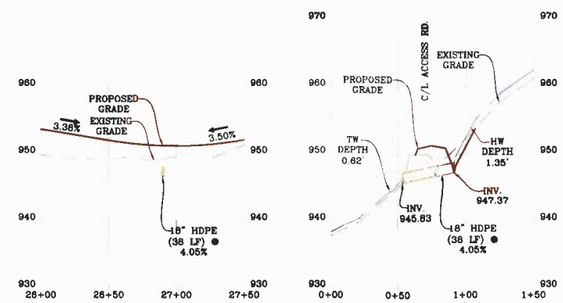
STREAM CROSSING "G" SECTIONS



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

CROSS SECTION "B-B" SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

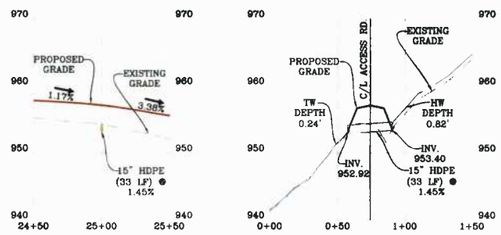
STREAM CROSSING "H" SECTIONS



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

CROSS SECTION "B-B" SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "I" SECTIONS



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1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
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14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "G", "H" & "I".

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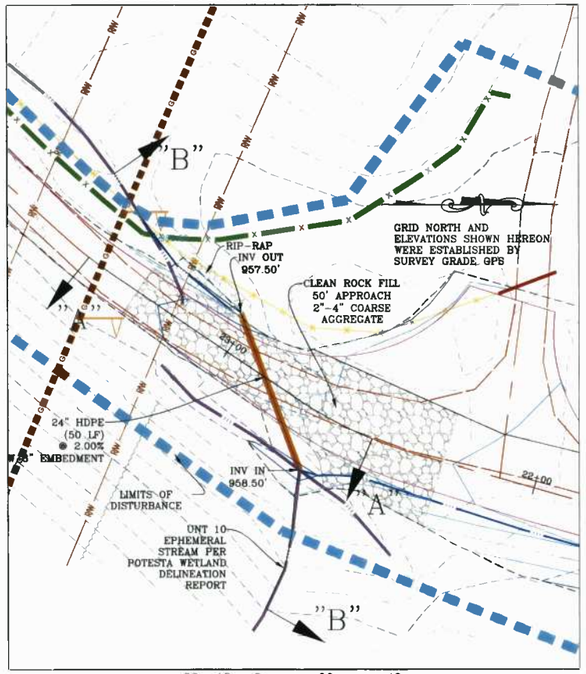
MINOR STREAM CROSSING DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 21 OF 28

STREAM CROSSING DETAILS

STREAM CROSSING "J" DETAILS



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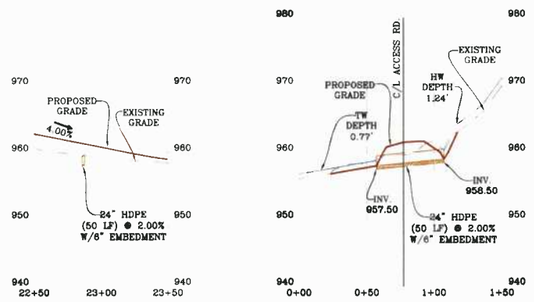
SCALE: 1" = 20'

STREAM CROSSING "J" SECTIONS



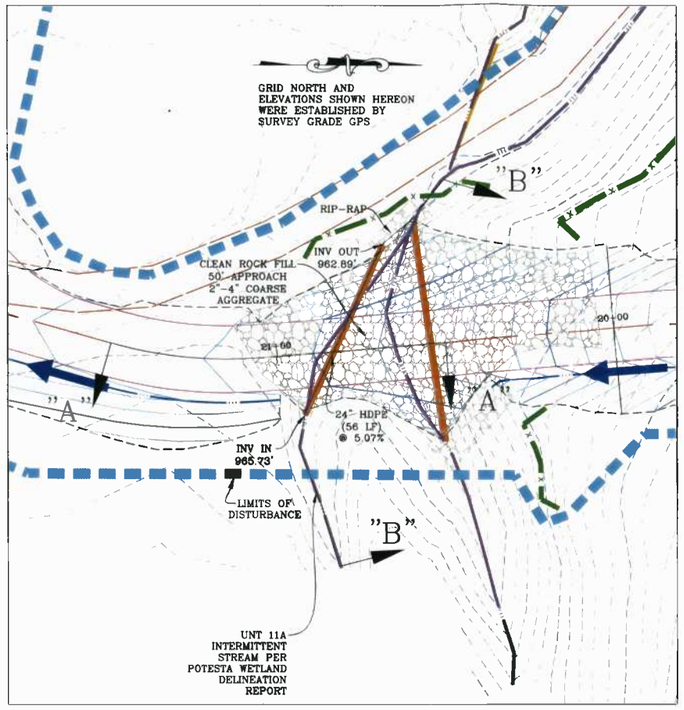
CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "K" DETAILS



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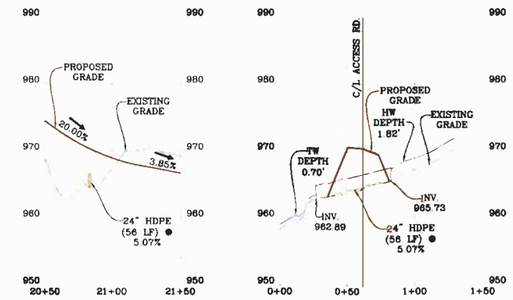
SCALE: 1" = 20'

STREAM CROSSING "K" SECTIONS



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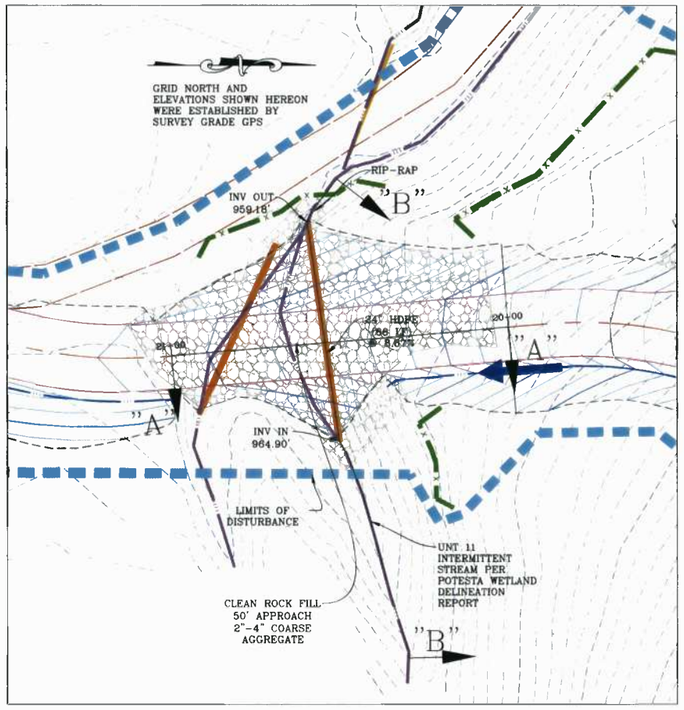
CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

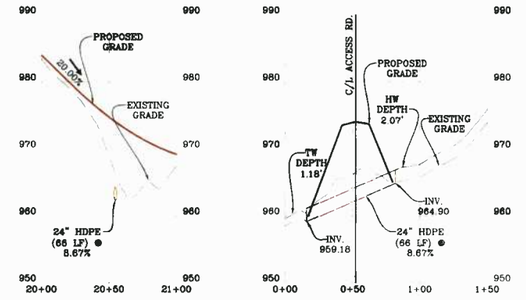
STREAM CROSSING "L" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

STREAM CROSSING "L" SECTIONS



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THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
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OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
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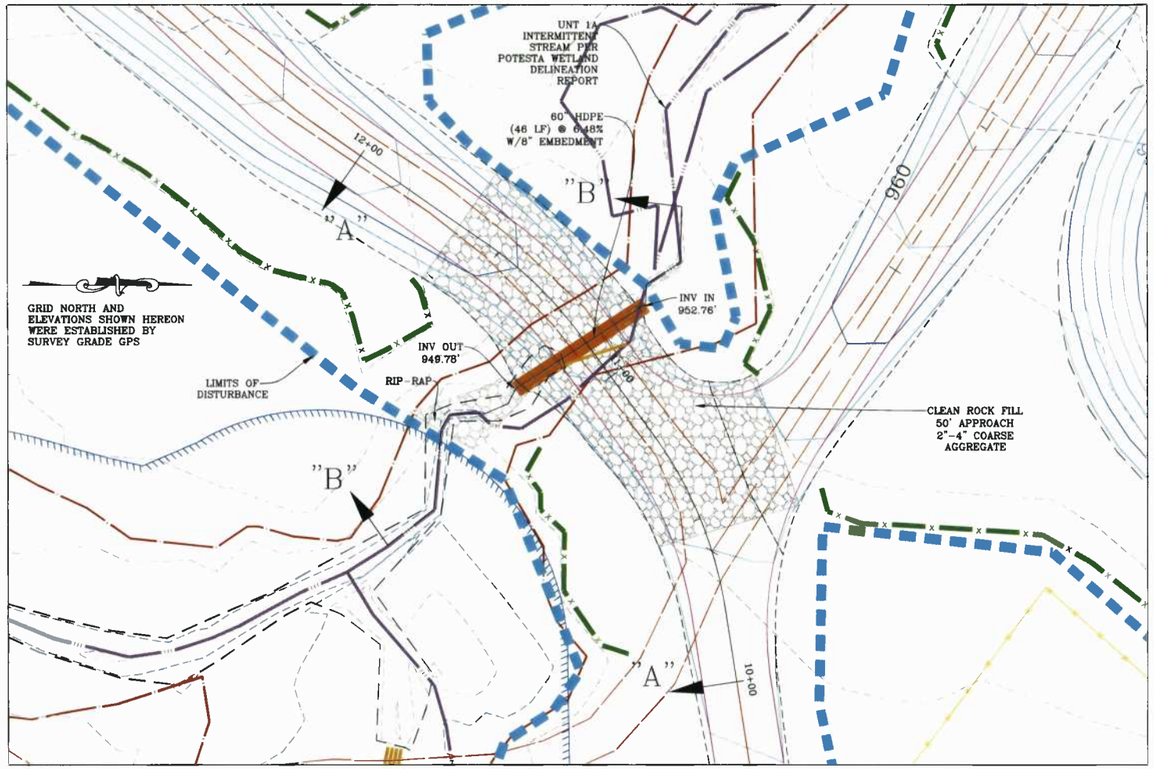
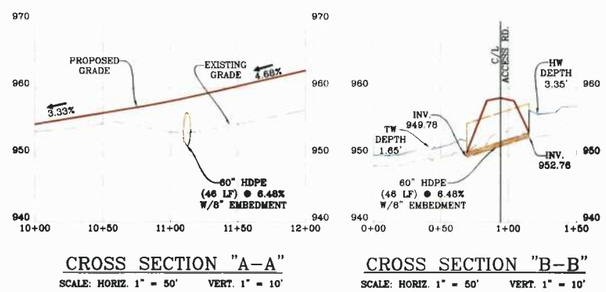
FILE NO. 7889
SHEET 22 OF 28

STREAM CROSSING DETAILS

STREAM CROSSING "M" DETAILS



STREAM CROSSING "M" SECTIONS



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6.25.2013

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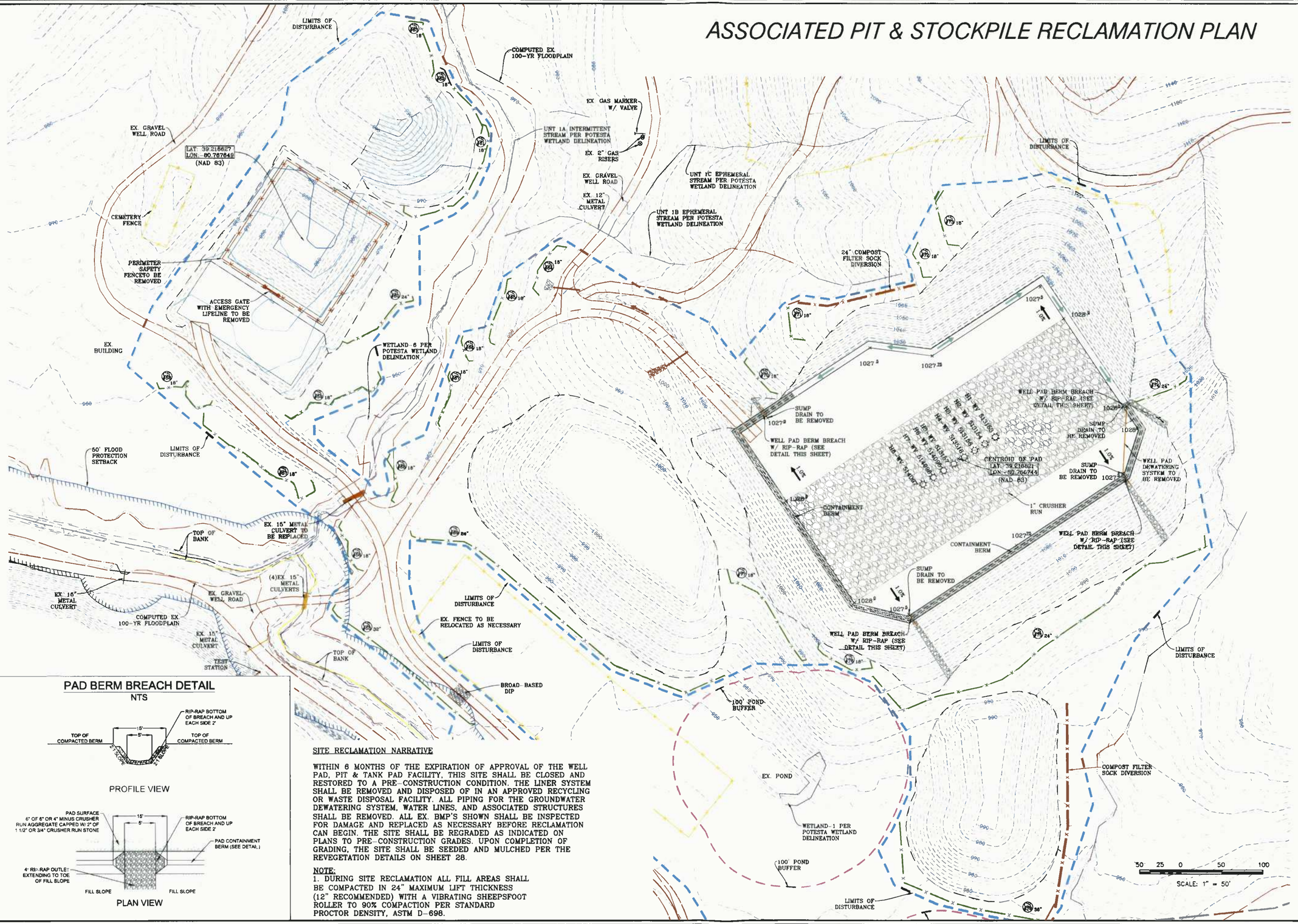
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: AS SHOWN
DESIGNED BY: CSK
FILE NO. 7889
SHEET 23 OF 26

ASSOCIATED PIT & STOCKPILE RECLAMATION PLAN



PAD BERM BREACH DETAIL

NTS

PROFILE VIEW

PLAN VIEW

SITE RECLAMATION NARRATIVE

WITHIN 6 MONTHS OF THE EXPIRATION OF APPROVAL OF THE WELL PAD, PIT & TANK PAD FACILITY, THIS SITE SHALL BE CLOSED AND RESTORED TO A PRE-CONSTRUCTION CONDITION. THE LINER SYSTEM SHALL BE REMOVED AND DISPOSED OF IN AN APPROVED RECYCLING OR WASTE DISPOSAL FACILITY. ALL PIPING FOR THE GROUNDWATER DEWATERING SYSTEM, WATER LINES, AND ASSOCIATED STRUCTURES SHALL BE REMOVED. ALL EX. BMP'S SHOWN SHALL BE INSPECTED FOR DAMAGE AND REPLACED AS NECESSARY BEFORE RECLAMATION CAN BEGIN. THE SITE SHALL BE REGRADED AS INDICATED ON PLANS TO PRE-CONSTRUCTION GRADES. UPON COMPLETION OF GRADING, THE SITE SHALL BE SEEDED AND MULCHED PER THE REVEGETATION DETAILS ON SHEET 28.

NOTE:
1. DURING SITE RECLAMATION ALL FILL AREAS SHALL BE COMPACTED IN 24" MAXIMUM LIFT THICKNESS (12" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 90% COMPACTION PER STANDARD PROCTOR DENSITY, ASTM D-698.

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THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
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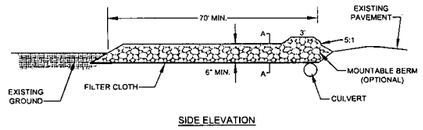
ASSOCIATED PIT & STOCKPILE RECLAMATION PLAN
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

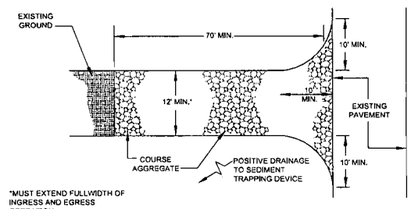
DATE: 12/23/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 24 OF 28

FIGURE 3.02.1

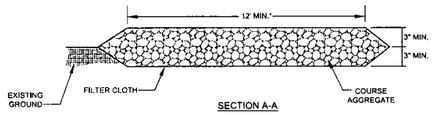
STONE CONSTRUCTION ENTRANCE



SIDE ELEVATION



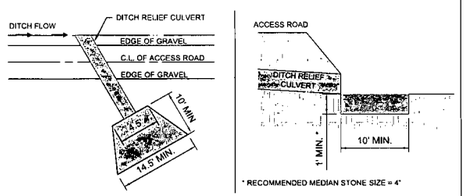
PLAN VIEW



SECTION A-A

SOURCE: ADAPTED from the 1983 Maryland Standards for Soil Erosion and Sediment Control via DSWC

TYPICAL DITCH RELIEF CULVERT OUTLET TREATMENT



PLAN VIEW
NTS

SECTION VIEW
NTS

NOTE:
ALL DITCH LINE PROTECTION SHALL BE INSTALLED AS RECOMMENDED IN THE WEST VIRGINIA EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE (BMP) MANUAL. DITCH LINE PROTECTION SHALL BE BASED ON THE FOLLOWING GRADES:

1. LESS THAN 3% - GRASSED
2. 3-9% - GRASS WITH ROLLED EROSION CONTROL PRODUCTS (RECP)
3. GREATER THAN 9% - RIPRAP OR EQUIVALENT GEOTEXTILE

IF HIGH EROSIVE SOILS ARE ENCOUNTERED DURING CONSTRUCTION, THE ENGINEER SHOULD BE CONTACTED FOR FURTHER EVALUATION.

Modified Figure 3.1 - Typical Roadside Ditch Section
Sump at Ditch Relief Culvert

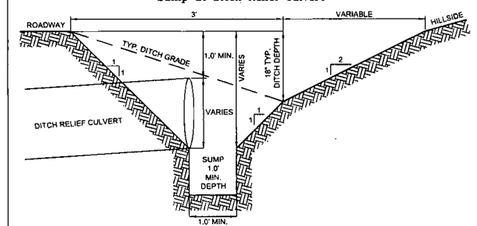
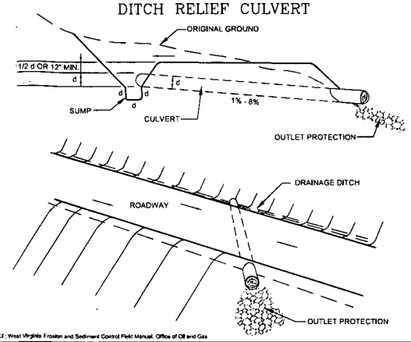


FIGURE II-4

DITCH RELIEF CULVERT



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

Table II-5

Pipe Sizes for Culverts Across Roads		
Drainage Area (Ac)	Pipe Diameter (In)	Pipe Capacity (Cfs)
10	15	5
20	18	9
30	21	12
50	24	18
80	27	24
100	30	29
300	36	60
500	42	85

Table II-6

Spacing of Culverts	
Road Grade %	Distance (Ft)
2-5	500-300
6-10	300-200
11-15	200-100
16-20	100

FIGURE 3.05.1

ROCK CHECK DAM

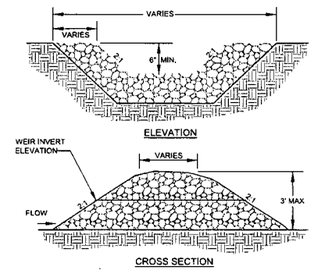
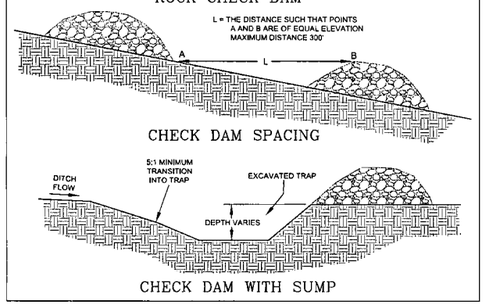
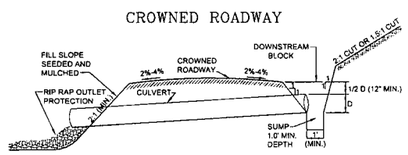


FIGURE 3.05.2

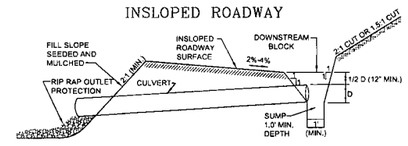
ROCK CHECK DAM



CROWNED ROADWAY



INSLOPED ROADWAY



Cut and fill slopes shall be stabilized immediately upon completion of roadway grading. These areas shall be blanketed wherever they are located within 50 feet of a surface water or within 100 feet of a surface water where a suitable vegetative filter strip does not exist.

A durable top dressing shall be provided for soils having low strength.

Roadside ditches shall be provided with adequate protective lining.

Adequately sized culverts or other suitable cross drains shall be provided at all seeps, springs, and drainageways.

Roadway shall be inspected weekly and after each runoff event. Damaged roadways, ditches, or cross drains shall be repaired immediately.

SOURCE: PA DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF OIL AND GAS MANAGEMENT 5500-PM-OG0111 APPENDIX F BMP CONSTRUCTION DETAILS MODIFIED

TURNOUT

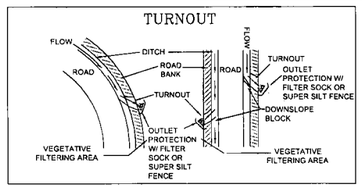
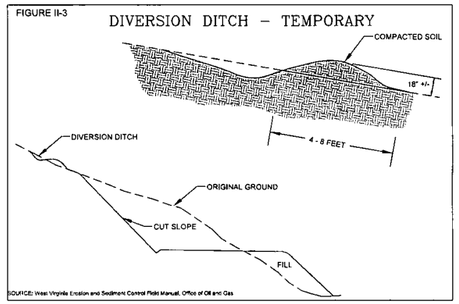


FIGURE II-3

DIVERSION DITCH - TEMPORARY



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

TOE BENCH DETAIL

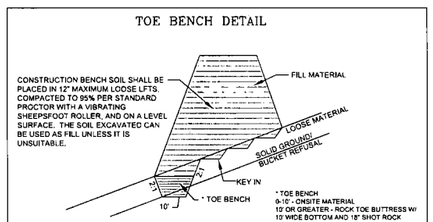
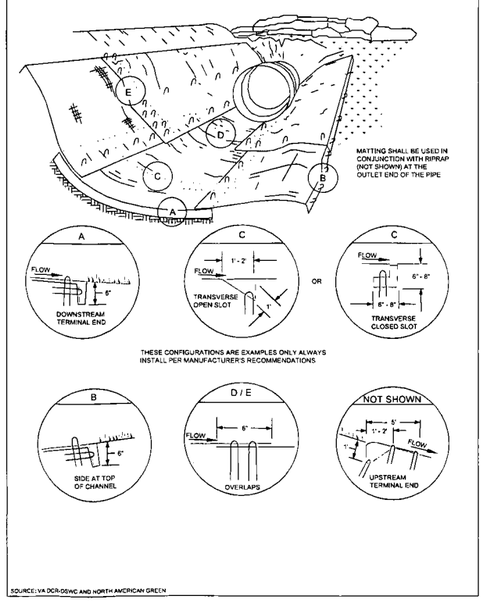


FIGURE 3.13.1

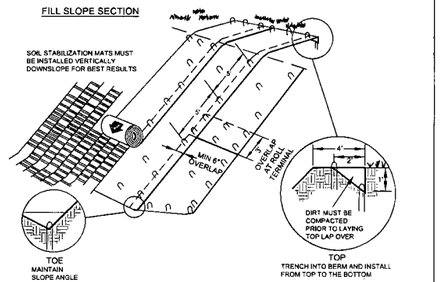
TYPICAL RECP CHANNEL INSTALLATION



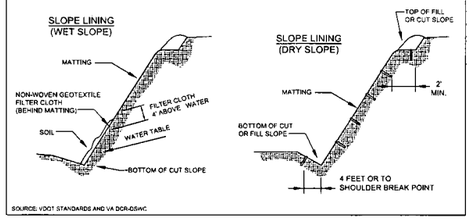
SOURCE: VA DCR-DSWC AND NORTH AMERICAN GREEN

FIGURE 3.13.2

ROLLED EROSION CONTROL PRODUCTS



NOTE: SLOPE SURFACE MUST BE SMOOTH AND FREE OF ROCKS, LUMPS, GRASS AND STICKS. MATS MUST BE PLACED FLAT ON SURFACE FOR PROPER SOIL CONTACT.



SOURCE: VDOT STANDARDS AND VA DCR-DSWC

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PROFESSIONAL ENGINEER
12-23-2013

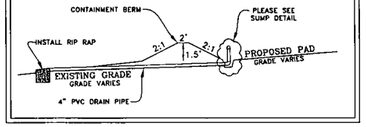
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

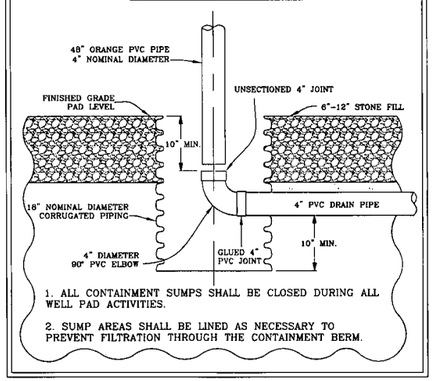
DATE:	12/23/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	25 OF 28

BERM TYPICAL

NOT TO SCALE

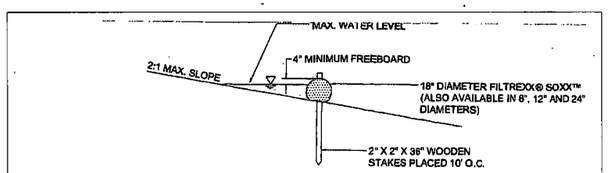


SUMP TYPICAL

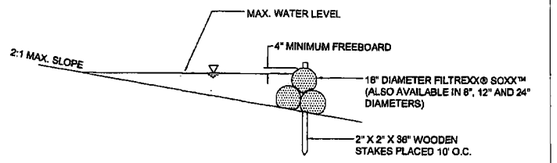


1. ALL CONTAINMENT SUMPS SHALL BE CLOSED DURING ALL WELL PAD ACTIVITIES.

2. SUMP AREAS SHALL BE LINED AS NECESSARY TO PREVENT FILTRATION THROUGH THE CONTAINMENT BERM.



SINGLE INSTALLATION SECTION
NTS

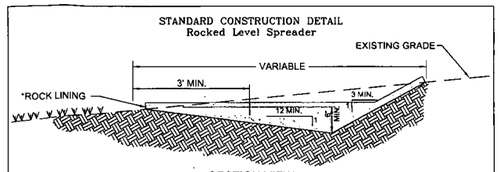


PYRAMID INSTALLATION SECTION
NTS

FILTREXX® RUNOFF DIVERSION SECTIONS

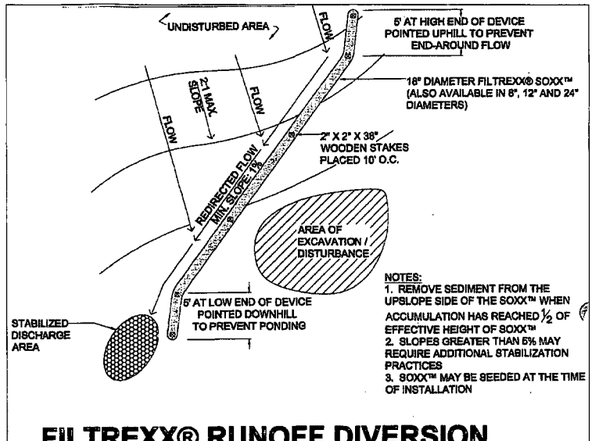
NTS

STANDARD CONSTRUCTION DETAIL
Rocked Level Spreader



SECTION VIEW
NTS

*All Level Spreader rock shall be a minimum of R4.

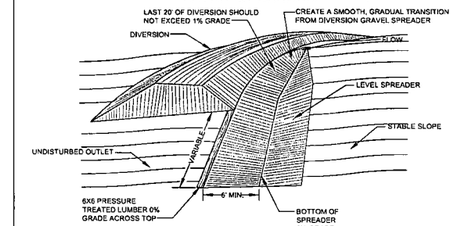


NOTES:
1. REMOVE SEDIMENT FROM THE UPSLOPE SIDE OF THE SOXX™ WHEN ACCUMULATION HAS REACHED ½ OF EFFECTIVE HEIGHT OF SOXX™
2. SLOPES GREATER THAN 5% MAY REQUIRE ADDITIONAL STABILIZATION PRACTICES
3. SOXX™ MAY BE SEEDED AT THE TIME OF INSTALLATION

FILTREXX® RUNOFF DIVERSION

FIGURE 3.02.1

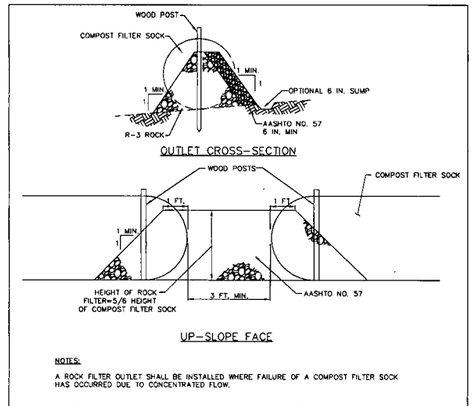
LEVEL SPREADER



PERSPECTIVE VIEW

NOTE: ALL TEMPORARY BERMS, SWALES AND LEVEL SPREADER DITCHES MUST RECEIVE TEMPORARY SEEDING AND MULCHING AFTER INSTALLATION

SOURCE: ADAPTED FROM N.C. DES Control Planning and Design Manual and VA DCSCI



OUTLET CROSS-SECTION

UP-SLOPE FACE

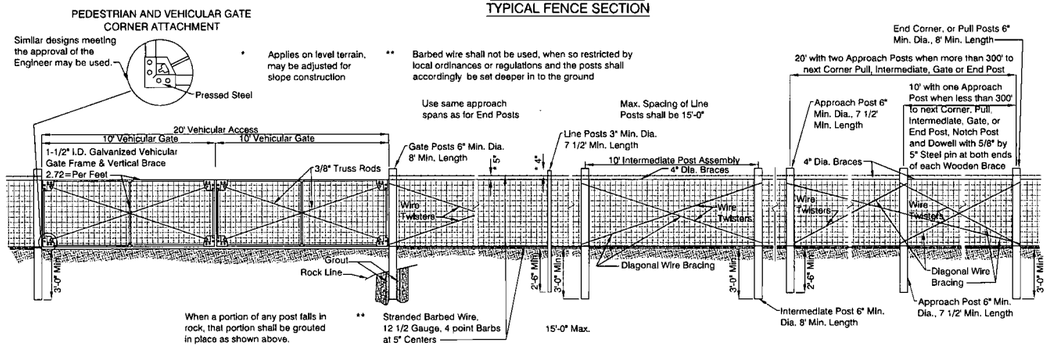
NOTES:

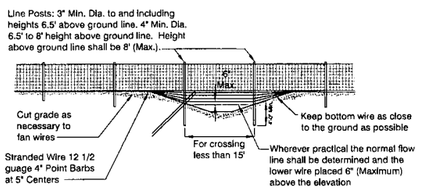
A ROCK FILTER OUTLET SHALL BE INSTALLED WHERE FAILURE OF A COMPOST FILTER SOCK HAS OCCURRED DUE TO CONCENTRATED FLOW.

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

ROCK FILTER OUTLET
(MODIFIED FROM PA DEP)
NOT TO SCALE

CONSTRUCTION DETAIL
TYPICAL FENCE SECTION





DETAIL SHOWING TYPICAL SECTION AT MINOR DEPRESSIONS AND WET WEATHER CROSSINGS

NOTES:

Posts and braces may be either round or square shaped. Dimensions shown on the plans are for round posts and braces only. When square posts are used, line posts shall be 3" square (min.);braces 4" square (min.); corner, end, pull, gate, approach, and intermediate posts 6" square (min.).

The positioning of the fence fabric and barbed wire on the posts, as shown on the "Typical Fence Section" detail, applies for level and gentle sloping terrain. For fence erected on slopes, the positioning may be adjusted to meet the slope conditions as long as the adjustment is continued from post to post in a uniform manner. Trenching on slopes may be warranted. On slopes, posts will continue to be erected vertically, unless otherwise directed, and the ends of the fencing fabric shall be cut on a skew as may be necessary for proper connection to the posts.

Dumped rock channel protection will be used at channel crossings when called for on the plans.

Install drainage structure terminal installation as called for on the plans and/or as shown on typical fence details.

Unless otherwise specified, or directed by the Engineer, the farm field fence may be installed with the fence fabric and barbed wire positioned on either side of the fence posts.

Hardware and miscellaneous fittings, not specifically designated herein as to type or dimensions, shall conform to the applicable requirements of Section 608 of the Specifications and shall be of good quality commerical design acceptable to the Engineer.

In lieu of the barbed wire detailed herein, the following additional types are acceptable, provided they retain the "4-point barb at 5-inch centers" requirement and provided they meet or exceed the strength and coating requirements for the standard, 12 1/2 gauge, barbed wire as called for in 712.10 of the Specifications.
(a) stranded, 15 1/2 gauge, high carbon steel barbed wire
(b) one strand, 12 gauge, steel barbed wire

Vehicular gate frames (and vertical braces) may be either galvanized steel pipe members as shown herein or may be triple-coated steel pipe members meeting the requirements specified on Standard Sheet F2. All other metal components of the gate shall be galvanized, with the exception of the die-cast aluminum corner fittings, or pressed steel corner fittings.

BRUSH PILE SEDIMENT BARRIER
FIGURE II-10

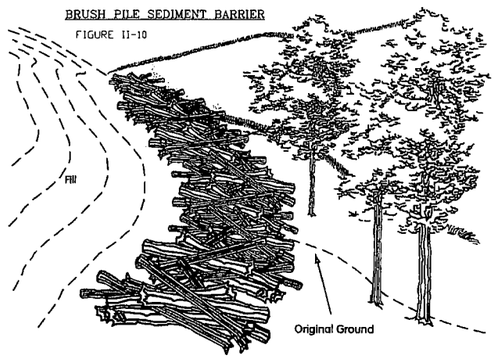
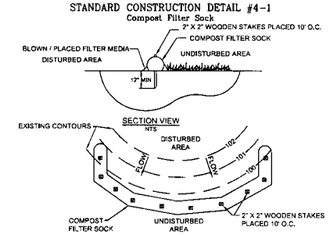


Table 4.1
Compost Sock Fabric Minimum Specifications

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" 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				HDPE 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.					

STANDARD CONSTRUCTION DETAIL #4-1
Compost Filter Sock



PLAN VIEW
NTS
Adapted from Filtrexx

Sock fabric shall meet standards of Table 4.1. Compost shall meet the following 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 Maximum

Compost Filter Sock shall be placed at existing level grade. Both ends of the sock shall be extended at least 8 feet up the slope at 45 degrees to the main sock alignment. Maximum slope length above any sock shall not exceed manufacturer's maximum permissible slope length.

Traffic shall not be permitted to cross filter socks.

Accumulated Sediment shall be removed when it reaches 1/2 the above ground 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.

In the event the ground is frozen, #5 rebar with safety caps shall be used instead of wooden stakes to anchor the filter sock. Once the ground thaws the rebar anchors shall be removed and replaced with 2" x 2" wooden stakes and installed as shown in the detail above.

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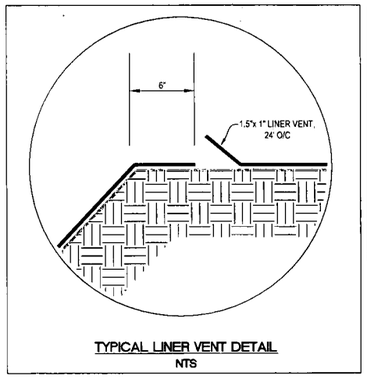
12/23/2013

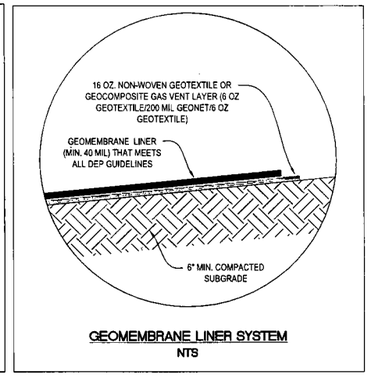
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

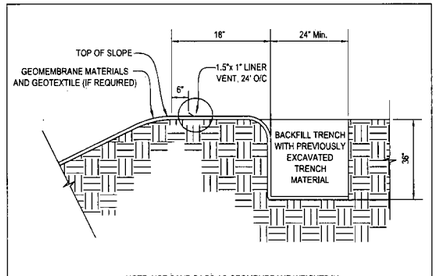
DATE: 12/23/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 26 OF 28



TYPICAL LINER VENT DETAIL
NTS

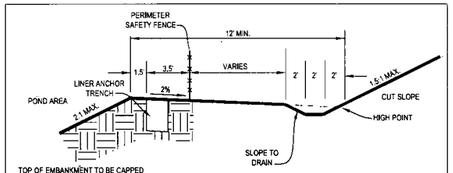


GEOMEMBRANE LINER SYSTEM
NTS

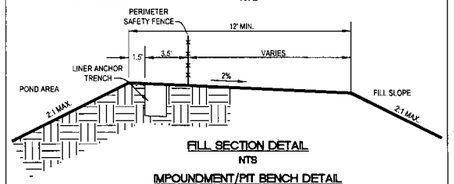


NOTE: USE SAND BAGS AS GEOMEMBRANE WEIGHTS IN TRENCH DURING GEOMEMBRANE INSTALLATION

TOP OF BERM ANCHOR TRENCH DETAIL
NTS



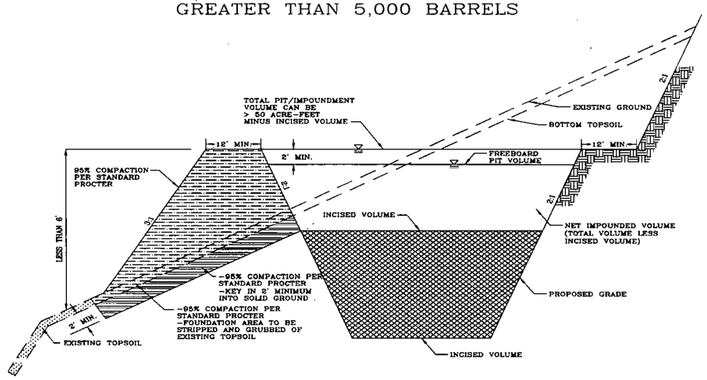
CUT SECTION DETAIL
NTS



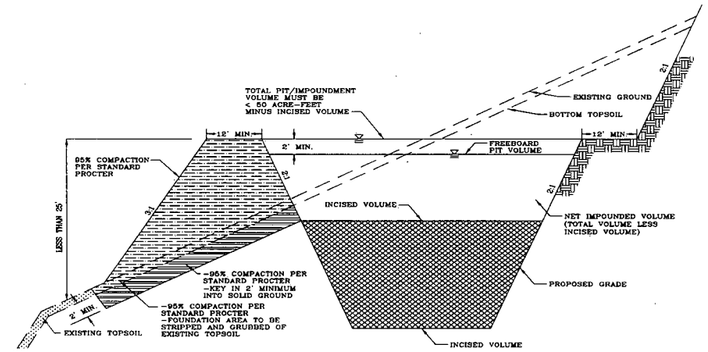
FILL SECTION DETAIL
NTS

IMPOUNDMENT/PIT BENCH DETAIL
NTS

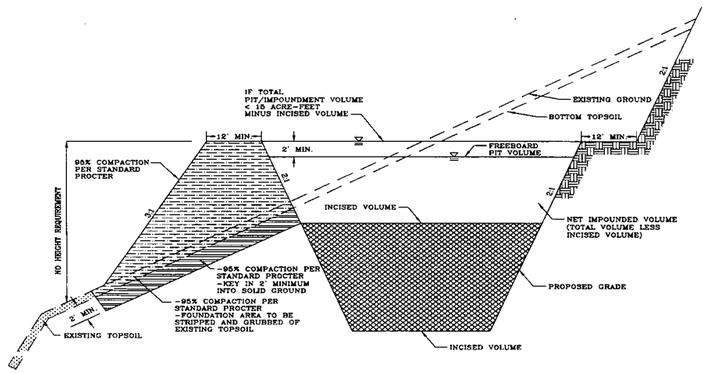
WEST VIRGINIA CODE 35 CSR 4
DESIGN AND CONSTRUCTION REQUIREMENTS FOR ASSOCIATED PITS, ASSOCIATED IMPOUNDMENTS, & CENTRALIZED IMPOUNDMENTS GREATER THAN 5,000 BARRELS



SECTION VIEW



SECTION VIEW



SECTION VIEW

NOTES:
1. ALL FILL SHOULD BE KEYED IN TO ORIGINAL GROUND EVERY 2-5 VERTICAL FEET DEPENDING ON EXISTING GROUND SLOPE

2. MINIMUM OUTSIDE AND INSIDE EMBANKMENT (FILL) SLOPES SHALL BE 2H:1V. THE INSIDE AND OUTSIDE SLOPES MUST ADD UP TO 5H:1V.

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CHAD S. KLUG
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STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
12/23/2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 27 OF 28

REVEGETATION

Taken from the
West Virginia Erosion and Sediment Control Field Manual
West Virginia Division of Environmental Protection Office of Oil and Gas
Charleston, W.Va.
Section IV

Temporary Seeding

a. 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.

b. Seed Mixtures and Planting Dates
Refer to Tables 2 through 4 for recommended dates to establish vegetative cover and the approved lists of temporary and permanent plant species, and planting rates. Table 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.

c. Seed Application
Apply seed by broadcasting, drilling, or by hydroseed according to the rates indicates 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

a. 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.

b. 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.

c. 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 b, Permanent Seeding Mixtures Suitable for Establishment in West Virginia.
Notes:
1. All legumes must be planted with the proper inoculants prior to seeding.
2. 'Latheo' Flatpea is potentially poisonous to some livestock.
3. Only endophyte free varieties of Tall Fescue should be used. Tall Fescue and Crownvetch 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 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.

d. 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

a. 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 seeded 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 seeded 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 seeded 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 seeded 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.

b. 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.

c. Specifications
From Table IV-6 select the type of mulch and rate of application that will best suit the conditions at the site.

d. 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 three inches.
2. Mulch netting
Follow manufacturer's recommendation when positioning and stapling the mulch netting in the soil.

Table IV-1
Recommended Seeding Dates

Planting 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 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 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
Sundangrass	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 4a
Permanent Seeding Mixture

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

** '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 4b
Wildlife and Farm Friendly Seed Mixtures

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

** '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-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 100 to 150 bales	Cover 75% to 90% of Surface	Subject to wind blowing or washing unless tied down
Wood Fiber Pulp Fiber Wood - Cellulose Recirculated Paper	1000 to 1500 lbs	Cover all Disturbed Areas	For hydroseeding

Tables IV 1-4 taken from Natural Resources Conservation Service Manual 'Critical Area Planting'

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CONSTRUCTION DETAILS
OXF 159
WEST UNION & SOUTHWEST DISTRICT
DODDRIDGE COUNTY, WV

DATE: 12/23/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7869
SHEET 28 OF 28